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## Fatal Injuries Caused by Guns Using Shotshell: Case Reports and Ballistic Studies

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**ABSTRACT:** The authors present six cases of homicide and suicide in which the weapon involved was a handgun using shotshell. The injuries caused are described and the ballistic characteristics of the weapons are studied. Such weapons, which are relatively easy to obtain, are not as innocuous as they may appear, since they may be modified either by changing the barrel or by removal of the device inside the barrel which is intended to prevent the firing of solid slugs.

**KEYWORDS:** pathology and biology, ballistics, shotshell, fatal injury

Apart from shotguns for hunting, guns using shotshell are the only weapons capable of firing projectiles that are sold without restrictions. More and more often, these are the firearms involved in incidents with medicolegal consequences (assault and battery, homicide and suicide) [1], even if they do not always cause fatal wounds [2].

These handguns are revolvers or pistols with a restricted barrel that prevents the firing of solid slugs. Only shotshell can be used. The restricting device is usually a bar, a cross-piece or a choke (Fig. 1).

The most common calibers in France are the 22 (5.5 mm) and 9 mm. Various cartridges correspond to the different calibers. Often the lead shot in the cartridges is not calibrated, except in 9 mm cartridges.

According to the decree of August 6, 1987, these weapons were classified as sixth category weapons in the French legislation, that is, they could be sold freely but not

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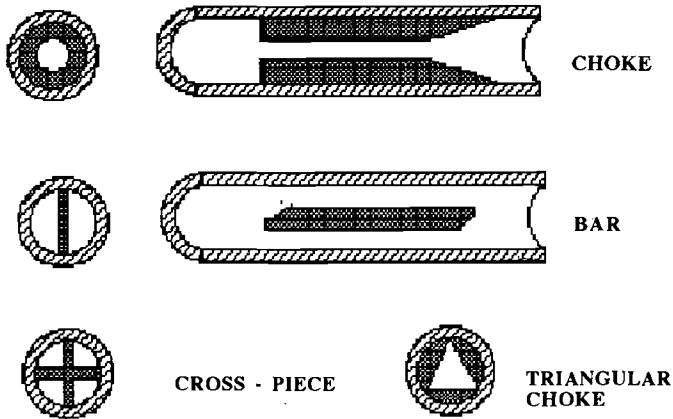


FIG. 1—Mechanical devices preventing the use of solid slugs.

carried or transported. Since January 1993, they are fourth category weapons. The owner is required by law to declare possession of the gun to the authorities.

Between 1988 and 1992, we were concerned with six deaths caused by weapons using shotshell: three homicides and three suicides. Two of the murder victims were women killed by their husband, the third was a girl killed by her mother, who then committed suicide with the same weapon. Two women and one man committed suicide using these weapons.

The ballistic characteristics—penetration, spread and powder stippling—of weapons of the type used in the above cases were studied in a series of test firings to determine their wounding capacity at various ranges and the effect of a modified barrel with the choke removed. The variability of the characteristics observed and the capacity of these weapons for inflicting lethal wounds at close range are the essential point in the observation of these cases.

### Cases 1 and 2

A 45-year-old woman using a 22 handgun, shot her 18-year-old daughter while the daughter was asleep. The weapon was touching the victim and the shot was fired into the left temple. It crossed the temporal muscle, the cranial vault and the brain. Lead shot penetrated the brain and crossed the third ventricle. Pellets were found in contact with the contralateral dura mater. The mother then shot herself with the same weapon pressed above the left ear (she was left-handed). The shot crossed the bone and the left hemisphere of the brain. There was hemorrhage of the left lateral ventricle and considerable subdural hematoma.

### Case 3

A 32-year-old woman was holding a 9 mm during an argument with her husband. Her husband seized the weapon, turned it against her left eye and fired. The lead shot penetrated the skull. A second shot was fired with the weapon in contact with the left ear, penetrating the petrous portion of the left temporal bone. The left hemisphere of the brain was destroyed (Fig. 2).



FIG. 2—Entrance wounds of a 9 mm gunshot used in Case 3.

#### Cases 4 and 5

A 52-year-old artisan jeweller, who was in the process of divorcing his wife, shot her in her sleep with a 9 mm pistol, fired at the nape of her neck. Pellets crossed the occipital bone, partly destroying the occipital region of the brain, causing hemorrhagic attrition of the cerebellar tonsils. The man then shot himself in the right temple. The entrance tunnel was very short, measuring 3 cm, in the right hemisphere and pellets were widely scattered in this hemisphere, some being found in contact with the dura mater, with considerable right subdural hemorrhage.

#### Case 6

The second woman who committed suicide was 45 years old. She shot herself directly in contact with the right side of the temple with a 9 mm weapon. The shot passed through the temporal muscle and bone and caused a loss of substance of the right hemisphere of the brain and a subdural hemorrhage (Fig. 3. *a,b,c*).

#### Materials and Methods

Test firings were conducted with weapons of the type involved in the cases described. These were the 22 Arminius GR, 9 mm Rohm GR, 9 mm Harpax from which the choke had been removed, and 9 mm Derringer. The first two are the most common in France. The three revolvers have similar characteristics (Table 1).

Targets were telephone books, cardboard, cotton wool and softwood. Using 9 mm double load and 22 cartridges, shots were fired from various distances (muzzle in contact, 10 cm, 30 cm and 1 meter) as certain authors have described varying muzzle-to-target distances even in cases of suicide [3]. Three parameters were compared: powder stippling, spread and penetration.

#### Results

The effects of range in two similar weapons of different caliber (22 Arminius GR with a choke, and 9 mm Rohm with a bar): powder stippling was visible up to 30 cm (12 in) on cardboard, and on X-rays up to 10 cm (4 in) with both weapons.

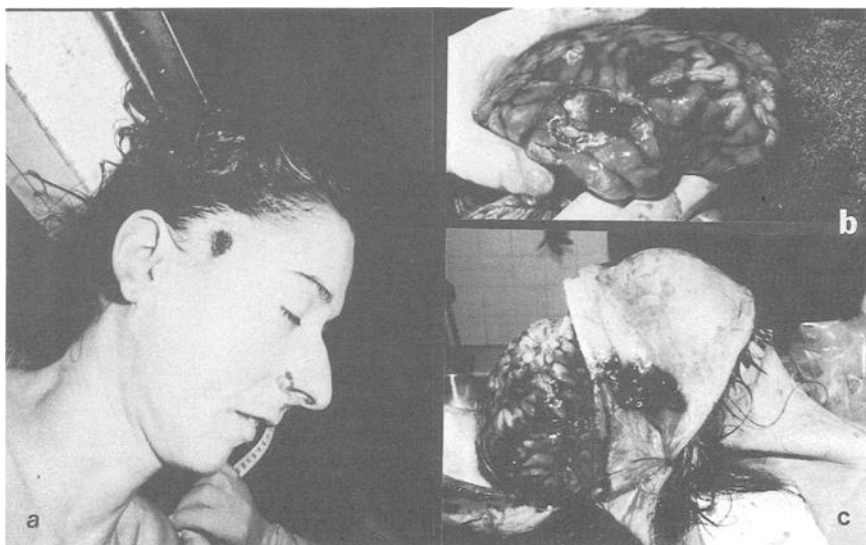


FIG. 3—(a) Entrance wound of a 9 mm shotshell; (b) the lesion of the right temporal muscle and the subdural hemorrhage; and (c) the right hemisphere atrition.

Spread: on cardboard, shotshell started to spread at 10 cm (4 in) with both weapons, spread was grossly the same up to a range of one meter (Fig. 4).

Penetration in cotton/wool and softwood grossly the same up to one meter with both weapons. Some variations were observed, but these were not reproducible. In some cases, at 10 cm (4 in) pellets from the 22 penetrated deeper than the 9 mm in both targets (Table 2) (Fig. 5).

We compared the effects of identical ammunition used in two different 9 mm weapons, the Derringer, with a short barrel, and the harpax that had been modified by removing the choke. Results were radically different. With the modified harpax, spread was 38 times less and penetration was 15 times greater than with the Derringer.

We also compared the modified Harpax with the non-modified 22 Arminius GR and 9 mm. Powder stippling was less with the modified weapon, disappearing at a range of between 15 and 20 cm (6 in and 8 in). Spread was also less with the modified weapon, being 4 cm<sup>2</sup> (1½ sq in) at a range of 30 cm (12 in), and penetration was increased

TABLE 1—Characteristics of the two most common French weapons using shotshell: 22 and 9 mm.

Caliber	5,5 (22)	9 (Flobert two-shot)
Weapon	Arminius HW 7GR	Rohm RG 699
Pistol chamber	8 cartridges	6 cartridges
Length of barrel	64 mm	63 mm
Bore	9 mm	11 mm
Device for prevention of use of solid slugs	6 mm choke	bar
Type of shot	74n° 12 pellets	80n° 75 pellets
Total lead shot weight	1,5 g	7,5 g
Initial velocity	120 m/sec	200 m/s

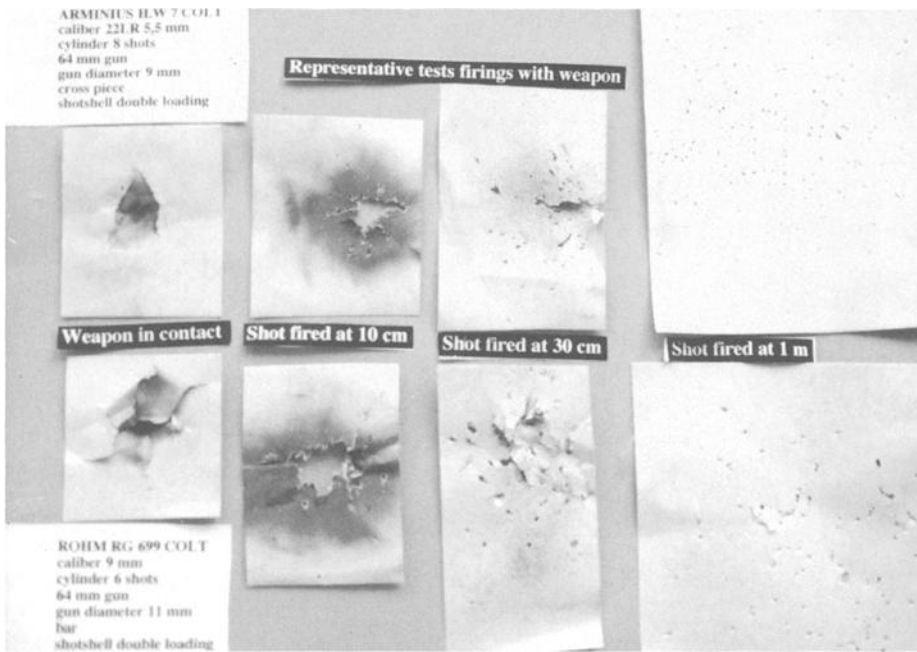


FIG. 4—Comparison of pellet scatter and powder stippling at different ranges with the 22 Arminius GR and 9 mm Rohm GR.

three-fold: at 2.54 cm (1 in), pellets penetrated 431 pages of the telephone book, and still penetrated 52 pages at 120 cm (48 in).

**Discussion**

In these cases of fatal injury, all the shots were fired with the gun touching or pressed against the victim. The entrance wound was always in the head [4] and there was never any exit wound. Powder stippling was consistently observed around the wound. The injuries affected areas where bone was thinnest. Death was immediate in all but one case.

Autopsy findings were similar in all cases: a short tunnel-like trajectory penetrating

TABLE 2—Ballistic study of the 22 and the 9 mm: cotton wool and softwood targets.

	Caliber	22	9 mm
Weapon in contact	Penetration	45 mm	70 mm
	Scatter	14 mm	20 mm
		+3 Isolated pellets	+4 Isolated pellets
Shot fire at 10 cm (4 in)	Penetration	40 mm	50 mm
	Scatter	1 Isolated pellet	2 Isolated pellets
30 cm (12 in)	Penetration	70 mm	55 mm
		1 Isolated pellet at 100 mm	
	Scatter	not measured	Diameter 150 mm

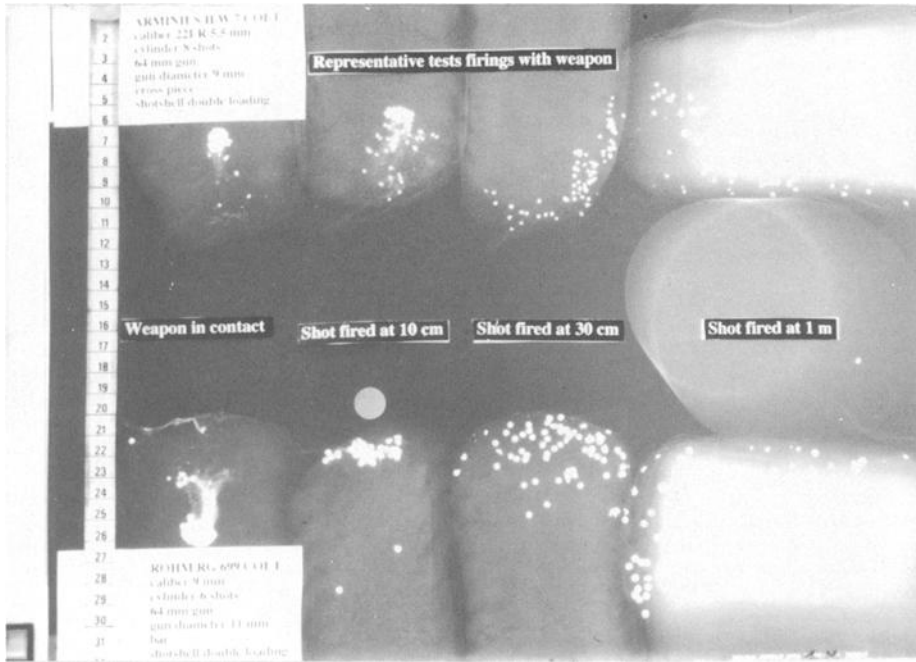


FIG. 5—Comparison of penetration in cotton wool at different ranges with the 22 Arminius GR and 9 mm Rohm GR.

some centimeters into the brain. Pellets lodged within the brain, sometimes in the same hemisphere, sometimes in the opposite hemisphere to the entrance wound. The test firings gave no clear explanation on this point, because it proved to be impossible to reproduce shots with a constant depth of penetration, and this phenomenon was independent of the caliber of ammunition used. The smaller pellets of the 22 caliber cartridges penetrated deeper than the 9 mm.

Constant findings were blood clots, brain pulp, and scattering of pellets within the zone of attrition, which was cone-shaped with a wide base and penetrated into the white substance for a varying distance. These cranio-encephalic lesions are associated with subdural and intradural hemorrhage. The depth of the zone of attrition was not constant. Perforation of bone has also been described with other weapons such as air guns, even though they are reputed less dangerous [5]. The fatal injuries caused by these weapons, always results from shots fired from very close range, with the weapon in contact with the skull.

In summary, with two similar weapons, the ammunition used did not radically affect the wounding characteristics. However, the wounding characteristics did in fact differ from one weapon to another. In particular, the length of the barrel, and above all modification by removal of the choke were important factors. No two shots were identical, even if fired by the same person with the same ammunition. To attempt to discover the range and the position of the person who fired the shot, test firings must be carried out in each individual case to recreate the original conditions as far as possible.

Under the French legislation, these weapons were subject to a certain degree of control as ownership must be declared to the authorities. However, the modifications they may undergo cannot be controlled and so potentially dangerous weapons are in circulation.

This is particularly true in a country where control of all other weapons is strict and handguns using shotshell are the only weapons available to those who wish to possess a firearm.

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