JOURNAL OF FORENSIC SCIENCES

J Forensic Sci, May 2010, Vol. 55, No. 3
doi: 10.1111/j.1556-4029.2009.01284.x
Available online at: interscience.wiley.com

CASE REPORT
PATHOLOGY AND BIOLOGY

Mattias Kettner,[1] *M.D.; Frank Ramsthaler,*[1] *M.D.; and Axel Schnabel,*[1] *M.D.*

''Bubbles''—A Spot Diagnosis

ABSTRACT: Aspiration of blood is a phenomenon observed in violent and natural death scenarios. Bloodstain patterns evolving from expectoration of aspired blood may look suspicious of a violent genesis and thus mislead crime scene investigators. In the present case, a woman was found lying in a pool of blood on the kitchen floor. Furthermore, bloodstains covered her face, clothing, and surrounding furniture and walls. Bloodstain pattern analysis and medicolegal inspection of the suspected scene of crime were carried out and revealed dispersed stains with enclosed gas bubbles in the absence of signs of physical violence leading to the assessment of a natural manner of death. The bloodstains were attributed to expiration of blood because of an internal bleeding. Medicolegal autopsy confirmed the on-site diagnosis as a fatal esophageal varix rupture was found.

KEYWORDS: forensic science, bloodstain pattern analysis, aspiration, esophageal varix, expectoration, exspiration, hemoptysis

Bloodstain pattern analysis has gained in importance in the reconstruction of crime scenes over the last years because forces and velocities during the chain of action are reflected by stain distribution, density, morphology, and size (1–4). While the method is usually employed in the cases of suspected crimes involving physical violence, it may as well serve as a useful tool in identifying natural death scenarios in postmortem examination, e.g., in cases of varicose vein rupture (5–7). Detailed knowledge of stain patterns and their diagnostic value is of eminent importance for medical examiners and police experts and may serve to reduce police investigation efforts. Here, we present a case in which bloodstain pattern analysis indicated natural death in the absence of physical violence.

Case Report

A 77-year-old woman was found dead lying on the kitchen floor. The emergency team documented a "fatal fall with cranial bone fracture." Given the blood distribution at the scene, which included her head and the surrounding walls and cupboards, the emergency team called the police. Police investigation showed that the deceased had had no contact with neighbors or relatives for at least 24 h and had no medical history of relevant diseases. An examination team of the Center of Legal Medicine was requested by the police to conduct a medicolegal inspection and analyze the bloodstain pattern. An initial inspection of the unaltered scene was carried out by both members of the team followed by photographic documentation of the scene and consecutively of isolated individual patterns (8). In the course of the subsequent medicolegal inspection, the body was removed from the original site and examined in an adjacent part of the apartment. Eventually, the apartment was sealed to allow for any further examinations, e.g., "stringing."

Upon arrival at the scene, the body lay on the right backside in the corner of the kitchen (Fig. 1). The rearward wall and an adjoining wooden cupboard as well as the surrounding floor showed oval and round, red and brown stains. The head was lying in a pool of blood and the face, which was covered with incrusted blood, was directed toward a bucket. Here, a roundish bloodstain pattern was found in which the spray-like dispersed droplets showed multiple "air bubbles" and centrifugally increasing lengths (Fig. 2*a,b*). A plastic bowl that was located just in front of the cupboard showed round to oval blood droplets, which covered the edges and the base of the bowl, but not the sides (Fig. 3). A crotcheted curtain just above the bucket showed oval bloodstains (Fig. 1) and was ripped off the three outward brackets.

Upon external examination, no signs of physical violence against the head or any other part of the body were seen. We assessed a chain of action in which an internal bleeding led to aspiration of blood which was then exhaled while walking toward the corner of the kitchen with an agonal fall leading to a final position of the head facing the bucket.

FIG. 1—*Suspected scene of crime. Seventy-seven-year-old woman lying dead in the corner of the kitchen with her head in a pool of blood. Note the distribution of stains on the neighboring objects.*

[1]Center of Legal Medicine, Institute of Forensic Medicine, Goethe-University Frankfurt/M., Kennedyallee 104, Frankfurt/M. 60596, Germany.

Received 9 Oct. 2008; and in revised form 11 Jan. 2009; accepted 7 Mar. 2009.

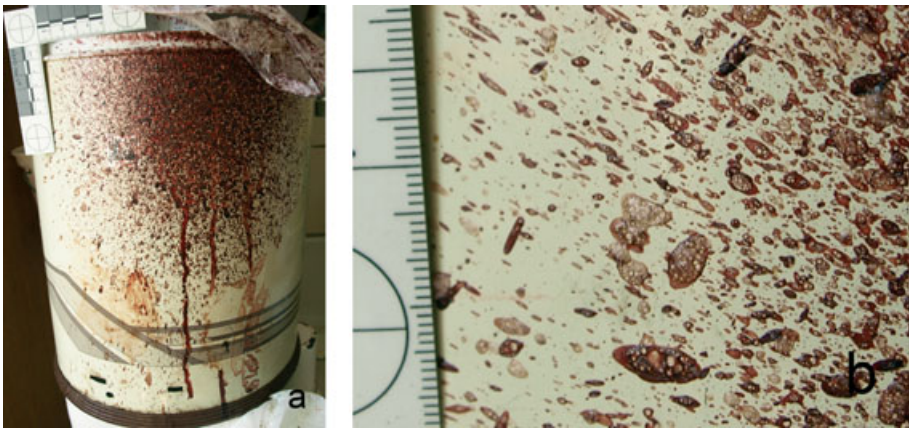

FIG. 2—*Bucket showing a spray-like dispersion of stains with centrifugal distribution (a) and enclosed gas bubbles (b).*

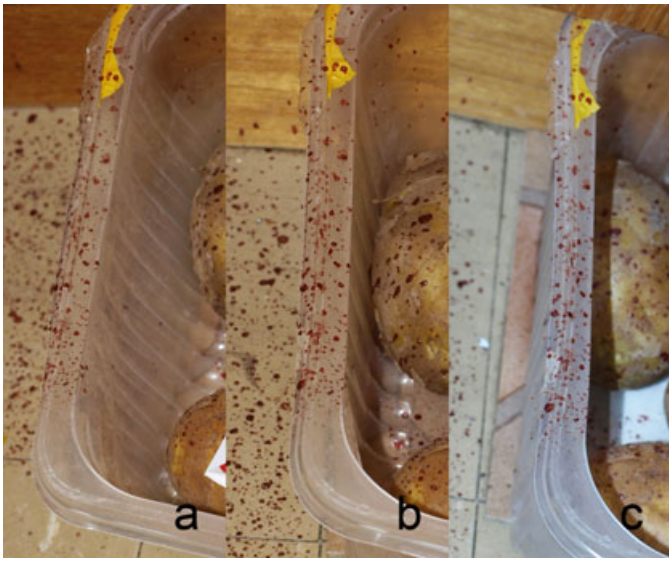

FIG. 3—*Edge and base of a plastic bowl with round and oval droplets (b). Note that stains do not cover the sides (a,c).*

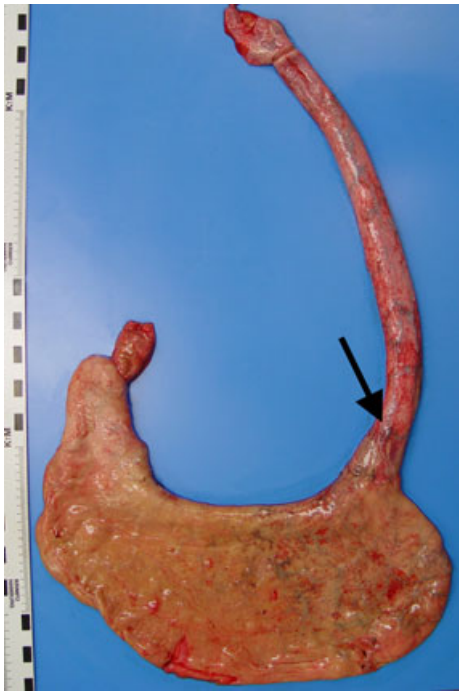

FIG. 4—*In toto preparation of the stomach and esophagus. Macroscopic esophagitis (pronounced in the lower third) and ruptured varix just above the cardiac ostium (arrow).*

Medicolegal autopsy revealed esophagitis and a ruptured esophageal varix close to the ostium cardiacum (Fig. 4). The stomach contained *c.* 300 mL of a sanguinous liquid only partially intermingled with stomach contents that showed a coffee-ground aspect. Upon preparation of the trachea and bronchial system, brownish sanguinous liquid intermingled with foam was found. The internal organs were anemic. Preparation of the coronary arteries revealed coronary sclerosis with stenosis of the anterior descending of the left coronary artery. Death was attributed to severe internal and secondarily external hemorrhage because of the rupture of an esophageal varix.

Discussion

Bloodstain pattern analysis is frequently used to analyze the suspected scenes of crime. Typically, information gained from these analyses is used for reconstructing chains of actions concerning crimes. Expectoration of blood is a phenomenon encountered in crime settings as well as in natural death because of internal and secondarily external bleeding. Bloodstain patterns resulting from hemoptysis have been described to be pale in coloration (9), which may be as a result of commingling with mucus and the inclusion of gas. In our case, paleness was not noticed resulting from intermixture with stomach contents. Furthermore, exhaled blood may mimic gunshot spatter (9) (please note the mist-like alignment of stains in Fig. 3*a*) and may display mucous strands connecting stains (which we did not encounter in the present case). Here, a distinct stain pattern with brownish sanguineous stains enclosing gas bubbles was seen, that, in the absence of signs of physical violence, enabled us to diagnose blood aspiration and subsequent expectoration. The distribution of stains resembled that of a gunshot, i.e., a high velocity impact, but the stain sizes varied substantially which may be caused by varying degrees of gas enclosement. An alternative explanation might be a lack of energy to result in droplet atomization. The underlying pathological process leading to antecedent internal bleeding had to be situated either in the upper

gastrointestinal tract (e.g., esophagus) or in the bronchial system (e.g., tumor bleeding). Even though in our case the sanguineous fluid appeared to be intermingled with stomach content, discrimination of the origin of the hemorrhage on the basis of stain coloration alone seems difficult, because dried bloodstains frequently display a brownish aspect as well. The on-site diagnosis was confirmed by medicolegal autopsy. The findings of this case suggest that gas bubbles enclosed in sanguineous stains may be a spot diagnosis of blood aspiration and may help to identify the cases of natural death caused by internal bleeding in the absence of signs of physical violence.

References

1. Karger B, Rand S, Fracasso T, Pfeiffer H. Bloodstain pattern analysis—casework experience. Forensic Sci Int 2009;181(1):15–20.
2. Pizzola PA, Roth S, De Forest PR. Blood droplet dynamics—I. J Forensic Sci 1986;31:36–49.
3. Pizzola PA, Roth S, De Forest PR. Blood droplet dynamics—II. J Forensic Sci 1986;31:50–64.
4. Hulse-Smith L, Illes MS, Illes M. A blind trial evaluation of a crime scene methodology for deducing impact velocity and droplet size from circular bloodstains. J Forensic Sci 2007;52:65–9.
5. Sauvageau A, Schellenberg M, Racette S, Julien F. Bloodstain pattern analysis in a case of fatal varicose vein rupture. Am J Forensic Med Pathol 2007;28:35–7.
6. Byard RW, Veldhoen D, Manock C, Gilbert JD. Blood stain pattern interpretation in cases of fatal haemorrhage from ruptured varicose veins. J Forensic Leg Med 2005;14:155–8.
7. Evans GA, Evans DM, Seal RM, Craven JL. Spontaneous fatal haemorrhage caused by varicose veins. Lancet 1973;2:1359–61.
8. Gardner RM. Defining a methodology for bloodstain pattern analysis. J Forensic Identif 2006;56(4):549–57.
9. Bevel T, Gardner RM. Bloodstain pattern analysis with an introduction to crime scene reconstruction, 3rd edn. Boca Raton, New York, London: CRC Press, 2008.

Additional information and reprint requests:
Mattias Kettner, M.D.
Zentrum der Rechtsmedizin
Institut für Forensische Medizin
Goethe-Universität Frankfurt am Main
Kennedyallee 104
Frankfurt am Main 60596
Germany
E-mail: M.Kettner@med.uni-frankfurt.de