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EVALUATION OF INCOMPATIBLE CROSSMATCH AT A TERTIARY CARE BLOOD CENTER

Transfusion Medicine

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ABSTRACT

Introduction: For the provision of safe and effective blood or blood component; pretransfusion testing is necessary. cross-matching is one of the basic tests. Problems occurred during crossmatching should be resolved by proper methods and standard operating procedures (SOPs). The aim of this study is to find the incidence and cause of incompatible crossmatch and to formulate root cause analysis to help ensure safe and effective transfusion. Also, to document and analyzed the cause behind incompatible crossmatch. **Materials And Methods:** This study was conducted Prospective at our blood centre for October 2020 to October 2022. Blood request form was received along with 2 ml labeled sample in ethylenediaminetetraacetic acid and plain tube. Crossmatching was done by column agglutination method in poly specific (IgG+C3d) bead cards by ortho clinical diagnostic. In case of incompatible results, it was resolved using appropriate steps. **Results:** The major cause of incompatibility is alloimmunization (48.83%). Other causes of incompatibility were HDFN (16.30%), AIHA (10.46%), DIHA (7.00%), Donor DCT positive (7.55%), other blood grouping error (7.55%), sampling error (1.16%) and technical error (1.16%). most commonly seen in females (65.70%). **Conclusion:** Alloimmunization was most prevalent cause of incompatible crossmatch. The most common allo anti body identified is anti D. Incompatible crossmatch give rise to a challenge in the field of transfusion medicine. Root cause analysis for identifying all the contributing factors to a problem so that corrective action can be taken. The approach for this is a safe transfusion.

KEYWORDS

Incompatible Crossmatch, Indirect Coombs Test, Direct Coombs Test, Alloimmunization, Antibody Screening, Antibody Identification.

INTRODUCTION:

Blood transfusion (hemotherapy) is a therapeutic intervention in modern practices like the treatment of various hematological disorders, emergencies like polytrauma, postpartum hemorrhage and surgical procedures like cardiac transplant surgeries, etc.). One of the main responsibilities of transfusion services is to provide safe blood and blood component to the right patient at the right time. For pretransfusion testing is necessary. The pretransfusion test is based on the principle of agglutination so that we prevent immune mediated hemolytic reaction. This pretransfusion tests contain a number of steps. Cross-matching is one of the basic tests. This crossmatching is performed before every transfusion of blood or blood components Crossmatching is done to ensure that transfused blood is compatible with patient to provide therapeutic benefit. It helps in detecting the presence of antibodies in the recipient against the RBC of the donor. Problems occurred during crossmatching should be resolved by proper methods and standard operating procedures (SOPs) so that we can avoid unnecessary delayed in transfusion. If transfusion can be stand over, the resolution of problem should be beneficial to the patient even though apparently compatible units are available.[1] occasionally it happens that some nonspecific reaction may not themselves be dangerous to patient but may interfere with compatibility testing. Once these problems have been resolved, units which are incompatible may preferable to for transfusion; it is necessary that problem should be completely resolved before transfusion when nonspecific agglutination is present. [2]

The clinical and serological evaluation, which let to transfusion of best matched (least incompatible) blood; which requires a combine response of clinician and transfusion medicine specialist.[3] The aim of the study was to find the prevalence and cause of incompatible crossmatch by column agglutination test and to formulate root cause analysis to help ensure safe transfusion.

MATERIALS AND METHODS:

This was a prospective study conducted in a tertiary care hospital in western India for 2-year period from October 2020 to October 2022. Annual collection of the centre is average 25,000. Annual issued blood and blood component are 35,000. A duly filled and authorized Blood Request form along with 2 ml labelled sample in ethylene-diaminetetraacetic acid (EDTA) and 4 ml plain tube was received. Samples should be freshly collected with filled all details of patients. Samples having visible evidence of gross deterioration/ hemolysis were excluded from the study. Detail history of patients like previous transfusion, medication history, pregnancy or abortion was taken.

ABO and Rh Blood group of recipient and donor was done by column agglutination test was done by complete grouping card by Tulip diagnostics. Cross-matching was done by column agglutination technique in poly specific (IgG + C_3d) gel card of tulip diagnostics. Ten microliters of 0.8% donor red cell suspension in LISS, 25 µl of patient's serum added in cassette, incubated at 37°C for 15 min, and centrifuged for 10 min. In case of any incompatible result, it was resolved using appropriate steps.

Direct anti-globulin test by column agglutination technique in AHG phase. Indirect anti-globulin test by column agglutination technique in AHG phase. Antibody screening with 3 cell panel and Antibody identification with 11 cell panel by micro plate solid phase system in NEO IRISã Immucor.

In case of incompatible major cross-match results, it was resolved using appropriate steps as shown in FIGURE 1.

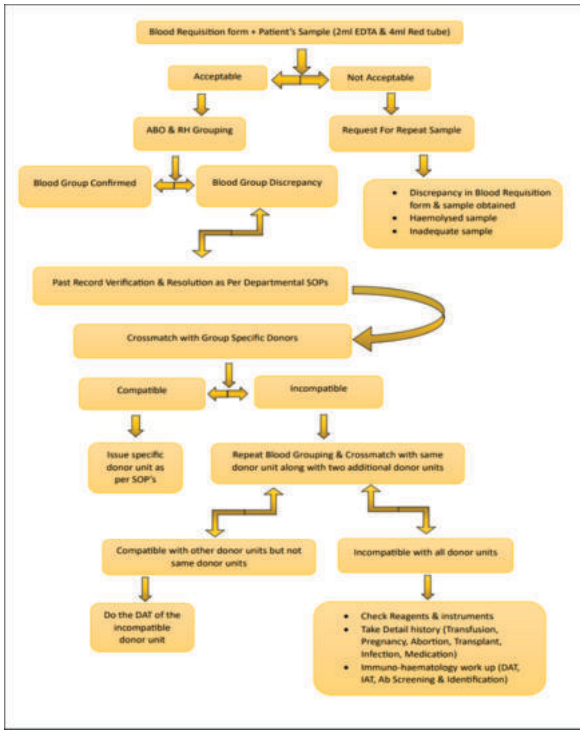

Figure 1: Approach To Incompatible Crossmatch

RESULT

In this study out of 80,332 samples total of 78,412 cross-matches were done in our setup. Only 172(0.21%) patients were found to be incompatible and evaluated and an appropriate donor unit was issued. The crossmatch incompatibility was much higher in the females (n=113,65.70%) than in the males(n=59,34.30%).The overall distribution of incompatibility ranges in age is 1 DOL to 80 years. In which maximum incidence of 34.90% (n=60) in the age group 21-30 years. A minimum incidence of 1.74% (n=3) was observed in the age group 71-80 years of age FIGURE 2.

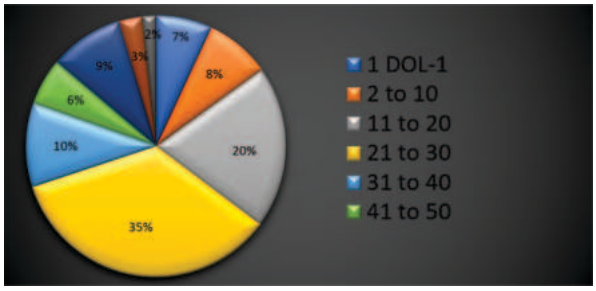

Figure 2: Age Distribution.

Out of the total of 172 samples highest incidence of incompatibility is showing in FIGURE 3 diagnosed anemia (n=78,45.34%) other cases like ANC (n=43,24.85%),HDN(n=10,5.81%), Auto-Immune disease like SLE, Sjogren's syndrome MTCD, etc. (n=4,2.32%), Cancer pt (n=3,1.72%), TB (n=1,0.60) CKD (n=5,2.90%), Cardiac disease (n=2,1.16%), Liver's disease (n=6,3.50%), Bone Marrow Transplantation (n=1,0.60%), Trauma (n=4,2.32%%) and Miscellaneous (n=13,7.55%).

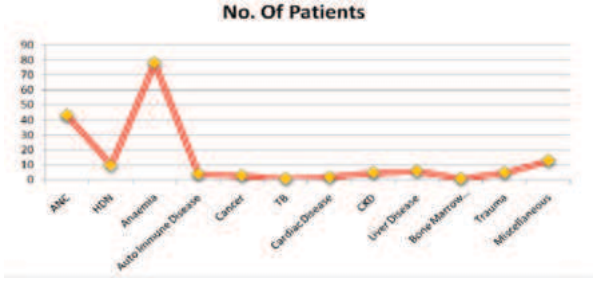

Figure 3: Diagnosis Associated With Incompatible Crossmatch.

In anemia cases, there is a higher incidence of Thalassemia Major and other like Macrocytic Anemia, Thalassemia Intermedia, Thalassemia Minor with ANC and Sickle Cell D's. During the evaluation reason behind incompatibility is diagnosed after all laboratory investigations and taking a detailed history of the patient. In which there is most common cause analyzed is alloimmunization 84(48.83%). The least common is due to sampling error 2(1.16%) and technical error 2(1.16%).

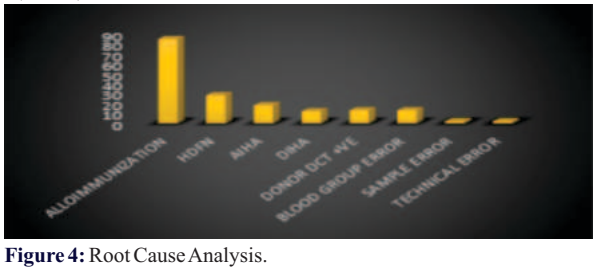

Figure 4: Root Cause Analysis.

There is a total of 13(7.55%) donors are DAT positive due to which crossmatch is incompatible in those cases. All donors are strongly positive with grades (2+ or 3+).

A total of 65 patients are tested for antibody screening and identification. Which shows different antibodies out of which the most commonly detected antibody is Anti-D (27.70%). The second most common is Anti-E (9.23%) and Anti-c (9.23%).

Table:1 Specific Antibodies Detected In The Study Population

Specific Antibody	No of patient
Anti-D	**18**
Anti-c	**6**
Anti-C	**1**
Anti-S	**4**
Anti-E	**6**
Anti-e	**3**
Anti-K	**4**
Anti-N	**3**
Anti-s	**1**
Anti-M	**2**
Anti-p	**1**
Anti-Lua	**5**
Anti-Cw	**1**
Anti-Kpa	**2**
Anti-Jka &Jkb	**2**
Anti-Leb	**1**
Anti-Fyb	**1**

DISCUSSION:

Pre-transfusion testing is the safe margin. It includes proper blood sample acceptability, determining ABO and Rh blood grouping, screening for red blood cell antibodies, identification of specific unexpected antibodies, selection of donor blood units that are appropriate for the recipient's ABO and Rh blood group and unexpected antibody status, and performing a crossmatch between donor and recipient. The causes for the incompatible crossmatch could be due to patient or donor unit factors and technical or clerical errors.[4]

The incidence of persistent incompatible crossmatch cases was 0.21% similarly the study by Bhatt et al. in Western India showed an overall incidence of incompatibility was 0.21% and the study by Bhattacharya et al. in the eastern part of India incidence was 0.69%. The majority of incompatible cross-matches were found in females (65.70%) which is comparable to a study conducted by Bhatt et al. in the Western part of India [5] and Bhattacharya et al. in the eastern part of India.[6]

In our study, the most common age group is 21 to 30 years (n=60, 34.90%) contrast to Bhattacharya et al. the most common age group is 11 to 20 years (39%).[6]

In Our study Alloimmunization (48.43%) was the most prevalent cause of incompatible crossmatch which is similar to the study conducted by Bhattacharya et al [6] in this Alloimmunization (38%) was the most prevalent cause of incompatible crossmatch, whereas in contrast to the study connected by Bhatt et al [5] where AIHA (40%) was the most prevalent cause of incompatible crossmatch. Stainsby et al (2005) have given a thorough overview of the causes of ABO incompatible blood transfusion in the UK.[7]

In our study, we found 13 cases of incompatible crossmatch due to DAT-positive donor units. Now a days, there is an emphasis on the use of type and screen and electronic crossmatch instead of type and crossmatch in pretransfusion testing. These can miss DAT-positive donor units unless DAT screening of donors is included in pretransfusion testing. Since these eight units were discarded, we cannot comment on their effects if transfused. Similar cases of incompatible crossmatch due to DAT-positive donors were reported by Puri et al. [8] There are no clear guidelines and policies for the deferral of DAT-positive donors. Mostly, blood donors with a positive DAT result appear to be perfectly healthy and have no obvious signs of hemolytic anemia. However, a careful evaluation may show evidence of increased red cell destruction.

The antibodies present in the recipient's serum that can give incompatible results during crossmatch are either alloantibodies or autoantibodies which are generated due to loss of immunological tolerance to see RBCs antigens. This result is comparable to the study observed by Goldfinger and Lu [9] and the study by Bhattacharya et al [6] in which the most common antibody detected belonged to the Rh system. But the specific most common antibody was Anti-E followed by Anti-c (34.78%) and Anti-D (4.34%). Whenever any alloantibody (s) were detected corresponding antigen (s) negative compatible or best-matched unit was issued after consultation with the treating clinician [1]. Each of these transfusions was under the supervision of the treating clinician.

CONCLUSION:

Alloimmunization was most prevalent cause of incompatible crossmatch. The most common allo-anti body identified is Anti D.

Incompatible crossmatch give rise to a challenge in the field of transfusion medicine. A logical stepwise approach will enable the provision of safe transfusion.

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