Prevalence of Red Cell AlloAntibodies & AutoAntibodies in Patient & Donor attending a Tertiary Care Hospital in South Gujarat

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ABSTRACT

Introduction Red Blood Cell (RBC) alloimmunization may result from disparity of RBC antigens between donor and recipients. Data about alloimmunization rate & frequencies of the blood group antigens other than ABO and Rh in South Gujarat population is limited. Aim: To study the prevalence and to find frequency of RBCs alloantibodies in Patients & Donors, a tertiary care hospital, in South Gujarat.

Material and Methods: A Retrospective study was performed utilizing data during the period from year 2017 to 2019. Antibody screening was carried out in 51870 patients and 29105 donors, using both tube and column agglutination technique.

Result: The overall prevalence of irregular RBCs antibodies was 153(0.19%). A total of 7(0.024%) donors showed presence of irregular antibodies among 29105 donors. A total of 146(0.28%) patients showed presence of allo or auto antibodies among 51870 patients. The majority of these patients had a single alloantibody (39.04%), remaining 29.45% had multiple antibodies, 8.22% had autoantibodies, 2.74% had blood group discrepancy, 29.45% cases were not determined. The Anti D antibody comprised the most common alloantibody (19.17%) followed by the Anti Lewis (b) antibodies (6.85%). The highest incidence of alloimmunization was observed in patients of obstetrics and gynecology.

Conclusion: The study emphasizes the necessity for carrying out immunohematology studies prior to every blood transfusion. The alloimmunization complicates the transfusion outcomes. Implementation of red cell antibody screening in all the blood donors and patients routinely helped us to understand the prevalence of antibodies in defined study region and its importance in providing compatible blood products and to avoid transfusion reactions. Authors recommend pretransfusion antibody screening and identification; along with provision of Rh phenotype matched blood to multi transfused patients.

Keywords: RBC antigens, Alloantibodies, Autoantibodies, Blood Transfusion.

INTRODUCTION

Red Blood Cell transfusion has become a life-saving therapy for patient management in modern medicine. As many of the patients require blood transfusion during their illness or lifetime. The blood transfusion services must ensure safe blood supply with quality management. Alloimmunization of red blood cells is a common and potentially serious consequence of blood transfusion. Presence of alloantibodies in patients leads to difficulty in finding compatible blood.[1] Thus, knowledge of such all alloantibodies is essential for selecting appropriate RBC products for transfusion. Antibodies that may cause hemolysis include those specific to most of the major and the minor blood groups.[2,3,4,5,6,7] The exact kinetics of alloimmunization are not clear, these RBC antigens and alloantibodies differ significantly among human populations and ethnic groups; hence may depends on genetic and acquired patient-related factors, dose and the immunogenicity of the antigens.[1,8,9] Autoantibodies can also be found along with alloantibodies which have been reported (to be as high as 28%).[10] The concomitant presence of auto- and alloantibodies may further complicate serological workup and cause difficulty in finding the compatible cross match blood, still may result in decrement in post transfusion survival of RBCs.[11,12,13] The extended matching would be a solution, but associated costs and logistics, is another concern in our country, especially when resources are limited.[11] The author performed this study to investigate the type and frequency of antibodies against RBCs antigen. This study was done to look at prevalence and distribution of antibodies among blood recipients & donors in south Gujarat.

MATERIAL AND METHODS

This study for allo and auto antibody screening & identification for 51870 patients & 29105 Donors was conducted at blood bank attached to Immune-Haematology and Blood Transfusion department of the tertiary care hospital in South Gujarat between the years 2017 to 2019. All the patients and donors underwent antibody screening by indirect antiglobulin/ coombs test by using inhouse pooled O cells & screen positive cases were further tested with commercial pooled O cells, antibody screening & identification panels to precisely characterize the irregular antibody and to determine their specificities in case of alloantibodies. Antibody screening and identification performed using commercially available

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RBCs panels of Reagens Kft, Budapest, Hungary (Reacells I, II, III & ReaCell Panel), & RBC panels of DiaMed GmbH, Switzerland (ID DiaCell I II III & ID DiaPanel) by using column agglutination technique(Gel). The presence of auto antibody was checked by direct coombs test & auto control of the patient/donor. In suspicious cases of cold antibodies; blood grouping, auto control, compatibility test & ICT were conducted at all three thermal amplitude (04 degree C, 37 degree C & at room temperature). Advanced investigations such as Adsorption, Elution by Heat Elution & Acid Elusion using DiaMed GmbH, Switzerland (DiaCidel), Papain enzyme treatment of RBCs using Tulip Diagnostics, Goa, India (LIQUIPAP), reaction with cord blood cells, Select cell panel, Saliva testing (Inhibition test), Saline Replacement method, Donath Landsteiner test, etc. were performed whenever required. Donors' or patients' demographic details like age, sex and ethnic origin were recorded along with their medical & transfusion history if any. Various statistics like percentage & *P* value were calculated using Microsoft Excel 2010 software.

RESULTS

A total of 29105 donors (28613 males & 492 females) and 51870 patients (21035 males & 30835 females) were included in the present study. Age of the donors included in the study ranged from 18 to 60 years and for patients it's from 01 day to 82 years. Among the alloimmunized cases, the age ranges for donor and patient from 25 to 44 years and 26 to 50 years with a mean age of 30.42 +/- 8.60 years and 28.57 +/- 14.36 years respectively. Among total number of donor and patients, 07 (0.024%) and 146 (0.28%) respectively were positive for different type of irregular antibodies. 12 (08.2%) patients among 146, were having auto antibodies while 01 (14.28%) donor was having autoantibody among 07 donors. Among the 07 donors with antibodies, all were male donors. Among 146 patients with antibodies, 41 were male patients which were 0.19% of total male patients & 28% of total patients with antibody while 105 female patients were positive for antibody which were 0.34% of total female patients & 72% of total patients with antibody.

Female patients were significantly more positive for irregular antibodies (Chi-square test 2 tailed *P* value is 0.0028). The odds ratio for male and female positivity was 1.75 indicating that female were almost 02 times more prone to develop alloantibodies in comparison to male patients. Among the positive cases, blood group distribution is shown in table 1.

One out of seven donors and 27 out of 146 patients had multiple antibodies while remaining donors and patients had single auto/allo antibody. Among the total 07 donors with alloantibody, 04 (57.14%) were having Anti Leb antibodies, 01 (14.29%) was having Anti M, 01 (14.29%) was having Cold Auto Antibody, whereas 01 (14.29%) was not determined due to having multiple antibodies in serum but has low titer in plasma. In case of 146 patients with

ABO/Rh group	Allo/Auto immunized Donors in Numbers	Allo/Auto immunized Donors in %	Allo/Auto immunized Patients in Numbers	Allo/Auto immunized Patients in %
O	00	-	37	25.34%
A	06	85.71%	41	28.08%
B	00	-	46	31.51%
AB	01	14.29%	16	10.96%
Rh positive	06	85.71%	105	71.92%
Rh negative	01	14.29%	35	23.97%
Total	07	100%	146	100%

Table-1: The distribution of blood groups among the study patients

Antibody	Number of Donors found Positive	Percentage	Number of patients found Positive	Percentage
Anti D	0		28	19.17%
Anti c	0		5	3.42%
Anti E	0		3	2.05%
Anti Le^a	0		7	4.79%
Anti Le^b	4	57.14%	10	6.85%
Anti M	1	14.29%	2	1.37%
Anti N	0		1	0.68%
Anti Jkb	0		1	0.68%
Anti c + Anti E	0		5	3.42%
Multiple Antibodies	0		22	15.07%
AutoAntibodies	1	14.29%	12	8.22%
Auto + AlloAntibodies	0		3	2.05%
Not Determined	1	14.29%	43	29.45%
Antibodies with BG Discrepancy	0		4	2.74%
Total	7	100%	146	100%

Table-2: The distribution of irregular erythrocyte antibodies detected

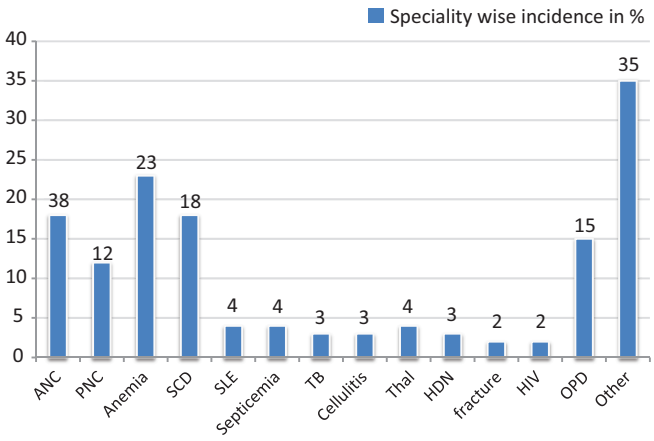

Figure-1: A bar chart showing the sample distribution according to their medical histories

alloimmunization 28 (19.17%) were having Anti D, 10(06.85%) & 07 (04.79%) were having Anti Leb & Anti Lea respectively, 05 (3.42%) were having Anti c, 05 patients with anti c & anti E, 03 (2.05%) were having Anti E, 02 (01.37%) patients with anti M and one (0.68%) patient with each anti N, anti Jkb. (Table 2) During the study period, 27 patients were with multiple antibodies, 12 with autoantibody, 03 were with auto and allo antibodies and in 43 cases antibody specificity could not identified.

DISCUSSION

The knowledge of prevalence of different blood group antigens in any population is always helpful in managing cases of alloimmunization, autoimmunization, and multiple transfused patients, who are likely to develop antibodies against these minor blood groups as it is not practically feasible to match all these minor antigens before transfusion so as to avoid immunization. As blood is routinely matched with respect to major blood group antigens i.e. ABO and Rh D antigen, there is a high probability that the donor will have minor blood grouping antigens not present in the recipients which will result in alloimmunization. Finding compatible units in blood banks with limited facilities, for such patients in local population is a difficult task, especially if patient has developed more than one antibody. Other than RBC alloimmunization, immunological complications of repeated RBC transfusion include difficulties obtaining compatible blood, development of autoantibodies, acute or delayed hemolytic transfusion reaction, and hemolytic disease of the new born.[14] Factors influencing the immunization rate and distribution of RBC alloantibodies include age, gender, ethnicity, number of transfusions, autoimmune disease, immunoglobulin level, lymphoproliferative disease, solid malignancy, and amount of incompatible erythrocytes received by the individual through transfusion.[15]

Data from various studies reported that the role of alloimmunization in blood donors varies from 0.05% to 3.9 %.[15,16,17,18,19,20,21,22,23,24] In present study, the immunization rate was (0.024%) among blood donor, which is comparable with the similar study done by Pahuja et al. showed prevalence of 0.05%.[18] Garg et al. reported a prevalence of 0.09% among the whole blood donor.[17] On the contrary, Giblett had reported 0.32% prevalence in blood donor.[27] several study has reported that the rate in blood donor varies from 0.32% to 2.4%.[21,27] The study from Seattle, Washington, had reported 0.32% incidence of irregular erythrocyte antibodies in blood donors, and study by Winters et al. in 2001, reported a prevalence of 0.89%.[15] In our study, the highest frequency of alloantibodies was identified in blood donor aged between 25 and 44 years in our study, which is similar to study done by Deepti Sachan et al.[28] Most frequent antibodies identified were from Lewis system; Anti Lewis(b) found to be 71.43%, which can be clinically significant when detected at 37 degree C, which causes a problem in pretransfusion testing. One (14.29%) donor had autoantibodies (DAT Positive), which is much higher than reported by Tiwari et al. (0.04%) and Kaur et al. (0.05%).[16,23] As per our institutional policy, DAT-Positive blood units were discarded. One (14.29%) case was not determined, due to low titer or dilution of antibodies in donor plasma.

In present study, overall immunization rate was (0.28%) in patients; which is low when compared with a study done by Thakral et al. who reported prevalence of 3.4%.[29] In a similar study in Tehran and Kuwaiti, prevalence of alloimmunization reported was 0.97% and 0.8 to 1.6% respectively.[12,21] Female patients had higher rate of alloimmunization than male in the study, which is similar with the study done by Shamsuz zaman.[30] 105 (68.63%) out of 146 immunized patients were women, with significant association in chi-square test (*P* value <0.05). which is similar to a systemic review by Verduin et al., showed that women have slightly higher rate of alloimmunization than men although they Categorically state that, based solely on sex difference, results do not satisfy recommending additional matching for women.[31] The high prevalence of alloimmunization in patients of obstetrics and gynecology could be due to immunization through pregnancy and high incidence of RBC antigenic exposure in this group.

The most prevalent antibodies in present study were against D (19.17%), Lewis-b (6.85%), Lewis-a (4.79%), c (3.42%), E (2.05%), E + c (3.42%) antigens. Reemameen also reported anti D as the most common antibody.[21] In present study of 28 patients with anti D majority were multiparous females who might have formed anti D due to previous pregnancies or transfusion. whereas Al-Joudi et al. reported anti E as the most common antibody; which is similar to the study done by Thakral et al. and Shamsuz zaman.[29,30,32] The difference in antibody specificity could be attributed to the difference in the study population.

The differences in antigenic composition of Indian population and the Caucasian, Blacks and Chinese populations highlight certain important points. One of these is the use of screening cell panels with foreign antigenic profile. Most of the transfusion centers in our country that perform antibody screening to detect the presence of unexpected antibodies in their patients mostly use commercially prepared screening cell panel procured from western countries. The intention of improving blood safety by performing antibody screening

in all prospective patients is a great step towards reducing adverse reactions caused by transfusion.[25] However, the use of screening cells prepared from foreign donors still leaves a possibility where the antibodies, especially the ones against minor antigens may go undetected.[26] Salamat et al. also emphasized that red cell panels sourced from local population would be better for detection of antibodies as cell panels from nonindigenous populations may miss certain antibodies against antigens in local population.[33] The issue of routine antibody screening of all patients requiring transfusion, that too, in resource limited countries is debatable.

CONCLUSION

Red cell antibody screening of the donor adds a layer of safety in transfusion. Which emphasizes the need for the mandatory screening and identification of irregular RBC antibodies among blood donors and it creates an eye view of the necessary for better use of donor blood, more efficient services as well as safe and compatible blood transfusion, especially for previously alloimmunized individuals. The indigenous development of local cell panels would be a better option to ensure adequate supplies of reagent red cells and introduction of type and screen policy for all the patients. In addition, we recommend that in cases where the antibody is found in blood donor, they should be informed, so that in future if they require any transfusion they can inform the blood bank prior. Patient with identified alloantibodies can be flagged in a database and the information can be shared between institutions and shared with the patient in the form of report issuing to the concern person as well as patient education if possible to avoid the complication of immunization, provide corresponding antigen negative blood following antibody screen and identification. Female shows higher predominance of RBC alloimmunization than males in case of patients. Overall, anti D and anti Lewis (b) are the most common clinically significant antibodies identified in population of south Gujarat.

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