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Original Research Article

Evidentiary value and effects of contaminants on blood group factors in medico-legal grounds

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Abstract

Background: Blood is considered to be the most common trace evidence obtained from the scene of crime. Blood grouping reveals vital information regarding identification, in relation to crime investigation. With this respect contamination with dust, rust, bacteria and detergent will have any effect on blood grouping was studied.

Material and methods: Randomly A, B, AB, Rh positive samples were taken in duplicates and were added with rusted pins, dust particles, detergent, staphylocopcci bacteria and without any addition one tube was kept in room temperature. Controls were kept in refrigerator at 4-8 ˚C to compare the results.

Results: There were lots of changes in blood groups after 10 days of incubation in all tubes with contamination. Blood samples in dust after 10 days incubation had changed from A, B, AB to O blood group with Rh negativity. Blood samples in rust had retained with original ABO group but Rh positives were converted to Rh negative. Detergent tubes had also changed Rh positives to negatives retaining original ABO. There was no change in either ABO or Rh blood groups in tubes with Staphylococci bacteria.

Conclusion: Stains contaminated with common agents like dust, rust, bacteria and detergent give inconclusive results by mixed agglutination method with passage of time. The results may be accepted with caution, as the opinion might be medico legally significant.

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Key words

Blood group, Contamination, Medico-legal.

Introduction

Human identification is based on blood type which is determined by the presence or absence of certain identifiers on the surface of red blood cells. These identifiers, also called antigens, identifies own red blood cell type. There are four main ABO blood type groupings: A, B, AB, and O. These blood groups are determined by the antigen on the blood cell surface and the antibodies present in the blood plasma. In addition to the ABO group antigens, there is another blood group antigen located on red blood cell surfaces known as the Rhesus factor or Rh factor, this antigen may be present or absent from red blood cells [1]. The use of blood groups and protein polymorphisms to identify possible sources of human stains left at the scene of a crime is still being practiced by judiciary. Blood grouping is still vital in identifying an individual though newer DNA typing methods are available in many scenarios [2].

Blood is considered to be the most common trace evidence obtained from the scene of crime. Collection of bloodstain from the scene of crime as well as from the victim and suspects is an important procedure for crime investigation [3]. Grouping of forensic blood stains is known to be trustworthy, but for investigation of transfusion reactions at necropsy whole red cells must be used [4]. Grouping blood has no reliable results if it is contaminated with various agents like dust, rust, detergents or any bacterial contamination. Also stored blood contaminated may also yield erroneous results with passage of time. These results will be definitely of value in medico legal cases [3].

With this background, this study was taken up, to study the effects of various contaminants on blood stored and the blood grouping results.

Material and methods

This study was done in the Department of Pathology, Mandya Institute of Medical Sciences, Mandya. Blood samples (5 ml) of different blood groups were randomly collected from blood bank attached to our college. A, B, AB, O and Rh positives samples were taken in sterile vacutainers in 6 duplicates.

One tube was kept as control which was stored in refrigerator at 4-8 ˚C. Second tube was kept at room temperature. Third tube of all blood samples were added with a pinch of dust. Fourth tube was added with rusted pins of iron, fifth tube with chunks of detergent and last tube of all blood groups were added with Staphylococcus species bacteria.

All the tubes were kept at room temperature except the controls for 20 days. On the first day, grouping was done and results were noted. At regular intervals on 5^{th} day, 10^{th} day, 15^{th} day and 20^{th} day, blood grouping was done and results were noted.

Blood grouping was done using slide agglutination method with anti-A, anti-B, Rh antisera using standard methods [1].

Results

Slide agglutination results were noted and analyzed. On 1^{st} day of blood grouping the results were same as the controls without any change in the blood groups. On 5^{th} day, there was no change in blood groups except for

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weaker reactions in few blood samples from tube with dust particles.

There were lots of changes in blood groups after 10 days of incubation in all tubes with contamination which has been predicted as per **Table - 1**.

Blood samples in dust after 10 days incubation had given varied results, all blood groups (A, B, AB) had changed to O blood group with Rh negativity. Few blood samples in rust had retained with original ABO group but Rh positives were converted to Rh negative. Detergent tubes had also changed Rh positives to negatives retaining original ABO. There was no change in either ABO or Rh blood groups in tubes with Staphylococci bacteria.

Discussion

The reliability of blood grouping from contaminated stains has been always questioned in medico-legal scenarios.

The tissues of the body decompose at different rates after death, but little is known of how long red cell antigens persists [4]. Blood grouping is a very important issue in crime scenes. Before days only blood group identification was useful method in fixing up the identity of criminal. Though nowadays, DNA typing methods are available, still blood grouping is important in issues where there are any mismatched blood transfusions and complications.

In this study, there was gross change in the blood group after 10 days of blood storage especially when contaminated with dust. There was loss of A and B antigens giving the blood group as O. Rh positive blood had turned up into Rh negative in blood with dust, detergent and rust after 10 days of storage. Another similar study has shown similar report with changes in A, B, AB and Rh in blood contaminated with dust, detergent and bacteria [3]. Our study supported the findings of other authors who strongly advised against the use of blood grouping of decomposed and contaminated stains, as the results may be inconclusive [5].

In contrast to one study [3], our study indicated that bacterial contamination has no change in any blood groups. This can be justified saying that our blood is usually having transient bacteremia with oral and skin colonisers like Staphylococci species which usually doesn't alter the blood groups. A study reported the existence of gram negative coccobacilli which affected the blood group A substance and other study have reported the effects of aerobic soil microorganisms and cell free extracts, which decomposes blood group substances [6, 7, 8].

The reports of false agglutinogens in stored blood have appeared [4]. It becomes very important that blood stains on rusted weapons will just change in Rh factor. This has been in contrast with a study which has said that rust did not show any effect on the RBC or the agglutinogenic capacity and grouping could be satisfactorily done up to the third week [3]. Rh factor appears more vulnerable to rust (ferric oxide).

In detergent sample, there was change in Rh factor after 10 days of incubation in B blood group. Similar findings were noted in the sample marked detergent the Rh was negative at 10^{th} day. It has been established that hemagglutination is dependent on the membrane flexibility and deformability of the erythrocytes, which in turn is influenced by the ATP content [9, 10]. Detergents contain alkaline agents, which alter the fragility of the erythrocyte membrane that in turn affects the antigenicity [7].

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Conclusion

Blood grouping though is an important identity in identifying crime; it is not reliable if it is contaminated with dust, detergent, rust etc. Older stains in crime will be usually contaminated. So we have to be careful while identifying blood groups in case of medico-legal issues.

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Table – 1: Results of blood grouping in various tubes with different conditions.

Blood group	Days	Control tube	Room temp	Dust	Rust	Detergent	Staphylococci
A	1	+VE	+VE	+VE	+VE	+VE	+VE
	5	+VE	+VE	+VE	+VE	+VE	+VE
	10	+VE	+VE	**O +VE**	+VE	+VE	+VE
	15	+VE	+VE	**O –VE**	+VE	+VE	+VE
	20	+VE	+VE	**O –VE**	+VE	+VE	+VE
B	1	+VE	+VE	+VE	+VE	+VE	+VE
	5	+VE	+VE	+VE	+VE	+VE	+VE
	10	+VE	+VE	**O –VE**	+VE	**B-VE**	+VE
	15	+VE	+VE	**O –VE**	**B-VE**	**B-VE**	+VE
	20	+VE	+VE	**O –VE**	**B-VE**	**B-VE**	+VE
AB	1	+VE	+VE	+VE	+VE	+VE	+VE
	5	+VE	+VE	+VE	+VE	+VE	+VE
	10	+VE	+VE	**O –VE**	**AB-VE**	+VE	+VE
	15	+VE	+VE	**O –VE**	**AB-VE**	+VE	+VE
	20	+VE	+VE	**O –VE**	**AB-VE**	+VE	+VE
O	1	+VE	+VE	+VE	+VE	+VE	+VE
	5	+VE	+VE	+VE	+VE	+VE	+VE
	10	+VE	+VE	**O –VE**	+VE	+VE	+VE
	15	+VE	+VE	**O –VE**	+VE	+VE	+VE
	20	+VE	+VE	**O –VE**	+VE	+VE	+VE