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ORIGINAL ARTICLE

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# Firearm fatalities and injuries from hunting accidents in Germany

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**Abstract** Accidental hunting firearm injuries and fatalities (257 cases from 1961 to 1992) were evaluated in detail. Most persons responsible for the accident were more than 40 years old and experienced in hunting, and 26% of the gunshot wounds were fatal. In 77% of cases the victim was shot by another person and in 23% the wound was self-inflicted. The firearms/ammunition used were pellets from shotguns (63%), bullets from rifles (31%), shotgun slugs (3.5%) and bullets from handguns (2.5%). In 22% of all accidents from pellets severe eyeball injuries were involved, and 38% of the wounds were caused from a distance of 5 m or less, including all self-inflicted injuries. The most frequent factors responsible for the accident were: improper handling of the firearm (37%), failure to notice the victim (24.1%), covering the victim while swinging on the game (14.8%), ricocheting projectiles (13.6%), inadequate storage of the firearm (11.7%) and mistaking the victim for game (9.3%). In some cases more than one factor contributed to the accident. Defective firearm/ammunition, as the only non-human factor, was involved in only 1.6% of accidents. Some aspects of the prevention and the forensic investigation of hunting accidents are discussed.

**Key words** Ballistics · Gunshot wounds · Hunting accidents · Unsafe hunting practices

## Introduction

Accidental fatalities and injuries from firearms during hunting constitute a significant fraction of all accidental shooting incidents. Depending on the country and geographic region, estimates vary between 7% and 60% (Copeland 1984; Morrow and Hudson 1986; Ornehult and Eriksson 1987). Because the proportion of unintentional firearm fatalities among all firearm deaths is low (Copeland 1984; Morrow and Hudson 1986), the total number of accidental hunting firearm fatalities is also low. Consequently, publications addressing the subject are rare and mostly report only one or a few cases (Ballhause 1957; Holzer 1974; Rabl 1988; Capannesi and Sedda 1992; Strauch and Wirth 1995). Cole and Patetta (1988) conducted a case-by-case review of 78 fatal and non-fatal hunting firearm injuries, and Carter (1989) published statistical data on 6587 hunting firearm accidents collected by the North American Association of Hunter Safety Coordinators. This report is an effort to identify common features in firearm hunting accidents and to assist in the prevention and the forensic investigation of these cases.

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## Material and methods

Case reports on firearm injuries and fatalities in connection with hunting from 1961 to 1992 in Germany were collected and evaluated. The records originated from insurance companies, prosecution departments and from the Institute of Legal Medicine, University of Münster. Twelve cases were excluded because details of the firearm/ammunition or the circumstances were insufficient or because they obviously misinterpreted a suicide as an accident, thus leaving 257 cases for analysis. Most of these records contained reports from the police as well as medical and ballistic reports.

## Results

Some 67% of the accidents occurred during the major small game hunting season from October to January. Of the persons using the firearms 66% were older than 40 years. The age group 16–30 years contributed to only 7.5% of the accidents. The degree of hunting experience was known in 177 cases. Inexperienced hunters (less than 5 years of hunting) caused only 6.2% of accidents. Experienced hunters (more than 5 years of hunting) were responsible for 92.1% of accidents, and the remaining 1.7% were caused by children.

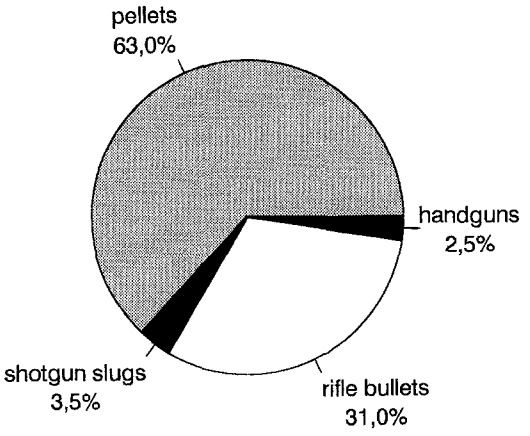


**Fig. 1** The firearms/ammunition used in 257 hunting accidents

In 198 of the 257 cases (77%) the victim was shot by another person, and in 59 cases (23%) the gunshot wound was self-inflicted. Injuries caused by pellets from a shotgun occurred in 162 cases (63%), and 95 injuries (37%) were due to solid projectiles (Fig. 1). The shooting distance (Fig. 2) was known in 253 cases; in 96 (38%) of these it was 5 m or less. This figure includes the 59 (23%) self-inflicted gunshot wounds, all of which were fired from a distance of less than 1 m.

Sixty-eight (26%) of the gunshot wounds resulted in the death of the victim. There were 27 fatalities from shot (16.6% of all accidents with shot) and 41 fatalities from solid projectiles (43.2% of all accidents from solid projectiles). Non-lethal but severe injuries were caused in 76% of all accidents with shot pellets and in 48% of all accidents with solid projectiles. The distribution of the injuries, even when self-inflicted injuries were analysed separately, showed no marked preference for any particular body region (Fig. 3) except that there were 38 injuries to the eye (15%). Of these eyeball injuries, mostly severe penetrations resulting in amaurosis, 35 were caused by pellets from shotguns.

The form of hunting was known in 251 accidents; of these, 35.5% occurred during battues, 25.5% during typical unaccompanied hunting and 12.8% at home or in the car before or after hunting. The remaining 27% were distributed among various other types of hunting. An estimation of the visibility at the moment of the accident was possible in 244 cases. The visibility was unrestricted in 190 cases (77.9%). Very poor visibility due to darkness or undergrowth was recorded for 28 cases (11.5%).

The factor causing the accident was determined in all 257 cases. A total of 334 instances of unsafe hunting practice could be identified (Table 1) because several accidents were caused by a combination of factors. Improper handling of the firearm caused 95 accidents (37%). Although a variety of mechanisms are included here, the majority of these accidents occurred when a person carrying a loaded but secured firearm stumbled or fell while climbing over an obstacle or into a raised hide. In 62 cases (24.1%) the person shooting failed to notice the victim although he/she was not out of sight (lack of observation); shot pellets accounted for 54 of these accidents, solid projectiles for only 8. In 38 cases (14.8%) the accident was

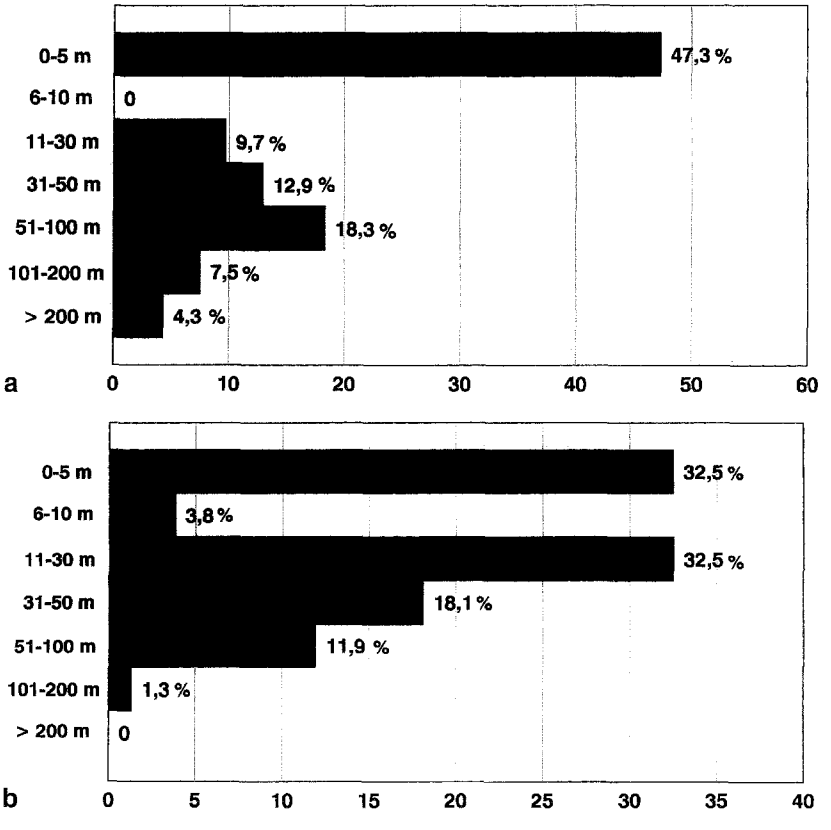


**Fig. 2** The shooting distances in 253 cases. In 4 cases, the shooting distance was not determined. **a** 93 cases of solid projectiles (bullets, shotgun slugs). **b** 160 cases involving pellets from shotguns

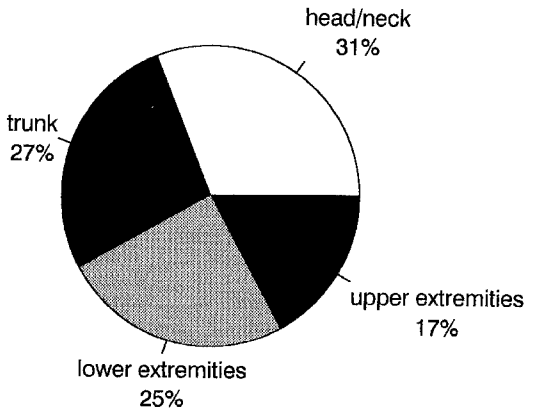


**Fig. 3** The locations of the entrance wounds. The impact site was located in more than one body region in a number of injuries from pellets. So 237 hunting accidents where the impact site was known resulted in 296 wounds of entrance

**Table 1** The factors responsible for the 257 accidents (several factors sometimes combined to cause an accident)

| Factor | Cases |
|---|---|
| Improper handling of firearm | 95 (37%) |
| Victim (in sight) was not noticed | 62 (24.1%) |
| Covering victim while swinging on game | 38 (14.8%) |
| Ricochet | 35 (13.6%) |
| Inadequate storage of firearm | 30 (11.7%) |
| Mistaking victim for game | 24 (9.3%) |
| Underestimation of effective range | 17 (6.6%) |
| Violation of agreements | 17 (6.6%) |
| Defective firearm or ammunition | 4 (1.6%) |
| Incorrect ammunition | 3 (1.2%) |
| Unsuccessful coup de grace | 2 (0.8%) |
| Telescopic sight misused as binoculars | 2 (0.8%) |
| Miscellaneous (e.g. firing from a driving car) | 5 (2.0%) |
| Total | 334 (130%) |

caused by the shooter covering the victim while swinging on the game; shot pellets were involved in 35 of these cases. Ricocheting projectiles were responsible for 35 accidents (13.6%). Inadequate storage of the loaded firearm in the car or at home resulted in 30 accidents (11.7%), most frequently when the firearm was picked up by the muzzle and an object caught in the trigger and discharged the weapon. The frequency of additional unsafe hunting practices is shown in Table 1.

Of the 59 self-inflicted gunshot wounds, 55 (93.2%) were caused by improper handling of the firearm. A defective weapon was responsible for two self-inflicted injuries, and the remaining two were caused by an unsuccessful coup de grace and a case of incorrect ammunition.

## Discussion

The collection of cases of accidental hunting firearm wounds in this study was not systematic due to the rarity of cases. As a consequence, no firm epidemiological conclusions can be drawn. However, the relatively high number of cases documented allows common features in firearm hunting accidents to be identified.

The seasonal variation with a maximum from October to January is an expected finding (Cole and Patetta 1988; Carter 1989; Harruff 1992). Contrary to previous findings (Cole and Patetta 1988), however, the vast majority of persons causing accidents were older than 40 years and were experienced hunters. This cannot be due exclusively to the unsystematic collection of cases. It might be explained by the fact that a hunting safety course is mandatory in Germany, possibly leading to a different age distribution of German hunters. Additionally, a decreased level of caution with the lapse of time may be responsible for the high number of experienced hunters causing accidents.

Our findings on the relative frequencies of the types of firearms used (Fig. 1) are very similar to those of Carter (1989). Apart from the preferential use of different kinds of ammunition for hunting different game, the distinct ballistic properties of pellets (low mass, dispersion etc.) and bullets from centre-fire rifles are reflected by the lower number of fatalities from shotguns, the longer shooting distances in accidents involving bullets and the predominance of pellets in accidents due to particular unsafe hunting practices (e.g. covering the victim while swinging on the game or failing to notice the victim although he/she was not out of sight).

The fatality rate in this series was 26%, compared to fatality rates quoted in other publications of 13% (Carter 1989) and 28% (Cole and Patetta 1988). Because minor injuries may not be reported, the actual fatality rate may be even lower than 13%. A striking finding was the high number of eyeball penetrations by pellets (22% of all accidents from pellets), at shooting distances up to 150 m. Included is one fatality caused by a single pellet from a distance of 60 m; the pellet perforated the thin back of the orbit and entered the brain. The lack of skin makes the eye very vulnerable to pellets even when their penetration power is no longer sufficient to perforate the skin. Pellet dispersion increases the chance of hitting the eye. Security glasses, which are commercially available, are reported to offer protection against 3-mm pellets from a shooting distance of 15 m upwards (Stiefel 1984).

Most accidents were due to violation of basic hunting rules. The most frequent single violation concerned the proper handling of the firearm. Cases when a firearm discharged without touching the trigger because of a fall or a sudden blow predominated. When questioned, most of the hunters involved referred to the safety device, which in their opinion was enough to exclude accidental discharge of the firearm. But safety devices are not reliable, especially if only the trigger and not the firing pin is arrested. The only completely reliable safety device is to keep the gun unloaded. The position of the hair trigger at the moment of discharge was not considered in this study because it cannot be reconstructed. A number of frequent unsafe hunting practices (e.g. failing to notice the victim in sight, covering the victim while swinging on the game,

mistaking the victim for game and violating agreements) can be summarized as over-eagerness to shoot or "blinker phenomenon" and are responsible for approximately 50% of the accidents. Fluorescent orange clothing increases the visibility of the wearer (Cole and Patetta 1988) and might keep some hunters from shooting "human game". Underestimation of the effective range of the projectile endangers people invisible to the hunter. This error was responsible for 6.6% of all accidents. Ricocheting projectiles caused 13.6% of the accidents. In one extraordinary case similar to that described by Brüning (1941), a pellet ricocheted from the wing of a snipe and caused a penetrating wound of the eyeball. The angle of ricochet cannot exactly be predicted but is usually smaller than the angle of impact (Sellier 1971). Signs of ricocheting projectiles are fragmentation before impact and scratch traces or deformation not corresponding to that in tissue or to the "natural" deformation of pellets inside the barrel (Sellier 1971). An elongated entrance wound is likely to be due to a ricocheting and thus tumbling projectile as long as an acute angle of impact can be excluded. These findings should be searched for when investigating a hunting accident.

Comparison of the relative frequencies of these unsafe hunting practices with the findings in the literature is difficult because of varying classifications. According to Carter (1989), the most common error is mistaking the victim for game, which, together with accidents where the victim was beyond the target and in the field of fire caused half of the accidents. Carrying loaded weapons in vehicles was responsible for approximately 15% of accidents. Örnehult and Eriksson (1987) and Cole and Patetta (1988) found that improper handling and incorrect carrying of the firearm caused approximately 50% of accidents.

The subgroup of self-inflicted gunshot wounds accounts for 23% of all accidents in this series and for 35% in the large statistical series by Carter (1989). According to the records, 55 of the 59 cases in our series were caused by improper handling of the firearm. However, accidental self-inflicted gunshot wounds are difficult to differentiate from suicides or attempted suicides (Copeland 1984; DiMaio 1985; Karger 1995). A contact shot is typical for suicide, while a non-contact close range shot is typical for self-inflicted accidents (Nippe 1937; DiMaio 1985; Karger 1995). Unfortunately, most records did not differentiate between contact and non-contact close range shots. Apart from the shooting distance, a thorough investigation should include the entrance wound, the geometry of the trajectory, gunshot residues, backspatter, the firearm, the recovered projectile, the clothing of the victim, an examination of the scene and an effort to reconstruct the events (Karger 1995). Most records showed deficiencies in this respect. Consequently, a small number of disguised suicides may be included in the group of self-inflicted accidents, although the more obvious ones were excluded. It was surprising to find that the possibility of intentionally shooting another person during hunting was considered in very few of the investigations.

Interesting is the fact that a defective firearm or ammunition could be verified in only two cases of self-inflicted wounds and in only four (1.6%) of all accidents. Carter (1989) found defective firearms in 2% of his series. This demonstrates that human error, not technical defects, is responsible for the overwhelming majority of accidents. The knowledge of the most common human errors and of typical features of the resulting accidents outlined above will assist in the forensic investigation of hunting accidents.

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