

F. Monticelli · S. Seidl · P. Betz

## Air rifle injury with an entrance through the nose: a case report and review of the literature

Received: 18 March 2002 / Accepted: 27 June 2002 / Published online: 4 September 2002

© Springer-Verlag 2002,

**Abstract** A case of attempted homicide is reported where a 31-year-old woman was shot in the left nostril with a pellet from an air rifle. The projectile channel reconstruction showed penetration of the nasal septum, the maxillary and sphenoid cavities and the dura mater, with the pellet finally lodging in the anterior cranial fossa between the sinus cavernosus and the internal carotid artery. The patient was finally discharged from hospital in a good physical condition without any neurological symptoms. Although the muzzle velocity of the air rifle was within the legal limits, the present case demonstrates the potential lethality of air weapons considering the site of entrance of the pellet.

**Keywords** Air rifle · Gunshot injury · Potential lethality

### Introduction

An air rifle is a weapon which uses the expanding force of compressed air to propel a projectile down a rifled barrel. Most of the cases of severe injuries caused by air weapons reported in the literature are accidents or attempted suicides [1]. In addition to the velocity and the resulting energy of the pellet, the entrance site highly influences the outcome of injuries [2, 3]. The majority of air weapon injuries with skull penetrations reported in the literature describe an entrance route through the eye, the temple, or the forehead [4, 5, 6]. To our knowledge no case of skull penetration through the nasal cavity has been described so far. Such a case is presented in the following case of an attempted homicide.

F. Monticelli (✉)  
Institute of Legal Medicine, University of München,  
Frauenlobstrasse 7a, 80337 München  
e-mail: fabio.monticelli@rechts.med.uni-muenchen.de,  
Tel.: +49-89-51605111, Fax: +49-89-51605144

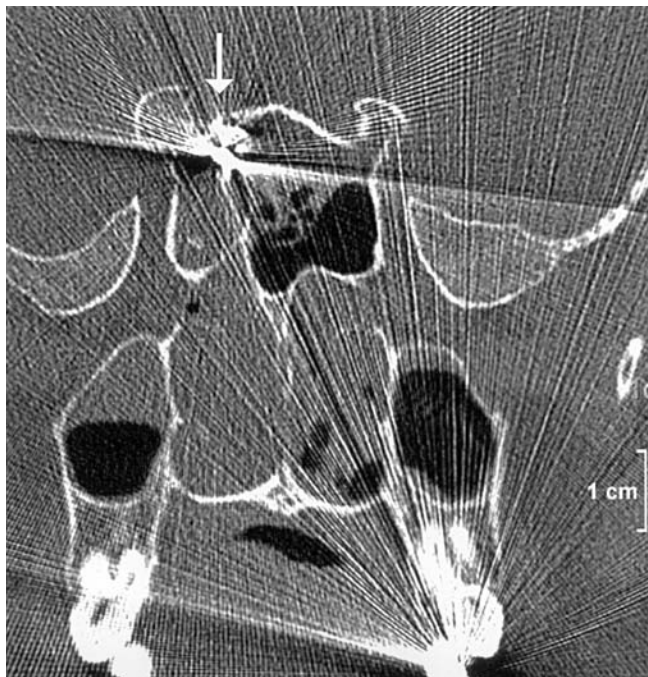
S. Seidl · P. Betz  
Institute of Legal Medicine, University of Erlangen,  
Universitätsstrasse 22, 91054 Erlangen

### Case report

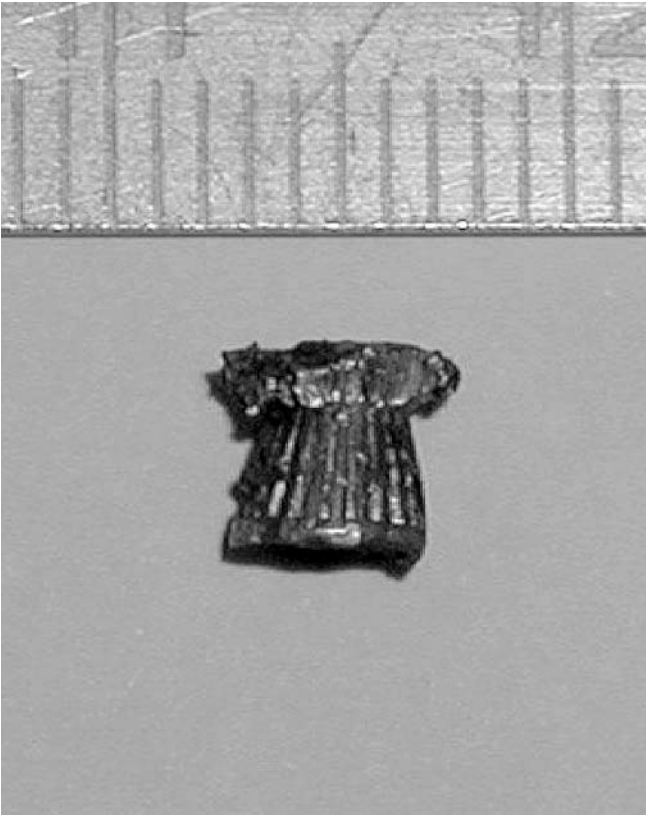
A 31-year-old woman was shot by her husband with an air rifle at short range into the left nostril during a quarrel following an argument. The weapon used was a “Hämmerli” air rifle (type Puma) which, according to the manufacturer’s specifications, can attain a muzzle velocity of 178 m/s (corresponding to 583.98 feet/s).

The victim suffered no loss of consciousness, or neurological symptoms and was immediately placed under medical care. On clinical examination there was no exit wound, a massive liquor-rhoea and bleeding from both nasal cavities was apparent. Further otorhinolaryngological inspection revealed a lesion of the inferior nasal concha in the left cavity and a small defect in the nasal septum.

X-ray examination of the head revealed the presence of two differently sized metallic bodies, which initially seemed to be located in the sphenoid cavity near the anterior cranial fossa and in the left



**Fig. 1** Coronal computed tomography of the head, showing the pellet (arrow) in the anterior cranial fossa



**Fig. 2** Pellet fragment after surgical removal

maxillary sinus, respectively. A subsequent CT-scan finally showed a lesion of the sphenoid bone between the processus clinoides anterior and the tuberculum sellae with the main fragment located just above the floor of the anterior cranial fossa (Fig. 1).

The surgical removal of the fragments, which was performed in the local department of otorhinolaryngology, revealed two fragments of a 4.5 mm (0.177 inches) calibre waisted Diabolo pellet. The main fragment was slightly deformed (Fig. 2) and was lodged in the anterior cranial fossa between the sinus cavernosus and the internal carotid artery. The smaller particle was located in the mucosa of the nasal septum. The reconstruction of the shot trajectory showed that after being fired into the left nostril, the main fragment penetrated the nasal septum, leaving the smaller particle in the mucosa. The main fragment then traversed the left maxillary and sphenoid cavity finally penetrating the dura mater and lodging in the anterior cranial fossa between the sinus cavernosus and the internal carotid artery.

A 10-day course of intravenous antibiotic treatment was given. The patient fully recovered after 2 weeks and was finally discharged in good physical condition. No neurological sequelae during a 6-months follow-up have been observed. At present the offender is charged with attempted murder and is in custody.

## Discussion

The lethality of air weapon injuries has been controversially discussed for many years. Even in 1965 Skurczynski demonstrated that air rifles can develop enough power to cause projectiles to penetrate the skull, depending on the distance between the weapon and the penetrated tissue [7]. Nevertheless, at that time airguns and air rifles were regarded as relatively harmless weapons.

A literature review showed that the majority of the fatal cases involved children under the age of 16, with boys outnumbering girls [8, 9, 10, 11, 12]. The head was the most common part of the body penetrated [13, 14, 15] and the site of entrance may be the eye [16, 17, 18], the temple [19], or the forehead, with consecutive penetration of the brain [20]. Numerous cases led to permanent impairment or even death, while the minority showed a complete recovery with or without surgical removal of the foreign body [21, 22].

The present case shows that low energy weapons with energy values below 7.5 J are able to cause intracranial injuries. To our knowledge the present case is the first one describing penetration of the skull through the nasal cavity due to an air rifle injury. The thin bone lamellae of the paranasal cavities could not prevent the pellet from penetrating the skull. Former assumptions that air weapons could not produce the energy necessary to penetrate the frontal or temporal bone, including the majority of infantile cases, have to be reassessed. The technical development of airguns and air rifles in the last 10–15 years resulting in higher muzzle velocity and energy, is reflected in the higher incidence of air weapon injuries in children and adults [23, 24]. Nowadays it should be undisputed that when used inappropriately, air weapons are potential lethal weapons.

Nevertheless a clear preponderance of children as victims of air weapon injuries reflects the overall incidence of accidental airgun injuries. The infantile and incompletely developed bone tissue highly influences the capacity of the pellet to penetrate the endocranium. However, this case shows that the unusual site of entrance through the nose could lead to severe injuries in adults as well, independently of the muzzle velocity or energy.

**Acknowledgements** The authors thank Mrs. Woods for correcting the manuscript.

## References

1. Cohle SD, Pickelman J, Connolly JT, Bauserman SC (1987) Suicide by air rifle and shotgun. *J Forensic Sci* 32:1113–1117
2. Karger B, Puskas Z, Ruwald B, Teige K, Schuirer G (1998) Morphological findings in the brain after experimental gunshots using radiology, pathology and histology. *Int J Legal Med* 111:314–319
3. Stein KM, Bahner L, Merkel J, Ain S, Mattern R (2000) Detection of gunshot residues in routine CTs. *Int J Legal Med* 114:15–18
4. Shaw MD, Galbraith S (1977) Penetrating airgun injuries of the head. *Br J Surg* 64:221–224
5. Kijewski H, Berg S, Sprung R (1980) Suizid mit Luftgewehr. Untersuchungen zur Wundballistik von Druckluftwaffen. *Z Rechtsmed* 84:209–220
6. Green GS, Good R (1982) Homicide by use of a pellet gun. *Am J Forensic Med Pathol* 4:361–365
7. Skurczynski W (1965) Air rifle gunshot wounds in the region of the neck and head. *HNO* 13:223–226
8. Blocker S, Coin D, Chang JHT (1982) Serious air rifle injuries in children. *Pediatrics* 69:751–754
9. Ford EJ (1987) Air gun injuries in children. *Am Fam Physician* 36:157–158

10. Reddick EJ, Carter PL, Beckesstaff L (1985) Air gun injuries in children. *Ann Emerg Med* 14:1108–1111
11. Spitz L (1969) Air rifle injuries in children. *S Afr Med J* 43: 557–560
12. Miner ME, Cabrera JA, Ford E, Ewing-Cobbs L, Amling J (1986) Intracranial penetration due to BB air rifle injuries. *Neurosurgery* 19:952–954
13. Warlow TA (1996) Firearms, the law and forensic ballistics. Taylor and Francis, London
14. James WRL (1962) A fatal air rifle pellet wound of the brain. *Med Sci Law* 2:153–154
15. Milroy CM, Clark JC, Carter N, Ruddy G, Rooney N (1998) Air weapon fatalities. *J Clin Pathol* 51:525–529
16. Bowen DI, Magauran DM (1973) Ocular injuries caused by airgun pellets: an analysis of 105 cases. *BMJ* 1:333–337
17. Moore AT, McCartney A, Cooling RJ (1987) Ocular injuries associated with the use of air guns. *Eye* 1:422–429
18. Höllerhage HG, Dorfmueller G (1992) Ausgedehnte Hirnverletzung durch Suizidversuch mit Luftgewehr und ultraschallgeschützte Entfernung des tief intrakraniellen Projektils. *Nervenarzt* 63:641–643
19. Jamjoom AB, Rawlison JN, Clarke PM (1989) Airgun injuries of the brain. *Injury* 20:344–346
20. Shaw MD, Galbraith S (1977) Penetrating airgun injuries of the head. *Br J Surg* 64:221–224
21. Rothschild MA, Schneider V (2000) Gunshot wound to the head with full recovery. *Int J Legal Med* 113:349–351
22. Hammon WM (1975) Missile wounds. In: Vinken PJ, Bruyn GW (eds) *Handbook of clinical neurology*, part 23. Injuries of the brain and skull, Part I. North Holland Publishing Co, Amsterdam, pp 505–526
23. Naude GP, Bongard FS (1996) From deadly weapon to toy and back again: the danger of air rifles. *J Trauma* 41:1039–1043
24. Bond SI, Schnier GC, Miller FB (1996) Air-powered guns: too much firepower to be a toy. *J Trauma* 41: 674–678