International Congress Series 1288 (2006) 538–540

www.ics-elsevier.com

BPA analysis as a useful tool to reconstruct crime dynamics. Part II

M. Pizzamiglio, P. Fratini, T. Floris, P. Cappiello, A. Matassa, N. Festuccia, L. Garofano *

Raggruppamento Carabinieri Investigazioni Scientifiche, Reparto di Parma, Italy

Abstract. This paper concerns a case of a gruesome double murder committed by two minors, a girl and her boyfriend, who killed a 40-year-old woman and her son, who was just 12. The victims were the mother and the young brother of the girl, and the murder was committed in their house, as the victims came back from the gym. We refer to technical activities we conducted at the crime scene and the analytical approach we adopted, based on DNA as well as on BPA analyses of bloodstains we recovered, studied and collected during CSI. Following this integrated analytical approach, also supported by fingerprint and footprint exams, it was possible to understand the role of the two young killers and thus reconstruct the dynamics of the event. © 2005 Published by Elsevier B.V.

Keywords: Forensic science; Bloodstain pattern analysis; Crime scene reconstruction

1. Introduction

Very often, murder cases, especially those characterized by large spatter blood pattern, exhibit a complex scenario, which makes it difficult to reconstruct the crime dynamics. In this regard, the BPA approach, especially when it is coupled with DNA and other forensic tools, can provide a very useful contribution to the investigations [1,3,5].

2. Materials and methods

Technical activities were carried out both at the crime scene and in our lab and consisted in an accurate inspection at the scene, followed by photographing the sites in general and, in particular, the position, size and dimension of the bloodstains projected in the different areas of the house (floors, walls, etc.). Due to the specific shape and number of blood stains spattered, we decided to select three major

* Corresponding author. Tel.: +39 0521 537701; fax: +39 0521 206396.
E-mail address: risprcte@carabinieri.it (L. Garofano).

0531-5131/ © 2005 Published by Elsevier B.V.
doi:10.1016/j.ics.2005.10.050

areas where it was worth applying the BPA. The first area was situated in the dining room, just outside the kitchen where the first victim had been murdered, and concerned a large quantity of blood drops located on the floor, which appeared to have been partially washed and was surrounded on both sides by projected bloodstains (see Fig. 1) which were all processed, in order to calculate the point of origin.

All the directions of significant bloodstains (marked in the picture with a red circle) were 2D-analysed to determine the area of convergence located on the floor (marked in the picture with a blue circle). Every labelled bloodstain was then photographed and the respective width W, length L and distance from the area of convergence X were measured. The impact angle θ was calculated too by using the trigonometric formula: $\theta = \arcsin(W/L)$. Lastly, the height of origin from the floor was calculated by means of the trigonometric formula: $Y = X \text{ tg } \theta$ [2,4].

The second area we considered, photographed and measured, concerned the stairs connecting the dining room and the bedroom floor. It was characterized by dripped bloodstains with typical round morphology suggesting orthogonal impact [1,3,5] together with bloody footprint impressions that were subsequently compared with the two suspects' footprints. There were also other latent bloodstains revealed by the luminol treatment and processed as above.

The third area was the girl's bedroom, which was characterized by many significant bloodstains, especially concentrated on the side of desk. Many of these were projected bloodstains, exhibiting a right direction: most likely the area of convergence was near label "84". Under label "84", a typical wipe bloodstain was observed too.

Bloodstains were collected by swabbing with "OralSwab" (Whatman). Phenol–chloroform and other extractions were conducted, followed by quantification with Slot-Blot procedure using

Fig. 1. A picture of the floor of the crime scene where the most significant blood droplets of the child (red circles) were projected all around the main trace (blue circle). Black arrows show the direction of pattern. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 1

Bloodstain	X (cm)	W/L	θ	Y (cm)
8	58	0.22	13°	13
9	83	0.35	20°	30
10	54	0.11	6°	6
12	75	0.39	23°	32
16	88	0.94	71°	0

Quantiblot kit (ABD). Results were analyzed with GeneGnome (Syngene Bio Imaging) with Slot Quant Software (Hitachi v. 2.1.5.5).

Genotyping were done by PCR using both Identifiler, Yfiler (ABD) and PowerPlex 16.2 kits (Promega) according to the original protocols. PCR fragments were separated with capillary electrophoresis using both ABI Prism 310 and 3100 Automatic Sequencer (ABD) and the size call allele was done by GeneMapper v. 3.2 (ABD).

3. Results

DNA typing of the bloodstains located on the floor and those on the stairs appeared to belong to the young victim, while the bloody footprint impressions had been left by the girl smeared with her mother's blood. Quantitative BPA analyses applied to the bloodstains located in the dining room allowed us to determine the point of origin, which was located in the area of convergence at a height from the floor ranging between 0 and 30 cm (see Table 1). In the girl's bedroom, bloodstains located on the side of the desk suggested that the boy was hit when he was almost lying on the floor and that during this dramatic criminal action wipes were produced from his body.

4. Discussion

The results we obtained allowed us to support the hypothesis that the child was first hit in the dining room while running up to help his mother who had been assailed by his sister and her boyfriend, as shown by the bloodstains dripped on the floor as well as the blood projected around. Besides, the typical orthogonal bloodstains, together with bloody footprints on the stairs, confirmed that the boy, already injured, was then "taken" upstairs by his sister who had just taken part in her mother's murder. Furthermore, analyses showed that different attempts were made in order to kill the young brother who was very severely injured in his sister's bedroom. As a conclusion, it is possible to say that in complex murder cases like this one the combination of BPA and DNA analyses together with other forensic techniques is fundamental as they can strongly support the investigation giving relevant data for the reconstruction of the event's dynamics.

References

[1] T. Bevel, Gardner, M. Ross, Bloodstain Pattern Analysis, 2nd ed., CRC Press LLC, 2002.
[2] C. Moore, Three-dimensional models for bloodstain pattern analysis, JFI 52 (2) (2002) 183–203.
[3] A.Y. Wonder, Blood Dynamics, Academic Press, 2001.
[4] A.L. Carter, The directional analysis of bloodstain patterns theory and experimental validation, Can. Soc. Forensic Sci. J. 34 (4) (2001) 173–189.
[5] S.H. James, W.G. Eckert, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press LLC, 1999.