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Rebirth of Exploding Ammunition—A Report of Six Human Fatalities

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ABSTRACT: We report six human fatalities caused by exploding handgun bullets. There appears to be no significant wounding difference between exploding and nonexploding ammunition. The history and diagnostic characteristics of exploding bullets are stressed.

KEYWORDS: pathology and biology, wound ballistics, ballistics, exploding ammunition, X-ray examination, patterned injuries, firearms, handguns

There has been an enduring fascination with bullet designs to enhance wounding capabilities since the invention of firearms. Round bullets for Christians and square bullets for Turks was the pattern envisioned by James Puckle in his design for a machine gun in 1718. The concept of an exploding small arms bullet arose with the advent of percussion primers early in the 19th century. Longmore credits a Captain Norton with the invention of exploding rifle bullets in 1822 [*1*]. The bullets were of two kinds. One contained black powder; the other, fulminate of mercury. In each a cylindrical cavity about a third of the bullet diameter extended from the front nearly to the base. A percussion cap sealed the hole in the nose of the bullet loaded with black powder. A plug of wood sealed the entrance to the hole in the fulminate of mercury bullet.

In 1862, the British army adopted the Metford shell-bullet for use in the converted Enfield rifle. The cavity contained fulminate of mercury and was sealed at the apex with a plug of wax. The bullet was 0.55 caliber and weighed 525 grains empty and 582 grains filled [*1*].

Explosive bullets were used by Union and Confederate forces during the War Between the States [*2,3*]. Such rounds typically consisted of a lead bullet with a copper or iron tube inserted into the front. The tube was filled with black powder, and a percussion cap sealed the front of the cavity [*2*]. These bullets were dangerous to the user of muzzle-loading weapons because the tamping of the load could set off the charge in the bullet. A safer design, introduced by Gardiner in 1863 [*2,3*], was not designed to be detonated by impact. Each bullet had cast inside it a copper vessel resembling a miniature bottle. The neck of this chamber opened at the base and was filled with slow-burning black powder to ignite the main charge. It was intended to have a 1.25-s explosion initiation delay after the gun discharged. These bullets were issued to the Union forces in calibers .54, .58, and .69. They weighed 363 grains

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for the two smaller and 451 grains for the largest caliber. This ammunition was limited to shoulder arms.

Japan and Russia experimented with and used exploding rifle bullets to a limited degree during World War II. The primary use was against objects such as ammunition dumps and aircraft rather than against individuals [2].

The recent appearance of explosive handgun ammunition for civilian use necessitates a review of the wounding principles, diagnostic features, and characteristics of such ammunition. Velet Cartridge Co. and Bingham Ltd. are currently the only two American manufacturers of exploding ammunition. The Velet Cartridge Co. produces semijacketed exploding bullets in the following calibers: .25 ACP, .32 ACP, .380 ACP, 9-mm parabellum, .38 Special, .41 Magnum, .44 Special, .44 Magnum, and .45 ACP. Ordinary commercial hollow-point ammunition has the nose of the bullet bored out. Into the cavity is placed black powder and a lead shot. Over this is placed a percussion cap, which is usually painted red. More recently such ammunition has had the black powder replaced by Pyrodex®, a synthetic black powder, and a pistol primer replaces the percussion cap.

Exploder® ammunition, manufactured by Bingham Ltd., is available in the following calibers: .32 ACP, .380 ACP, 9-mm parabellum, .38 Special, .357 Magnum, .41 Magnum, .44 Special, .44 Magnum, .45 ACP, and .45 Colt. It is prepared in essentially the same way as the Velet Cartridge Co. rounds except that the lead shot is not used (Fig. 1). The primer has usually been painted yellow. Recently, Exploder ammunition with a red percussion cap has been encountered.

Each manufacturer claims that the ammunition can be handled like any other type of ammunition. Each claims the ammunition was developed primarily for an effective nonricocheting and low-penetrating bullet for civilian and police use. Each states that its ammunition delivers more than twice the "stopping power" (not further defined) of high-velocity hollow-point ammunition.

Six recently investigated deaths involving exploding ammunition have permitted us to evaluate its effects upon human subjects. In all cases the ammunition was Exploder, manufactured by Bingham, Ltd.

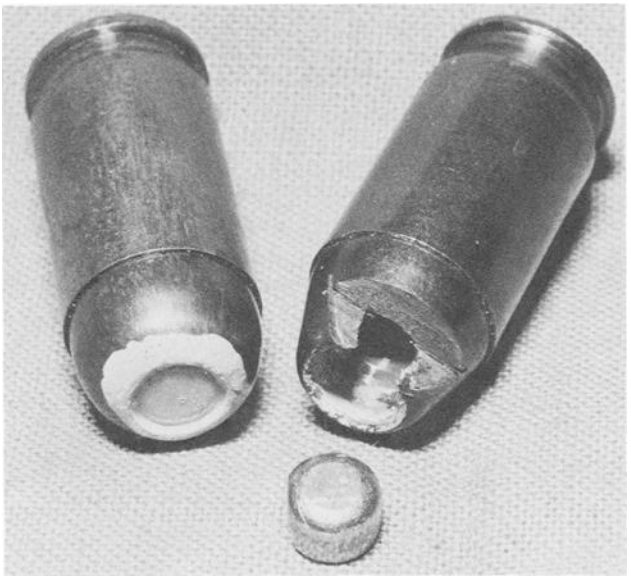


FIG. 1—*Intact and disassembled .380-caliber Exploder ammunition. Note primer and cavity in nose of bullet.*

Case 1

A 24-year-old white male was found in bed with a typical contact stellate gunshot wound of the forehead. A 50-mm (2-in.) barrel Charter Arms .38 Special revolver was beside the left cheek. The revolver was loaded with five Exploder .38-caliber cartridges. Only one had been expended. The scene and circumstances were consistent with a self-inflicted gunshot wound.

X-rays disclosed multiple bullet fragments and a peculiar cup-shaped metallic object. The stellate gunshot wound of the forehead was scorched and had soot deposited about the central margins of the wound. The wound measured 19 mm ($^3/_4$ in.) in its center with four tears of the margins. The tears measured 50, 25, 13, and 10 mm (2, 1, $^1/_2$, and $^3/_8$ in.) (Fig. 2). There were multiple fractures of the frontal, parietal, and anterior basal portions of the skull. A wound track proceeded from front to back, downward, and slightly to the right. The pulpified wound track extended through the medial aspect of the left frontal lobe, cerebral peduncles, and brain stem. The bullet exited the basilar portion of the occipital bone slightly to the right of the midline. A deformed copper-jacketed .38-caliber bullet was lodged in the posterior scalp tissue. A detonated primer cup with red paint, a primer anvil, and a small lead core fragment were located within the wound track at the level of the pons. The fragments (including primer cup and anvil) weighed 91.9 grains.

Case 2

An 18-year-old white male was shot once in the upper abdomen with a 50-mm (2-in.) barrel Smith & Wesson .38 Special revolver from a distance of several feet. The bullet entered just below the xiphoid process and deposited two minute fragments of brass-colored metal in the rectus abdominus muscle. The bullet then perforated the pericardial sac, the apex of the heart, the diaphragm, the left lobe of the liver, the stomach, the tail of the pancreas, the spleen, again the diaphragm, the lower lobe of the left lung, and the eleventh rib posteriorly. The bullet exited the left back, coming to rest in the clothing. X-rays of the abdomen and

FIG. 2—*Case 1. Contact entrance wound illustrating close similarity of characteristics of the surface wound produced by exploding ammunition to those produced by ordinary nonexploding ammunition of like caliber.*

chest revealed lead fragments adjacent to the eleventh rib as well as a cup-shaped object and a three-pronged fragment in the gastric area. Subsequent autopsy resulted in recovery of a detonated yellow primer cup from the stomach and a primer anvil from the adjacent abdominal cavity.

Case 3

A 22-year-old white female was shot once in the left side of the face with .380 Exploder ammunition. A single cruciform wound was in the left cheek. The medial portion of the wound was round with a 2-mm abraded margin. On the adjacent skin were two unburned flakes of powder. Radiating from the 16-mm (5/8-in.) central perforation were three distinct tears. The superior tear was 2.5 cm long and the lateral tear, 5.7 cm. The inferior tear measured 3.8 cm. No scorching of the margins was present. The track of the wound was from front to back. The left maxillary bone was almost completely destroyed. Comminuted fractures of the body and ramus of the left mandible were present. Bullet and bone fragments exited the left cheek immediately anterior to the left ear. The exit hole was a 16-mm (5/8-in.) semilunar tear of the skin. Fragments of bone protruded from the exit. Associated with this perforating gunshot wound were multiple skull fractures of the left middle fossa and multiple cerebral contusions. X-rays revealed many small metallic fragments along the track of the wound. No primer cup was present. Seven small bullet fragments weighing 31.4 grains were recovered. The remainder of the bullet fragments were recovered from the rug near the head.

Case 4

A 56-year-old white male was shot seven times with a .380 automatic pistol. Two of the seven gunshot wounds were graze wounds, one over the posterior right shoulder and the other on the right leg. Neither wound had any unusual characteristics, and no bullet fragments were recovered.

Of the remaining five wounds, two were of intermediate range with powder stippling while three were of indeterminate range with no powder stippling. X-rays revealed four areas in which bullet fragments were concentrated. Each of three areas contained a primer cup. The two intermediate range wounds were in close proximity to one another on the posterior neck. They caused almost complete destruction of the sixth cervical vertebra and spinal cord as well as marked fragmentation of the bullets. No radiographic evidence of primer cups was seen because the primer extensively deformed on striking bone. Each of the three remaining wounds had radiographic evidence of exploding-type ammunition. One wound was located in the supraclavicular portion of the left upper chest. The entrance wound was circular and measured 10 mm (3/8 in.) in diameter with a concentrically abraded margin. The bullet fragmented the left clavicle and penetrated the trapezius muscle. Along the track were found multiple bone fragments and five bullet fragments totaling 35.8 grains. Bullet remnants consisted of two copper jacket fragments, three lead core fragments, and a detonated primer cup, the round smooth surface of which bore specks of yellow paint.

Another wound perforated soft tissue of the left arm with reentry into the left lateral chest. There was fragmentation of the left seventh rib, perforation of the left hemidiaphragm, and laceration of the apex of the heart. In the wound track were located five bullet fragments totaling 71.6 grains. Four were pieces of lead core and one was copper jacket. THe primer cap revealed by X-ray could not be located.

Yet another wound was located on the left lower back adjacent to the midline. The entrance wound was oblong and measured 10 by 6 mm (3/8 by 1/4 in.). The bullet track was forward and to the right. It perforated the right half of the third lumbar vertebra and the ascending mesocolon, ending in the right lobe of the liver. Three bullet fragments totaling

77.5 grains were recovered from the liver. The fragments consisted of a copper jacket, lead core, and a detonated primer cup. Small flecks of yellow paint were present on the surface of the primer cup.

Case 5

A 41-year-old male was shot once in the back to the right of the midline. The wound was of indeterminate range without powder stippling. Radiographic studies revealed a single metallic object behind the sternum at the second costosternal junction. The circular entrance wound measured 13 mm (1/2 in.) in diameter. There was a concentric prominent abraded margin. The bullet perforated the soft tissues of the back, the inferior vena cava, and the right lung and lodged in the undersurface of the sternum. A .45 ACP copper-jacketed projectile weighing 181 grains was recovered. Present in the nose of the projectile was a detonated primer cup, which bore yellow paint.

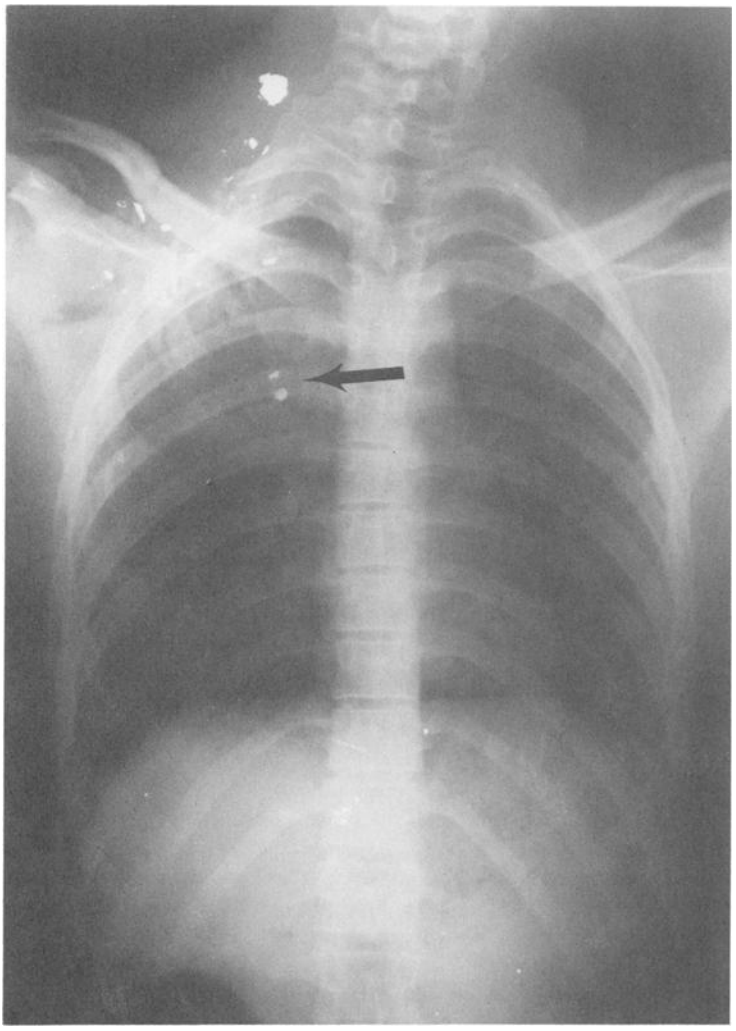


FIG. 3—*Chest X-ray in Case 6. Note how the primer anvil and primer cup can easily be overlooked. The arrow points to both of them lying close together.*

Case 6

A 21-year-old white male robber was shot five times at close range with a 102-mm (4-in.) barrel Smith & Wesson .357 Magnum revolver. Radiographic studies revealed multiple bullet fragments of the head, right chest (Figs. 3 and 4), right forearm, and right leg (Fig. 5). Also identified radiographically were a primer cup in the head, a primer cup and primer anvil in the right lung field, and a primer cup and anvil in the right thigh (Fig. 6).

A detonated primer cup and primer anvil were recovered from the right lung and similarly from the distal right femur. A primer anvil was recovered from the right forearm. A patterned 3-mm round contused abrasion of the skin of the right chest was caused by the impact of the primer cup from a fragmenting Exploder bullet that initially perforated the right thumb (Fig. 7).

FIG. 4—*Close-up of X-ray in Case 6. Arrows point to primer cup and primer anvil.*

FIG. 5—*Case 6. Entrance gunshot wound of right leg; .357-caliber, Exploder ammunition. Note surface similarity to wound caused by nonexploding ammunition of like caliber.*

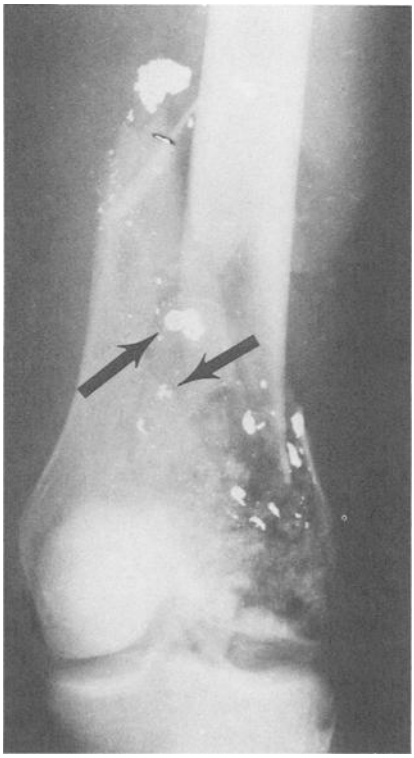


FIG. 6—*Case 6. X-ray of right leg shows component parts of Exploder ammunition. Arrows point to primer cup and primer anvil.*

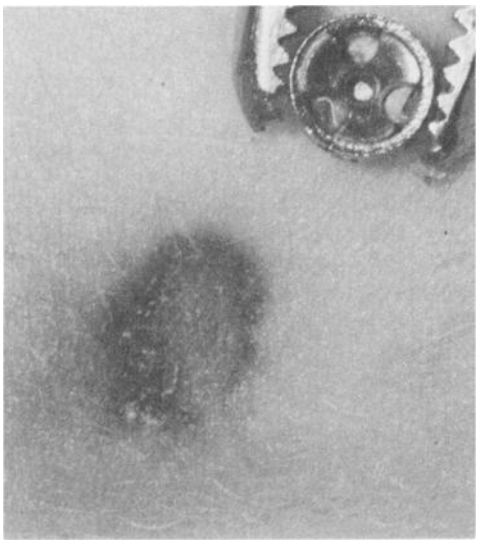


FIG. 7—*Case 6. Pattern of contused abrasion from the impact of the primer on skin. The nondetonated primer is shown close by for comparison.*

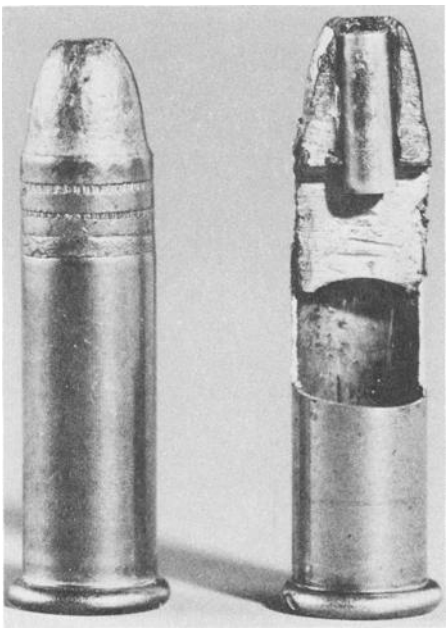
Discussion

Exploder brand ammunition was used in all six cases. Each of eight wound tracks contained a detonated primer. Primer-detonated bullets struck bone prior to or at the time of detonation in all but Cases 1 and 6. In Case 5, even though the primer detonated, it was still in its recess in the nose of the bullet.

Entrance wounds from exploding ammunition were indistinguishable from those inflicted by otherwise similar nonexploding bullets. In all six cases the internal injuries did not appear to be any more severe than those resulting from nonexploding ammunition of similar mass and velocity. The large, irregular appearance of the wound of the cheek in Case 3 is considered to be the result of a tangential path in an area where skin is stretched tightly over a bony framework. This circumstance can result in tearing of the skin with nonexploding ammunition. In Case 6 the primer cup impression on the chest skin resulted when the bullet was fragmented by the right thumb and the primer cup became a secondary missile that struck the skin.

The nature of the ammunition was discovered only when the primer cup and anvil were detected by dissection or X-ray. X-ray examination is important for almost all gunshot wounds. It is possible for a semijacketed bullet to pass through the body and leave behind only its jacket, a vital piece of evidence. X-ray studies are even more necessary to search for evidence of exploding ammunition because the primer cup and anvil are not easily detected by dissection.

Identification of ammunition type is a valuable investigative tool. Exploding ammunition is relatively scarce in most areas of the country. It is theoretically possible for police agencies to check local gunshops to determine the purchase of such ammunition in an attempt to trace a criminal.



Devastator ammunition: (left) *intact bullet and* (right) *a cross section.*

Addendum

Since this paper was written, an attempt was made to assassinate President Reagan using exploding ammunition. .22 Long Rifle (LR) Devastator® ammunition was alleged to have been used. This ammunition is constructed from ordinary commercially available .22 LR hollow point ammunition. A hole, approximately the diameter of the hollow cavity, is drilled in the tip of the bullet. An aluminum cylinder is then inserted in this hole. The cylinder has been previously filled with an explosive mixture and sealed at its open end. The cylinder is inserted with the now-sealed end towards the base of the bullet. The other end of the cylinder is recessed a few hundredths of an inch. RDX explosive was originally used in the cylinder. This was subsequently replaced with lead azide. This latter mixture was in the bullet with which President Reagan was shot. Devastator ammunition was also manufactured in .22 Magnum caliber.

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