CASE REPORT

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Determination of Direction of Fire from Graze Gunshot Wounds of Internal Organs

REFERENCE: Dixon, D. S., **"Determination of Direction of Fire from Graze Gunshot Wounds of Internal Organs,"** *Journal of Forensic Sciences*, JFSCA, Vol. 29, No. 1, Jan. 1984, pp. 331-335.

ABSTRACT: Graze gunshot wounds of internal organs produce injuries similar to those seen on the skin surface. Careful examination of the distribution of lacerations on the tissue tags along the margins of the graze trough may permit a determination of the direction of fire.

KEYWORDS: pathology and biology, wound ballistics, ballistics, direction of fire, graze gunshot wounds

A previous experimental study by the author [*1*] has shown that the direction of fire of a graze gunshot wound of the skin surface can be determined by a careful examination of the so-called skin tags located along the lateral margins of the graze wound trough. The projections of skin should be examined, preferably with a hand lens or dissecting microscope, to determine which border of the skin tag is lacerated and which is abraded. The lacerated edge of the tag is located toward the weapon, while the abraded margin is away from the weapon. This characteristic appearance is shown schematically in Fig. 1.

It is not dependable to use the direction in which the skin projection points as the direction from which the projectile originates, since this requires a subjective interpretation by the observer. This simplistic approach permits the observer to reorient the skin tags to point in whatever direction he desires and may therefore lead to a false interpretation of direction of fire.

This paper presents three cases with graze gunshot wounds of internal organs; the direction of fire is determined by analysis of the lacerated margin of tissue projections along the graze wound trough and is verified by corresponding skin wound configurations.

Case Material

Case 1

A 24-year-old male was shot once in the chest with a handgun of unknown caliber during a robbery of his apartment.

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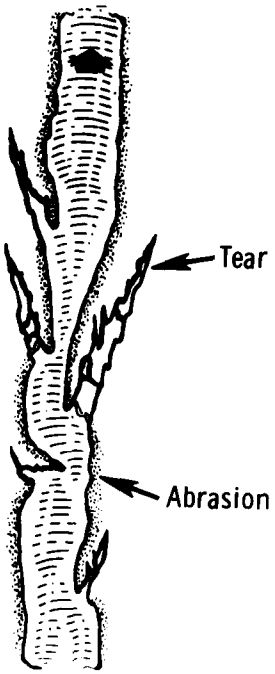

FIG. 1—*Schematic diagram of graze wound, demonstrating characteristics observed under dissecting microscope or with hand lens. The arrow at the top of the diagram indicates the direction of fire (AFIP Neg. 77-10083-1).*

The entrance wound was located on the skin of the left chest, overlying the seventh intercostal space anterolaterally. It was a typical entrance with a circular defect measuring 0.6 cm (1/4 in.) in diameter and an eccentric margin of abrasion measuring a maximum of 0.3 cm (1/8 in.) in width posteriorly. The corresponding exit wound was a slit-like defect without abrasion margin measuring 1.6 cm (5/8 in.) in length located just inferior to the right nipple.

During its course from the decedent's left side to his right side, the projectile perforated both lungs, the liver, the left dome of the diaphragm and the pericardial sac and grazed the posterior aspect of left and right ventricles of the heart.

Figure 2 shows the graze wound trough of the posterior aspect of the heart; it measured 7 cm (2 3/4 in.) in horizontal dimension and 1.5 cm (3/5 in.) in vertical dimension. A large tag of myocardium covered by epicardium was noted on the superior margin of the graze trough; it measured 2.5 cm (1 in.) in length and revealed a laceration on the margin of the tag located toward the decedent's left side.

Since the lacerated margin of the tag is on the side of the tag toward the weapon, according to the principle established in the previous study [*1*], the direction of fire was from the decedent's left to right. This interpretation was verified by the skin wound configurations.

Case 2

During an altercation, a 33-year-old male was shot once in the chest with a .38-caliber handgun at a range of 1.5 to 3 m (5 to 10 ft).

A typical entrance wound was located on the upper left chest medially just below the sternoclavicular joint. It consisted of a circular defect measuring 0.6 cm (1/4 in.) in diameter with an eccentric margin of abrasion measuring a maximum of 0.5 cm (3/16 in.) in width superiorly.

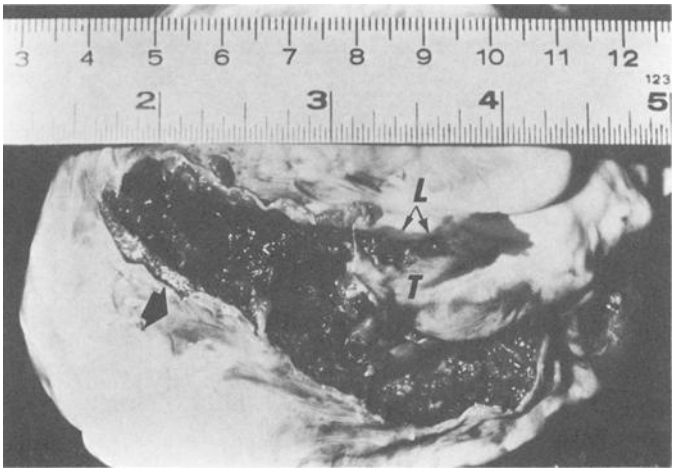

FIG. 2—*Graze gunshot wound of posterior left and right ventricles of heart measuring 7 by 1.5 cm. The configuration of the myocardial tag* (T) *along the superior margin of the trough indicates a direction of fire* (large arrow) *from left to right (decedent and photo as references).* L = *lacerated edge of myocardial tag.*

The gunshot track was directed from the decedent's front to back and markedly downward; it perforated the aortic arch, the thoracic aorta, the left lung, and the left hemidiaphragm and grazed the posterior surface of the left kidney. A projectile was recovered from the left side of the abdomen at the level of the left twelfth rib; there was no exit wound.

The graze wound of the posterior surface of the upper pole of the left kidney is shown in Fig. 3; the upper pole is shown on the right side of the photograph. The graze wound measured 5 cm (2 in.) in vertical dimension and 0.9 cm (3/8 in.) in horizontal dimension. Multiple tags of

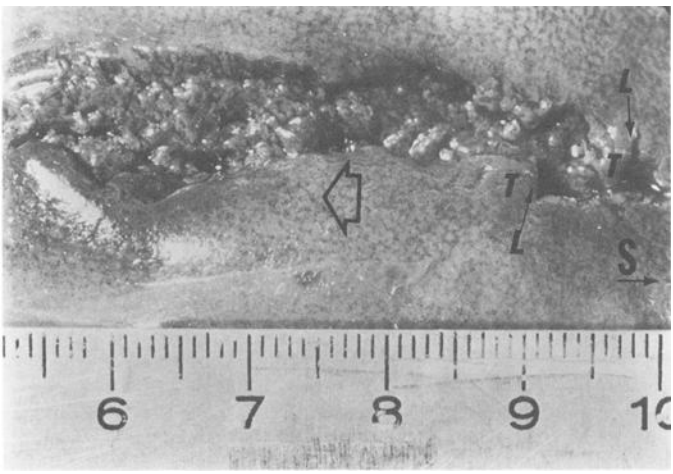

FIG. 3—*Graze gunshot wound of posterior surface of upper pole of left kidney measuring 5 by 0.9 cm. The configuration of the renal tags* (T) *along the margins of the trough indicates a direction of fire* (large arrow) *from right to left (photo as reference).* S = *superior pole of left kidney;* L = *lacerated edges of renal tags.*

renal tissue were noted along the margins of the graze wound trough at its superior end (right side of Fig. 3); all tags demonstrated lacerations on their superior margins, indicating a direction of fire from superior to inferior. This interpretation was verified by the location of the entrance wound and by the point of projectile recovery.

Case 3

During the commission of a bank robbery, a 16-year-old male was shot once in the chest by an off duty officer with a .38-caliber handgun.

The entrance wound was located on the left side of the chest on the nipple; it was a characteristic circular defect measuring 0.5 cm (3/16 in.) in diameter with an abrasion margin measuring a maximum of 0.3 cm (1/8 in.) in width. There was no exit wound.

The projectile perforated the upper lobe of the left lung, the pericardial sac, the heart, the liver (as a graze wound), the right hemidiaphragm, and the lower lobe of the right lung, coming to rest in the muscles of the right side of the back.

The graze wound of the superior aspect of the right lobe of the liver is shown in Fig. 4; it measured 7 cm (2 4/5 in.) horizontally and 1.5 cm (3/5 in.) from anterior to posterior. A large projection of hepatic tissue was noted on the anterior margin of the trough; it measured 2 cm (4/5 in.) in length and demonstrated a laceration on the margin of the tag located toward the decedent's left side. This indicated a direction of fire from left to right, as verified by the location of the entrance wound and the point of projectile recovery.

Discussion

These cases all demonstrate graze wounds of internal organs with parenchymal tags along the margins of the graze trough. The same principle that has been used to determine the direction of fire in cutaneous graze wounds can be applied to internal organs; specifically, the side of the parenchymal tag demonstrating a laceration is the side of the projection toward the weapon. In the presented cases, this observation is verified by the locations of entrance and

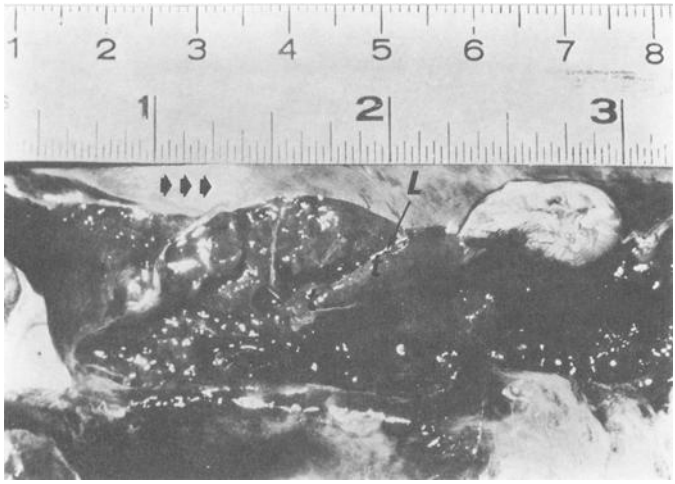

FIG. 4—*Graze gunshot wound of superior aspect of right lobe of liver measuring 7 by 1.5 cm. The configuration of the tag* (T) *of liver tissue on the anterior margin of the trough* (top of photograph) *demonstrates a direction of fire as indicated by the large arrow from left to right (decedent and photo as references).* L = *lacerated edge of hepatic tag.*

exit wounds (Case 1) or by the locations of entrance wound and point of projectile recovery (Cases 2 and 3).

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References

[1] Dixon, D. S., "Determination of Direction of Fire from Graze Gunshot Wounds," *Journal of Forensic Sciences*, Vol. 25, No. 2, April 1980, pp. 272-279.

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