

Distribution of ABO and Rh-D Blood Groups Among Blood Donors: Western India Data

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Abstract

Introduction: The distribution of ABO and Rhesus (Rh) - D blood groups varies from one population to another. The ABO and Rh blood groups play an integral role in blood transfusion service. They also have an important and useful role in population genetic studies and certain medico-legal cases. We carried out this study with the aim of determining the distribution of ABO and Rh blood groups among blood donors. This would also help in the planning of the ever increasing demand for safe blood and blood products.

Aim: This study was undertaken with the aim of determining the distribution of ABO and Rhesus blood groups among blood donors in a tertiary care hospital in Western India.

Materials and Methods: A retrospective study was performed over 5 years. The ABO blood grouping and Rhesus typing were done by tube method using venous blood samples.

Results: The most common blood group was "O" (32.38%), followed by "B" (31.40%), "A" (26.70%), and "AB" (9.51%). The frequency of Rh positive group (94.62%) is more than Rh negative group (5.38%).

Key words: ABO groups, Blood donors, Blood transfusion, Rhesus groups

INTRODUCTION

The ABO blood groups and Rhesus (Rh) blood group antigens are the most frequently studied genetic markers. Although the antigens involved in ABO and Rh blood groups are stable throughout the life, ABO and Rh genes and phenotype vary widely across different races and geographical areas.¹ The aim of any blood transfusion to the patient is that it should be beneficial to the patient. This is possible when we provide the patient with donor red cells that optimally survive after transfusion and serve their function.² The distribution of ABO and Rh blood groups is important for the effective management of

blood banks.³ The ABO blood group system was the first human blood group system discovered by Landsteiner in 1900.⁴ The ABO blood group system is the only system in which antibodies are constantly present in the serum of human beings whose red cells lack the antigens. Depending on whether Rh antigen is present on red cells or not, Rh phenotype is classified as Rh - D positive and Rh-D negative. Although all individuals share the same blood group system, they differ in the frequencies of a specific type.⁵ ABO and Rhesus (Rh) groups varies markedly in different parts of the world. Karl Landsteiner discovered the blood groups ABO and classified it into A, B, and O groups. Blood group AB was discovered by Landsteiner's associate, Von Decastello and Sturli in 1902. The Rh (D) antigens have greater immunogenicity than all other red cell antigens except A and B antigens. Transfusion of ABO-incompatible blood can be associated with acute intravascular hemolysis, renal failure and death. So in the blood bank, every blood donation is screened for ABO and Rhesus factor. This

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study was conducted with the aim of determining the distribution of ABO and Rhesus blood groups among blood donors.

MATERIALS AND METHODS

This was a retrospective study conducted over a period of 5 years. Venous blood was collected in EDTA and plain clean vacutainer tubes and allowed to clot naturally at room temperature. The ABO blood Grouping and Rhesus typing were determined by tube method. Forward grouping was carried out using monoclonal anti- sera; anti-A, anti-B, anti-AB, and anti-D (Eryclone, tulip diagnostics Ltd.). Results of ABO grouping were confirmed by reverse grouping using known A and B red cells. Rhesus negativity was confirmed by repeat testing and by Du-gel cards (DiaMed - ID, Coombs Anti-IgG cards).

Each antiserum was validated before using it including titer and avidity of each new lot. For reverse group testing, cells were pooled from three different known donor samples. These pooled cells were prepared daily using pretested known blood group samples.

Statistics

After data collection, data entry was done in Excel. Data analysis was performed with the help of Epi Info version 8. Qualitative data have been presented with the help of frequency, and percentage table and association among various study parameters was assessed with Chi-square test. $P < 0.05$ was taken as significant.

Table 1: Total blood collection and sex distribution of donors

Year	Total donors (%)	Male (%)	Female (%)
2007	14810 (19.32)	13736 (17.92)	1074 (1.40)
2008	15394 (20.08)	14128 (18.43)	1266 (1.65)
2009	14849 (19.37)	13289 (17.34)	1560 (2.04)
2010	15820 (20.64)	14703 (19.18)	1117 (1.46)
2011	15780 (20.59)	14507 (18.93)	1273 (1.66)
Total	76653	70363 (91.79)	6290 (8.21)

Table 2: Group wise distribution of blood donors

Year	Blood Group A (%)	Blood Group B (%)	Blood Group AB (%)	Blood Group O (%)	Rhesus positive (%)	Rhesus negative (%)	Total donors (%)
2007	3971 (5.18)	4623 (6.03)	1363 (1.78)	4853 (6.33)	14005 (18.27)	805 (1.05)	14810 (19.32)
2008	4077 (5.32)	4843 (6.32)	1512 (1.97)	4962 (6.47)	14534 (18.96)	860 (1.12)	15394 (20.08)
2009	4003 (5.22)	4641 (6.05)	1427 (1.86)	4778 (6.23)	14033 (18.31)	816 (1.06)	14849 (19.37)
2010	4189 (5.46)	5006 (6.53)	1382 (1.80)	5243 (6.84)	14990 (19.56)	830 (1.08)	15820 (20.64)
2011	4229 (5.52)	4955 (6.46)	1609 (2.10)	4987 (6.51)	14964 (19.52)	816 (1.06)	15780 (20.59)
Total	20469 (26.70)	24068 (31.40)	7293 (9.51)	24823 (32.38)	72526 (94.62)	4127 (5.38)	76653

RESULTS

We studied ABO and Rh blood groups in 76,653 donors composed of 91.79% male and 8.21% female donors as shown in Table 1. They were in the age group of 18-60 years. The distribution of ABO and Rh groups is shown in Table 2. Out of 76,653 donors, the most common blood group was "O" (32.38%), followed by "B" (31.40%), "A" (26.70%), and "AB" (9.51%) which was found to be statistically significant ($P < 0.05$). Rh positivity was found in 72,526 (94.62%) donors while 4,127 (5.38%) donors were Rhesus negative.

DISCUSSION

Although ABO and Rh genes and phenotypes are stable throughout the life, they vary widely across races and various geographical boundaries. These genes and phenotypes also have different biochemical compositions.⁶ The polymorphism in these blood group system is important in population genetic studies, in evaluating the probability of hemolytic disease in the newborn, resolving paternity dispute cases and for forensic purposes. The distribution of ABO and RH-D phenotypes in different populations has been extensively studied. These blood group systems are not only important in blood transfusions but also associated with different diseases including cardiovascular diseases, organ transplantation, and erythroblastosis in neonates. Blood transfusion is a life-saving procedure but can cause acute and delayed complications. Complications of blood transfusions with wrongly labeled blood groups may be mild or can be life-threatening. Rh system found to be second most important blood group system due to hemolytic disease of newborn. The importance of Rh system has found in Rh-D negative individuals in subsequent transfusions once they develop Rh antibodies. This D antigen is the most important in transfusion practice in which the person whose red cell lacks the D antigen do not regularly have anti-D in their serum. The aim of this study was to determine the distribution

of ABO and Rhesus blood group among blood donors. In our study, the most common blood group was “O” (32.38%) followed by “B” (31.40%), “A” (26.70%), and “AB” (9.51%) which is comparable with other studies. The study by Nag and Das⁵ in West Bengal population were also observed that “O” blood group (34.8%) was common followed by blood groups “B” (33.6%), “A” (23.9%), and “AB” (7.7%) which is comparable with our study. Studies by Anjali *et al.*,⁷ Periyavan *et al.*,⁸ Enosolease and Bazuaye,⁹ Das *et al.*,¹⁰ Mwangi¹¹ also showed that blood group “O” was the most common followed by group “B,” “A” and “AB” which is comparable with this study and also the findings regarding occurrence of Rh typing was almost in agreement to that from our study. In our study, Rh positivity was found in 72,526 (94.62%) donors while 4,127 (5.38%) donors were Rhesus negative. The study by Randriamanantany *et al.*¹² also showed that Rh positive was by far the most prevalent which is comparable with our study. Other studies conducted by Hamed *et al.*¹³ showed 94.23% Rh (D) positivity and 5.77% Rh (D) negativity while Thakral *et al.*¹⁴ showed 93.39% Rh (D) positivity and 5.56% Rh (D) negativity which is comparable with our study.

CONCLUSION

We established that among the various ABO and Rh-D blood groups, blood group “O” is the most common followed by blood groups “B,” “A” and “AB” with a predominance of Rh positivity. In addition to compatibility test in blood transfusion practice, knowledge of the blood group distribution is also important for geographical information, genetic studies and for forensic studies in the population.

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