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Blood Group Detection by Absorption-Inhibition and Absorption-Elution Methods from Blood Stains on Stone

Nihal Açikgöz H*

Ankara University, Institute of Forensic Sciences, Turkey

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***Corresponding author:** H Nihal Açikgöz, Ankara University, Institute of Forensic Sciences, Ankara, Turkey, Tel: 009056325531604; Fax: 003123192077; Email: nacikgoz@yahoo.com

Abstract

In this study, blood type determination was performed for two years using the absorption-inhibition and absorption-elution methods, which are frequently used for blood group identification. The sensitivity of these two methods was investigated along with the effect of time on blood group identification. It was determined that there was no obvious difference between the two methods. Positive results of the group assignment were obtained from the bloodstains.

Keywords: Absorption-elution; Absorption-inhibition; ABO blood group system

Introduction

ABO blood group system and blood samples are important in forensic sciences. Since most of the forensic cases involve blood at a scene, most of the material sent for examination is bloodstains, which play an important role in identity determination. Identification of the bodies discovered is important in terms of the civil code as well as for maintaining social peace [1,2]. Blood stains found in a location may belong to one person or more [3]. In a case of murder or injury blood stains of both the victim and the suspect can be found at the scene [4]. Stains provide crucial data in establishing the link between the suspect and the scene [2,5]. From the blood stains, group determination and DNA analyzes can be performed to find who the stain belongs to [6]. In order to determine a blood group using biological fluids of a person, they must have a secret or status. Specific blood group antigens are present only in persons with secretor status [7]. In order to determine the later, stains should be tested with the anti-H antibody [2,5]. While Absorption-inhibition method is commonly used to identify groups from bloodstains, absorption-elution method gives result using a much lesser material. However, since there is no extensive study in the literature regarding the role of the period of time and the environment on the expedited bloodstains, this work is aimed to investigate whether there is a difference between the methods in terms of sensitivity and their effect according to the stains' age and their environment.

Materials and Methods

This study was conducted between 1996-1998 at Ankara University, Forensic Medicine Department using blood samples belonging to healthy people taken from Ankara Red Crescent Blood Center. Samples of fresh blood were also collected in our laboratory and their types were confirmed. The blood was tested with anti-H antibody to confirm the secret or status. The positive ones were stained on each of four sides of a stone. Wide stains were placed separately from each other's (Figure 1). The date and the blood type label were noted. The stones were stored under laboratory conditions. A day later, cotton buds soaked in physiological serum were rubbed onto the stains. Then, blood group determinations were made by absorption-inhibition and absorption-elution methods using the rubbed cotton buds.

Figure 1: AB blood group bloodstain on stone.

Results

The results obtained from this two-years' study using the methods of absorption-inhibition, absorption-elution are given below. Using the methods of absorption-inhibition and absorption-elution, a number of 5840 group determinations were made during 730 days for each method to determine the blood group from bloodstains formed on a stone that are frequently thought to be encountered on an open field scene. Using the absorption-inhibition method, false negative results were obtained once every 120 days from type A. Other than this, positive results were achieved during two years. Positive results were also obtained from type B during two years. On the 75th and 150th days, false negative results were found twice a day and positive results were achieved during two years. Positive results were obtained from the type O throughout two years by the absorption-inhibition method. In the absorption-elution method, type A had a false positive result in the first year, false negative during one and a half year in type B and positive results in all the other groups during two years. The results of our study are presented in Table 1. In the absorption-inhibition method, the percentages of average positive results of the stones stained with blood types A, B, AB, and O within two years were: 91.6% in type A, 100% in type B, 83.3% in type AB and 100% in type O.

Table 1: Results obtained by absorption-inhibition and absorption-elution methods throughout 2 years

Method	Group	Days									Years		
		30	45	60	75	90	120	150	180	270	1 year	1.5 year	2 years
Absorption inhibition	A	+	+	+	+	+	FN‡	+	+	+	+	+	+
	B	+	+	+	+	+	+	+	+	+	+	+	+
	AB	+	+	+	FN‡	+	+	FN‡	+	+	+	+	+
	O	+	+	+	+	+	+	+	+	+	+	+	+
Absorption elution	A	+	+	+	+	+	+	+	+	+	FP‡	+	+
	B	+	+	+	+	+	+	+	+	+	+	FN‡	+
	AB	+	+	+	+	+	+	+	+	+	+	+	+
	O	+	+	+	+	+	+	+	+	+	+	+	+

‡: False negative.

‡: False positive.

The percentage of positive results in the absorption-elution method was 91.6% in type A, 91.6% in type B, 100% in type AB, 100% in type O. During this study, 3 (0.6%) false negative results in the absorption-inhibition method and 1 (0.2%) false negative and 1 (0.2%) false positive results in the absorption-elution method were found. It is known that pseudo agglutination may occur when cold agglutinins are present and when erythrocyte suspension is contaminated. The reason for the detection of false positives may also be attributed to contamination [8]. If anti-A, anti-B sera are inadequate, false negatives may appear due to the loss of antibody effect when antiserum is left in the room for a long time and then frozen and defrosted several times. Hemolysis in erythrocytes may also cause negative results [9]. Bacterial contamination in the absorption-elution method can cause hemolysis [10]. Since our experiments detected the very small number of false positives and false negatives, these false results were not taken into account. Results reported by Açikgöz et al. and Sen et al. support our work. The positive results of a two-years' period using stones proved that blood stains' groups could be determined using both methods. It has been found that there is no difference in the positivity of blood group assignments results made using the absorption-inhibition and the absorption-elution methods.

Conclusion

In our study, there is no obvious difference between the methods of absorption-inhibition and absorption-elution in the determination of the bloodstains' groups. When the amount of the stain is sufficient, the result of the application of these two methods is more accurate. When the amount of the stain is insufficient for the two methods, it has been determined that the absorption-elution test can be relied on alone. In all the materials, the percentages of correct results of blood types A, B, AB, and O over a period of two years were found to be 93.75% in the absorption-inhibition method and 95.83% in the absorption-elution method. Although there was a difference of 2.08% between the two methods, the absorption-elution method seems to be more sensitive. However, no statistical difference ($p > 0.05$) was revealed. In this case, the absorption-elution method may be sufficient when the amount of the stain is very small. Since antigens in blood stains found on an open field are destroyed much sooner than in other environments, samples should be sent to test centers where the examination is conducted in a very short time.

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