

ORIGINAL ARTICLE

FREQUENCY AND DISTRIBUTION OF BLOOD GROUPS IN BLOOD DONORS IN WESTERN AHMEDABAD – A HOSPITAL BASED STUDY

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ABSTRACT

Background: Up till now about 400 red cells antigen have been identified. The majority are inherited by Mendelian fashion. The ABO and Rhesus (Rh) blood group system are most important for blood transfusion purposes, parental testing, legal medicine and in population genetic study.

Objective: This study was conducted to determine and compare the frequency of ABO and Rh blood groups in blood donors in secondary care teaching hospital at Western Ahmedabad, Gujarat, India.

Materials and Methods: A retrospective study was conducted at Blood bank, GMERS Medical College, Sola, Ahmedabad over a period of seven years from 1st January 2005 to 31st December 2011. Blood group of the blood donors was determined by commercially available standard monoclonal antisera by test tube agglutination technique.

Results & conclusion: Out of 5316 subjects, 5076 (95.48%) were male and 240 (4.52%) were female subjects. The commonest ABO blood group present was B (39.40 %) followed by O (30.79 %), A (21.94 %) and AB (7.86 %) in blood donors; while in Rhesus system, 5053(95.05%) donors were Rh-positive and 263(4.95%) donors were Rh-negative. The study has a significant implication regarding the inventory management of blood bank and transfusion services for the patient admitted in our secondary care teaching hospital.

Key Words: Blood groups, ABO, Rhesus (Rh)

INTRODUCTION

Blood group antigens are hereditary determined and plays a vital role in transfusion safety, understanding genetics, inheritance pattern, and disease susceptibility. Nearly 700 erythrocyte antigens are described and organized into 30 blood group systems by the International Society of Blood Transfusion of which ABO and Rh are important.¹

The ABO blood group system is widely credited to have been discovered by the Austrian scientist Karl Landsteiner, who found three different blood types in 1900.² He described A, B and O blood groups for which he was awarded the Nobel prize in 1930. Alfred Von Decastello and Adriano Sturli discovered the fourth type AB, in 1902.³

The Landsteiner's discovery opened the door to the birth of a wide spectrum of discoveries in the field of immunohaematology, blood transfusion among humans irrespective of their natives, unmatched-pregnancy, legal medicine, anthropology and the

discovery of other blood group systems, all are deemed as an applications or as a result of Karl's discovery.^{4,5} The discovery of the ABO blood groups by Karl Landsteiner was an important achievement in the history of blood transfusion that was followed by discovery of Rh (D) antigen.^{6,7}

Blood groups are genetically determined. The vast majority are inherited in a simple Mendelian fashion and are stable characteristics which are useful in paternity testing.⁸

Blood groups are known to have some association with diseases like duodenal ulcer, diabetes mellitus, urinary tract infection, Rh incompatibility and ABO incompatibility of newborn.⁹

All human populations share the same blood group systems; although they differ in the frequencies of specific types. The incidence of ABO and Rh groups varies markedly in different races, ethnic groups, and socio-economic groups in different part of the world.¹⁰

The frequencies of ABO and Rh blood groups vary from one population to another and time to time in the same region. The knowledge of distribution of ABO and Rh blood groups at local and regional levels are helpful in the effective management of blood banks and safe blood transfusion services. Identification of Rh system is important to prevent the erythroblastosis fetalis; which commonly arises when an Rh negative mother carries an Rh positive fetus.

Knowledge of the distribution of ABO and Rh blood group is essential for effective management of blood banks inventory, be it a facility of a smaller local transfusion service or a regional or national transfusion service. It is, therefore, imperative to have information on the distribution of these blood groups in any population.¹¹

Knowledge of blood group distribution is also important for clinical studies, for reliable geographical information and it will help a lot in reducing the maternal mortality rate, as access to safe and sufficient supply of blood will help significantly in reducing the preventable deaths.

Apart from their importance in blood transfusion practice, the ABO and Rh blood groups are useful in population genetic studies, researching population migration patterns as well as resolving certain medico-legal issues, particularly of disputed paternity cases. In modern medicine besides their importance in evolution, their relation to disease and environment is being increasingly important.^{12,13} It is, therefore imperative to have information on the distribution of these blood groups in any population group.

Objective:

This study is aimed to determine frequency and distribution ABO and Rh blood group patterns among blood donors in western Ahmedabad, Gujarat and compare with other data from similar studies within the India and all over the world.

MATERIAL AND METHOD

The present retrospective study was carried out at blood bank, GMERS Medical College and Civil

Hospital, Sola, Ahmedabad (A secondary care teaching hospital) during the 7 year period from January 2005 to December 2011.

The blood collections were taken from the voluntary donors at outdoor blood donation camp and in-house blood bank as well as from replacement donors at blood bank.

Total 5,316 donors were considered medically fit and accepted for blood donation during the study period. All were of age between 18-60 years. After blood donation, blood group was determined by forward blood grouping (cell grouping) by test tube agglutination method. Commercially available standard antisera A, antisera B, and Antisera D were used after validation at blood bank. Reverse blood grouping (serum grouping) was performed by test tube agglutination method with Pooled known A, B and O cell that are being prepared daily at the blood bank. Final blood group is confirmed only if both forward group (cell group) and reverse group (serum group) are identical. Rh negative blood groups were confirmed by antiglobulin technique. All weak D groups were considered as Rh positive.

The donor blood group data were recorded on specially formed proforma, tabulated, analyzed and compared with the similar studies by other authors.

OBSERVATION & RESULT

It can be seen from table no. 1 that 95.48 % of accepted donors (5073 out of 5316) were male. And only 4.52 % (240 donors) were female.

Table 1: Age Groups and Sex Wise Distribution of Accepted donors

Age groups	Male	Female	Total
18-20	142	1	143 (2.68)
21-30	2181	104	2285 (42.98)
31-40	2630	134	2764 (51.99)
41-50	105	1	106 (1.99)
51-60	18	0	18 (0.33)
Total	5076 (95.48)	240 (4.52)	5316 (100)

Table 2: Distribution of ABO & Rh Blood Group Systems

ABO Bl. Gr	Male			Female			Total		
	Rh +ve	Rh -ve	Total	Rh +ve	Rh -ve	Total	Rh +ve	Rh -ve	Total
O	1461 (28.78)	101 (1.98)	1562 (30.77)	68 (28.33)	7 (2.92)	75 (31.25)	1529 (28.76)	108 (2.03)	1637 (30.79)
A	1070 (21.07)	43 (0.84)	1113 (21.93)	52 (21.67)	2 (0.83)	54 (22.50)	1122 (21.11)	45 (0.84)	1167 (21.95)
B	1924 (37.70)	79 (1.55)	2003 (39.46)	85 (35.42)	7 (2.91)	92 (38.33)	2009 (37.79)	86 (1.62)	2095 (39.41)
AB	375 (7.38)	23 (0.45)	398 (7.84)	18 (7.50)	1 (0.42)	19 (7.92)	393 (7.39)	24 (0.46)	417 (7.85)
Total	4830 (95.15)	246 (4.85)	5076 (100)	223 (92.92)	17 (7.08)	240 (100)	5053 (95.05)	263 (4.95)	5316 (100)

Majority of donor population (5049 donors forming 94.97 % of total) was from the age groups of between 21 to 40 yr. This finding is consistent with the other studies.¹⁵

The gender wise distribution of ABO and Rh blood group systems is described in detail in table no. 2. It can be seen that 2095 donors (39.40 %) were detected to be having B blood group followed by O group (1637 donors, 30.79 %), A group (1167 donors, 21.94 %) and AB group (417 donors, 7.86 %). Sex of the donor was

found to have no effect on ABO blood grouping of the donor. While looking at the rhesus grouping, on an average, 95.05 % accepted donors (5053 donors) were Rh positive and remaining 4.95 % (263 donors) were Rh negative. On gender wise examination, 4830 out of 5076 male donors (95.15 %) were Rh positive whereas remaining 246 male donors (4.85 %) were Rh negative. Regarding female donors, the rates were 92.92 % (223 female donors) and 7.08% (17 female donors) respectively.

Table 3: Comparison study on frequency of ABO and Rh phenotypes at different geographical areas (in percentage)

Place of Study	A	B	AB	O	Rh +	Rh -
Within India						
Shimoga-Malnad ¹⁴	24.27	29.43	7.13	39.17	94.93	5.07
Davanagere ¹⁵	26.15	29.85	7.24	36.76	94.8	5.52
Eastern Ahmedabad ¹⁷	23.3	35.5	8.8	32.5	94.2	5.8
Punjab ¹⁸	21.9	37.6	9.3	9.3	97.3	2.7
Bangalore ²⁰	23.85	29.95	6.37	39.82	94.2	5.79
Chittoor ²¹	18.95	25.79	7.89	47.37	90.6	8.42
Vellore ²²	18.85	32.69	5.27	38.75	94.5	5.47
Present study	21.94	39.40	7.86	30.79	95.05	4.95
Outside India						
Pakistan ¹⁹	23.8	38	10	10	89.1	10.9
Nepal ²³	34	29	4	33	96.7	3.33
Australia ²⁴	38	10	3	49	NA	NA
Britain ²⁵	41.7	8.6	3	46.7	83	17
USA ²⁶	41	9	4	46	85	15
Niger-Delta ²⁷	23.8	20.7	2.8	52.7	93.9	6.12

DISCUSSION

Majority of the studies within India have described a large number of male donors compared to female donors.^{15,16} This is because of the fact that in developing country like India, because of social taboo, cultural habits, lack of motivation and fear of blood donation, female donors was very less. In addition, large numbers of females from the menstruating age-groups are anemic with low weight, so declared unfit for blood donation and eliminated by the predonation screening and counseling. Hence, general health of females needs to be improved by good nutritional diet and iron supplements. The fears regarding blood donation in females needs to be driven out by making them aware about the advantages of blood donation.

21-40 years age group is the main work force of any of the society. So, they are the most common age group encountered donating blood. Many of the older people suffer from hypertension, diabetes mellitus, low hemoglobin and ischemic heart diseases and hence may abstain from donating or considered unfit during predonation counseling.

Knowledge of frequency of ABO Blood Groups is an important tool to determine the direction of recruitment of voluntary donors as required for each zone across the country. The distribution of ABO blood group varies regionally, ethnically and from one

population to another. The comparison of frequency and distribution of ABO and Rh group in the blood donors at western Ahmedabad (present study) with the similar studies carried out within and outside India is described in table – 3.

While looking at ABO grouping, it can be read from table – 3 that the distribution of ABO and Rh grouping was comparable to the studies done at Eastern Ahmedabad¹⁷, Punjab¹⁸ and Pakistan.¹⁹ All these studies have described ‘B’ as the most frequent and ‘AB’ as the least common blood group. The second most common is ‘O’ in present study as well as in study carried out at Eastern Ahmedabad.¹⁷ Whereas studies at nearby areas of Punjab and Pakistan has shown ‘A’ being the second most common blood group.

Studies at Southern India^{15,20,21,22} have described contrast findings with ‘O’ being the most common blood group followed by ‘B’, ‘A’ and ‘AB’. In Nepal²³, which is connected to western India, as well as Australia²⁴, Britain²⁵ and USA²⁶, ‘O’ and ‘A’ are the common blood groups that are followed by B and ‘AB’. In Nigeria²⁷ ‘O’ is the predominantly encountered blood group accounting for more than 50 % of donors and AB has least common occurrence.

While looking at Rh grouping, 89-95 % donors all over the world are detected as Rh+ve except at Britain and U.S.A. where the frequency of Rh positivity is 83–85

% . Here it is a well known fact that many of the people residing at USA have migrated from Britain.

Apart from transfusion service, knowledge of the blood group system helps to take preventive measures against the diseases which are associated with different blood groups, to prevent the dangerous transfusion reactions and efficient management of blood bank and transfusion services to the needy patients.

There is known genetic association of specific blood groups to certain diseases in certain population. Studies concerned about possible association between ABO blood group and cardiovascular diseases have confirmed that persons of group A are affected more frequently with coronary heart disease, ischemic heart disease, venous thrombosis and atherosclerosis, while its low in people with blood group 'O' which stated to have protective effect against these diseases.^{28,29,30} 'O' group individuals are known to have a 14 % reduced risk of squamous cell carcinoma and 4 % reduced risk of basal cell carcinoma when compared to non-O group.³¹ It is also associated with a reduced risk of pancreatic cancer.^{32,33} The 'B' antigen links with increased risk of ovarian cancer.³⁴ Gastric cancer has reported to be more common in blood group 'A' and least in group 'O'.³⁵

So, it is advisable to do blood grouping studies in each region for drafting proper national transfusion policies and supplying blood to the needy patients during emergency. In short, generation of a simple database of blood groups, not only provides data about the availability of human blood in case of regional calamities, but also serves to enable insight into possibilities of future burden of diseases.

CONCLUSION & SUGGESTIONS

1. The present study concludes that 'B' blood group is the commonest blood group amongst the blood donors at Western Ahmedabad. This is followed by 'O', 'A' and 'AB' blood group respectively.
2. Regarding Rhesus blood group system, Rh positive donors were 95.05% and Rh negative were 4.95%.
3. Blood donation by the females was very low and it needs to be increased by improving health status and awareness about blood donation.
4. Every individual be ABO grouped at birth since the antigens are naturally occurring. Groups of individual indicated on national identity cards, driving licenses and school/office identity cards will be of tremendous use in case of acute hemorrhage or anaemia in children when urgent transfusion of yet to be cross matched blood is required.
5. It is necessary to conduct similar well designed studies in other states of India in order to determine the blood group frequencies in them. The data generated in the present study and several

other studies of different geographical region of India will be useful to health planners while making efforts to face the future health challenges in the region.

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