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Original Research Article

A COMPARATIVE STUDY BETWEEN EMERGENCY, REGULAR AND GEL CARD METHODS OF CROSS MATCHING IN A TERTIARY CARE CENTER

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ABSTRACT

Background: Serological incompatibilities are to be identified prior to any blood product transfusion. Cross matching can be performed by various methods, including rapid saline method, indirect antiglobulin method and gel method which consume different amounts of time. **Aims:** The present study was taken up to compare various methods of cross matching and to identify pros and cons of different methods.

Materials and Methods: The present study is a prospective four-month study taken up in a tertiary care blood center attached to the government general hospital. Cross matching was performed using either of the three methods available based on time period available. Transfusion reactions that occurred after each method of cross matching were recorded.

Results: A total of 2776 cross matchings and blood transfusions were done over this period. 12 cases of transfusion reactions were recorded of which highest number occurred in cases of coombs method.

Conclusion: Gel method was found to be the easier and safer when compared with other methods.

Keywords: Coombs method, Emergency Cross match, Gel card method, incompatibility, Rapid Saline method.

INTRODUCTION

Cross matching is a procedure performed prior to transfusion of blood or blood products to detect any serological incompatibilities in the blood of donor and recipient. The three commonly employed methods are emergency cross match (Rapid saline method), regular cross match (Indirect antiglobulin method) and Advanced cross match (Gel method)

Emergency cross matching is also known as Immediate-spin cross-matching (ISCM) that is faster, but less sensitive. It can save lots of time since incubation and the antihuman globulin (AHG) phase of testing are not required. In Regular method, antiglobulin reagent is added which detects IgG antibodies in addition to IgM antibodies.

Lapierre introduced gel tests using principle of controlled centrifugation of red cells through sephadex gel contained within a microtube.[1] Gel card method is not only useful for cross matching but also for ABO and Rh(Rhesus) typing and identification of alloantibodies. Gel card method is better than conventional tube method because of its simplicity, stability of results, dispensation of controls, absence of wash phase with comparable sensitivity and specificity.[2]

The present study was carried out to compare various methods of cross matching and to know the advantages and disadvantages of various methods.

MATERIAL AND METHODS

This was a prospective study conducted for a period of 4 months from September 2023 to December 2023 in the Blood bank, Government general hospital, Guntur. All the samples with proper requisition forms for cross matching were included in the study. All the samples with incomplete details were excluded from the study. Emergency cross matching was done whenever there is a request from the clinicians. In the remaining cases, regular method or gel card method was followed depending on the availability of the gel cards.

All the protocols for cross matching were followed according to Directorate general services (DGHS) manual.[3] In emergency cross matching, two tubes were taken. In one tube, labelled as major tube, 4 drops of patient's serum is mixed with 2 drops of 3% suspension of donor RBC at 2:1 ratio. In the second tube, labelled as minor tube, 4 drops of donor serum is mixed with 2 drops of 3% saline suspension of patient's RBC. Then centrifuge both the tubes for 1 minute at 1000rpm, discard the supernatant, place a drop on slide, wash the slide with 0.9% NS and view it under microscope for any agglutination. Only IgM Antibodies (Ab's) can be detected by this method.

In the regular method, after adding serum and RBC to both major and minor tubes, incubate them for 45 minutes at 370c and then centrifuge for 1min at 1000rpm. Discard the supernatant, add 1-2 drops of AHG, wait for 5min, place a drop on slide, wash and view under microscope. Both IgM and IgG antibodies can be detected by this method.

In gelcard method, first label the gel card and then remove the aluminium foil. Then 0.8% donor red cell suspension was prepared by adding 10µl of packed red cells of the donor in 1ml LISS in another test tube. Next add50µl of 0.8% donor red cell suspension to the gel card followed by 25µl patient serum to it. Incubate the gel card in gel card incubator for 15 minutes at 370C. After incubation, centrifuge the card in gel card centrifuge machine for 10 min and then read the result. If RBC's were settled at bottom of particular microtube it means there is no agglutination (Negative)and donor's blood is compatible to the recipient.

Positive results are graded from 1+ to 4+. A 4+ reaction shows solid band of RBC's on top of the gel. A 3+ reaction has agglutinated RBC's in the upper half of gel column. A 2+ reaction is characterized by RBC agglutinates dispersed throughout the column, while a 1+ reaction shows RBC aggregates in mainly lower half of the column.

Data wasanalyzed using Statistical package for social sciences (SPSS) version 26. Descriptive statistics like frequencies and percentages for categorical variables were used to represent the data.

RESULTS

A total of 2776 crossmatchings were done over a period of four months. The age of the patients ranged from one day to 81years. There were 1063males(38.3%) and 1713 (61.7%) females.

Gel method was done in 1347(48.5%) cases, regular method in 1219 (43.9%)cases and emergency cross matching in 210 (7.6%) cases. The time required to perform gel method was 15- 20 minutes, regular method was 45-60minutes and rapid saline method was 10 minutes.

The blood groups transfused in the present study were O+ve1089(39.3%) cases, B+ve 923(33.2%), A+ve 501(18.1%), AB+ve 151(5.4%), O-ve 51(1.8%) Cases,B-ve 41(1.5%), A-ve 16 (0.6%)cases, AB-ve 4 (0.1%)cases.

Indication for blood transfusion wasanemia in 1384(49.8%) cases, surgery in 852(30.6%) cases followed by fractures, burns, infectious conditions like pneumonia, haemoperitoneum, thalassemia and sickle cell disease.

Packed red blood cells (PRBC) were transfused in 2727 (98.2%) cases and whole blood in 49 (1.8%) cases. Pediatric bags (20-180ml) were issued in 119 (4.2%) cases.

Transfusion reactions were seen in 12 (0.43%) cases, most of which were chills, fever, urticaria and hypotension. All the reactions were mild. The indication for transfusion was surgery in 6 cases, anemia in 5 cases and thalassemia in 1 case. The reactions occurred in 4 (0.3%) cases of gel method, 6 (0.5%) cases of coombs method, and 2 (0.9%) cases of saline method. Out of 12 cases, reactions occurred in 11 adults and 1 child. These reactions occurred in six cases of O+veblood group, four cases of A+ve blood group and one case each of B+ve blood and AB+ve blood group.

DISCUSSION

Blood grouping and cross matchings have proven to be of immense importance in safe transfusion and in avoiding serious transfusion reactions. Hektoen suggested that the safety of transfusion may be improved by crossmatching of blood between donors and recipients.[4] Later Ottenberg performed first transfusion after cross matching.[5] Coombs introduction of antiglobulin test in 1945 further improved the safety of transfusion by making it possible to detect not only the IgM or immediate agglutinins but also IgG or incomplete antigens which recipients may develop against other blood types.[6] During the last 100years cross matching along with antibody screening has become standard practice in transfusion medicine. Introduction of cross matching and serologic testing has immensely improved the safety of transfusion in near elimination of hemolytic transfusion reactions. Today misidentification of intended transfusion recipient is more likely to cause a reaction rather than an error in

cross matching. Further adaptations like computer crossmatching and molecular genotyping may play further role in improving safety of blood transfusion. Swarup et al. had done comparative study on coombs method and gel card method on 1000 samples.[7] Their study showed that gel card method is better than conventional spin tube method because of its simplicity, stability of results with comparable sensitivity and specificity.

Garg et al. have found that regular cross matching with addition of AHG has 100% sensitivity and specificity, but it requires skilled expertise.[8] Voak et al. found that over‐vigorous agitation to dislodge the cell button can cause false‐negative results.[9] The washing step often causes elution of weakly bound antibodies. The end‐points of the reaction are unstable and reading requires a high level of expertise.[10] Prolonged incubation phase delays the release of blood in emergencies. Low ionic strength solution (LISS) medium increases the rate and amount of alloantibody uptake and decreases the incubation time.[11,12] But it has a disadvantage that it increases the uptake of gamma globulins and complement leading to false positive reactions.[13,14] Gel card method has many advantages over conventional methods. It has an objective reading phase, results are standardized and reproducible. There is no washing phase and hence no elution of antibodies thus contributing to the improved sensitivity of the test. The reactions are stable for several days and can be photocopied or photographed for future reference. Lange et al. found increased incidence of false positives with gel card method compared to conventional tube methods.[15] Alwar et al. also found certain disadvantages like high cost, false positive reactions (macrocytosis, marked leukocytosis and increased Erythrocyte sedimentation rate) and the possibility of missing C3d coated red cells.[16]

Dhariwal et al. studied 800 random samples and compared tube method with gel card method and concluded that tube method is more time consuming, results are subjective and this method is not suitable for future record keeping.[17] Though regular cross matching is still considered gold standard in pretransfusion testing, it still has various disadvantages and depends on accurate hand to eye work of the laboratory personnel.

The sensitivity and specificity of both gel card method and coombs method is 100% whereas the specificity of saline method is 98.9%.[2]

CONCLUSION

Gel column method is easier, safer method for cross matching compared to saline and coombs methods. Though the cost is little higher side, it has more sensitivity compared to other methods.

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