Edmund R. Donoghue,[1] *M.D.*; *Mitra B. Kalelkar*,[2] *M.D.*; *Joann M. Richmond*,[2] *M.D.*; *and Shakuntala S. Teas*,[2] *M.D.*

Atypical Gunshot Wounds of Entrance: An Empirical Study

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ABSTRACT: Atypical gunshot wounds of entrance occur when bullets deviate from their stable nose-on trajectory before entering the body. When this occurs, the resulting wound may have an atypical D-shaped appearance. Ray-like abrasions or bruises may radiate from the corners of the wound. Unstable nonaxial flight may be caused by intermediate targets, ricochets, inappropriate weapon/ammunition combinations, poor weapon construction, or use of misaligned silencers. If a bullet is deformed before entrance the configuration of the resulting wound may be bizarre, and the wound configuration may closely resemble the configuration of the striking bullet. Nine cases are presented showing the effects of various intermediate targets. A number of methods for the investigation of atypical wounds are discussed.

KEYWORDS: pathology and biology, wound ballistics, ballistics, gunshot wounds, atypical gunshot wounds, intermediate target, ricochet, criminalistics

Atypical gunshot wounds of entrance occur when bullets deviate from their stable nose-on trajectory before striking the body. The atypical appearance of these wounds occurs primarily for two reasons: first, unstable nonaxial flight; second, missile deformation. Menzies et al [*1*] indicate that unstable nonaxial flight may be caused by intermediate targets, ricochets, inappropriate weapon/ammunition combinations, poor weapon construction, or use of misaligned silencers. Hatcher et al [*2*] state that undersized bullets or lead bullets fired at too high a velocity in quick twist barrels will tumble. They also point out that bullets will yaw during the initial stabilization period after leaving the muzzle.

The forensic science literature contains little regarding the identification of atypical gunshot wounds of entrance. Gonzales [*3*] compared a rectangular wound of the leg with a flattened, recovered bullet that ricocheted from the floor before entrance. The wound showed marginal abrasion and had a ray-like abrasion radiating from one corner. He noted, "where these distortions [of the bullet] occur prior to entrance in the body, they may modify to a considerable extent the appearances and the other characters of the entrance wound." Later, Gonzales et al [*4*] stated, "the bullet may be deformed and flattened before striking the skin, as in a ricochet from a hard flat surface, and leave a wound of entrance larger than

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[1]Deputy chief medical examiner, Office of the Medical Examiner of Cook County, Chicago, IL and associate in clinical pathology, Northwestern University School of Medicine, Chicago, IL.

[2]Deputy medical examiners, Office of the Medical Examiner of Cook County, Chicago, IL.

the original missile, usually of an irregularly ovoid or triangular shape." Jauhari [5], in studying ricochets from metal plates, observed that the bullets became unstable after ricochets and were invariably deformed. He concluded, "atypical wounds of entrance are therefore expected from ricocheting bullets." Spitz [6] described a case where a ricocheting 9-mm jacketed bullet entered the forehead of the victim and produced an entrance resembling a contact gunshot. Test firings using bullets inverted in their cartridge cases reproduced the wound. Stahl et al [7] reported the case of a man shot in the chin with a .357 Magnum lead bullet that passed through a pane of tempered glass. The entrance wound had a stellate configuration suggestive of contact firing. Menzies et al [1] reported the occurrence of atypical entrance wounds in experimentally produced noncontact firings of silenced weapons. Dixon [8] described the occurrence of a large, atypical entrance wound of the head in a young male shot through tempered safety glass with a 9-mm jacketed hollow point bullet. Dixon [9] had earlier pointed out that particulate matter from intermediate targets could mimic the gunpowder stippling seen in close-range gunshots.

Characteristics of Atypical Gunshot Wounds of Entrance

Atypical entrances present most commonly as D-shaped wounds with marginal abrasion (Figs. 1 to 4). Ray-like abrasions or bruises may extend from the corners of the base of the wound (Figs. 1, 2, and 4). These D-shaped wounds represent the lateral projection of the bullet on the body surface; more simply stated, the bullet strikes the body sideways.

More bizarre wounds may be seen when the bullet is deformed before entering the body (Figs. 5 to 9). In these cases the wound configuration may closely resemble the configuration of the striking surface of the bullet. In fact, it may be possible to make detailed point-to-point comparisons of wound and bullet and demonstrate that the bullet was deformed before striking the body. Marginal abrasion is almost always present about these wounds.

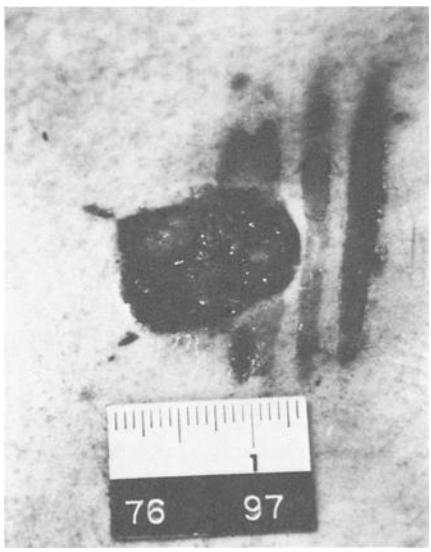

FIG. 1—*Case 1: D-shaped atypical entrance wound produced when a .38 caliber fully jacketed bullet struck one of three pens in the pocket of the victim. Note the ray-like abrasions in the corners of the wound base. About the wound there are three patterned abrasions caused by the impact of the pens against the chest wall. (Case 1 used with kind permission of Russell S. Fisher, M.D., chief medical examiner, State of Maryland. Photograph by Special Agent James Adcock, U.S. Army C.I.D.).*

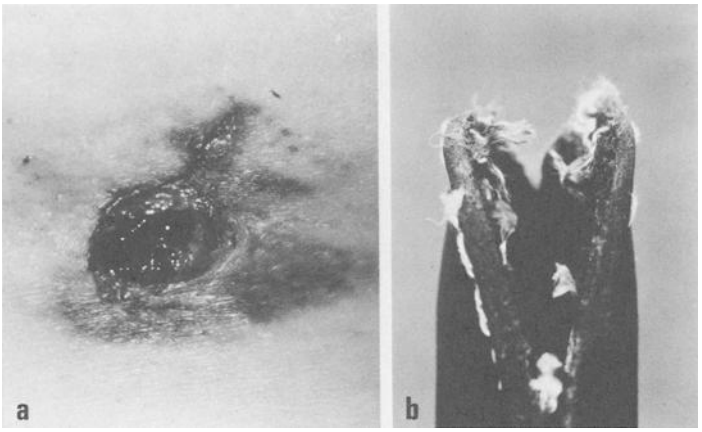

FIG. 2—*Case 2: Atypical entrance wound of the right breast* (a), *produced when a dropped single-action .357 Magnum revolver discharged through the end of a closed holster* (b). *Note the D-shaped configuration of the wound, the laceration of the upper corner, and the triangular bruising on both corners.*

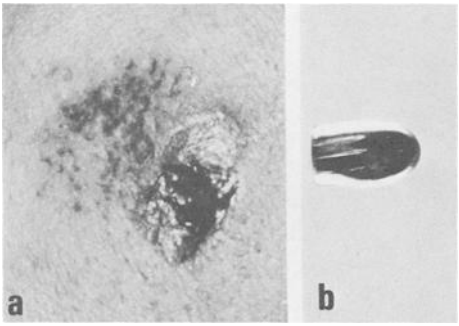

FIG. 3—*Case 3: D-shaped atypical entrance wound of the face* (a) *produced when a .25 caliber fully jacketed semiautomatic bullet* (b) *passed through a wooden door before striking the victim. Note the irregular area of pseudostippling, mimicking gunpowder stippling on the upper margin of the wound.*

Lacerations are frequent in atypical entrances and may cause confusion with contact entrance wounds (Figs. 2 and 6). Particulate matter shaved from the bullet or dislodged from intermediate targets may mimic gunpowder stippling (Fig. 3); this pseudostippling may cause these wounds to be confused with close-range entrances. At times, intermediate targets may be imprinted in the form of abrasions or bruises on the skin about the wounds (Figs. 1 and 7).

Examination of the bullet may also yield important information. Particulate matter from ricochet points or intermediate targets may be present on the recovered bullet. Metal projections on the bullet may cause abrasions or lacerations about the wound (Figs. 4 to 6). The striking surface of the bullet is occasionally imprinted by the intermediate target (Fig. 7). Spitz [*6*] relates a case in which the base of a ricochet bullet was imprinted with the weave of the victim's trousers. Menzies et al [*1*] indicate that shaving of the bullet and effacement of the rifling marks may be seen when silencers are used.

FIG. 4—*Case 4: D-shaped atypical entrance wound of the wrist and the recovered fully jacketed .38 caliber bullet that ricocheted from a portable police radio before passing through the wrist and entering the chest. Three ray-like abrasions are present at the corners of the wound base. A small laceration is present at one corner of the base. Note the angular laceration on the margin of the wound and the pointed projection on the margin of the bullet. (Case 4 used with kind permission of James L. Luke, M.D., chief medical examiner, District of Columbia. Photograph by James L. Luke, M.D.)*

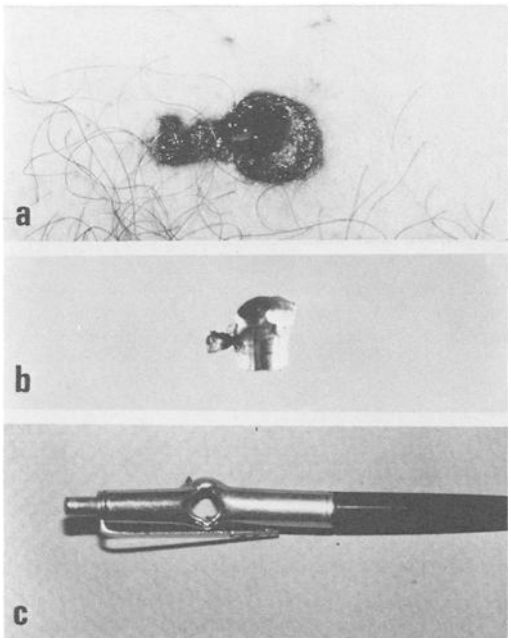

FIG. 5—*Case 5: Key-shaped atypical entrance wound* (a) *produced when a lead .22 long bullet* (b) *passed through a ballpoint pen* (c) *before entering the body. Note the abrasion in the nine o'clock position of the wound and the lead projection on the recovered bullet.*

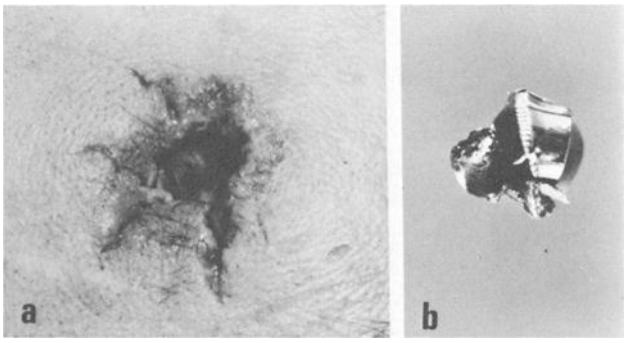

FIG. 6—*Case 6: Lacerated atypical entrance wound* (a) *produced when a .38 caliber jacketed soft point bullet* (b) *ricocheted from a door before entering the head of the victim. A wide margin of abrasion is present about the central defect. Note the complex laceration of the lower margin of the wound; the upper portion of the laceration shows a punched-out defect highly suggestive of the lead projection on the deformed bullet. (Bullet negative has been reversed to facilitate comparison).*

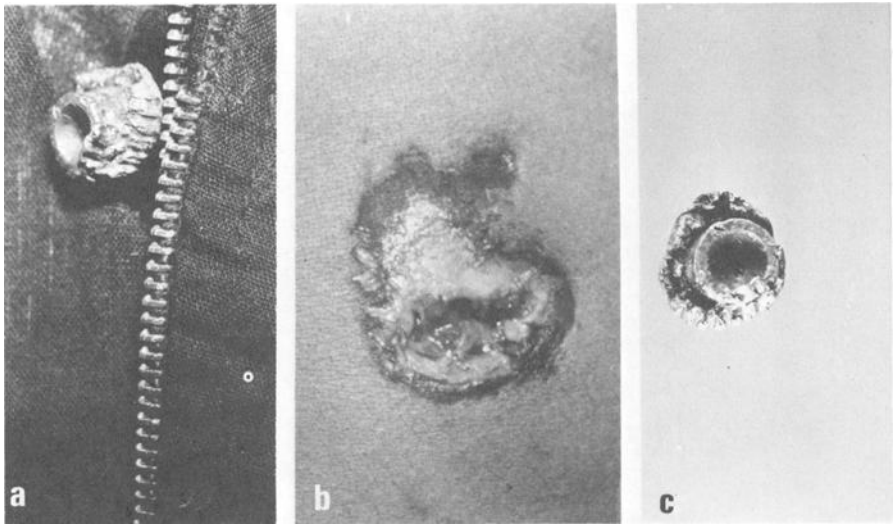

FIG. 7—*Case 7: Recovered .38 caliber lead bullet* (a) *is compared to the jacket zipper it struck before entering the body. Note the imprint of the zipper on the bullet. A large atypical entrance wound* (b) *whose central defect corresponds in shape to the deformed bullet* (c) *was present on the right chest. Also note the imprint of the zipper on the margin of the wound.*

Selected Illustrative Cases

Case 1

A firearms dealer (Fig. 1) was shot with a .38 caliber fully jacketed bullet which struck one of three ballpoint pens in his left shirt pocket before entering his body. A punched-out atypical entrance wound, 30.5 by 20.3 mm (1.2 by 0.8 in.),[3] was present on the left upper

[3] Original measurements were done in inch-pound units.

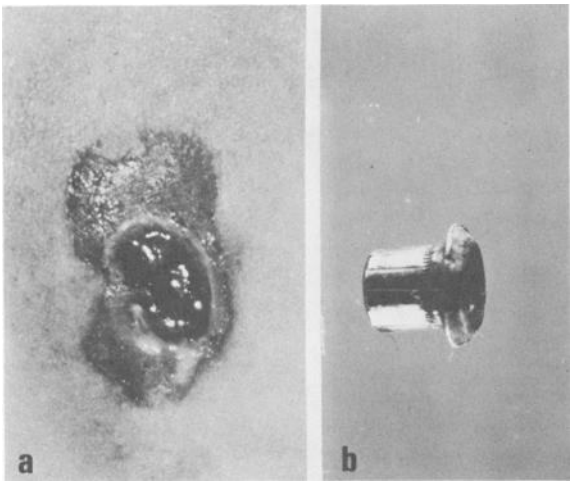

FIG. 8—*Case 8: Atypical re-entrance wound* (a) *produced when a .38 caliber semijacketed hollow point bullet* (b) *passed through the victim's left arm and mushroomed before reentering the chest. Note the large area of irregular abrasion on both margins of the wound.*

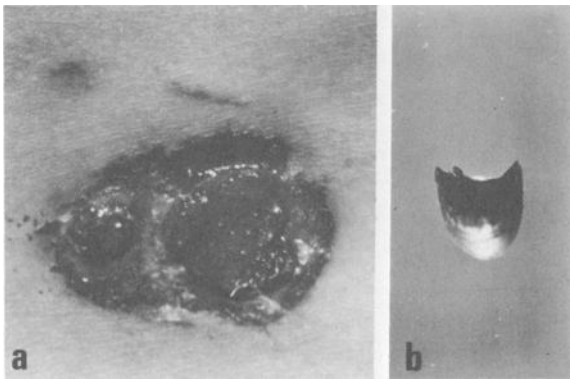

FIG. 9—*Case 9: Complex oval atypical entrance wound* (a) *produced by severe misalignment of cylinder and bore in a .38 caliber revolver. The smaller satellite defect was produced when a jacket fragment* (b) *was sheared off because of the severe indexing problem. The larger central defect was produced by the bullet core and remaining jacket. (Bullet negative has been reversed to facilitate comparison.)*

chest. The central defect was D-shaped, representing the lateral projection of a round-nosed bullet. At both corners of the wound base were ray-like abrasions, 5.1 mm (0.2 in.) each. About the wound were three patterned abrasions caused by the impact of the pens against the chest wall.

Case 2

A middle-aged housewife (Fig. 2) was shot when a single-action .357 Magnum revolver was dropped and discharged a bullet through the end of a closed holster. On the right breast

there was a D-shaped atypical entrance wound, 20.3 by 15.2 mm (0.8 by 0.6 in.). At the upper corner of the wound base there was a laceration, 12.7 mm (0.5 in.) long. A triangular bruise, 12.7 by 5.1 mm (0.5 by 0.2 in.), extended from the lower corner of the wound. On the lower margin of the wound there was a bruise 45.7 by 17.8 mm (1.8 by 0.7 in.). Marginal abrasion was present about the central defect.

Case 3

A male machinist (Fig. 3) was shot with a .25 caliber fully jacketed semiautomatic bullet that passed through a wooden door before entering his body. A D-shaped atypical entrance wound, 15.2 by 10.2 mm (0.6 by 0.4 in.), representing the lateral projection of a round-nosed bullet, was present on the left side of the face. On the lateral margin of the wound there was an irregular area of pseudostippling, 15.2 by 10.2 mm (0.6 by 0.4 in.), caused by wood particles from the door.

Case 4

A police officer (Fig. 4) was shot with a .38 caliber fully jacketed bullet that ricocheted from her portable two-way radio before passing through her wrist and entering the chest. An atypical entrance wound, 20.3 by 15.2 mm (0.8 by 0.6 in.), with circumferential abrasion was present on the front of the wrist. The central defect was D-shaped, representing the lateral projection of a round-nosed bullet. At both corners of the defect were ray-like abrasions, ranging in size from 5.1 to 7.6 mm (0.2 to 0.3 in.). A laceration, 2.5 mm (0.1 in.) long, was present in one corner of the base. On the lateral margin of the wound there was an angular laceration that corresponded to a pointed projection on the margin of the dented bullet.

Case 5

A male automobile mechanic (Fig. 5) was shot with a lead .22 long bullet that passed through a ballpoint pen in his shirt pocket before entering his body. An irregular key-shaped wound was present on the left chest. The central defect of the wound measured 5.1 mm (0.2 in.). At the nine o'clock position on the wound there was an abrasion, 10.2 by 5.1 mm (0.4 by 0.2 in.), that corresponded to a lead projection on the recovered bullet.

Case 6

An adult male (Fig. 6) was shot in the head with a .38 caliber jacketed soft point bullet that ricocheted from a door before entering his body. A lacerated atypical entrance wound, 12.7 by 7.6 mm (0.5 by 0.3 in.), was present of the back of the head. A wide margin of abrasion, 5.1 mm (0.2 in.), was present about the central defect. There was a complex laceration, 12.7 mm (0.5 in.), on the lower margin of the wound. The upper portion of the laceration showed a punched-out defect highly suggestive of a lead projection on the deformed bullet. Three lacerations, each measuring 10.2 mm (0.4 in.), were present on the upper and lateral margins of the wound.

Case 7

A young male gang member (Fig. 7) was shot with a .38 caliber lead bullet that struck the zipper on his jacket before entering his body. A badly deformed lead bullet bearing an imprint of the zipper was recovered from the left ventricle of the heart. A large atypical entrance wound, 15.2 by 7.6 mm (0.6 by 0.3 in.), was present on the right chest. The central

defect corresponded in shape to the deformed nose of the bullet. There was a wide collar of abrasion about the wound measuring 7.6 mm (0.3 in.), except in the nine-to-twelve-o'clock position where it measured 12.7 mm (0.5 in.). On the lateral margin of the wound there was a patterned imprint caused by the impact of the zipper on the chest wall.

Case 8

An adult male bicyclist (Fig. 8) was shot with a .38 caliber semijacketed hollow point bullet that passed through his left arm and mushroomed before reentering the body. A punched out atypical reentrance wound, 15.2 by 10.2 mm (0.6 by 0.4 in.), was present on the left chest. Large areas of irregular abrasion were present on the margins of the wound.

Case 9

A male student (Fig. 9) was shot with a .38 caliber revolver that demonstrated a severe misalignment of cylinder and bore. A complex oval atypical entrance wound, 30.5 by 20.3 mm (1.2 by 0.8 in.), was present in the right supraclavicular region. The punched-out central defect measured 12.7 mm (0.5 in.); a satellite entrance defect measured 7.6 mm (0.3 in.). Two defects resulted when a fragment of the bullet's metal jacket was sheared off because of poor indexing of the cylinder and bore.

Discussion

The recognition of atypical gunshot wounds of entrance is important for at least two reasons: first, it may indicate the existence of an intermediate target, in which case caution should be exercised in expressing any opinion regarding range of fire; second, it may indicate the possibility that a ricochet has occured, which may have bearing on the intent of the shooter. There is, however, at least some evidence that ricochet bullets may behave in a fairly predictable manner, especially at short range [*10*]. Test firings of ground ricochets were conducted at the FBI ranges in Quantico, VA, using Army "E" bobber targets measuring 50.8 cm (20 in.) in width and 101.6 cm (40 in.) in height at a range of 22.9 m (25 yd). The bottom of the target was at ground level. The initial point of aim or impact was concrete or asphalt, on the ground, 6.4 m (7 yd) in front of the target. The ammunition tested was .38 special, .357 Magnum, .45 auto, and 9-mm Luger. Depending upon the ammunition used, the target was hit from 80 to 100% of the time. The target hits displayed a tight grouping and the D-shaped or bizarre configurations characteristic of atypical entrance wounds.

Ideally, the investigation of atypical gunshot wounds begins at the scene of the shooting. At this time, ricochet points or intermediate targets may be identified. Windows and doors are common intermediate targets. Broken glass or splintered wood should bring these possibilities to mind.

X-ray studies are always of value in the examination of gunshot wounds, and these may identify deformed missiles and particulate matter from intermediate targets even before they are recovered from the body.

The autopsy should begin with examination of the clothing worn by the victim. The shape of defects found in the clothing may indicate whether the missile became unstable before or after passing through these items. Trace evidence such as glass may be found on the clothing.

At autopsy, careful observation of the wounds should be made for the morphologic characteristics previously described. The possibility of patterned imprints of the intermediate target on the skin should be kept in mind. Well-prepared photographs of the wound are highly desirable. A microscopic section of the wound is desirable to ascertain whether gunshot residue is present and to identify foreign matter in or about the wound. In-

deed, in the case reported by Stahl et al [7], the nature of the wound was clarified when glass was found in the paraffin-embedded tissue taken by the pathologist.

The pathologist ought to expend as much effort in studying the bullet as the wound. The bullet should be examined immediately upon removal for any particulate matter that might be present. Obvious deformities, flattening, shearing, or mushrooming should be noted. The possibility of an imprint on the striking surface of the bullet needs to be kept in mind. Photographs of the bullet with multiple views should be taken immediately because a deformed or mushroomed bullet may have to be drastically altered to facilitate examination of rifling marks by the firearms examiner. To visualize rifling marks, it may be necessary to break off the lead cap of a mushroomed bullet; a metal jacket that has peeled back over rifling marks may have to be unfolded. If photographs are not taken, there may be no way of demonstrating the original configuration of the recovered bullet.

The recovered bullet should be turned over to the firearms examiner who may, among other things, supply valuable information regarding the functioning of the firearm. In cases where a weapon is recovered, the firearms examiner may supply useful information regarding the safety of the weapon and the possibility of accidental discharge.

Summary

When a bullet deviates from its stable nose-on trajectory, the resulting wound of entrance may have an atypical D-shaped appearance. Ray-like abrasions or bruises may radiate from the corners of the wound. If a bullet is deformed before entrance the configuration of the resulting wound may be bizarre; in these cases the wound configuration may closely resemble the configuration of the striking bullet. Atypical gunshot wounds of entrance may be confused with close-range or contact entrance wounds.

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Address requests for reprints or additional information to
Edmund R. Donoghue, M.D.
Deputy Chief Medical Examiner
Office of the Medical Examiner of Cook County
2121 W. Harrison St.
Chicago, IL 60612