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A Comparision of Conventional Tube Method and Column Agglutination Technology in an Immuno Haematology Laboratory

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ABSTRACT

Background: Rapid technological advancements in pretransfusion procedures in an immuno-hematological laboratory are a result of the increased focus on the quality and safety of blood products. Numerous automated pretransfusion testing platforms have been developed as a result of the inherent drawbacks of the gold standard conventional tube method. The invention of Column Agglutination Technology was the biggest advancement among these.

Aim:

1. To compare the results of blood grouping and crossmatching by Conventional Tube Method and Column Agglutination Technology.

2. To statistically evaluate the results obtained betweenColumn Agglutination Technology and ConventionalTube Technique in our immunohematology laboratory.

Materials and Methods:

The study was performed in blood bank of a tertiary hospital in Mangalore during the month of January,2022 in which 500 samples were subjected to blood grouping and cross matching. The data obtained was extensively studied. Sensitivity, specificity and statistical analysis were done by Fisher's exact test.

Results: In comparative evaluation of CAT and CTT of 500 samples, there was concordance rate of 99.6% in blood grouping and concordance of 99.8% in crossmatching. In both the scenarios, the discordance was evaluated and foundCAT is superior to CTT. The most common blood group of both studies was 0 positive. Statistical analysis using Fisher's test proved statistically significantdifference between grouping and cross-matching via both tests with a p value of 0.000001 and 0.01 respectively. The sensitivity and specificity of bothtests showed CAT to be superior with 100% sensitivity and 100% specificity while in CTT, the sensitivity was 100% with 66.6% specificity.

Conclusion: The study establishes that CAT is more sensitive, specific, rapid, reliable procedure and is a better substitute of CTT in pretransfusion testing.

Keywords: Column Agglutination Technology;Conventional Tube Method; Blood grouping; Cross matching.

I. INTRODUCTION

Rapid technical advancements in the immunohematology laboratory are a result of the growing focus on the quality and safety of blood products. Pretransfusion test is a critical element of entire transfusion process.[1,2]

Immunohematology's traditional pretransfusion testing methods are rather laborious. Despite being the gold standard, the manual approach has drawbacks. Drawbacks include interobserver variability, low affinity, antibody elution during washing phase, and results that can vary depending on the cell serum ratio. Additionally, the process is labor-intensive and entirely operator reliant.[3]

These flaws have been addressed by column agglutination technology (CAT), which has significantly improved the calibre and reproducibility of results. Since of its semi-automated characteristics and user-friendly modules, it is perfect for a wide range of red cell serology tests in blood banks because it reduces the possibility of false weak or false negative results. Therefore, column agglutination technology has the potential to significantly reduce effort due to its open system. [3]

The present study is a comparative evaluation of conventional tube method (CTT) and column agglutination technology in an immunohematology laboratory in our blood bank.

OBJECTIVES OF THE STUDY

1. To compare the results of blood grouping and crossmatching by Conventional Tube Method and Column Agglutination Technology.
2. To statistically evaluate the results obtained between Column Agglutination Technology

and Conventional Tube Technique in our immunohematology laboratory.

II. MATERIALS AND METHODS:

The study was performed in blood bank of a tertiary hospital in Mangalore during the month of January,2022 in which 500 samples were subjected to ABO and Rh blood grouping and cross matching by the Conventional tube method and Column Agglutination technology.

The following samples were excluded from the study

1. Hemolyzed samples
2. Neonates in view of incompetent development of antibodies.
3. Transfusion transmissible infections(TTI) reactive samples.

For forward grouping by conventional tube method, the patient's red blood cells were washed three times in normal saline(0.9NaCl) and5% cell suspension was made. 6 micro tubes were vertically arranged in a rack labelled as A, B,AB,D,A1 and H. One drop of antisera is added into the corresponding labelled tubes respectively along with 1 drop of patient's 5% cell suspension into each labelled tube.The contents of the tubes were gently mixed and kept at room temperature for 45-60 minutes.Agglutination indicates the presence of corresponding antisera in serum.

For reverse grouping, 3 small test tubes are labelled as A cells, B cells and O cells. 2 drops of 5 % pooled cells of A, B and O are added in the respective tubes with 2 drops of serum to be tested in each tube. The mixture is incubated at room temperature for 5 mins and centrifuged at 1000RPM for 1 min. Agglutination indicates the presence of antisera.

For column agglutination technology, the procedure given by Ortho workstation system were followed using Ortho BioVue ABD CTL Reverse cassettes. 40ml of patient's plasma or serum sample is added in A1 cell or B cell columns for reverse grouping and 10microL of 3-5% of patients RBC cell suspension was added to Anti A, Anti B, Anti D and control columns(1-4) in the cassette for forward grouping. 10 microL of 3-5% concentration of Affirmagen or In-house A1 cell is added in column 5 and B cell in column 6. For crossmatching, 40microL of either patients' serum in case of major cross match or donors' serum in case of minor cross matchwere added to the column.

Centrifugation was done for 5mins and results were interpreted. Positive results were graded as 1+ to 4+ where 4+ indicates the presence of agglutinated cells formed as a band at the top of the bead column.The data obtained was extensively studied. Sensitivity, specificity and statistical analysis were done by Fisher's exact test.

III. RESULTS:

In the present study, a total of 500 cases of donor and recipient samples received at blood bank in a tertiary hospital in Mangalore were studied for comparative evaluation, blood grouping and cross matching using conventional tube method and column agglutination technology.The study population comprised of 43.8%(219) males and 56.2%(281) females. Therefore, male to female ratio is 1:1.2 in our study. The age distribution ranged from 0 month to 84 years with the mean age of 42.6 years. The maximum number of patients were in age group of 41-50 years and the minimum were in 80-90 years.ABO and Rh blood grouping on 500 samples were tested parallel by the CTT and CAT. The results were compared. The two techniques showed a concordance of results for 496/500(99.2%) samples tested for blood grouping while there was discordance in 4 out of 500 samples(0.8%).In a study done by RaginiS et.al, similar results were found with497 (99.4%)samples were compatible, and 3 (0.6%) samples were incompatible with Gel card method, but by test tube method 492 (98.4%) samples were consistent. [4] Majority of the patients had 0 positive blood group followed by A positive blood group.In the present study, 500 cases were also evaluated for cross matching by CAT and CTT, there was concordance between 2 methods in 494 cases(98.8%), however 6 cases of incompatibility were detected in CAT while only 4 cases of incompatibility weredetected in CTT.Comparative evaluation of CAT and CTT was done for statistical analysis using fisher method and the p value of 0.01 was obtained which showedstatistical significance. In multiple studies done by Garg Set.al, D Cheng et.al, Swarup D et.al and Nam et. al, they found CAT to be most efficacious when compared to CTT.[5,6,7]

IV. CONCLUSION:

The traditional gold standard CTT due to its variable sensitivity, low reproducibility, time consuming and labor intensiveness, technical errors and requirement of experienced staff to interpret the results lag the CAT.

Thus, Column agglutination technique with improved sensitivity, standardized operative procedure and increased productivity is a simple, rapid test which can be employed in immunohematology laboratory.

CONFLICT OF INTEREST:

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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