

CASE REPORT

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Fetal Gunshot Wound Characteristics

ABSTRACT: Firearm injury in pregnant women is reported in the literature; however, no articles to date address the forensic analysis of the wounds sustained by the fetus. This is a report of a 40 weeks gestational age fetus who died following multiple perforating gunshot wounds, while his mother survived. The fetal wounds were atypical, consisting of irregular perforations with radiating linear lacerations and adjacent abrasions. The unusual wound pattern may have been due to the presence of interposed targets, the shoring of the fetus against itself and the uterine corpus, and the intrinsic character of fetal skin.

KEYWORDS: forensic science, wounds, gunshot, fetus, pregnancy

Gunshot wounds to the gravid uterus were reported first in 1845 (1). In most cases, the pregnant uterus is a target for wounds in the third trimester, when it is the largest. Such wounds are inflicted in a variety of circumstances, including domestic violence and attempted suicide. The gravid uterus and its contents often shield other maternal organs, and the mother may survive such injuries while the fetus dies (1).

Case reports in the literature describe the clinical aspects related to these types of injury, but we were unable to find any describing the forensic aspects. We report a case of multiple gunshot wounds to a gravid uterus with maternal survival and fetal demise, including an analysis of the atypical nature and pattern of the fetal gunshot wounds. We postulate that there are at least three factors that cause unusual gunshot wound characteristics in the fetus: the presence of interposed targets, the shoring of the fetus against itself and the uterine walls, and the composition of fetal skin.

Case Report

A 27-year-old black woman with an intrauterine pregnancy at 40 weeks gestational age presented to the Emergency Department with multiple perforating gunshot wounds to the upper abdominal quadrants and the lateral right back. These wounds, which were examined only by clinicians and not by forensic pathologists, were not described in any detail in the patient's chart. Multiple .380 caliber shell casings and spent rounds were found at the scene. Upon arrival at the hospital, the patient's condition was critical and there was no time to perform a sonogram. Doppler auscultation revealed no fetal heart tones. She was taken to the operating room for exploratory laparotomy and cesarean section delivery. A stillborn male infant with multiple gunshot wounds to the trunk and lower

extremities was delivered from the right occipitotransverse position via lower uterine segment transverse incision. There were two perforating wounds to the placenta, with retroplacental hemorrhage and abruption. The mother sustained two perforating gunshot wounds to the fundus of the uterus which were oversewn, plus perforating wounds of the cecum, small intestine and the lower pole of the left kidney, requiring small bowel resection and left heminephrectomy. The mother recovered from these injuries.

The normally developed and well-nourished 3.9 kg fetus had three perforating gunshot wounds to the lower back and legs. Each of the gunshot wounds was an irregular perforation with lacerations and nonuniform margins. Some of the wounds had segmental portions of 0.15 cm margins of abrasion. Others had larger adjacent abrasions. There were two closely approximated gunshot wounds at the lower aspect of the left back consisting of 0.6 cm and 1.3 cm perforations (Fig. 1). There were two gunshot wounds to the left leg (Fig. 2) and one to each thigh (Fig. 3 and Fig. 4), all of which consisted of 0.8 cm perforations. All of the wound tracks had extensive soft tissue hemorrhage, and there were injuries of the right femur, pelvic bone, urinary bladder, rectum and pelvic blood vessels. There were approximately 8 mL of clotted and liquid blood in the peritoneal cavity.

Discussion

The gunshot wounds in the case described above did not have the characteristic features of entrance and exit gunshot wounds. Typical entrance gunshot wounds consist of circular perforations with marginal collars of abrasion, and typical exit gunshot wounds consist of slit-like to roughly circular perforations without margins of abrasion. The fetal gunshot wounds in our case were atypical and they did not clearly demonstrate the direction of fire. In the following discussion, we attempt to explain why the wounds had atypical characteristics.

When bullets pass through interposed targets, the ballistic stability of the projectile is altered. An interposed target is any structure or material that a bullet passes through before entering a body, in-

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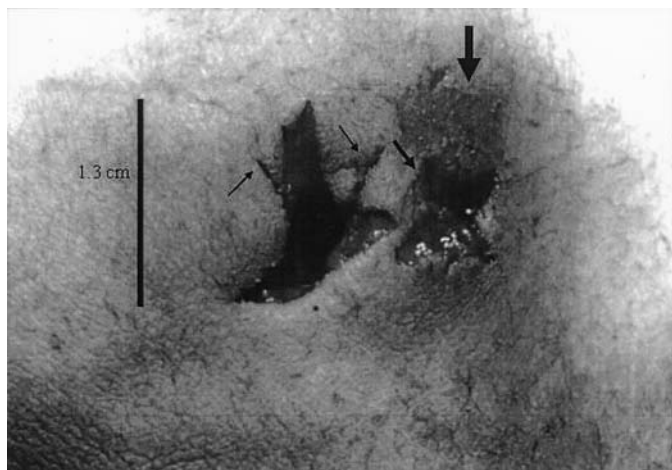


FIG. 1—Gunshot wound at the lower aspect of the left back. Large arrow indicates an adjacent abrasion; medium arrow indicates margin of abrasion; small arrows indicate lacerations.

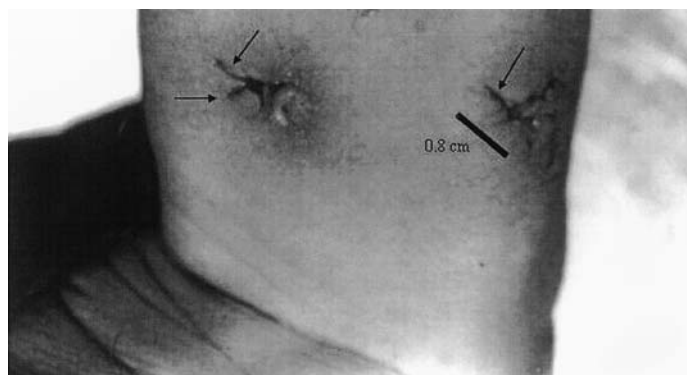


FIG. 2—Gunshot wounds to the left leg. Arrows indicate lacerations.

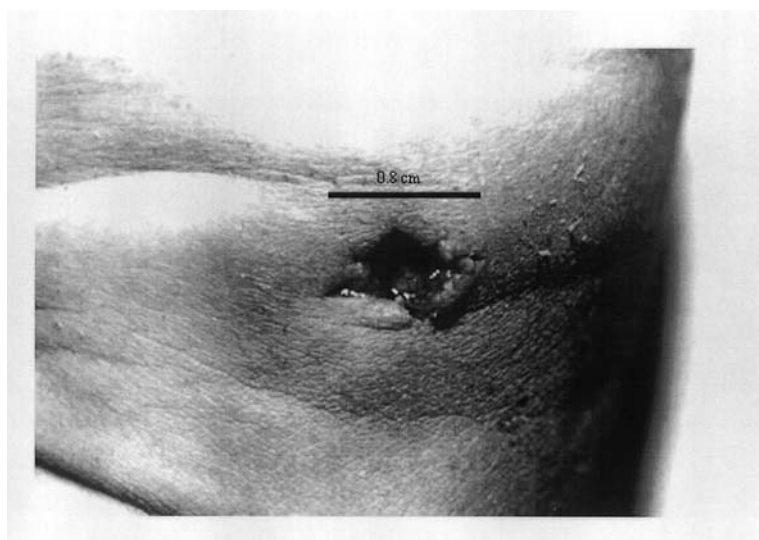


FIG. 3—Gunshot wound to thigh.

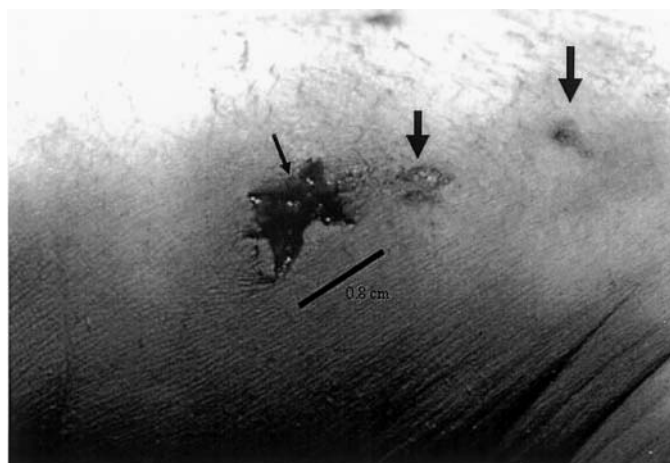


FIG. 4—Gunshot wound to thigh. Large arrows indicate adjacent abrasions; small arrows indicate lacerations

cluding windows, cars, layers of clothing or other persons. In the case of a fetus that is injured by gunfire, the maternal body, the uterine walls and the amniotic fluid all serve as intermediate targets which can alter ballistic stability.

Bullets in flight have forward and angular velocity. When a bullet contacts a target, it encounters the resistance of the surface as it penetrates, slowing its forward velocity. As the bullet penetrates a target, friction, dependent on the density of the substance penetrated, will slow the angular velocity. The foregoing forces change the relationship of the axis of the bullet with the axis of the path of travel, or the yaw angle. Also, many types of bullets deform as they enter a target, and the altered shape of the projectile may change the path (2).

After passing through an interposed target, a bullet will enter a second target with an altered trajectory, which may create an atypical entrance wound. Also, the bullet can drag portions of the interposed target, such as pieces of bone or glass along with it, which can further alter the entrance wound. Atypical injuries are known to occur as a result of passage of projectiles through an interposed target (3).

The muscular, gravid uterus has a dampening effect on bullets, often protecting the mother from more serious injury (1). In this case, the maternal abdominal wall, uterine corpus and amniotic fluid were interposed between the fetus and the bullets. The uterus and amniotic fluid could have altered the ballistic stability and thus contributed to the atypical nature of these gunshot wounds.

At term, the proportion of fetal tissue to amniotic fluid is increased, and many of the fetal body parts are in contact with each other and the uterus. Shored entrance and exit wounds, or wounds that occur when the skin through which a bullet enters or exits is pressed against a firm surface, are described in the literature. When an exit wound is shored, the skin may show an irregular margin of abrasion as the elastic skin is stretched by the exiting bullet and rubbed against the shoring surface. If an entrance wound is shored, it is less likely to show a uniform margin of abrasion, and the pattern of injury will depend on the nature of the surface in contact with the skin (4).

One example of a shored entrance wound occurs when a bullet perforates an extremity and then re-enters the trunk or other body part. In such a case, the skin at the reentry site is in contact with the exit wound on the shoring extremity, commonly producing an irregular wound with an atypical margin of abrasion (4). In our case, it is likely that the fetus was shored against both himself and the uterine walls. Generally, a term fetus is in a small space with a decreased fetus-to-amniotic fluid ratio, and the extremities are folded against the torso. The shoring of the wounds could partially explain their irregular shapes and asymmetric, nonuniform, and adjacent abrasions.

Fetal skin differs from the skin of an adult, or even the skin of a child. The composition of fetal skin depends on the gestational age of the fetus, as the morphogenesis of the appendages and the expression of the skin components is a sequential process.

The fetal epidermis is covered by a layer called the periderm, which is a simple epithelial layer that has many blebs and microvilli, creating a large surface area that is exposed to the fluid in the amniotic cavity. The periderm persists throughout gestation and modulates the interaction of fetal skin with amniotic fluid components, including steroids. Although it is not known which cell receptors are used, it is known that steroids in the amniotic fluid affect both the water transport function of and the types of keratin expressed in fetal skin, and that fetal skin has a greater water content than adult skin (5). A more hydrated skin is softer and would then present less resistance to a projectile. This could lessen the stretching caused by an entering or exiting projectile, causing an altered margin of abrasion or an atypical exit wound.

At term, the collagens in the fetal skin are the same types that exist in adult skin and they assume an adult configuration, but the relative amounts of collagen types differ. The predominant collagen in adult skin is type I, which is a thick, fibrous collagen, and the predominant collagen in fetal skin is type III, which is a fibrillary, interstitial type of collagen. In adults, type III collagen is restricted to the basement membranes and the perivascular areas (5). This difference in collagen types may affect the strength of the skin and its resistance to the shearing forces caused by the velocity of a projectile.

In summary, we present a case of a fetus who sustained fatal gunshot wounds in utero. The wounds consisted of irregular perforations with radiating lacerations and adjacent abrasions. The interposition of the uterine corpus and amniotic fluid, the shoring of the fetus against himself and the uterine corpus, and the consistency of fetal skin may have played a role in producing the unusual appearance of these wounds.

References

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