B112 Bloodstain Patterns Associated With Gunshot Wounds — Misconceptions

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The goal of this presentation is to provide attendees with a better understanding of the conditions under which gunshot wounds will produce blood droplet spatter.

This presentation will impact the forensic science community by having a positive impact on bloodstain pattern interpretation in shooting cases by clearing up misconceptions.

Much confusion appears to exist concerning bloodstain patterns produced by gunshots. This confusion can lead to misinterpretations in attempts to reconstruct past shooting events transpiring at crime scenes. Confusion on the part of laypersons such as lawyers, judges, or the members of a jury may be at least partially attributable to graphic media portrayals of shootings in film and television where volumes of blood spurt out of the wounds. If transcripts of testimony and textbooks are a good indication, confusion also exists among some experts charged with the responsibility of reconstructing shootings. The latter may be attributable to poor training, lack of a suitable scientific education, poorly designed experiments, and inappropriate published photographs in training materials.

Projectiles (e.g., bullets) impacting or traversing materials often can be expected to produce secondary projectiles. These secondary projectiles can consist of fragments of the materials struck or fragments of the projectile itself in the case of a hard target surface such as concrete or steel. The type of secondary projectile which predominates depends on the hardness of the initial projectile relative to the hardness of the material with which it interacts. In controlled experimental work, the secondary projectiles can be studied using high-speed photography and/or by placing "witness papers" near the point of impact or projectile exit. Witness papers are specially prepared surfaces, commonly white paper supported by a frame, used to reveal the path of a projectile or secondary projectiles. Of course, in "real world" case investigations, neither of these recording mediums is typically available. Any record produced of such secondary projectiles will depend upon the fortuitous proximity of surfaces capable of retaining evidence of such secondary projectiles.

Published photographs of a bullet traversing a blood-saturated sponge are very misleading. Something in the vicinity of 90% to 95% of the weight of a blood-soaked sponge or section of open cellular foam is due to the blood contained therein. This is not a good experimental model for shots traversing many regions of the human body. Only about 5% to 7% of the weight of a human body is blood. In addition, the blood is not evenly distributed throughout the body. In most regions and tissues in the body, the blood is confined to capillary beds. The function of the fine-diameter capillaries is to provide more intimate contact between the oxygen carrying red cells and somatic tissues dependent upon oxygen. Life-sustaining oxygen transport would be inefficient without hemoglobin and small-diameter capillaries. The capillaries have inside diameters of approximately 5µm. Some publications discussing blood spatter produced by gunshot wounds refer to drops with stain diameters of 1mm as being diagnostic for gunshot-derived blood spatter. This dimension is 200 times that of the capillary diameter. Thus, for a bullet traversing capillary-supplied tissue, no coalesced volumes of liquid blood are encountered. The bullet may carry tissue and fragments of capillaries with it and deposit them on a surface near the exit wound (or even on a surface near the entrance wound). In this circumstance, there will be no droplets of blood deposited. In actual cases, histological examination of the deposited tissue fragments has revealed fragments of capillaries with red cells lined up single-file within them. Again, there are no blood droplet stains. On the other hand, if the bullet encounters a volume of coalesced blood along its path, such as that contained in larger blood vessels or even the heart, fine droplets of blood can contribute to the spatter pattern. After a bullet has traversed capillary-supplied tissue, blood will flow into the wound channel, coalesce to form larger volumes, and may be available for spattering during a follow-on shot to the same area. Clothing which becomes saturated with blood flowing from a wound may behave like the blood-soaked sponge discussed above, if it is struck by another bullet. Additional ways in which gunshots can produce fine droplet spatter will be discussed.

The point needs to be made that special conditions are required in order for a gunshot to produce airborne droplet spatter patterns. Principally, there must be a volume of coalesced blood along the bullet path along with a suitable nearby target to collect and record the pattern of any blood droplets that are projected from the wound. These points will be illustrated using experimental models and actual case examples.

Blood Spatter, Gunshot, Shooting Reconstruction