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METHODOLOGY FOR DETERMINING THE PRESENCE OF BLOODSTAINS IN PHYSICAL EVIDENCE IN FORENSIC MEDICINE

Mukhitdinova Zumradkhon Abduvositovna
Andijan Branch of the Republican Scientific and Practical Center of Judicial Medical Expertise

Abstract: Throughout the entire existence of forensic medicine, the problem of establishing the age of the formation of traces of blood on material evidence, which is of great importance for resolving the issue of the time of the commission of a crime and, accordingly, the involvement of a particular person in it, continues to remain extremely relevant.
Keywords: forensic medicine, method, blood, evidence.

INTRODUCTION

The importance of the problem has been repeatedly noted at All-Union congresses of forensic physicians, where the need for its further research and development of solutions was pointed out [1]. One of the most well-known methods for determining the age of blood stains, the most accessible in practical application, is the assessment of their color [2], which N.S. Bokarius proposed to give by comparing with a scale of samples [3]. However, this same method is perhaps the most subjective, since it depends not only on many environmental factors and the properties of the carrier, but also on the color perception capabilities of the researcher [4]. Attempts to objectify the assessment of color change, carried out by Schwarzacher using a Pulfrich step photometer, were also not accompanied by obtaining unambiguous results, and therefore did not receive wide distribution [4].

MATERIALS AND METHODS

A method for comparing the color intensity of a solution prepared from a cut-out of the stain under study with the addition of distilled water for fresh stains and 15-20% potassium alkali solution for old stains, with control samples of a known age, was presented by Müller [2]. The limitation of the applicability of the method was the need for a constant supply of fresh blood stains to use as a control, as well as the requirement for strict standardization of the research conditions. Wenig E. et al. [3] proposed a solution to the issue of the age of blood stains based on an assessment of the degree of migration of chlorine ions from the stain under study. Subsequently, research in this direction was continued by Russian scientists A.K. Tumanov, G.S. Samuseva [3], A.G. Logvinenko, O.N. Turebaev [4]. They also noted that the migration of chlorine ions is significantly influenced by the nature of the carrier object and the humidity of the air, therefore, the use of this method should be accompanied by a thorough preliminary study of all the conditions in which the carrier object was initially located, which is very difficult to accomplish in expert practice, and sometimes even impossible [2].

RESULTS AND DISCUSSION

The age of a blood stain up to 4-6 months old can be determined by the rate of its discoloration in an aqueous solution of arsenous acid (using the Dragendorff method) or chlorine water [2], in which fresh stains discolor within 1 hour, and stains 1 year old - 5 hours. The low accuracy of the method, among other things, depending on the subjective color perception of the expert, also significantly limited its applicability. Blood is a colloidal polymer solution in which plasma is a solvent, salts, low-molecular organic substances of plasma are dissolved substances, and proteins and their complexes are colloidal components. With the development of laboratory services, one of the popular areas of blood research has become the biochemical method, based on the detection of changes in the quantitative ratio of enzymes, amino acids and trace elements in its stains,

largely due to the duration of the postmortem period [1]. Thus, Schwarz [4] proposed to determine the age of blood stains by the content of catalase, A.S. Gladkikh and V.N. Guzheedov [3] studied the activity of cholinesterase, leucine aminopeptidase and oxytocinase of serum. In the experiment, these enzymes were preserved for 3-5 months, 50-60 days and 80-100 days, respectively, depending on the storage conditions. In their works, Yu.Ya. Kuleshov et al. and Kh.A. Khakimov et al. noted an increase in 17-oxyketosteroids, while P.M. Stombaugh, J.J. Kearney recorded a decrease in LDH isoenzymes depending on the shelf life of blood stains. Acherkan N.N. [3] determined the persistence of glutamate-pyruvate transferase. Permyakov N.K. et al. used an assessment of the pH of the blood in a stain to judge its age, which significantly decreased with increasing storage period of the sample under study. Gladkikh A.S. et al. conducted a study of the isoenzyme spectra of alcohol dehydrogenase and cytochrome oxidase in the blood of living individuals and corpses. Zaretskaya E.F. studied the persistence of glyoxalase-1 on various tissue carriers.

However, even the authors of the works themselves indicated that the fluctuations of the studied enzymes, macro- and microelements of the blood, reached a significant level, since they were caused not only by the time factor, but also by the level of their initial content in the blood of a still living person. In addition, the inevitable influence of environmental factors on the carrier object also required their adequate consideration. It is known that the drying of blood is accompanied by the destruction of antigens of erythrocyte, serum and enzyme systems, which determine its group properties. This process is determined by the effect of various environmental factors (solar radiation, precipitation, etc.) on the blood stain on the carrier object, as well as the adverse effects of all kinds of contaminants. The stability of agglutinogen O to the effects of environmental factors, depending on the time the blood remains in the stain, was noted by Bronnikova M.A. and Sibireva V.P. The persistence of antigens of the MNSs and Pp systems in blood samples during long-term storage for up to 3 years was studied by Chukavina T.E. and co-authors.

In scientific research in forensic medicine in recent years, biophysical methods have become widespread, which have a certain simplicity and ease of use, along with high sensitivity and the ability to objectively record and evaluate the results obtained with their help. Since over time, hemoglobin in a blood stain undergoes a series of changes, changing from oxyhemoglobin to methemoglobin, and then to hematin, Klein, spectroscopically, attempted to judge the age of the stain by the quantitative ratio of oxy- and methemoglobin, which was developed in the works of A.K. Tumanov and F.I. Gurov, who determined the age of blood stains by the spectra of hemoglobin, oxyhemoglobin, methemoglobin, etc., using an ISP-51 spectrograph with an FEP-1 photoelectric converter in the wavelength range of 400-650 nm.

CONCLUSION

Thus, determining the age of a blood stain on material evidence, being a pressing problem for law enforcement officers and forensic experts, is solved by using a wide variety of research methods, such as visual, subjective assessment of the color of the blood stain, and the use of fairly complex, laboratory, objective methods for studying changes occurring in the blood stain over time.

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