ISSUES IN MEDICINE

Toy gun injuries — more than meets the eye

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A MEDLINE search ascertained that damage to the eye caused by spring-loaded air guns shooting plastic projectiles has not yet been reported in the literature. A countrywide spate of eye injuries caused a large number of patients to present to our unit. Investigation was conducted into the nature of the injuries, features of the toy guns involved as well as social aspects relating to the injuries.

What was done

At the start of the 1998 Christmas season it was noted that an unusually high number of our patients had sustained injuries caused by toy guns. Prior to this time only a few isolated cases of this nature had been seen. The guns concerned were spring-loaded air guns made in China and labelled with a variety of names of well-known guns (Fig. 1). They contained a magazine capable of holding several brightly coloured rigid 5 mm plastic balls (Fig. 2). The guns are termed 'soft ball guns' by the police service.

Fig. 1. Example of one version of the 'soft ball guns' available in our community.

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Fig. 2. Disassembled gun with magazine and projectiles. (Note that the spring seen here is not the internal spring mechanism, which powers air propulsion of the projectile.)

A record was kept of all new patients presenting to Groote Schuur and Red Cross War Memorial Children's Hospital eye clinics during December 1998 and January 1999. In order to prevent further injuries caused by what appeared to be one of the year's most wanted Christmas gifts, the mass media including local and national television and newspapers were informed of the damage toy guns can cause. This resulted in widespread publicity concerning the danger of such toys. Interviews with doctors, parents, children and toy traders formed the main content of the stories published. Following this campaign there was a marked decline in new presentations.

The medical records of 33 injured patients were reviewed. Many of our patients are from poor socio-economic circumstances and do not have the resources to attend follow-up appointments. For this reason an attempt was made to encourage patients to return by offering payment of an incentive upon completion of a 6-month follow-up assessment. Patients were reminded of the appointment telephonically and / or postally. Nine out of the 33 patients returned for this visit. All were children. They were examined and interviewed along with their parents to obtain details of the incident and to assess attitudes towards these popular toys.

Ballistic testing was arranged through the South African Police Service.

What was found

Thirty-three cases were collected during the Christmas spate of injuries. The few sporadic cases seen before and after this were not included in this report.

The majority of patients (24/33, 73%) were 15 years old or younger. Twenty-one out of 33 (64%) were males of mixed ancestry, 7/33 (21%) were males of black ancestry and 5/33 (15%) were females of mixed ancestry. Seventeen right and 16 left eyes were injured.

The most common clinical finding was hyphaema (17/33, 52%), followed by traumatic uveitis (12/33, 36%), corneal abrasion/contusion (10/33, 30%), iris injury (10/33, 30%), vitreous haemorrhage (3/33, 9%), raised intraocular pressure (2/33, 6%), and epiretinal membrane (1/33, 3%).

In the majority of patients the visual outcome was good (visual acuity (VA) ≥ 20/30). Eye findings in the 4 patients with VA of 20/40 or worse included:

Counting fingers vision in a child with a relative afferent pupil defect who required vitrectomy for non-resolving dense vitreous haemorrhage. She had presented with a hyphaema and had experienced prolonged raised intraocular pressure despite medical and surgical intervention.

A child with a VA of 20/40 required pars-plana vitrectomy, peeling of an epiretinal membrane and silicone oil following a non-resolving vitreous haemorrhage.

Visual acuity of 20/80 and 20/40 in two patients who were only examined once and failed to return for follow up.

In 8 cases the VA was not available. This usually occurred where the patient was very young, too distressed or too unco-operative to undergo accurate testing on the initial visit, and then failed to return for follow-up. Language difference between ophthalmologist and patient was a problem in many cases, especially after hours

Management of these preventable injuries necessitated consumption of scarce hospital resources, which could have been better utilised in other areas of our service. Ten admissions of 7 patients, including 3 who needed surgery on 5 occasions, amounted to a total of 38 inpatient days. Fifty-eight outpatient visits were kept. Since most injuries occurred during the school holidays little school time was lost, although 24 patients were minors and as a consequence an adult needed to accompany them to the clinic resulting in the loss of a substantial number of working days. One single mother from out of town spent more than half a month's wages on hospital visits.

Of the 9 patients who returned for 6-month follow-up, all were under the age of 13 years. Seven were injured inside the home or garden; 5 were injured while playing with the child who fired the gun and 4 were innocent bystanders. In response to open-ended questioning about their perceptions of the toy guns, all children indicated that they thought the guns were bad or said that they were frightened of them. Nevertheless 6 of the 9 children demonstrated excellent skill in loading and operating the guns when presented with non-working or working versions. They showed lack of concern about looking down the barrel or pointing the gun at people in the room. None of the parents present at consultation attempted to correct the unsafe ways in which their children handled the toy. When parents were asked about what action should be taken, 7 thought all projectile toys, non-projectile gun replicas, and real guns should be banned. The remaining 2 parents were gun owners and thought that only toy guns should be banned.

Following the media campaign, which has been repeated over three subsequent festive seasons, fewer patients with toy gun-related eye injuries have been presenting to this department, although sporadic cases have been seen.

Ballistic testing revealed the guns to have a muzzle velocity of 53 m/second. The 5 mm solid plastic projectiles had a mass of 0.115 g, giving a kinetic energy of 0.162 J. Of concern was the propensity for projectiles to jam in the magazine.

Discussion

These toy guns are inexpensive (equivalent to the cost of three loaves of bread), easily available (toy shops and street markets) and unregulated. In this series they have caused significant eye injuries, with 2 definite cases of permanent visual impairment. They have been associated with consumption of medical resources, behavioural implications of great concern in our social context, and economic stress to the families involved. Despite repeated lobbying by medical professionals and child accident prevention groups, these toys are still unregulated in our country.

Epidemiology

The socio-economic and ethnic groups presenting during the epidemic reflect the normal population of the clinics serviced by our department. The children's desire to emulate their elders may have led to the behaviour of the boys injured by these toy guns. In our communities, permeated with gang networks, gun ownership is common. The visual media may have provided further role models. Body language of children presented with toy guns during the interviews closely mimicked that of television action heroes.

The race and age of the patients in this state sector series differ from those reported in a local survey of pellet gun injuries seen in the private and state sector in 1978.[1] In that series 67% of patients were white (mostly aged 5 - 21 years), possibly reflecting the inaccessibility of such expensive playthings to the remainder of the population at that time. The socio-economic background of economic deprivation and

violence seen in our study is similar to that reported in a recent Chicago survey of childhood firearm injuries where young 'black' (and Hispanic) males living in poverty dominated the casualties.[2]

Ballistics

Our patients have been more fortunate than those in an American series in which 6 out of 16 children shot in the eye with BB guns were blinded in the injured eye.[3] This spring-loaded airgun differs from BB guns in that the 5 mm round projectile is made of plastic rather than metal, and being of lower mass, imparts less kinetic energy. Table I compares ballistic characteristics of the guns in our study with examples of guns[4] that could impart sufficient kinetic energy to penetrate intact skin or a human eye at close range.

Table I. Comparison of airgun characteristics[4]

Type of gun	Mass of projectile (g)	Muzzle velocity of gun (m/sec)	Kinetic energy of projectile (J)
'Smith and Wesson M645 soft ball'	0.115	53	0.162
Airgun that penetrates intact skin	0.518	107	2.96
Airgun that penetrates human eye	0.518	40	0.41

Air guns have muzzle velocities of 76 - 290 m/second compared with pistols, which have muzzle velocities of 228 - 448 m/second.

Social and medical implications

A study of toy gun-related injuries in which 33% of injuries were to the eye suggests that behaviour patterns learnt in childhood may be responsible for the surging incidence of adult gun-related deaths.[5] This is of concern in our Cape Town community, which currently has a rising incidence of firearm-related deaths among children and adolescents.[6]

Undesirable features of toy guns extend beyond the immediately obvious. The projectiles of the spring-loaded airguns that caused the injuries reported in this study are known to jam in the magazine with great frequency. This encourages children to peer down the barrel. The projectiles are small enough to be aspirated and have the potential to cause death by asphyxiation. During the time of our initial successful media campaign more than 20 projectiles were retrieved from various orifices of children attending Red Cross Children's Hospital casualty. In a similar study 2 children died of asphyxiation following aspiration of projectiles.[5] Public awareness needs to include these aspects of danger associated with such toys.

In addition these guns are so realistic that their use in various forms of attempted robbery in our communities has been documented. Appearance, size of parts, as well as ballistic features should be taken into consideration when drafting legislation. The importance of legislation as well as public awareness is emphasised in four articles describing life- and eye-threatening pellet gun injuries.[4,5,7,8]

Children in the age group most commonly injured by toy guns are unlikely to heed, or may be too young to read, warnings included with the packaging. The package insert of the guns described in this study has pictorial instructions warning against shooting at eyes and faces, but the text is all written in Chinese (Fig. 3). In this study, even children already injured by the toys showed little subsequent concern for safe handling of guns. Similarly, when observed in the clinic parents of injured children did not seem concerned about the safety of their child's behaviour. A recent report reveals that the

Fig. 3. Pictorial safety instructions with Chinese text.

main cause of injury resulting in enucleation in Canada was the airgun. It suggests that the setting in which the injuries occurred is demonstrative of the lack of insight of parents and children into the dangers of airguns.[8] This is confirmed in a survey which showed that parents who kept firearms in the home substantially underestimated the risk of injury this posed to their children.[9] It seems reasonable to assume that the misconception that children aged 6 - 12 years can safely handle a loaded gun would also apply to toy guns.

The local media campaign to raise public awareness of the danger of toy guns has been followed by a reduction in the incidence of injuries. This could, however, have been the result of changing fashions in toys. Fortunately, unlike real gun injuries, most of the injuries reported in this study occurred in the younger age group, where some parental control is still possible. For this reason the media could play an important role in preventing future injuries, particularly if parents can be discouraged from allowing their children to own such toys. A printed media campaign educating American children and adults about gun safety had no influence on their behaviour.[10] For this reason further studies would be needed to confirm that television is definitely effective in changing toy gun-related behaviour of parents and children before significant expenditure were invested in this mode of education. Legislation banning the existence of toy guns, rather than warning labels or other forms of parental education may be an effective solution to the problem.[5] Energy put into development, manufacture and marketing of unsafe toys needs to be redirected into promotion of attractive, safe and educational toys.

The Quaker Peace Society donated funding to cover patients' transport costs. The South African Police Service performed ballistic testing of the guns for this study and supplied information on the law relating to these guns and the role of the police service in relation to this spate of injuries. Chief Professional Nurse D Powell, Chief Professional Nurse Y Jacobs and staff recognised the surge of injuries, collected the cases, and initiated media publicity.

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