

# Arterial Bloodstain Patterns on Clothing – An Interesting Case Linking the Accused to the Scene

L. Allyn DiMeo, CSCSA<sup>1</sup> Jane Taupin, M.A.<sup>2</sup>

**Abstract:** Distinctive blood patterns produced by breaching an artery of the body may be found at crime scenes. The victim often dies before medical assistance arrives and there may be extensive and diagnostic arterial patterns produced at the scene by the victim. However, it is rare to observe arterial patterns on the clothing of the offender even if that individual tries to render aid. This case study describes extensive arterial bloodstain patterns at the crime scene and on the clothing of the accused, which linked the accused to the time and place of the victim bleeding from the damaged artery. Bloodstains on the clothing were considered by the authors to be just as important as the bloodstain pattern evidence at the scene.

**Keywords:** forensic science, arterial pattern, blood pattern analysis, clothing, homicide

Arterial bleeding is an example of bloodstaining and is described as projected patterns produced under pressure (1, 2). Projected stains result from a force other than impact. An arterial pattern is produced when an artery is cut or severed. Repeated projections of blood often cause a characteristic pattern of “rise and fall” corresponding to the diastolic and systolic pressure in the heart. The arms, legs and neck have arteries close to the surface that may project blood when damaged and unimpeded by clothing or other parts of the body. There are many documented cases of extensive arterial patterns produced while the victim was ambulating through the scene. The distinctive ‘rise and fall’ pattern of arterial bleeding may be produced on walls, flooring, furniture and other stationary objects. There is little documentation in the forensic literature, however, of arterial bloodstain patterns on the clothing of the perpetrator.

The structure and composition of the fabric of the garment will influence the appearance of any bloodstain on that garment (Chapter 5, reference 3). Clothing does not have the smooth, non-adsorbent surface of walls and floors, and as a result, bloodstains may be distorted in shape compared to those observed at crime scenes. This distortion will depend on the ability of the fabric to absorb the bloodstains and the looseness of the weave, knit or felt of the garment material. Consequently, the composition and construction of the clothing of any bloodstained garment must be considered in the evaluation of any possible arterial bloodstain patterns.

The following homicide case (4) illustrates an arterial bloodstain pattern on an unexpected area of clothing of the accused which provided evidence linking that accused to actions at the crime scene.

## Case Report

The accused and the victim shared an apartment in an apparently intermittent relationship with a history of domestic disturbance. During the night of the offense in March 2009, the police had responded to their apartment on three occasions regarding disturbance calls. Gunshots were later heard from the apartment and the accused also called 911 from his residence to report that his roommate had been shot. Police arrived to find the accused outside the second floor apartment.

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<sup>1</sup> Forensic Specialist, Arcana Forensic Services, Inc., San Diego, California, USA

<sup>2</sup> Forensic Consultant, Melbourne, Australia

They entered the premises to discover the victim deceased on the floor of his bedroom having sustained several gunshot wounds to his upper body.

The victim was discovered in a supine position with his body rolled towards the right hip. He was clad only in a pair of green shorts and was barefoot. Bloodstains were present on the visible areas of his body and the front of his shorts. Arterial bloodstains were present on surfaces near his body which included the front door of a small refrigerator, a cylindrical clothes hamper, a curtain and miscellaneous materials (Figure 1). The arterial patterns could be traced from the bedroom, through the hallway (Figure 2), and to the front room. Arterial patterns with altered flow patterns were observed on the inside of the front door (Figure 3).



Figure 1. View of victim on floor of bedroom.

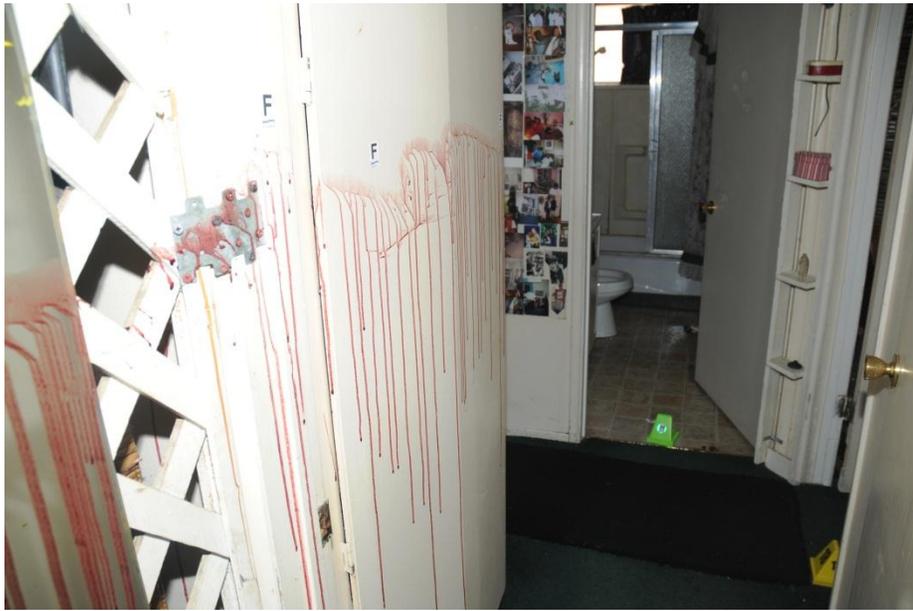


Figure 2. View of arterial bloodstain patterns on hallway wall.



Figure 3. View of arterial bloodstain patterns on interior of front door.

The accused was arrested and photographed in his clothing. Detectives observed bloodstains on the back of his T-shirt that they considered as consistent with “arterial spurting”. They also observed additional bloodstains on his blue jeans and the top of his shoes. The accused initially claimed that he never saw the shooting and found the victim in his bedroom.

The first author of this study was asked by the defense to review the bloodstain patterns at the scene and received the photographs and autopsy report. The autopsy report described four gunshot wounds to the upper body. One bullet entered the left upper arm, perforating the left brachial artery and both lungs before lodging in the muscle behind the chest cavity. The death was determined to be due to multiple gunshot wounds and the victim exsanguinated in only a few minutes.

It was agreed by all parties that the gunshot that perforated the left brachial artery of the victim occurred while he was in an undeterminable area of the front room. The arterial bloodstain patterns and altered flow patterns on the inside of the front door were created when the victim was within the apartment and the door was closed or was in the act of closing. He bled from the entry wound in the left upper arm onto vertical surfaces in the front room and entrance of the hallway producing arterial bloodstain patterns.

The victim then moved through the hallway creating arterial bloodstain patterns on the left side of the wall as he entered into his bedroom and collapsed on the floor. There were no interruptions observed in the arterial patterns along the hallway wall, which was significant in interpreting the bloodstains on the clothing of the accused.

Bloodstain patterns with the distinctive morphology of arterial bloodstain patterns were observed on the back of the T-shirt of the accused in the area between the shoulder blades and the bottom of the garment (Figure 4a), on the left rear pant pocket and on the lower left front pant leg (Figure 4b). Drip stains were noted on the top surfaces of both of his shoes. It was concluded that these bloodstain patterns were deposited on the clothing of the accused when the victim was bleeding from the gunshot wound that perforated his left brachial artery. The accused was standing upright near the victim either in the front room or in the bedroom when the victim projected blood onto his clothing, as there was still sufficient pressure from the artery to reach the upper back area of his T-shirt.

The clothing of the accused was photographed by the police. The black T-shirt was a typical mass-produced knitted garment so that assumptions can be made as to composition (cotton, polyester/cotton or similar) and construction (a plain knit). These types of garments have moderate absorption properties and do not significantly distort bloodstains or spatter.



Figure 4a. View of arterial bloodstain pattern on the rear of the shirt of the accused.



Figure 4b. View of arterial bloodstain pattern on the front of the jeans of the accused.

There was a linear progression of blood across the back of the T-shirt with projected bloodstains towards the lower back right panel, and flow patterns of blood from the linear progression produced through gravity. This type of morphology corresponds to arterial bleeding with projected blood sufficient to produce flow patterns. The width of the back of the garment was also sufficient to diagnose an arterial projection mechanism; conclusions may be more limited if the distance of travel is somewhat shorter than in this case. If this type of pattern was observed on a wall or other smooth surface at a crime scene then the initial hypothesis would generally be an arterial bloodstain pattern. Finding such a pattern on clothing introduces extra considerations.

The front left leg of the blue jeans exhibited large projected bloodstains which also accorded with the hypothesis of arterial bleeding as the accused was standing, facing the victim. Jeans are typically composed of cotton denim in a twill weave construction. This construction does not significantly distort blood drops as they land on the clothing.

A bloodstain pattern analyst may often encounter surfaces at crime scenes that are not ideal for elucidating morphology and determining a possible mode of mechanism of deposition. For example, walls may be porous or pitted, coated in paint with repellent properties, and blood may be deposited on joining walls at right angles to each other. The analyst makes allowances for these factors in their interpretation; and sometimes no conclusion can be reached. Similarly, the analyst needs to consider properties of the clothing on which blood is deposited when evaluating bloodstain patterns on clothing. The construction and composition of the clothing may impact the morphology of the bloodstain pattern. It is recommended that the clothing examiner have some background knowledge of garment construction and composition in considering their potential interaction with stains and deposits.

Cast-off blood patterns may occasionally be found on the upper back of the clothing of the perpetrator (Chapter 5, reference 3). These patterns are produced when a bloody implement is swung and blood droplets are released. These patterns are generally linear and associated with cast-off patterns on the ceiling and walls of the scene that are the most common targets for these types of patterns. Cast-off patterns do not exhibit the large quantities of blood as seen in arterial patterns and should readily be distinguished from projected bloodstains. However, if there is insufficient blood for a pattern to be discerned, the conclusions may be equivocal. The analyst should consider all possibilities until the type of weapon, wound descriptions and other bloodstain patterns have been correlated with the bloodstain patterns on the clothing.

Arterial bleeding can often be distinguished from venous projection due to the lower amount of pressure in the venous system (1,5). Cases of chronic venous insufficiency syndrome with hemorrhage may also produce similar patterns, but these are observed more on the lower walls and floor where the hydrostatic pressure is high in the legs. Nevertheless, it is imperative to ascertain at autopsy that an artery was severed and this can then be correlated with confidence to the projection patterns observed.

Complex patterns of small spatter can also occur at a scene with arterial bleeding. Small spatters are frequently associated with arterial spurts in addition to the more classical large volume projections with typical downward flow patterns on a vertical surface. Spine-like satellite spatters are also commonly observed within arterial patterns (1).

Bloodstain pattern analysts have recognized that there is an overlap between blood patterns produced in what was traditionally termed high, medium and low velocity events; and thus terminology has been adopted to incorporate stain morphology relative to mechanisms that may have produced them, with medical history and scene related facts (1). The analyst should be careful not to over-interpret each and every stain of a pattern and analyze the pattern as a whole, still recognizing that there may be overlapping mechanisms.

The criminal case against the accused was resolved on the first day of trial. The accused accepted a plea to involuntary manslaughter and the use of a firearm, although he always maintained that he was not the shooter.

## Conclusion

This case study shows that examination of the clothing of the accused may reveal more important information than that of the crime scene. The findings of the bloodstain pattern analysis at the scene, blood patterns on the clothing of the accused, and the autopsy report of the deceased, formed a cohesive and concordant narrative of what may have happened during the crime event.

It is recommended that if bloodstain patterns are initially observed on the clothing of the accused that they are photographed and then examined for bloodstain pattern analysis. The composition and construction of the garment should also be considered as this may impact on the morphology of the observed bloodstains. The bloodstain patterns on the clothing of the accused, the blood patterns at the crime scene, and the autopsy examination can then be correlated for a scientifically defensible analysis.

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Additional information and requests to:

Lisa Allyn DiMeo,  
Forensic Specialist,  
Arcana Forensic Services, Inc.  
PO Box 1448  
La Mesa, California, 91944  
USA

