

## Injury

# Air weapon injuries: a serious and persistent problem

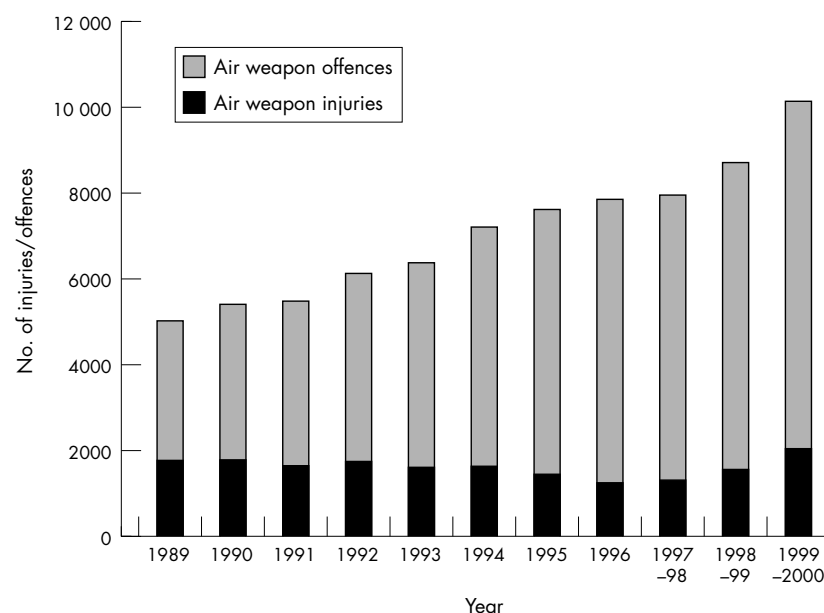
H Ceylan, A McGowan, M D Stringer

## Air guns and rifles are potentially lethal weapons

At first sight, air guns and air rifles may appear relatively harmless but they are in fact potentially lethal weapons. They use the expanding force of compressed air (or gas) to propel a projectile down a barrel and have been in general use since the time of the Napoleonic wars. The projectiles are usually lead pellets or ball bearings. Technological refinements have increased the muzzle velocity and hence the penetrating power of these weapons. In a review of experimental studies, DiMaio concluded that the critical velocity for penetration of human skin by an air gun pellet was between 38 and 70 m/sec (125–230 ft/sec).<sup>1</sup> Most modern air weapons exceed this velocity and many air rifles can deliver a projectile with similar muzzle velocity to a conventional hand gun.<sup>2,3</sup> Air weapons in the UK typically discharge a 0.177 inch or 0.22 inch calibre pellet of the diabolo waisted type, although several other pellet designs exist.<sup>4</sup>

Injuries from air weapons can be serious and even fatal.<sup>3,5-9</sup> This has long been recognised in the United States where all types of firearm injuries occur

more frequently in children than in the United Kingdom. Several case reports from the UK have highlighted the dangers<sup>10-14</sup> but have tended to focus on specific injuries to the eye or brain.<sup>10,15-17</sup> Air weapon injuries commonly involve teenage boys.<sup>18,19</sup> Our local urban experience in Leeds confirms this observation. A retrospective review of accident and emergency records at St James's University Hospital between January 1996 and June 2001 identified 73 injuries caused by air weapons (unpublished data). Thirty six (49%) patients were aged 18 years or less (median 15 years, range 4–18 years) and 29 (81%) were male. In 16 children the pellet penetrated the skin and in four this resulted in intra-abdominal or deep cervical trauma. In our series and others, approximately one third of injuries involved the head or neck. Most are reported to occur in public places or at home. They are predominantly a result of accidental shooting by a friend, relative, or the victim himself, usually in the absence of adult supervision.<sup>6,16,17</sup> Intentional shooting is uncommon,<sup>7,20</sup> but did account for at least six of our cases.



**Figure 1** Notifiable offences recorded by the police in which air weapons were involved and were reported to cause injury (Crime Statistics, England and Wales, 1999).<sup>22</sup>

## CRIME STATISTICS

In contrast to Scotland, the number of recorded air weapon offences in England and Wales has increased steadily since 1989 (fig 1).<sup>21,22</sup> For the year beginning 1 April 1999, there were 16 946 firearms offences in England and Wales, 10 103 (60%) of which involved air weapons.<sup>22</sup> Even allowing for a change in the counting rules for recorded crime in 1998, which expanded the coverage of less serious violence and minor criminal damage, the number of air weapon offences notified in 1999/2000 was 17% higher than in 1998/99. When air weapons were involved in an offence, they were nearly always fired (95% of offences). In most cases, this resulted in property damage but in 20% of offences they caused injury. Because air weapons are frequently used and are usually fired, they generated the largest number of all firearm injuries (1977) in 1999/00 (fig 1); these injuries were deemed to be serious (requiring admission to hospital or resulting in shock, fracture, or multiple wounds) in 171 (8.6%) cases although there were no recorded fatalities. Children are likely to be frequently involved in these offences as they account for the majority of injured victims in both the UK and USA.<sup>4,5,17,23</sup>

In the USA, where air weapons have often been regarded as toys,<sup>24</sup> Christoffel and colleagues<sup>5</sup> identified 52 000 injuries caused by air weapons in a two year period in the early 1980s, and McNeill and Annett<sup>23</sup> documented almost 33 000 cases during a one year period a decade later. In both studies, boys aged 10–14 years old were the main victims and perpetrators of these, mostly accidental, shootings.

## SERIOUS AND FATAL INJURIES

Air weapons are an important cause of serious eye injuries in adolescent boys. This was first highlighted in the UK in 1973<sup>15</sup> and continues to be a significant problem.<sup>17</sup> Sharif and colleagues<sup>16</sup> analysed 41 consecutive ocular injuries from air weapons during a 10 year period in Glasgow, more than 80% of which were in teenage boys. Four eyes needed enucleation and almost 40% of involved eyes had a final visual acuity of less than 6/60. Fatalities have also been described, particularly after pellets have penetrated the head, neck, or chest. Shaw and Galbraith<sup>10</sup> reported two deaths from penetrating cranial injuries: a 3 year old boy who sustained a subdural haematoma and a 15 year old boy who died 19 months later from rupture of an abscess surrounding a pellet. Although the Home Office criminal statistics show no fatalities in recent years, *accidental* deaths in children from air weapon injuries have occurred in England and Wales.<sup>4,25</sup>

## MANAGEMENT OF INJURIES

Air weapon injuries in children should be managed in the same way as any low velocity gun shot injury. Subcutaneous pellets are best removed. Urgent specialist referral is indicated for cranial, ocular, chest, abdominal, or vascular injuries as they may require emergency surgery. Cardiac injuries may be rapidly fatal.<sup>6</sup> Penetrating abdominal injuries involving hollow viscera or major blood vessels need prompt exploration and repair. Intracranial air weapon pellets should be removed if possible.<sup>10</sup> A pellet in lung parenchyma or muscle may be safely left in situ but there is a risk of infection.<sup>7, 20</sup> A pellet that has penetrated a joint or is associated with a fracture requires skilled orthopaedic management. A pellet lodged near a major blood vessel or nerve should ideally be removed.<sup>18</sup> The possibility of intravascular embolism must be considered if the pellet is absent from a suspected entry site and there is no exit wound; numerous examples of arterial and venous embolism of an air weapon pellet in children have been described.<sup>6, 12, 13, 26</sup>

The risk of lead intoxication from a retained air gun pellet is extremely small. Lead poisoning has been reported in a 4 year old boy who ingested a pellet that lodged in his appendix,<sup>27</sup> but we have been unable to find any other case of lead poisoning in a child with a retained air weapon pellet. Of 11 cases of retained orbital pellets described by Jacobs and Morgan,<sup>28</sup> none was subsequently found to have a raised serum lead concentration.

## THE LAW

There may be as many as 4 million air weapons in households in the UK.<sup>29</sup> What safeguards does the law provide on the use of air weapons by children? Despite having some of the strictest gun control laws in the world, most conventional air weapons in the UK do not require a licence and children under 14 years are allowed to use an air weapon if supervised by a person aged 21 years or more.<sup>30</sup> The law relating to these weapons in England and Wales has changed little in 30 years. However, the government is currently considering reclassifying some existing air weapons as "dangerous air weapons" and raising the age limit for such potentially lethal weapons.<sup>30</sup>

In conclusion, air weapons are capable of inflicting serious and potentially fatal injury in children. Little progress has been made since 1981 when Batch stated "The belief that airguns are harmless and have little penetrating power is widespread among children and their parents".<sup>11</sup> The rarity of air weapon injuries originating from gun clubs and sporting associations indicates that safe and responsible practices have been developed by these agencies, but careless or criminal use of air weapons by teenage boys outside these organisations is a concern. Several measures to reduce air weapon injuries have been suggested. These include stricter legislation on the ownership and use of air weapons,<sup>3, 17, 31</sup> promoting awareness of their hazards by wider education of the public, parents, and retailers,<sup>5, 19</sup> reducing the penetrating power of the pellet, and restricting use to supervised target ranges. It is time for a co-ordinated approach from the public, police, sporting associations, manufacturers and retailers, and politicians.

*Arch Dis Child* 2002;**86**:234–235

.....

## Authors' affiliations

**H Ceylan, M D Stringer**, Departments of Paediatric Surgery, Leeds Teaching Hospitals NHS Trust, Leeds, UK

**A McGowan**, Accident and Emergency Department, St James's University Hospital, Leeds LS9 7TF, UK

Correspondence to: Mr M D Stringer, Level 8, Gledhow Wing, St James's University Hospital, Leeds LS9 7TF, UK; mdstringer@dial.pipex.com

## REFERENCES

- 1 DiMaio VJM. Penetration of skin by bullets and missiles. *The Forensic Science Gazette* 1980;**11**:1–2.
- 2 Harris W, Luteran A, Curreri PW. BB and pellet guns—toys or deadly weapons? *J Trauma* 1983;**23**:566–9.
- 3 Naude GP, Bongard FS. From deadly weapon to toy and back again: the danger of air rifles. *J Trauma* 1996;**41**:1039–43.
- 4 Milroy CM, Clark JC, Carter N, et al. Air weapon fatalities. *J Clin Pathol* 1998;**51**:525–9.
- 5 Christoffel KK, Tanz R, Sagerman S, Hahn Y. Childhood injuries caused by nonpowder firearms. *Am J Dis Child* 1984;**138**:557–61.
- 6 DeCou JM, Abrams RS, Miller RS, et al. Life-threatening air rifle injuries to the heart in three boys. *J Pediatr Surg* 2000;**35**:785–7.
- 7 Radhakrishnan J, Fernandez L, Geissler G. Air rifles—lethal weapons. *J Pediatr Surg* 1996;**31**:1407–8.
- 8 Spitz L. Air rifle injuries in children. *S Afr Med J* 1969;**43**:557–60.
- 9 Beaver BL, Moore VL, Peclat M, et al. Characteristics of pediatric firearm fatalities. *J Pediatr Surg* 1990;**25**:97–100.

- 10 Shaw MDM, Galbraith S. Penetrating airgun injuries of the head. *Br J Surg* 1977;**64**:221–4.
- 11 Batch AJG. The air rifle: a dangerous weapon. *BMJ* 1981;**282**:1834.
- 12 Burkhitt DS, Dhasmana JP, Mortensen NJ, Wisheart JD. "Bullet embolism" to the popliteal artery following air rifle injury of the thoracic aorta. *Br J Surg* 1984;**71**:61.
- 13 Colquhoun IW, Jamieson MP, Pollock JC. Venous bullet embolism: a complication of airgun pellet injuries. *Scot Med J* 1991;**36**:16–17.
- 14 Okoye BO, Losty PD, Lloyd DA, Lamont GL. Air gun injuries in children: a continuing cause for concern. *J R Coll Surg Edinb* 1997;**42**:353–4.
- 15 Bowen DI, Magauran DM. Ocular injuries caused by airgun pellets: an analysis of 105 cases. *BMJ* 1973;**i**:333–7.
- 16 Sharif KW, McGehee CN, Tomlinson RC. Ocular trauma caused by airgun pellets: a ten year survey. *Eye* 1990;**4**:855–60.
- 17 Shuttleworth GN, Galloway PH. Ocular air-gun injury: 19 cases. *J R Soc Med* 2001;**94**:396–9.
- 18 Hutchinson GH. Airgun pellet injuries in children. *Practitioner* 1981;**225**:1058–60.
- 19 Robson WJ, Kumar K. Air weapon injuries in children: a case for education. *Arch Emerg Med* 1985;**2**:17–24.
- 20 Reid IS. Airgun injuries in children. *Med J Aust* 1974;**i**:64–6.
- 21 Scottish Executive. *Recorded crimes and offences involving firearms, Scotland, 1999*. Scottish Executive Report. Crown Copyright. Available at <http://www.scotland.gov.uk/stats/stat-search.asp>. Last accessed July 2001.
- 22 Criminal Statistics England and Wales. Statistics relating to crime and criminal proceedings for the year 1999. Chapter 3: Recorded crime in which firearms were reported to have been used or misappropriated. Available at <http://www.official-documents.co.uk/document/cm50/5001/5001-03.htm#c>. Last accessed July 2001.
- 23 McNeill AM, Annett JL. The ongoing hazard of BB and pellet gun-related injuries in the United States. *Ann Emerg Med* 1995;**26**:187–94.
- 24 Committee on Accident and Poison Prevention. Injuries related to "toy" firearms. *Pediatrics* 1987;**79**:473–4.
- 25 Anon. Boy, 13, dies after air-rifle shooting. *The Independent* 31 July 1999.
- 26 Massad M, Slim MS. Intravascular missile embolization in childhood: report of a case, literature review, and recommendations for management. *J Pediatr Surg* 1990;**25**:1292–4.
- 27 Lyons JD, Filston HC. Lead intoxication from a pellet entrapped in the appendix of a child: treatment considerations. *J Pediatr Surg* 1994;**29**:1618–20.
- 28 Jacobs NA, Morgan LH. On the management of retained airgun pellets; a survey of 11 orbital cases. *Br J Ophthalmol* 1988;**72**:97–100.
- 29 Campbell-Hewson G, Egleston CV, Busuttil A. The use of air weapons in attempted suicide. *Injury* 1997;**28**:153–8.
- 30 Metropolitan Police Firearms. enquiries/air weapons. Available at <http://www.met.police.uk/firearms-enquiries/airguns1.htm>. Last accessed July 2001.
- 31 Christoffel T, Christoffel K. Nonpowder firearm injuries: whose job is it to protect children? *Am J Public Health* 1987;**77**:735–8.