



DISTRIBUTION AND OCCURRENCE OF ABO AND RHESUS BLOOD GROUPS IN BLOOD DONORS OF GHAZIABAD: A HOSPITAL BASED STUDY

Pathology

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ABSTRACT

Introduction: Geographical distribution of ABO and Rhesus (Rh) antigens is important for blood transfusion services and population genetics studies. More than 400 red cells antigen have been identified, but the antigens determining ABO and Rh blood group systems are the most important in Transfusion Medicine.

Objective: This study was conducted with an objective to study the distribution of ABO and Rh blood groups among blood donors in a teaching hospital in Ghaziabad, Uttar Pradesh, India which is essential for effective management of blood inventory.

Material and Methods: It is a retrospective study conducted at the Blood Bank, Santosh Medical and Dental College Hospitals. The data was collected from 01/01/2016 TO 31/07/2020. Total 7078 blood donors were considered medically fit and accepted for blood donation. ABO and Rh typing was done by both forward and reverse grouping technique with tube agglutination method using commercially available standard monoclonal antisera and freshly prepared pooled cells.

Result: Out of 7078 blood donors, B blood group was most common (2561-36.2%), and the least blood group was AB Blood group (803 – 11.3%). There were more Rh-positive blood donors (6551 – 92.6%) as compared to Rh-Negative blood donors (527 – 7.4%).

Out of 7078 blood donors, 6766 (95.6%) were male and 312 (4.4%) were female donors.

Conclusion: The most common blood group among voluntary donors was B positive and least common blood group was AB negative. The study has a considerable implication with respect to the inventory management of blood bank and transfusion services for the patients admitted in our teaching hospital.

KEYWORDS

ABO, Rhesus (Rh), Blood Group, Blood Donors, Ghaziabad.

INTRODUCTION

Human blood groups are genetically inherited and exhibit varying degree of polymorphism. There is a significant difference in the frequency of distribution of the various blood groups in the population. Of the various blood group systems, the ABO blood group system is the most important blood group system in health and disease.¹

To date about 400 red cell antigens have been recognized by International Society of Blood Transfusion.² These antigens are organized into 36 human blood group systems, and each person has a unique spectrum of blood groups with the exception of identical twins or triplets whose blood groups are exactly the same.^{3,4} The most important human blood group systems for blood transfusion or transplantation are the ABO and Rhesus blood systems. Red blood cells contain a series of glycoproteins and glycolipids on their surface, which constitutes the blood group antigens.

Karl Landsteiner, a scientist from Vienna, discovered the ABO blood group system in the year 1901.¹ He identified three blood group types A, B and O. Alfred Von Decastello and Adrian Sturli discovered the fourth blood group AB, in 1902.⁵ Genes encoding the ABO system are located on the long arm of chromosome 9q and determine the presence or absence of A and B surface antigens. Antibodies of ABO system (Anti A and Anti B) are naturally occurring and are found in the serum of individuals missing the corresponding antigen.

The Rh blood group system was found in 1941.¹ Rh phenotype is classified as Rh – D positive and Rh – D negative depending on whether Rh antigen is present on red cells or not. The Rh - D antigens have greater immunogenicity than all other red cell antigens except A and B antigens. Incompatible blood transfusion can be associated with acute intravascular hemolysis, renal failure and death. It may cause of haemolytic disease of the newborn (HDN) and hence crucial in Obstetrics. Of all the Rhesus antigens, D antigen is most immunogenic. On exposure to the D antigen via pregnancy, transfusion or transplantation, individuals with initially absent D

antigen, produce Anti D. So in the blood bank, every blood donation is screened for ABO and Rhesus factor.

Despite the fact that all individuals share the same blood group system, they differ in the distribution and frequencies of a specific type.⁷ ABO and Rhesus (Rh) groups vary markedly in different parts of the world. The distribution and occurrence of ABO and Rh blood groups is vital for the effective management of blood banks.⁶ This study was conducted with the aim to determine the distribution of ABO and Rhesus blood groups among blood donors.

MATERIAL AND METHOD

It is a retrospective study conducted at the Blood Bank, Santosh Medical and Dental College Hospitals. The data was collected from 01/01/2016 TO 31/07/2020. This data included both voluntary and replacement donors who have donated blood in the blood bank or the voluntary blood donation camps conducted by the department. The donors were first registered and screened by filling up a registration form carrying all the information like personal details, demographic details, occupation and medical history. The medical officer then screened the donors according to blood donor selection criteria and guidelines from drug and cosmetic act and NACO. Individuals with good health, physically fit and mentally alert were selected for blood donation as donors. The donors were then requested to sign the donor questionnaire and inform consent form.

Total 7078 blood donors were considered medically fit and accepted for blood donation. After blood donation, ABO and Rh typing was done by both forward and reverse grouping technique with conventional tube agglutination method from pilot samples of the donors following standard operating procedures of the blood bank. The forward grouping was performed using commercially available standard monoclonal antisera Anti A, Anti B, Anti AB and Anti H (Tulip diagnostics ltd) and reverse grouping was performed using freshly prepared pooled cells (A cells, B cells, O cells). For Rh typing anti D antisera (Tulip diagnostics) of two different lots was used.

Different technologists did the forward and reverse grouping. The blood group was confirmed only when forward and reverse groups were identical. Rh-negative blood groups on screening were confirmed by the antiglobulin technique (Du testing). Weak D blood groups were regarded as Rh-positive.

All reagents were used after appropriate quality control tests. The donor blood group were recorded and analyzed.

Data was analyzed for frequency, distribution of ABO and Rh blood groups and Descriptive statistics like mean and percentages using Microsoft Excel.

RESULTS

The total healthy blood donors studied from January 2016 to July 2020 were 7078. Distribution of blood donors, according to gender shows, there were more male donors (95.6%) as compared to female donors (4.4%). Out of 7078 blood donors, B blood group was most common (2561-36.2%), and the least common blood group was AB Blood group (803 – 11.3%). We found that the percentage of ABO blood groups in donors in descending order as follows: B > O > A > AB. (Table 1). Rh blood group distribution of blood donors is shown in Table 1. There were more Rh-positive blood donors (6651 – 92.6%) as compared to Rh-Negative blood donors (527 – 7.4%). There was no difference in Rh blood group distribution in male and female blood donors. Distribution of blood donors according to gender and type of donor is shown in Table 2. There were more male donors (95.6%) than female donors (4.4%) and more replacement donors (70.1%) than voluntary donors (29.9%). Most common ABO and Rh blood group was B Positive (33.5%), and the least common was AB Negative (0.8%) (Fig 1). There was no Bombay blood group detected in the present study period.

Table 1. Distribution of ABO and Rh blood groups among the study population.

	A	B	O	AB	Total
Rh Pos	1667 (23.5%)	2375 (33.5%)	1761 (24.9%)	748 (10.6%)	6551 (92.6%)
Rh Neg	118 (1.7%)	186 (2.6%)	168 (2.4%)	55 (0.8%)	527 (7.4%)
Total	1785 (25.2%)	2561 (36.2%)	1929 (27.3%)	803 (11.3%)	7078 (100%)

Table 2. Distribution of blood donors according to gender and type of blood donor (voluntary and replacement) over the period of study.

Year	Male	Female	Voluntary	Replacement
2016	1450	104	414	1140
2017	1530	88	500	1118
2018	1240	80	418	902
2019	1940	20	612	1348
2020 (till July)	606	20	174	452
Total	6766 (95.6%)	312 (4.4%)	2118 (29.9%)	4960 (70.1%)

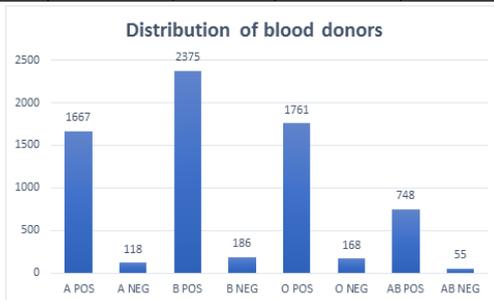


Fig 1. Graph showing ABO and Rh blood distribution among blood donors

DISCUSSION

The present study shows that blood group B occurs most frequently among the donors, and blood group AB is the least common. Knowledge of the distribution of ABO and Rhesus blood groups is an important element in determining the direction of recruitment of voluntary blood donors as required in each region and for effective management of blood banks inventory, be it at a facility of small local

transfusion services or regional or national transfusion services. In the present study males (95.6%) comprised the significant donation group as compared to female donors (4.4%) which is similar to other Indian studies.^{8,9} The lower rate of donation in females in developing country like India is due to cultural habits, social taboo, lack of motivation and fear of donation. Besides, large numbers of females from the menstruating age groups are anaemic with low weight, so unfit for blood donation. The general health of females should be improved by a good nutritional diet and iron supplements. The fears regarding blood donation in females need to be driven out by making them aware of the advantages of blood donation.

Voluntary blood donors in the present study were 29.9% in comparison to studies done by Garg P et al. and Girish C et al. where voluntary donations were 0.91% and 37.30% respectively.^{10,11} It is essential to increase the number of voluntary donations so that blood is available to all patients in an emergency without waiting for the replacement donors. Furthermore, the risk of transmitting transfusion-transmitted infections is less with voluntary donations.¹² Therefore voluntary blood donations are encouraged to get safe blood.

The most frequent blood group was B, followed by O, A, AB. This is similar to other studies from North India in which blood group B was found to be predominant.⁸ Studies from Southern India like Periyavan et al., Suresh et al. and Soonam John et al. showed a conflicts pattern of frequency where O blood group was predominant.^{9,13,14} In the Country like Pakistan and Nepal the predominant blood groups were B and A respectively.^{15,16} Studies from West zone, Central zone, and East zone like Agrawal A et al. showed a conflicts pattern of most common blood group was O positive.¹⁷ In the present study, 92.6% of blood donor population showed Rh positivity for D antigen, while 7.4% showed Rh D negativity. The Rh D positive blood group was found in the range of 91% to 97% across India in different studies.¹³⁻¹⁷ The blood group AB also found as the least common blood group in the range of 5% to 12% across India in different studies.¹³⁻¹⁷

Knowledge of frequency of various blood groups is vital for management and transfusion services and to determine the recruitment of voluntary blood donors in each zone across the country for maintaining the blood bank inventory. In addition to the transfusion service, knowledge of ABO and Rh blood groups are also beneficial in resolving certain medicolegal issues like disputed parentage and population genetic studies. It also helps in a preventive action against the diseases which are linked with blood groups. Studies conducted to find the possible association between blood groups and cardiovascular diseases have confirmed that persons with group A are more frequently affected with atherosclerosis, ischemic heart disease, coronary heart disease and venous thrombosis. In contrast, blood group O people have a lower incidence of these cardiovascular diseases.^{18,19} There is a 14 % lower risk of squamous cell carcinoma and 4 % reduced risk of basal cell carcinoma in blood group O individuals when compared to the non-O group.²⁰ Group O is also associated with a reduced risk of pancreatic cancer.^{21,22} Individuals with blood group B are at increased risk of ovarian cancer.²³ Gastric cancer is reported to be more frequent in blood group A and least in group O.²⁴ Hence generation of a simple database of blood groups via regional blood grouping studies not only help in drafting better National Transfusion Policy but also help in the efficient delivery of services during emergencies, natural disasters and enables insight into the future burden of Diseases.

CONCLUSION

The present study concludes that B (36.2%) blood group is the most common, and AB (11.3%) blood group is the least common blood group among voluntary blood donors in central Gujarat. Regarding the Rh blood group system, there were more Rh-positive blood donors (92.6%) as compared to Rh-negative blood donors (7.4%). Blood donation by females was meagre (4.4%) compared to males(95.6%). Health status of females needs to be improved. They should be motivated and made aware of the benefits of blood donation.

The study helps to prepare a database for the blood banks and helps in maintaining inventory by creating awareness as to which blood groups should be stored. It is beneficial to conduct similar well-designed studies in other states of India to determine the blood group frequencies in the different regions. So, it is advisable to have blood grouping studies in each region for drafting better national policies and for maintaining the adequate supply of blood to the needy patients during an emergency. The data generated in such studies will be useful

to health planners to face future health challenges in the region.

Ethical Clearance: The study was conducted after being cleared from the institutional ethics committee.

Source of funding: Nil

Conflict of interest: None

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