

Original articles

Penetrating eye injuries

B C K PATEL

Manchester Royal Eye Hospital

SUMMARY A review of all penetrating eye injuries treated at the Manchester Royal Eye Hospital over four years (1 January 1982–31 December 1985) was undertaken. A total of 202 penetrating eye injuries were seen of which 68 (34%) were in children under the age of 15 years. Airgun, dart, and knife injuries accounted for 28 (41%) of the injuries. Thirty seven patients (54%) achieved a good visual result (6/12 or better) and eight (12%) had enucleations. The period of inpatient treatment ranged from two to 18 days. From the analysis of the activities at the time of the injury, many of the injuries can be considered to be preventable.

Eye injuries are an important cause of visual disability in children.^{1 2} Penetrating eye injuries in children have a major impact in terms of long term morbidity and so are a matter of major socioeconomic importance. Prevention is of obvious importance but the causative factors must first be identified. Few studies have looked at the problem of penetrating eye injuries in children.

The purpose of this study was to analyse the causes, identify the types of injuries, and assess the visual outcome of penetrating eye injuries.

Patients and methods

The Manchester Royal Eye hospital is a 149 bed regional ophthalmic centre serving a population of approximately 1 million and has an annual accident and emergency department attendance of about 40 000 patients. Being a tertiary referral centre most penetrating eye injuries are referred to this hospital. We examined the records of all patients treated for penetrating eye injuries between 1 January 1982 and 31 December 1985. For patients aged 0–15 years details of the injuries including patient's age and sex, affected eye, activity at the time of injury, cause of the accident, extent of the injury, operative details, complications, and visual outcome were recorded. The total time spent as an inpatient was also noted.

Results

The total number of patients with penetrating eye injuries over the four year period was 202 (33 females and 169 males); of these 68 (34%) were children aged 0–15 years (56 boys and 12 girls).

Table 1 shows the sex distribution by year and table 2 shows the age and sex distribution. There were 33 right and 35 left eyes involved. Injuries at school accounted for eight cases while the remainder

Table 1 Annual distribution of penetrating eye injuries by sex

Year	Boys	Girls	Total
1982	12	7	19
1983	14	1	15
1984	15	1	16
1985	15	3	18
Total	56	12	68

Table 2 Age and sex distribution of penetrating eye injuries

Age (years)	Boys	Girls	Total
<1	1	0	1
1	1	1	2
2	1	1	2
3	1	1	1
4	6	0	6
5	4	0	4
6	5	2	7
7	3	0	3
8	5	0	5
9	3	2	5
10	3	0	3
11	4	2	6
12	6	0	6
13	5	0	5
14	4	1	5
15	4	2	6
Total	56	12	68

occurred during leisure hours. Injury was caused by another child in 26 cases (38%).

The causes of the injuries are shown in table 3. The severity of the injury and the visual outcome is shown in table 4. Results are divided into four groups: good (6/12 or better), fair (6/18–6/36), poor (6/60-perception of light), and no perception of light. Airgun, dart, and knife injuries accounted for 28 (41%) of all penetrating injuries in children. The details of the airgun and dart injuries are shown in

tables 5 and 6. The length of inpatient treatment ranged from two to 18 days with a mean of 5.6 days. Of the eight eyes that were enucleated, three were enucleated because they were damaged beyond repair, one because of endophthalmitis, three for cosmetic reasons, and one because of absolute glaucoma. There were no cases of sympathetic ophthalmitis.

Discussion

Children with eye injuries have been shown to make up 20%–29% of all ocular injuries requiring admission.^{3 4} Penetrating eye injuries are the most important part of this group of patients as they result in the most severe visual disability.^{5 6} Our ratio of boys to girls of 4.66:1 is similar to other studies.^{4 7 8} Among the boys the incidence of injuries is maximum during the early school years and is very low below the age of 4.

The commonest causes of perforating eye injuries in children are pointed objects of various sorts.^{1 2 5} In the present series they constituted 60%. Whereas explosives have accounted for some penetrating injuries in previous studies,^{2 8} there were none in the present series.

Roper-Hall found that children below the age of 14 years made up 38% of patients with penetrating injuries over the period 1950 to 1958,⁹ while the figure for Johnston was 28% between 1965 and 1969.¹⁰ Our figure of 34% is in keeping with this.

Table 3 Causes of penetrating eye injuries (n=68)

Cause	No of injuries
Darts	11
Glass	10
Knife	9
Airgun pellets	8
Stone	6
Twig	5
Bicycle	3
Sharp objects:	
Scissors	2
Compass	2
Pen	2
Fork	2
Needle	1
Coat hanger	1
Miscellaneous:	
Radiator	1
Swing	1
Hammering	1
Unknown	3

Table 4 Visual outcome for the four grades of injury (n=68)

Extent of injury	6/12 or better	6/18–6/60	6/60 or less	Enucleations
Cornea with or without uvea	24	4	3	2
Cornea plus lens damage	6	8	4	1
Posterior segment injury with or without vitreous loss	6	1	1	1
Extensive anterior and posterior segment injury	1	1	1	4

Table 5 Details of penetrating eye injuries caused by airgun pellets

Age years	Sex	Left or right eye	Circumstances	Visual acuity
16	M	Left	Fired accidentally by patient	6/9
14	M	Left	Walking in the park, fired at by unknown person	6/9
12	M	Right	Fired accidentally by patient	Count fingers
15	M	Left	Fired accidentally by brother	Perception of light
11	M	Right	Fired accidentally by patient	6/5
16	M	Left	Fired accidentally while cleaning	6/6
13	M	Right	Fired at by unknown person	6/60
10	M	Left	Fired accidentally by patient	6/60

Table 6 Details of injuries caused by darts

Case No	Age (years) Sex	Left or right eye	Circumstances	Injuries	Visual acuity
1	6 F	Right	Dart thrown by brother	Corneal perforation, iris prolapse	6/9
2	6 F	Right	Pulling dart out of dartboard	Corneal perforation, iris prolapse	6/9
3	13 M	Right	Dart bounced off a surface	Scleral perforation, vitreous loss, retinal detachment	Count fingers
4	7 M	Left	Playing with a dart	Scleral perforation, vitreous loss, lens damage	Perception of light
5	3 M	Left	Dart thrown by friend	Corneal and scleral perforation	6/5
6	11 F	Left	Pulling dart out of dartboard	Corneal perforation, iris prolapse	6/6
7	5 M	Left	Playing with a dart	Corneal perforation, iris prolapse, lens damage	6/60
8	4 M	Left	Poked with a dart by brother	Corneal and scleral perforation, iridodialysis, retinal detachment	6/60
9	12 M	Left	Dart thrown by friend	Corneal perforation, iris prolapse	6/9
10	13 M	Left	Dart bounced off a surface	Corneal perforation, iris prolapse	6/9
11	9 M	Right	Playing with darts	Corneal perforation, iris prolapse	6/9

Johnston found that 20% of the children in his series had injured their eyes playing with toys such as arrows and catapults whereas the remainder were due to articles in and around the house such as sticks, knives, scissors, wire, glass, and fireworks. He pointed out that most parents' apparent lack of awareness of potential danger to their children's eyes was an important factor. In Roper-Hall's series, bow and arrow injuries were the most common cause accounting for 25%. Detailed analysis of the causes of injuries were not available in that series. Lambah found that over the 10 years 1951 to 1960, 163 penetrating injuries were seen in children and arrows accounted for 26, airgun injuries 12, miscellaneous pointed objects including knives accounted for 41, and assaults for 17.⁸ The commonest causes in our series were darts (16%), knives (13%), and airgun pellets (12%). Miscellaneous sharp objects and glass related injuries each accounted for 15%.

In two major studies of penetrating eye injuries between 1950 and 1960 none were caused by darts.^{8,9} In more recent studies in the 1970s and 1980s darts have been identified as a cause of penetrating injuries in children.^{8,11} The game of darts was until recently an adult sport played largely in public houses. In recent years the sport has received extensive television coverage and has therefore become very popular. A survey of three large toy stores in London showed nine different

types of darts on sale manufactured by three different companies. Only one company printed a clear warning on all its products. The warning reads 'Darts is an adult sport. It is dangerous for children to play without supervision'. Some of the other products carried warnings in small print while three had no warning at all. It is interesting to note that none of the penetrating eye injuries in adults were caused by darts.

Among children the biggest danger is at play and it would appear that parents' apparent lack of awareness of potential danger to their children's eyes is an important factor. There is at present no requirement for a physician to report ocular injuries caused by dangerous toys to the Consumer Safety Unit. The European Community directive on the safety of toys comes into effect on 1 January 1990 but darts with metallic points are excluded as they are not regarded as toys. It is suggested that all darts on sale should carry a clear and prominently displayed warning.

Prompt publicity by the media has previously proved to be very effective in preventing injuries caused by other toys.⁹ The general public should be made aware of the vulnerability of children to injuries by darts. It may be argued that as the game of darts is recognised to be an adult sport darts and dartboards should not be sold in children's toy stores.

There have been several reports on penetrating

eye injuries due to airgun pellets in recent years.^{12 13} A licence is not required for an airgun or air pistol but no person under the age of 17 years can purchase or hire one. No person under the age of 14 can accept as a gift or have in his possession an air weapon except when under the supervision of a person over 21 or when he is a member of an approved club or when the weapon is being used at a shooting gallery. Any person with a loaded air weapon in a public place is liable to imprisonment or a fine. Five of the eight patients injured by an airgun, however, were below 14 years of age. In five cases the accidents were due to careless handling of the airguns by the patient, in the remaining three cases the children had been fired at by assailants. The generally poor visual outcome of these injuries is not surprising. Although the law could be changed to provide further restrictions, this would probably not prevent children from handling such weapons and instruction of parents and children in schools may be of greater benefit. Eye injuries involving airguns are completely preventable and the emphasis should be on the fact that like darts, airguns are not toys.

Household items can be potentially dangerous and result in serious ocular injury when improperly handled by a child. A significant number of injuries resulted from play with items such as knives, glass bottles, scissors, compasses, and pens. In general, these injuries were more frequent in children less than 6 years of age. Parental supervision is vital to the prevention of such injuries and all potentially dangerous items should be removed from the reach of infants or toddlers. The use of plastic bottles would eliminate many potential hazards of breakage.

The Consumer Safety Unit of the Department of Trade and Industry has since 1976 collected information about accidents in the home that require attention in the accident and emergency departments of 20 hospitals in England and Wales.

These do not at present include eye hospitals, however, and information on current causes of severe ocular trauma can only be obtained by studies carried out at major eye hospitals. This information is vital for the development of preventive measures. The reporting of the causes of all penetrating ocular injury to the Consumer Safety Unit would help to identify specific accident hazards.

References

- ¹ Niiranen M. Perforating eye injuries treated at Helsinki University Eye Hospital 1970 to 1977. *Ann Ophthalmol* 1981;**13**: 957-61.
- ² Werner S. On injuries to the eye in children. *Acta Ophthalmol (Copenh)* 1952;**30**:37-104.
- ³ Maltzman BA, Pruzon H, Mund ML. A survey of ocular trauma. *Surv Ophthalmol* 1976;**21**:285-90.
- ⁴ Grin TR, Nelson LB, Jeffers JB. Eye injuries in childhood. *Pediatrics* 1987;**80**:13-7.
- ⁵ Sternberg P, De Juan E, Michels RG. Penetrating ocular injuries in young patients. Initial injuries and visual results. *Retina* 1984;**4**:5-8.
- ⁶ Shock JP, Adams D. Long-term visual acuity results after penetrating and perforating ocular injuries. *Am J Ophthalmol* 1985;**100**:714-8.
- ⁷ Niiranen M. Eye injuries in children. *Br J Ophthalmol* 1981;**65**: 436-8.
- ⁸ Lambah P. Some common causes of eye injury in the young. *Lancet* 1962;**ii**:1351-3.
- ⁹ Roper-Hall MJ. The treatment of ocular injuries. *Trans Ophthalmol Soc UK* 1959;**79**:57-69.
- ¹⁰ Johnston S. Perforating eye injuries: a five year survey. *Trans Ophthalmol Soc UK* 1971;**91**:895-921.
- ¹¹ Eagling E. Perforating injuries of the eye. *Br J Ophthalmol* 1976;**60**:732-6.
- ¹² Bowen DI, Magauran DM. Ocular injuries caused by airgun pellets: an analysis of 105 cases. *Br Med J* 1973;**i**:333-7.
- ¹³ Young DW, Little JM. Pellet-gun eye injuries. *Can J Ophthalmol* 1985;**20**:9-10.

Correspondence to Mr BCK Patel, Moorfields Eye Hospital, City Road, London EC1 2PD.

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