A174 Re-Evaluating Previously Published Methods for Determining the Volume of Dried Bloodstains and Its Height of Fall

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After attending this presentation, attendees will have learned how pertinent blood volume determination is not only helping reconstruct and possibly solve a crime, but also in calculating the estimated height the blood droplet fell from. The correlation between volume, diameter, and height has long been disputed and this presentation will hopefully bring some clarity to that topic.

This presentation will impact the forensic science community being that inconsistencies have been found in previous published research on this topic. By bringing clarity to these issues people will have a better understanding of how blood droplet volume and height can help in the reconstruction of a crime scene.

Early in the study of bloodstain patterns certain relationships were observed that were not fully understood. One such relationship was the correlation between the diameter of a bloodstain and the height from which the resultant droplet fell. Often experiments were developed where a volume of blood was dropped from different heights onto a non-porous target surfaces. The resultant stains were evaluated and exhibited different diameters based upon the differences in height. As useful as this might prove, Balthazard and then later Pizzola pointed out that this relationship is dependent on the volume of the drop. Pizzola went on to further dispel the myth of the "normal droplet" demonstrating that the volume of the blood droplet will vary greatly based upon the surface from which the blood was dripping.

While not always significant on every case, there are times when the height of fall of bloodstain can be of reconstructive significance. To address this issue, a study done in 1986 evaluated if it is possible to determine the volume of blood from examination of the dried blood stain. This information would then be used in conjunction with the stain diameter to conduct experiments on the same target substrate to determine the approximate height of fall.

Four different methods were developed to obtain the dry weight of the blood on different substrates. Once the dry weight was obtained, the original volume was calculated by multiplying the dry weight by a dry weight constant (0.4167 mL/mg). The authors developed the dry weight constant through experiments with known volumes of human blood. The slope of the plot of dry weight vs. volume was the dry weight constant.

Currently this remains the only method in the peer reviewed literature to conduct such a determination and it is widely cited. Initially, the purpose of this study was to evaluate the error associated with this method. A more critical evaluation of the initial publication revealed significant issues. It was not possible to reproduce the published dry weight constant. Replotting the published data revealed what appears to be a typographical error. Instead of the published 0.4167 mL/mg, the dry weight constant was calculated to be 0.004135 mL/mg. When the experiments were reproduced with five different human subjects, the constant was not constant fluctuating between 0.0035 to 0.0040 mL/mg. Similar results were obtained when blood samples were collected with EDTA tubes or with no anticoagulant.

In light of these developments, this project will reevaluate the ability of this method to calculate the volume of dried stains and to determine the height of fall of individual droplets.

Dry Weight, Height of Fall, Blood Volume

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