Case Report

Considering the Target Surface in Bloodstain Pattern Analysis: An Unusual Case of Blood Pooling

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Abstract: The authors report on an unusual case of blood pooling into carpet. In February of 1998, an adult female was found dead in her home. The victim had died of a heart arrhythmia but had sustained a small laceration on the back of her head as the result of a fall.

Subsequent blood flow into the carpet immediately following death, as well as movement of the victim by paramedics, resulted in larger than expected staining on the underside of the carpet.

Introduction

The analysis of blood stains has been well documented by many authors including MacDonell (1997), Eckert and James (1989), and Bevel and Gardner (1997). The history of bloodstain pattern analysis can be traced back well over 100 years. Piotrowski (1895) conducted experiments on live rabbits in Krakow Poland to document bloodstains resulting from blunt and sharp force trauma. More recently, MacDonell conducted extensive study into bloodstain pattern analysis and established much of the current bloodstain terminology. Blood flow is a common type of stain encountered at crime scenes, and many

of the above authors have contributed to the description and documentation of this occurrence.

The International Association of Identification defines blood flow as "An accumulation of blood drops in motion, directed by gravitational pull or being shed by a moving source". Bevel and Gardner define passive blood flow as "a blood flow created by gravity alone, with no circulatory action involved" (p.70). Although blood flow patterns are commonly observed at crime scenes, little is reported in the scientific literature. While blood flow patterns are easy enough to recognize, consideration must be given to the target surface onto which the blood flows. Failure to do so can result in confusion or unrecognized evidence at a crime scene. MacDonell states that consideration of the target surface is imperative to a correct interpretation of bloodstains. While blood pooling and flow patterns are typically created by large volumes of blood, smaller volumes can create significant stain patterns as well.

Case

In February 1998, an adult female was found dead in her home by her husband. The victim was clothed and was lying in a supine position in the threshold between the kitchen and hallway (figure 1). Autopsy findings concluded that the woman had died of a heart arrhythmia. The victim suffered a 1 1/2" laceration on the back of her head as she collapsed in the kitchen and struck the edge of a half wall. A forensic pathologist determined that the wound was not a contributing factor to the victim's death. The metal corner edging of the wall was dented where contact was made, and several large paint chips were on the floor beneath. The point of contact was measured to be about 22" up from the floor.

In order for the victim to be examined by paramedics, she was pulled out into the hallway (away from the kitchen). This resulted in a second blood stain caused by blood escaping out of the head wound (figure 2). The victim lay in this position for approximately 45 minutes until an investigator from the coroner's office arrived. Upon examination by the coroner's investigator, the victim was rolled onto her right side and a second group of stains was created by blood escaping out of the nose and mouth (figure 2).

Figure 1

Measurements and observations of the stains during initial examination of the carpet by the senior author supported statements given by the husband, paramedics, and the witnessed events by both the senior author and Coroner's investigator as to the sequencing of the victim's positions and subsequent blood loss. The bloodstain denoting the position of the victim at the time of discovery (closest to the kitchen) was designated as "Stain #1". The stain marking the second position of the victim (resulting from the movement of the victim by paramedics) was designated as "Stain #2", and the grouping of three bloodstains from the victim's nose and mouth were designated as "Stain #3."

Stain #1 was measured to be approximately 10x8cm and was slightly wet to the touch upon examination (figure 3) . There was a wipe pattern at the north edge of the stain caused by the victim being pulled through. Corresponding stains were found on the victim's cloth-

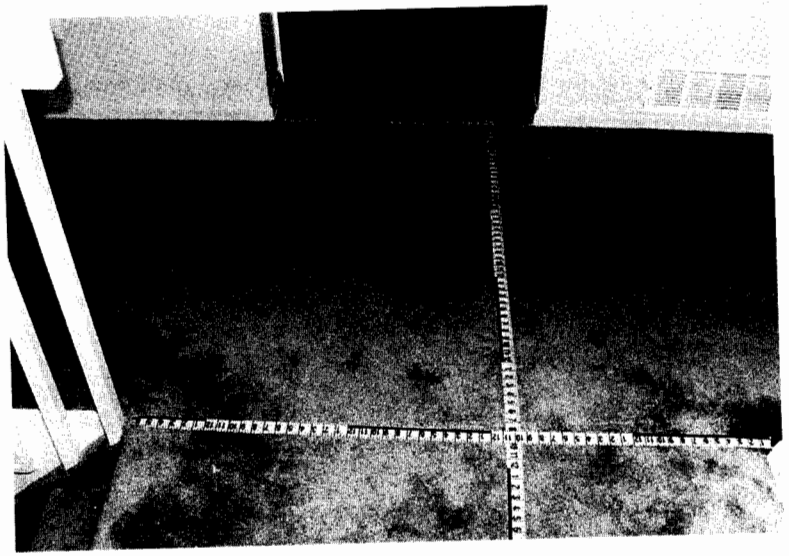

Figure 2

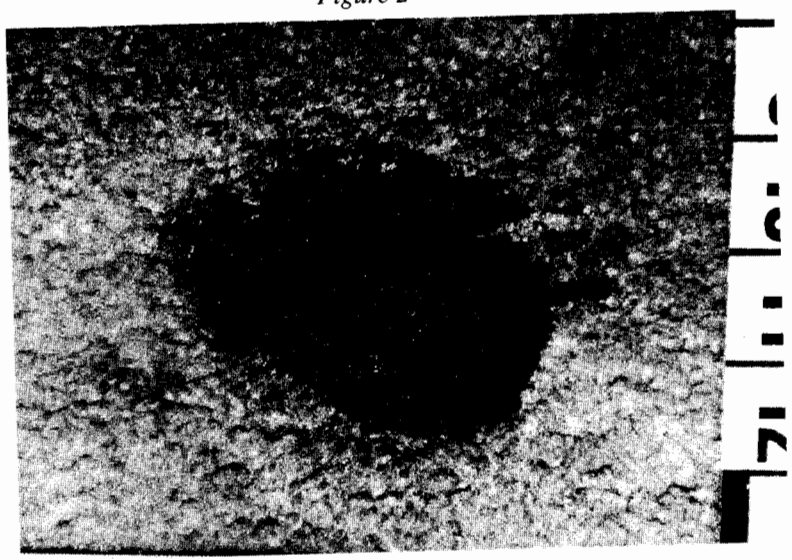

Figure 3

ing to support this. Stain #2 was measured to be approximately 3cmx6cm and was slightly wet to the touch (figure 4). The stain was

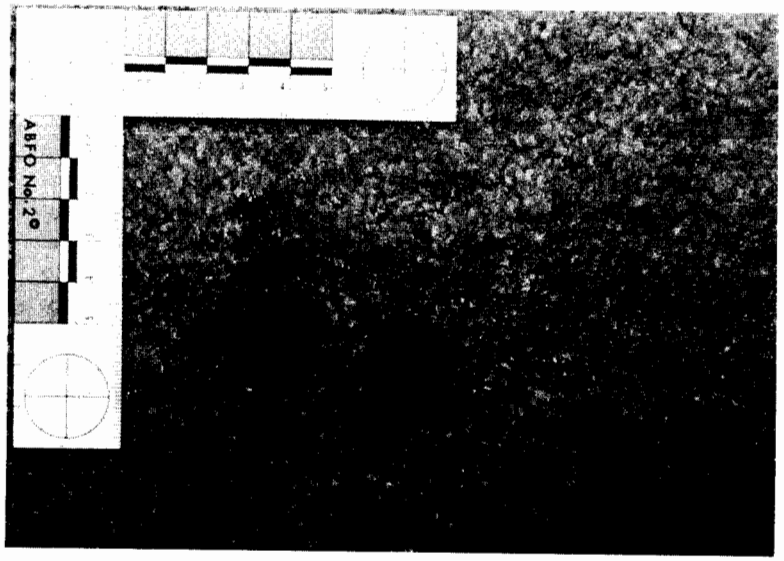

Figure 4

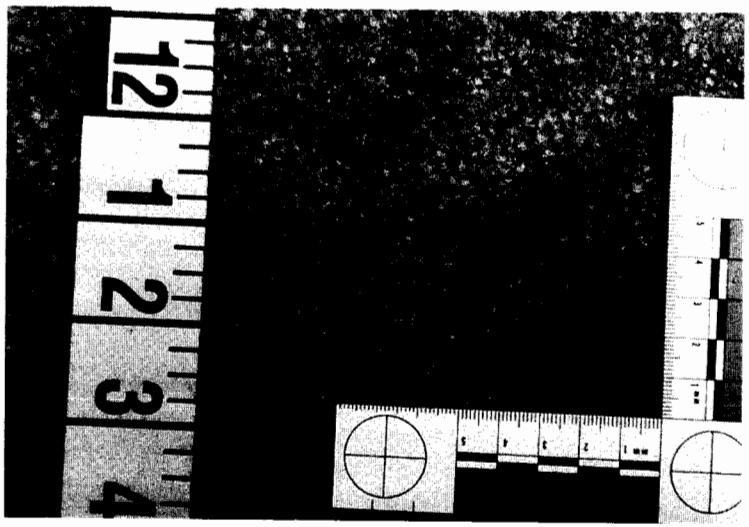

Figure 5

"dumbbell" shaped suggesting head position and one area of transfer. Stain #3 consisted of three individual stains resulting from blood escap-

ing out of the victim's nose and mouth. One stain (figure 5) is almost completely covered by the tape at the numeral three. During the scene investigation, (approximately three hours following discovery of the victim) the carpet was removed and the pad and sub-floor were examined for bloodstains. Blood was not readily visible on the carpet pad and a hand magnifier was needed to see the very faint transfers from the carpet above. No blood had transferred through the carpet pad and onto the sub-floor.

The carpet is described as a beige tufted loop with a synthetic fiber and latex backing (Reznikoff 1989). The carpet had been installed in the home less than ten months prior to the victim's death and was in very good condition. The carpet pad was a commercially available 1/2" pad. An examination of the underside of the carpet revealed larger than expected staining in the areas of stains #2 and #3.

Stain #1 was measured to be approximately 8cmx6cm. The weight of the victim's head on the carpet and pad created a concave depression which limited the ability of the blood to disperse.

In contrast, the size of Stain #2 on the underside of the carpet measured approximately 12cmx8cm. This represents an increase in surface stain size of about 500% (as compared to the traffic side). During the examination by paramedics, the victim's head was repositioned several times and was not in constant contact with the carpet. This loose contact did not cause the carpet to form a completely concave depression and the wet blood was allowed to disperse further than it would if the head was in constant contact. This is clearly illustrated when examining Stain #3 (figure 6).

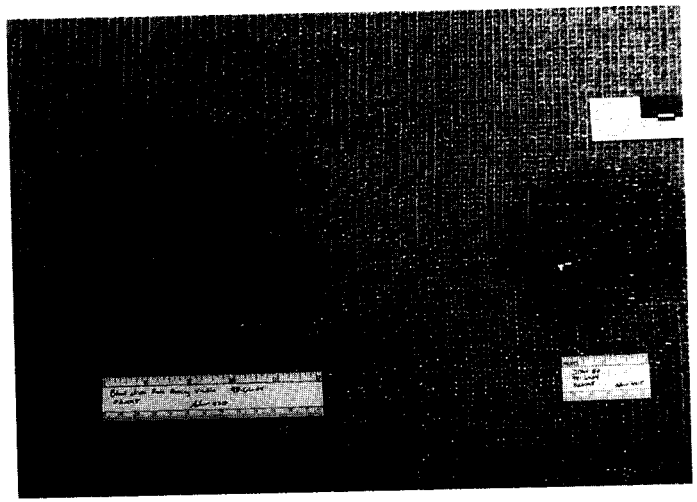

Figure 6

Stain #3 showed the most dramatic increase in size. The largest of the three stains measured 6cmx5cm. Contrary to the previous two stains, Stain #3 was never influenced by the weight of the victim's head and the wet blood was allowed to somewhat evenly disperse in all directions along the latex backing.

An examination of the individual fibers around the perimeters of the stains on the traffic side of the carpet revealed interesting results. The individual fibers were bloodstained on their lower half, while the top (traffic) portion was clean (figure 7). Additional testing by the senior author produced similar results to the above findings. No attempt was made to reproduce the exact amount of blood lost by the victim. Instead, a purple top tube of human blood was used for recreations of Stain #1. Single blood drops (approximately 0.05ml in size) were used to recreate Stain #3. A glass human shaped head, weighing approximately eight pounds, was used to represent the victim's head. Blood was poured onto the carpet and the head was immediately placed over the top of the stain. The head was left in that position for approxi-

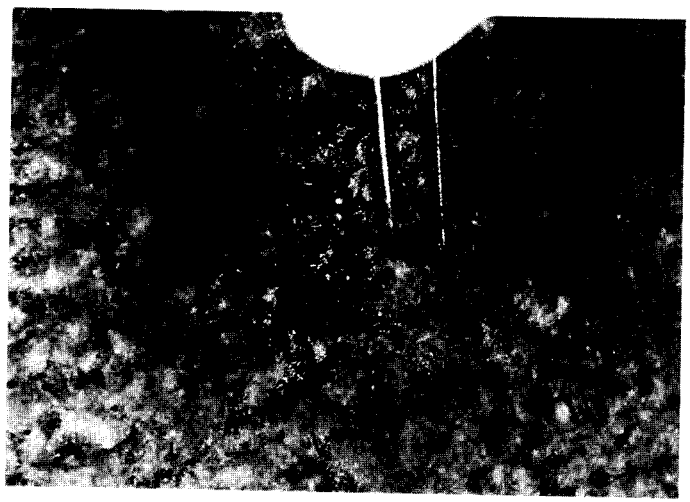

Figure 7

mately 60 minutes. The resulting stain showed similar confinement as did Stain #1. Additionally, the single blood drops dispersed similarly to Stain #3. Although many factors, such as age and wear of the carpet, type of pad, temperature and the volume of blood, may influence the degree to which the blood dispersed, the findings from the experiments help validate the evidence found at the crime scene.

Conclusion

Passive blood flow patterns are very commonly found at death scenes where the victim's circulatory system is breached. Although the flow pattern may be influenced by the position of the body, or other objects, care must be given to consider the surface onto which the blood flows. The above case illustrates how a target surface may possess physical characteristics which may also influence the flow pattern and produce unusual stains.

Reconstruction and experimentation has to be done with the same carpet and the same carpet pad. Unstained carpet and pad with at least four times the area of the stained material will be needed. Experimentation will help the analyst determine the degree to which the target surface influenced the flow pattern, but caution should be exercised in any interpretation. Analysts should rely on scientific methods, accurate case information, prior experience and peer review to reach a final determination.

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