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CASE REPORT

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Two cases of exenteration of the brain from Brenneke shotgun slugs

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Abstract A case of extended suicide resulted in two fatalities due to craniocerebral gunshots from a 12-gauge shotgun firing Brenneke shotgun slugs. In each case, the gunshot shattered the skull and the brain and in one case, large parts of the brain including a complete hemisphere were ejected similar to a "Krönlein shot". The location of the trajectory close to the base of the skull, the muzzle gases and the ballistic characteristics of the missile contributed to this rare form of head injury. The high mass and the large diameter of the lead missile do not necessitate a high muzzle velocity to crush large amounts of tissue or to produce an explosive type of head injury. The wadding material and the metal screw attached to the Brenneke slug can be of forensic significance.

Key words Brenneke shotgun slug · Gunshot · Exenteration of the brain · Incomplete Krönlein shot

Introduction

Shotgun slugs are large lead projectiles fired from smooth-bore barrels used infrequently for hunting big game (Petty and Hauser 1968; DiMaio 1985; Karger et al. 1996). In some countries, police forces are also equipped with shotgun slugs (Petty and Hauser 1968; Killam 1991). Human fatalities or injuries are very rare but do occur (Petty and Hauser 1968; Rao and Rao 1987; Piva et al. 1988; Ikeda et al. 1989; Pollak and Lindermann 1990; Davis 1993; Strauch and Wirth 1995; Bohnert et al. 1995; Gestring et al. 1996). The extraordinary ballistic characteristics and the sometimes unique design of the missiles can provide additional and unusual evidence for a forensic investigation, but for this the investigator requires knowledge of these special features. Apart from the use of a shotgun slug, the case reported is also interesting in that both gunshots resulted in exenteration of the brain and in one case in ejection of a complete hemisphere similar to a "Krönlein shot" (Krönlein 1899).

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Case report

In a case of extended suicide, a man killed his wife with a contact gunshot to the back of the head from a single-barreled 12-gauge "Baikal" shotgun loaded with a Brenneke shotgun slug. The woman was lying in the bed and her shattered head rested on blood-soaked pillows similar to a sleeping-position. The left hemisphere (approximately 550 g) with the base lacerated but the upper surface almost intact, lay on the quilt (Fig. 1). Multiple small bloodspatter stains, brain particles and bone fragments were present in the room up to a distance of 5 m. The stains on the rear wall were concentrated in a radial pattern (approx. 160°) which also showed a funnel-shaped soot stain and an oval missile defect of 5 × 2.5 cm (Fig. 1). The position of the stains indicated that the

Fig. 1 The female victim in the bed with a brain hemisphere lying on the quilt (arrow). The bloodspatter pattern, the funnel-shaped soot stain and the missile defect in the wall indicate a raised position of the head at the moment of the gunshot

Fig. 2 Brenneke shotgun slugs. From left to right: 1. The deformed lead slug from the case of the female (21.0 g, 23 mm largest diameter). 2. The slug (23.3 g, 22 mm largest diameter) with the wadding material, the screw and also feathers and textiles from perforation of the bed. 3. An identical unfired Brenneke slug with the wadding material attached by a screw (28.5 g lead projectile, 31.8 g complete projectile, 18.5 mm from rib to rib). 4. A complete 12-gauge Brenneke cartridge ("Rottweil", Dynamit Nobel AG)

Fig. 3 The shattered head of the female victim with large lacerations including the forehead and both eyes

Fig. 4 The original position of the head of the man. Several ruptures of the facial skin are seen independent of the large laceration

woman's head was slightly raised at the moment of the gunshot. A large and deformed lead projectile (Fig. 2) was found behind the rear wall in a hollow space. The head of the woman showed a star-shaped laceration of the scalp running from the back of the head over the vault to the face (Fig. 3). The right eye was destroyed and the cerebrum was completely missing (Fig. 3). The cerebellum and the brain stem were severed in the region of the pons and a thin film of subarachnoidal bleeding surrounded the cerebellum. The trajectory most likely passed from the back of the head through the right side of the brain to the forehead close to the base of the skull. Signs of acute anaemia and a fatty liver but no additional pre-existing diseases could be found during autopsy.

The man then shot himself in the forehead while lying on his back in the bed (Fig. 4). The frontal bone fragments were covered with soot. A portion of the scalp with attached hair, skull fragments and brain tissue was found in the vicinity. The scalp of the man showed a star-shaped jagged laceration running from the nose over the forehead and the vault to the back of the neck with several tears radiating to both sides (Fig. 4). Isolated ruptures of the skin due to distension were located at the forehead and the medial aspects of both eyes (Fig. 4). The bones of the vault and the base of the skull were completely shattered and the cerebrum was missing. The cerebellum, which was surrounded by a thin film of subarachnoidal bleeding, and the brain stem were still in situ but showed lacerations and hemorrhages in the upper portions. Signs of acute anaemia and a fatty liver were present. The pillow and the mattress showed a missile defect underneath the head. A deformed lead projectile with wadding material attached to the base by a metal screw and feathers and textiles adhering to it (Fig. 2) was found in a wooden cross-rib of the bed. Next to the bed lay the 12-gauge shotgun which the man had bought the day before the incident. The closed chamber contained a spent cartridge case (70 mm "Rot-

tweil Brenneke") and an identical cartridge case (see Fig. 2) lay on the floor. The blood alcohol concentration was zero in both cases.

The shattered skulls, the ejected or pulpified brains and the large and irregular lacerations of the scalps extending over the nose (Figs. 3, 4) indicate very high intracranial overpressure in both cases. The isolated skin ruptures in the face and forehead of the man in the vicinity of the entrance wound (Fig. 4) may be due to a strong subcutaneous effect of the muzzle gases.

Discussion

Different types of shotgun slugs such as the Sabot slug, the American Foster slug or the French Balle Blondeau vary in design (Sellier 1982; DiMaio 1985; Killam 1991). The Brennecke shotgun slug (Fig. 2) is a pure lead projectile with a unique design because felt and cardboard wads are screwed into the hollowed-out base (Sellier 1982; DiMaio 1985; Killam 1991; Kneubuehl 1995). This shifts the centre of gravity of the slug towards the nose, which allegedly decreases tumbling and improves accuracy (DiMaio 1985; Killam 1991). But the smooth barrel does not provide a tight fit or rotation to the missile as with rifled barrels and this limits the shooting accuracy to a distance of approximately 50 m (Sellier 1982; Killam 1991; DNAG, manufacturer's specifications). Diagonal ribs on the surface of the head of the slug do not contribute to stability but allow the use of choked shotgun barrels where the ribs are pressed flat inside the narrowing muzzle end of the barrel (Sellier 1982; Rao and Rao 1987; Kneubuehl 1995). The ribs, the wadding material and the screw can fragment or detach, as happened in the case of the woman. In cases of perforating slugs, these objects can be of evidentiary value if recovered from the corpse or the scene (Rao and Rao 1987; Pollak and Lindermann 1990).

The considerable penetration capacity of the Brenneke slug commonly results in exit wounds (Rao and Rao 1987; Piva et al. 1988; Pollak and Lindermann 1990). The large calibre of the slug can even be increased by secondary deformation (DiMaio 1985; Fackler and Malinowski 1985; Rao and Rao 1987; Pollak and Lindermann 1990). In the two cases presented, the final diameters were enlarged to about 1.3 times that of the original 18 mm calibre (see Fig. 2). Consequently, shotgun slugs crush large amounts of tissue and cause deep, gaping and sometimes mutiliating wounds with substantial loss of tissue (DiMaio 1985; Rao and Rao 1987; Killam 1991; Gestring et al. 1996) despite the fact that the muzzle velocity of 450–490 m/s (Sellier 1982; Killam 1991; DNAG, manufacterer's specifications) is low compared to bullets from rifles.

In cases of contact gunshots to the head, the high wounding effect of shotgun slugs is enhanced by the portion of muzzle gases entering the skull through the large bony defect. The slug and the rapidly expanding gases together produce severely elevated intracranial pressure (DiMaio 1985) which, in both the cases presented, was sufficient to shatter both skulls and to scatter brain and bone tissue in the room. In the case of the woman, a complete hemisphere and several large parts of the upper brain were ejected rather than pulpified. This comes close to a rare form of exenteration of the brain also known as a "Krönlein shot" (Krönlein 1899). The reason probably is that the trajectory traversed the brain close to the base of the skull so that internal pressure from both the missile and the muzzle gases comes from below and ejects the upper brain from the shattered vault and lacerated scalp (Franz 1910; Mertens 1917; Rißе and Weiler 1988). It appears that "high-velocity" missiles (Pankratz and Fischer 1985; Rißе and Weiler 1988) are not necessary for a Kröhnlein shot if the mass and calibre of the projectile are large and a portion of the muzzle gases can enter the cranium.

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