Int J Legal Med (1998) 111 : 219–223

SHORT COMMUNICATION

W. Rabl · T. Riepert · M. Steinlechner

Metal pins fired from unmodified blank cartridge guns and very small calibre weapons – technical and wound ballistic aspects

Received: 15 July 1997 / Received in revised form: 8 December 1997

Abstract Blank cartridge guns are generally regarded as being harmless and are not considered to be firearms in most countries. A comparison of the legal situations in Germany and Austria concerning weapons is given. There have been several reports of serious injuries and even fatalities due to these weapons. Ballistic experiments show that even unmodified blank cartridge guns and very small calibre weapons can fire wire nails and can inflict potentially fatal injuries even at distances of 50 cm. Two serious injuries inflicted by metal pins fired from a blank cartridge gun and a very small calibre weapon are reported. These cases suggest that such weapons should also be considered handguns in the legal sense.

Key words Blank cartridge gun · Very small calibre weapon · Metal pins · Ballistic aspects · Weapons act

Introduction

The acquisition and possession of firearms is limited by law in most countries. Those prevented by law from obtaining a regular firearm may procure one illicitly or resort to either blank cartridge guns or tear-gas guns, or to 'low impact' very small calibre weapons, air guns or CO_2 weapons, most of which are readily available on the market. It is a known fact that such weapons, when modified or fired at point-blank range, can cause life-threatening or even fatal injuries. Our observations and ballistic experiments show that even unmodified blank cartridge guns and very small calibre weapons can fire parts of wire nails and inflict potentially fatal injuries even at a distance of 50 cm.

W. Rabl (✉) · M. Steinlechner
Institut für Gerichtliche Medizin,
Karl-Franzens-Universität Innsbruck, Müllerstrasse 44/III,
A-6020 Innsbruck, Austria
Fax: +43 512 507 2770

T. Riepert
Institut für Rechtsmedizin, Johannes-Gutenberg-Universität,
Am Pulverturm 3, D-55131 Mainz, Germany

Legal provisions concerning weapons (Table 1)

Germany

In the German Weapons Act (Waffengesetz Deutschland 1994), firearms are defined as shooting devices intended for attack, defence, sport, play or hunting and used to propel projectiles down a barrel (section 1 para. 1 Weapons Act). Small arms are 'firearms using hot gases to discharge projectiles' or 'portable devices intended for discharging ammunition' (section 1 para. 4 Weapons Act). In Germany, regulations governing firearm certificates and compulsory registration are not applicable to blank cartridge guns, irritant guns and signal guns which correspond to their original design certification and which have been approved by the Physikalisch-Technische Bundesanstalt (PTB), or to any such guns where gunpowder in the ammunition does not weigh more than 15 mg (1st Weapons Ordinance).

At present, very small calibre 4-mm M 20 weapons also come under the Weapons Act in Germany and are classified as small arms. However, a gun licence has been required only since 8 March 1976. Before that, the Perfecta 4-mm M 20 pistol (see case 2) could be purchased without a licence as it had been tailored to the legal requirements dating from 1972. The danger of these 4-mm handguns was demonstrated by Tausch et al. (1976) who pointed out simple modifications to increase their efficiency e.g. alterations to the revolvers by closing the gas pressure releasing channels with epoxy resin or augmentation of the propelling charge with more gun powder to increase the kinetic energy of the missiles, so that in both cases fatal injuries on head and thorax could be produced.

According to the latest version of the Weapons Act, a gun licence is now compulsory for very small calibre handguns but proof of why the gun is required is not necessary due to their maximum kinetic energy of < 7.5 J. These guns include above all 4-mm rimfire weapons, long or short, with No. 7 (4.33 mm) or 4-mm M 20 bullets (Tausch et al. 1976).

Table 1 Comparison of legal provisions in Germany and Austria

	Germany	Austria
Legal basis	Weapons Act as amended on 8 March 1976 modified on 25 October 1994 BGBI III 7133-3	Edict of the Weapons Act 1996 on 10 January 1997 BGBI I 12:598-95
Definition: Weapon	Firearms, cut and thrust weapons	Intended to remove or impair, by direct impact, the ability of persons to attack or defend themselves, or to fire shots during the sports of hunting and shooting
Definition: Firearm	Must have a barrel Projectile is propelled down the barrel Intended for the purpose of defense, sport, play or hunting	Weapons from which solid bodies can be shot down a barrel in a determinable direction
Definition: Small arm	Projectile is propelled by hot gases	–
Definition: Handgun	Term is no longer in use Long guns: barrel and lock longer than 30 cm, total length > 60 cm Short guns: all others	Projectile is propelled by ignition of propellent max. total length: 60 cm
Firearms available without legal restrictions to persons over 18 years	Firearms with percussion pin or cap developed before 1 January 1871 PTB-approved blank, irritant and signal guns Air guns, spring-action and CO_2 weapons < 7.5 J	Matchlocks, wheel locks and flintlocks produced before 1871 Air guns or CO_2 weapons of caliber < 6 mm Gallery rifles Other types of low-impact weapons (ministerial ordinance)

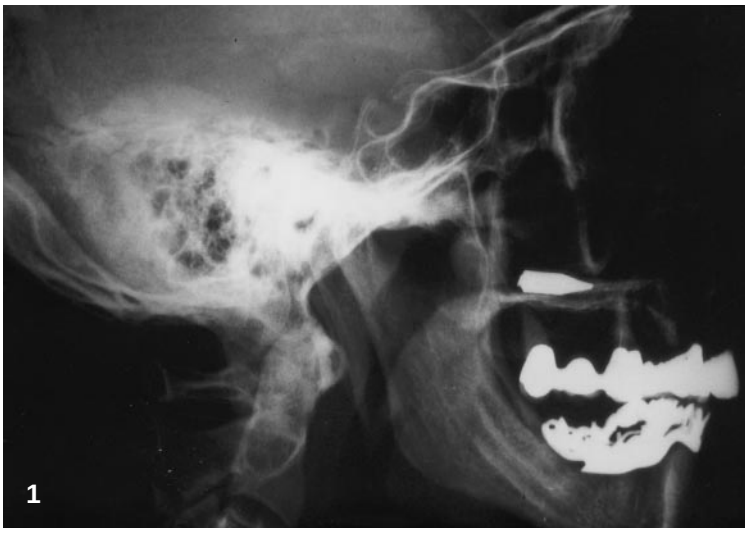

Fig. 1 Case 1; radiographic examination; metal-dense, pointed foreign body on the fundus of the right maxillary sinus

Fig. 2 Case 1; surgically removed pinched-off tip of a butcher's hook 15 mm in length and 4.8 mm in diameter

Austria

The Austrian Weapons Act (Waffengesetz Österreich 1997) defines firearms as weapons from which solid bodies (projectiles) can be discharged along a barrel in a determinable direction. Handguns are firearms with a maximum length of 60 cm from which projectiles can be discharged by igniting a propellant. The acquisition, possession and carrying of a handgun requires a licence. Exceptions to the strict regulations apply to matchlocks, wheel locks, flintlocks and other shotguns produced before 1871, as well as to air guns, CO_2 guns of calibers < 6 mm, gallery rifles and other 'low impact' guns defined as such by ordinance of the Minister of the Interior.

Case reports

Case 1 (GMI Innsbruck)

Case history and clinical findings

A 45-year-old taxi driver was threatened by a passenger and shot at with a 9-mm blank cartridge gun (Walther Big Bore). Initial clinical examination 1 h after the incident showed a 4-cm long, oblique bleeding wound in the area of the right temple. The depth of the wound showed conspicuous greyish-white, wax-like foreign

bodies. Radiography examination revealed a metal-dense, pointed foreign body on the fundus of the right maxillary sinus (Fig. 1). This was found to be the pinched-off tip of a butcher's hook 15 mm in length and 4.8 mm in diameter (Fig. 2). The patient was transferred to the department of oral surgery and the object was removed with the patient under local anesthesia. There were no serious complications and the man was discharged after a few days. His health was impaired for several weeks by a slowly healing trismus.

During reconstruction of the crime the offender, who was arrested shortly after the incident, stated that he had sealed the metal tip in the gun barrel by means of wax and had fired a standard 9-mm blank cartridge at a range of 20 cm. He was sentenced to 12 years imprisonment for attempted murder.

Ballistic examinations

Wax was used to seal 4.8-mm steel tips 15 mm in length and 1.25 g in weight in the barrel of a sample blank cartridge gun (Walther Big Bore 9 mm). The steel tips were discharged with a standard 9-mm blank cartridge after the wax had hardened (Fig. 3). The velocity of the projectiles was measured using a photoelectric barrier with the muzzle end positioned at a distance of 50 cm. Due to the test conditions it is possible that the photoelectric barrier might be triggered by particles other than the projectile e.g. pieces of wax and therefore some of the velocities measured may be too high. The distance of 50 cm was chosen to reduce this risk. At shooting distances greater than 50 cm there was the danger of destroying the measuring device due to low accuracy of the missile.

A total of ten shots produced velocities of 37–231 m/sec. Low speeds were measured for the first two shots, for which only the foremost section of the barrel was filled with wax. As the barrel warmed during the subsequent shots, it could be filled completely with wax, which resulted in velocities ranging from 134 to 231 m/sec (mean: 178 m/sec). Based on the mass of the projectiles, the kinetic energy was calculated to be approximately 11–33 Joule.

To check the results of the velocity measurements and to gain fundamental information concerning the biological effects, the anatomical structure of the head was simulated using a dry whitewood board covered with pigskin. The depth of penetration into wood allows an estimation of the depth of penetration into muscle and/or bone (Sellier 1982). The blank cartridge gun (Walther big bore) was prepared as described above and ten shots were fired at distances ranging from 5 to 25 cm. The skin was perforated at all ranges. The type of skin defect produced allowed estimates of the angle of impact of the metal tip. At orthogonal angles of impact and a firing range of 25 cm, the skin was perforated and the whitewood board was damaged to a depth of 4 mm. Oblique angles of impact caused circumscribed skin defects and superficial impressions in the board.

Since these experiments demonstrated the potential risk of penetrating the skull, some post-mortem experiments were carried out with a total of four shots fired to the temples of two corpses at a range of 20 cm. This was the shooting distance that was measured during the reconstruction of the case. The corpses were layed face-up and the shots were fired at right-angles to each side of the head. The blank cartridge gun was prepared as described above, using the same projectiles as for the pigskin experiments. At oblique angles of impact, which occurred in three shots, the projectiles went through the scalp and caused a circumscribed fracture centre in the temporal bone. At orthogonal angles one projectile penetrated the galea and skull cap and was found lodged in the brainstem (Fig. 4). The thickness of the perforated temporal bone was 3 mm.

Case 2 (RMI Mainz)

Clinical history and autopsy findings

A 79-year-old man was found dead in bed at home. Police investigations revealed that the married couple planned to commit suicide together and the man had shot himself in the head with a 4-mm Perfecta pistol 3 days previously as he lay in the bathtub. The next day he was put to bed by his wife and a female neighbour, who was reportedly unaware of the wound in the left temple because the man had worn a cap as usual. His wife noted down the further course of the symptoms of his injury until death occurred.

Autopsy showed a contact wound with a 3.5-mm puncture fracture in the left temporal bone which had been covered with an ordinary plaster. The wound canal went through the right frontal lobe of the brain and was angled toward the right in an upward and backward direction. The projectile, found lodged in the right temporal bone (Fig. 5), was a 23-mm long steel wire nail of 3.5-mm

Fig. 3 Case 1; ballistic examination of steel tip sealed with wax in the barrel of a blank cartridge gun Walther Big Bore 9 mm

Fig. 4 Post-mortem experiment; magnetic resonance image, firing range 20 cm; steel tip located nearby the brainstem

Fig. 5 Case 2; radiographic examination of projectile found lodged in the right temporal bone

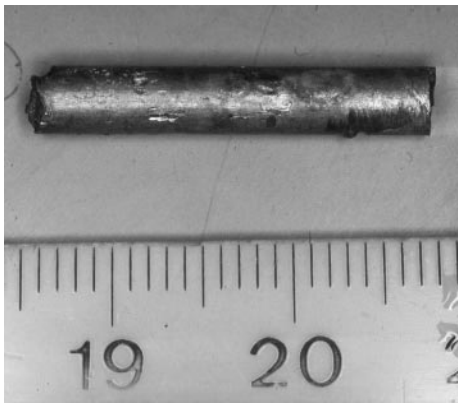

Fig. 6 Case 2; 23-mm long steel wire nail of 3.5-mm caliber, removed at autopsy

caliber (Fig. 6). The cause of death was an extensive subdural hematoma and a diffuse brain swelling.

Ballistic examinations

The gun was a Perfecta pistol (Mayer and Riem, model 50, caliber 4 mm M 20), a very small calibre repeating weapon carrying the approval number PTB 112 and a label limiting the bullet energy to < 7.5 J. Firing the standard 4-mm M 20 ammunition requires adapter cartridge cases. The cartridges in the magazine are presented to the striker by additional loading movements as the weapon is not self-loading.

Several adapter cases in the weapon's magazine had been prepared as propelling charges using 4-mm M 20 cartridges, spherical lead bullets or steel pins fixed with wax, and additional powder. One of the cartridges thus prepared was ignited inside the weapon, causing the injuries to the man who committed suicide.

Discussion

Blank cartridge guns are designed to deter or, if loaded with tear-gas ammunition, to temporarily incapacitate attackers especially for personal protection. The design of modern blank cartridge guns does not allow bullets to be inserted in the "loading chamber" at the back end of the barrel. Blank cartridge guns are readily available in many countries (Geertinger and Voigt 1981; Waffengesetz Deutschland 1994; Waffengesetz Österreich 1997) and registration is not compulsory.

Although blank cartridge guns are generally regarded as being harmless and are not considered firearms in most countries (Geertinger and Voigt 1981; Jacob et al. 1990; Waffengesetz Österreich 1997), there have been several reports of serious injuries and even fatal outcomes (Jacob et al. 1990; Rothschild and Krause 1996; Rothschild et al. 1994,1997; Tausch et al. 1974; Zink 1976), mostly due to illegal tampering of the weapon with the aim of firing live ammunition of the same caliber (Naeve and Schildt 1959; Rothschild et al. 1996). Modifications can also lead to accidental injuries or even backfiring of the shots (Oxley 1977; Rothschild et al 1994; Schulz and Schewe 1978). Also, when shots are fired at close range or with the muzzle held against the body, the direct pressure of the gas contained in the ammunition can cause massive tissue laceration (Geertinger and Voigt 1981; Maxeiner and Schneider 1989; Rothschild 1995; Rothschild and Krause 1996; Rothschild et al. 1994; Sattler and Wagner 1986; Tausch and Wagner 1978). In one case, the pressure of the exploding powder caused a lethal air/gas embolism in the right ventricle of the heart (Rothschild and Maxeiner 1994). The danger of shots fired from unmodified blank cartridge guns, tear-gas guns, irritant or signal guns generally increases as the firing range decreases. The direct action of the gas pressure makes contact shots particularly dangerous. Near contact shots produce smoke soiling and burning of the skin depending on the type of propelling powder (Nadjem et al. 1996).

The gas pressure released when firing a blank cartridge gun also causes a considerable acceleration of foreign bodies inserted in the front part of the barrel, turning these objects into projectiles or missiles which can cause fatal injuries. The relevant literature contains some reports of guns modified with the purpose of igniting or at least accelerating projectiles (Schildt 1957), spherical steel bullets (Maxeiner and Schneider 1989; Rothschild et al. 1994) or ammunition cases (Greiner 1973) by firing a gas cartridge.

Our investigations show that the kinetic energy of one and the same 'projectile', given the same propelling charge, depends essentially on the transmitted gas pressure and thus on the sealing of the barrrel. Using a 9-mm blank cartridge, we managed to accelerate a steel tip to 230 m/sec, which is equivalent to a kinetic energy > 33 J. As already mentioned the fact has to be taken into account that these velocity measurements and therefore the calculations of the kinetic energy may be falsified by wax particles triggering the photoelectric barrier. Nevertheless wire nails fired by an unmodified blank cartridge gun may penetrate the skull and lead to severe brain damage as could be demonstrated in postmortem experiments. Our results indicate that unmodified blank cartridge guns should also be considered handguns in the legal sense according to the Austrian weapons act as they can be used to propel projectiles along a barrel in a determinable direction by ignition of a propellant. Simple modifications of the ammunition of very small calibre weapons can considerably increase the bullet energy and therefore the risk of fatal injuries depending on the body region injured.

References

Geertinger P, Voigt J (1981) Über die Gefährlichkeit des absoluten Nahschusses aus Gaspistolen. Arch Kriminol 168:171–175

Greiner H (1973) Selbstmord mittels Schreckschussrevolver. Arch Kriminol 152:101–105

Jacob B, Huckenbeck W, Daldrup T, Haarhoff K, Bonte W (1990) Suicides by starter's pistols and air guns. Am J Forensic Med Pathol 11(4):285–290

Maxeiner H, Schneider V (1989) Verletzungen und Todesfälle durch Gas-/Schreckschusswaffen. Arch Kriminol 184:84–92

Nadjem H, Bohnert M, Schley K, Pollak S (1996) Befunde an Kleidung und Haut bei absoluten und relativen Nahschüssen mit Schreckschusswaffen. Arch Kriminol 197:175–184

Naeve W, Schildt H (1959) Schreckschuss- und Gasrevolver als gefährliches Werkzeug. Kriminalistik 13:66–69
Oxley DW (1977) An unusual tear-gas gun fatality. J Forensic Sci 2:606–609
Rothschild MA (1995) Tödliche Gaspistolenverletzung als "Arbeitsunfall". Rechtsmedizin 5:53–57
Rothschild MA, Krause DM (1996) Schreckschusswaffen – eine unterschätzte Waffengattung. Gefährlichkeit, Wirkungsweise und strafrechtliche Einordnung. Arch Kriminol 197:65–75
Rothschild MA, Maxeiner H (1994) Unusual findings in a case of suicide with a gas weapon. Int J Legal Med 106:274–276
Rothschild MA, Flener P, Sorgo G (1996) Tatwerkzeug in einem Mordfall: Signalstift oder Schießkugelschreiber? Arch Kriminol 197:31–40
Rothschild MA, Maxeiner H, Schneider V (1994) Cases of death caused by gas or warning firearms. Med Law 13:511–518
Rothschild MA, Karger B, Strauch H, Joachim H (1997) Fatalities from blank cartridge gun shots to the thorax. Int J Legal Med: [in Press]
Sattler W, Wagner HJ (1986) Tödliche Verletzungen durch projektillose Patronen. Kriminalistik 38:485–486
Schildt H (1957) Verschiessen von Geschossen aus Gas- und Schreckschusspistolen. Kriminalistik 11:430–431
Schulz G, Schewe G (1978) Todesfälle mit ungewöhnlichen Schussapparaten. Beitr Gerichtl Med 36:415–418
Sellier K (1982) Schußwaffen und Schußwirkungen I. Schmidt-Römhild, Lübeck, pp 269–272
Tausch D, Wagner HJ (1978) Über zwei tödliche Verletzungen mit Gas- und Schreckschusswaffen. Kriminalistik 32:451–452
Tausch D, Sattler W, Wehrfritz K, Wehrfritz G, Wagner HJ (1974) Tödliche Schussverletzungen mit "unbedenklichen" Gas- und Schreckschussfaustfeuerwaffen. Z Rechtsmed 75:71–77
Tausch D, Sattler W, Wehrfritz K, Wehrfritz G, Wagner HJ (1976) Die Gefährlichkeit der "freien" 4 mm Faustfeuerwaffen. Z Rechtsmed 77:201–218
Waffengesetz Deutschland (1994) Waffengesetz. In der Fassung der Bekanntmachung vom 8.März 1976. BGBl III 7133–3
Waffengesetz Österreich (1997) Erlassung des Waffengesetzes 1996. BGBl I 12:59–95
Zink P (1976) Tödliche Verletzungen durch Schreckschusswaffen. Z Rechtsmed 78:91–96