

Frequency of Blood Group Distribution in the Donors given Blood in a Tertiary Medical Center, Kolkata, West Bengal, India

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ABSTRACT

Introduction: Till now seven hundred red blood cell antigens are discovered which are organized into 30 blood groups, amongst which A,B,O and Rh groups are medicolegally important, like, blood transfusion reaction, paternity testing, legal medicine and for genetic relation with the various diseases. These groups are inherited in Mendelian fashion. So, our aim in this study was to determine the frequency of distribution of blood groups in different age groups as well as in between two sexes and at the same time to compare this frequency to the similar studies in different parts of the world.

Materials and methods: After proper screening procedure for exclusion of professional donors, patients with different comorbid diseases, we tested blood from 7044 people in our K P C Medical College and Hospital in the year 2013 to 2014 prior to collection. These blood were divided into A,B,O and Rh groups by forward grouping (cell grouping) and backward grouping (sera typing) by antiglobulin technique. Then these groups are tabulated according to 5 age groups between both sexes and compared with different studies throughout the world.

Results: Male to female ratio was 5.5:1 (5969 vs. 1075). Highest numbers of blood donors were from 21 – 30 and 31-40 age groups, both in case of males and females. Regarding the frequency of blood donation it was demonstrated that B groups were maximum followed by O, A and AB groups in both sexes.

Conclusion: This study will be the corner stone of innovative improvement in maintaining good data base system and improvement in blood transfusion services. This data base will prevent major transfusion reaction. It can direct the doctor regarding the possibility of certain cardiovascular and malignant diseases.

Keywords: Blood Group Distribution; A,B,O and Rh; blood transfusion

A, B, AB and O classifications universally. Blood groups are genetically determined inherited by Mendelian fashion and stable, hence, these are useful for paternity testing.⁵ This novel discovery of Landsteiner opened the door of immunohematology by which later it was discovered that blood group stems are associated with severe transfusion reaction, different mortal and morbid diseases. Nearly total 700 red blood cell antigens are discovered and these are organized into 30 blood group systems by International Systems of Blood Transfusion, of which most important systems are ABO and Rh groups.⁶ Rh group system was discovered in 1940 by Alex Wiener, Philip Levine and R.E. Stetson and ultimately this system has been proved as a major cause of transfusion reaction.⁷ The frequency of ABO and Rh blood group systems vary according to race, ethnicity and sex.⁸ Again, it varies from one population to another and time to time in same region. So, to provide effective management of blood banks and safe blood transfusion services, proper knowledge of ABO and Rh group distribution is necessary. Again, knowledge of distribution of these group systems is essential for the effective management as well as updation of local, regional and National transfusion services. For this, information of distribution of blood group system in any population is absolutely necessary.⁹ This knowledge of blood group systems reduces the maternal mortality rate as well as preventable death. These systems are also essential for the following, like, population genetic studies, research of population migration pattern, resolution of certain medico legal issues especially in case of disputed paternity, searching relation with different genetic diseases. So, our aim in this study was to detect the frequency distribution of ABO and Rh blood groups and at the same time to compare with different similar studies performed in different times World-wide including our country.

MATERIALS AND METHODS

This retrospective study was performed in K P C Medical College and Hospital only after getting clearance from

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our local Ethical committee. This study was conducted for 2 years. Blood were collected in our hospital and different blood donation camps arranged by local clubs as well as by Corporation of Calcutta. Before taking blood proper history, examination of vital signs was performed. The persons (came for blood transfusion) with heart failure, chronic renal failure, hematological disorders, bronchial asthma, hypothyroidism, bleeding disorders, hypertension and diabetes were considered as medically unfit for donating blood during this study period. The age groups were subdivided into five age groups, like, 11-20, 21-30, 31-40, 41-50 and 51-60 years. Total male and female donors were 5969 (84.74%) and 1075 (15.26%) respectively. After collection of blood grouping was performed by two methods. One is forward grouping (cell grouping) by test tube agglutination method with the help of commercially available standard antisera A, B and D after validation from the blood bank. And the other was reverse blood grouping (serum grouping) test tube agglutination method with the help of pooled antisera A, B, D prepared daily in the blood bank. The blood group of the donor was confirmed only when forward and reverse blood grouping provided identical group report by antiglobulin techniques. All D group donors were considered as Rh positive. Then all the blood group data were tabulated, analyzed and compared with the similar studies in India as well as outside the world.

RESULTS

Among the 7044 donors, male and female donors were 5969 (84.74%) and 1075 (15.26%) respectively. Highest number of donors were from 21-30 years age group (2731, 38.77%) followed by 31-40 years (2124, 30.15%), whereas, lowest number from 51-60 years (340, 4.82%).

Similarly, there was evidence of male preponderance as compared to females in 21-30 years (2361, 33.51% vs. 370, 5.25%) and 31-40 years (1782, 25.29% vs. 342, 4.85%). [Table 1]. In all groups, male donors were significant. In terms of ABO blood groups, highest number of donors were

S No	Age (years)	Total patients (%)	Males (%)	Females (%)
1	11-20	733 (10.44)	599 (8.50)	134 (1.90)
2	21-30	2731 (38.77)	2361 (33.51)	370 (5.25)
3	31-40	2124 (30.15)	1782 (25.29)	342 (4.85)
4	41-50	1116 (15.84)	942 (13.37)	174 (2.47)
5	51-60	340 (4.82)	285 (4.04)	55 (0.78)
	Total	7044	5969 (84.74)	1075 (15.26)

Table-1: Age and sex distribution in blood donors in rural areas

Blood Group	Total patients %	Total Rh+ %	Total Rh- %	Males			Females		
				Rh+	Rh-	Total	Rh+	Rh-	Total
A	1550 (22)	1505 (2.13)	45 (0.63)	1265 (17.95)	37 (0.52)	1302 (18.48)	240 (3.40)	8 (0.11)	248 (3.52)
AB	675 (9.58)	660 (9.36)	15 (0.21)	571 (8.10)	15 (0.21)	586 (8.31)	89 (12.63)	0	89 (12.63)
B	2627 (37.29)	2547 (36.15)	80 (1.13)	2166 (30.74)	73 (1.03)	2239 (31.78)	381 (5.40)	7 (0.09)	388 (5.50)
O	2192 (31.11)	2093 (29.71)	99 (1.40)	1754 (24.90)	87 (1.23)	1841 (26.13)	339 (4.81)	12 (0.17)	351 (4.98)
Total	7044	6805	239	5756	212	5968	1049	27	1076

Table-2: Age and sex wise distribution of blood donors

from B group (2627, 37.29%) followed by O group (2192, 31.11%), lowest being AB group (675, 9.58%). Total number of Rh positive donors was 6805 (96.61%) and Rh negative (239, 3.4%). In case of female donor, maximum were from B group (388, 5.5%) followed by O (351, 4.98%), A (248, 3.52%) and AB group (89, 1.28%) respectively. Male donors demoed similar pattern of distribution, like, B (2239, 31.78%), O (1841, 26.13%), A (1302, 18.48%) and AB group (586, 8.31%) respectively.[Table 2].

DISCUSSION

In our study, female donors were very less as compared to male donors (male: female 5.5:1). It may be due to the following factors, like, social barrier mainly Muslim and non-educated community, cultural habit of different religions, absence of motivation to donate blood and lastly fear of blood donation as it may reduce the quantity of blood in the body. Again, most females are declared unfit due to severe anemia in case of multipara, low body weight due to frequent pregnancy or malnutrition in case of Muslims, so they are obviously excluded from donating their blood. So, health of the females should be improved with the help of nutritious diet, iron supplement and avoidance of frequent pregnancy as well as abortions. Moreover they should be motivated to donate blood making them aware of the advantages of blood donation.

In our study people of 21-40 age groups were the major donors and lowest being 51-61 age groups. Because most of the adult people suffer from diabetes, hypertension, ischemic heart disease, chronic kidney disease and these diseases prevent them from giving blood transfusion.

Frequency of blood group varies ethnically in different regions of the world. It also varies from one population to another. Frequency distribution of ABO and Rh blood grouping in different states in India and outside India were compared in table 3. In case of ABO blood grouping, prevalence of blood group B were higher in Eastern Ahmadabad (35.5%)¹⁰, Punjab(37.6%)¹¹, Western Ahmadabad(39.4%)¹² and Pakistan(38%)¹³ which was similar to our study (37.29%) and AB group being least prevalent as that of our study (9.58%). In our study, O group was second most common group (31.11%) which was similar to the study done by Eastern Ahmadabad(32.85%)¹⁰, Western Ahmadabad(30.79%)¹², whereas A group was second most common group in Punjab (21.9%)¹¹ and Pakistan (23.8%).¹³ O group was demoed as third common group in Punjab (9.3%)¹¹ and Pakistan (10%).¹³

On the contrary, O group were most prevalent over oth-

Area of study	Group A %	Group B %	Group AB %	Group 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 Ahmadabad ¹⁰	23.3	35.5	8.8	32.85	94.2	5.8
Punjab ¹¹	21.9	37.6	9.3	9.3	97.3	2.7
Bangalore ¹⁶	23.85	29.95	6.37	39.82	94.2	5.79
Chittoor ¹⁷	18.95	25.79	7.89	47.37	90.6	8.42
Vellore ¹⁸	18.85	32.69	5.27	38.75	94.5	5.47
Hyderabad ¹⁹	19.57	34.11	5.76	40.54	97.01	2.99
Western Ahmadabad ¹²	21.94	39.40	7.86	30.79	95.05	4.95
Tripura ²³	23.77	32.8	9.64	32.95	97.06	2.94
Present study	22	37.29	9.58	31.11		
Outside India						
Pakistan ¹³	23.8	38	10	10	89.1	10.9
Nepal ²⁵	34	29	4	33	96.7	3.33
Australia ²⁰	38	10	3	49	NA	NA
Britain ²¹	41.7	8.6	3	46.7	83	17
USA ²²	41	9	4	46	85	15

Table-3: Comparison of frequency of ABO and Rh phenotypes in different regions in the world

er groups as demoed in the studies in Shimoga-Malnad (39.17%)¹⁴, Davanagere (36.76%)¹⁵, Bangalore (39.82%)¹⁶, Chittoor (47.37%)¹⁷, Vellore (38.75%)¹⁸, Hyderabad (40.54%)¹⁹ in India and Australia (49%)²⁰, Britain (46.7%)²¹ and USA (46%)²².

In study done in Tripura prevalence of blood group B and O was nearly similar (32.8% in group B and 32.95 in O group).²³ In countries outside India, like, Nepal, A group was demoed as highest prevalent group.²⁴

When we will consider Rh groupings, percentage of Rh positive donors were 89 to 97.25% in most of the countries of the world except in Britain and USA, where this percentage were 83 to 85 percent. This low percentage of Rh positive donors may be due to migration of people from Britain to USA.

It is well known fact that certain diseases are genetically associated with certain blood groups. Several studies in the World demonstrated a proper association of blood groups with many morbid diseases. People with group A may frequently affect from coronary heart disease, ischemic heart disease, venous thrombosis and atherosclerosis – these are of low incidence in people with group O, it may be due to presence of protective mechanism in these people.^{25,26,27} Again, people with blood group O have 14% reduced risk of squamous cell carcinoma as well as 4% reduced risk of basal cell carcinoma and pancreatic cancer as compared to any other blood group.^{28,29,30} Similarly gastric cancer is more prevalent in people with group A but least common in group O.³¹ Again, female with group B are more prone to develop ovarian cancer.³²

CONCLUSION

In our study, male to female donor ratio was 5.5:1. Most of the donors were in the age group of 21 to 40 years. B group were most prevalent followed by O and A, AB being the least prevalent. It is advisable to do proper blood grouping in all

the regions of the world to maintain good database of the blood group, which will help for the following reasons, like, knowledge of blood group frequencies worldwide, future prevalence of cardiovascular diseases, certain cancers in the body (gastric, ovarian, pancreatic cancers), decrease prevalence of certain cancers in the communities (squamous cell, basal cell, pancreatic cancers), paternity testing in case of medico-legal dispute for a baby, prevention of certain inevitable disease in newborn, like, hydrops fetalis and prevention of major transfusion reaction.

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