

DISTRIBUTION OF ABO AND RH BLOOD GROUPS AMONG BLOOD DONORS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

BACKGROUND

The ABO and Rhesus (Rh) blood group system is the most important system for blood transfusion purposes. The incidence of ABO and Rh groups varies markedly in different races, ethnic groups as well as socioeconomic groups in different parts of the world. This study was conducted to determine the frequency of ABO and Rh blood groups in a tertiary care teaching hospital in western Maharashtra.

MATERIALS AND METHODS

A retrospective data based study was conducted at the blood bank of Government Medical College, Miraj and Padma Bhushan Vasantdada Patil Government Hospital, Sangli, Maharashtra over a period of three years. A total of 12056 donors were studied. The commonest blood group was B (3698, 30.68%) followed by O (3685, 30.56%). Rh+ donors were predominant constituting 95.16% whereas only 4.84% donors were Rh-ve.

RESULTS

Blood groups of 12056 donors were studied. All patients aged between 18-60 years. Most of the donors were from 21-40 years.

CONCLUSION

The knowledge of distribution of ABO and Rh blood groups at local and regional levels is helpful in effective management of blood banks and safe blood transfusion services.

KEYWORDS

Blood group, ABO, Rhesus, donors.

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BACKGROUND

The Austrian scientist, Karl Landsteiner, in 1900, first discovered the ABO blood group system.¹ He described three blood groups, A, B, and O, for which he was awarded the Nobel Prize in 1930. Decastello and Sturli discovered the fourth type AB in 1902.¹ The Rh blood group was also defined by Landsteiner and Wiener in 1941.¹ More than 20 distinct blood group systems have been identified since then but the ABO and Rhesus (Rh) blood groups remain clinically most important. The Landsteiner's discovery opened the door to the field of immuno-haematology and blood transfusion.² It is the only system in which antibodies are consistently and predictably present in the serum of normal individuals whose red cells lack the antigens.³ Blood groups

are genetically determined. Gene for ABO antigens is on the 9th chromosome and Rh antigen gene is on the 1st chromosome.⁴ Majority of them are inherited in a simple Mendelian fashion and are stable, thus, are useful in paternity testing.⁵ The distribution of ABO blood group varies regionally, ethnically and from one population to another. India is a country with a lot of diversity in race, religion, and creed. This diversity is reflected in the distribution of blood groups in population within the country.⁶ In modern medicine, the need for blood group frequency and prevalence studies is multipurpose, including blood transfusion purposes, parental testing, legal medicine and in population genetic study. The present study was undertaken with an objective to study the distribution of ABO and Rh blood group systems among blood donors.

MATERIALS AND METHODS

A retrospective study was conducted at the blood bank of Government Medical College Miraj and Padma Bhushan Vasantdada Patil Government Hospital Sangli, Maharashtra over a period of three years, from January 2014 to December 2016. The blood was collected from the voluntary donors at outdoor blood donation camp and in-house blood

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bank as well as from replacement donors at blood bank. A total of 12056 donors were studied. After blood donation, blood group was determined by forward/cell blood grouping by test tube agglutination method. Commercially available standard antisera A, antisera B, and antisera D were used. Reverse/serum blood grouping was performed by test tube agglutination method with known pooled A, B, and O cells. Final blood group was given only if both forward (cell group) and reverse groups (serum group) were identical. Rh-negative blood groups were confirmed by antiglobulin technique.

RESULTS

Blood groups of 12056 donors were studied. All patients aged between 18-60 years. Most of the donors were from 21-40 years. (8932, 74.08%) Out of these, 11610 (96.30%) were males and 446 (3.70%) were females. (Table 1) The commonest blood group was B (3698, 30.68%) followed by O (3685, 30.56%). 28.73% (3464) donors belonged to blood group A whereas 10.03% (1209) donors were of AB blood group. (Table 2) Rh+ve donors were predominant constituting 95.16% whereas only 4.84% donors were Rh-ve.

DISCUSSION

Knowledge of the distribution of ABO and Rh blood groups is essential for the effective management of blood banks as well as for clinical studies, and to obtain reliable geographical information. It is also important in cases of organ transplantation and in the development of legal medicine, genetic research, and anthropology.⁷ It is, therefore, imperative to have information on the distribution of blood groups in any population. Blood group is based on the presence or absence of inherited antigenic substance on the surface of red blood cells and can be determined by specific antibodies.⁸ More than 600 surface antigens have been found on red blood cells. These antigens are genetically determined, and they appear early in foetal life and remain unchanged for whole life.⁸

The ABO blood group system is divided into four blood types on the basis of the presence or absence of A and B surface antigens. The blood groups are A, B, O, and AB. The frequency of ABO blood groups varies in the population throughout the world. The importance of ABO blood group system lies in the fact that A and B are strongly antigenic and anti-A and anti-B antibodies present in the serum of persons lacking the corresponding antigen are capable of producing intravascular haemolysis in cases of incompatible transfusion.⁹ Rh antigens are also highly immunogenic. Until now, 49 Rh antigens are described with D antigen being the most significant. D-negative individuals produce anti-D antibodies if they are exposed to the D antigen through transfusion or pregnancy and causes haemolytic transfusion reaction or haemolytic disease of foetus and new born.¹⁰ For this reason, the Rh status is routinely determined in blood donors, transfusion recipients, and in pregnancy. Studies have shown a possible association between ABO blood group and many diseases. Persons of

blood group A are affected more frequently with ischemic heart disease, venous thrombosis, and atherosclerosis, while the affection is low in people with blood group "O." "O" group individuals have reduced risk of squamous cell carcinoma, basal cell carcinoma and pancreatic cancer when compared to non-O blood groups. The "B" blood group females have an increased risk of ovarian malignancy. Gastric cancer is reported more commonly in blood group "A" and least in group "O." Hence, it is advocated to do blood grouping in each region for drafting proper national transfusion policies and supplying blood to needy patients during emergency.

Majority of the studies have described a large number of male donors compared to female donors similar to our study.¹¹ This is because of the fact that in developing countries like India, because of the cultural habits, lack of motivation, illiteracy and fear of blood donation, lower haemoglobin concentration, particularly in the menstruating age group, females rarely donate the blood. Hence, the females should be educated about the importance of good nutritional diet and should be made aware about the advantages of blood donation. Youth is the main workforce of any society. Age group of 21-40 years is the most common age group encountered in our study. Many of the older people suffer from chronic diseases like hypertension, diabetes mellitus, low haemoglobin, and ischemic heart diseases and hence may abstain from donating or considered unfit for blood donation.¹¹

In our study, blood group B was the commonest. Most of the studies in Northern India, (Chandra et al,¹² Garg et al,¹³ Singh P et al,¹⁴ Singh S et al¹⁵), Western India (Giri et al,¹⁶ Behra et al¹⁷ and Arya et al¹⁸) and Central India (Chaurasia et al⁶), showed B blood group as the commonest blood group, similar to our study. (Table 3) In contrast, studies done in Southern India (Suresh et al,¹⁹ John et al²⁰) and Eastern India (Nag et al,²¹ Badge et al¹¹) showed O group to be the commonest blood group. Thus, in the studies done in most parts of India the commonest blood group is either B or O followed by A and then AB. (Table 3) Outside India, in Pakistan the study done by Hammed et al,²² the commonest blood group is B which was similar to our study. The study done at Nepal by Pramanik et al²³ found the commonest blood group was A. The study done in South west Ethiopia,²⁴ Sudan,²⁵ and Tanzania²⁶ showed the commonest blood group as O, followed by A, B & AB. (Table 3) The incidence of Rh D positivity blood group in most of India as well as worldwide, varies from 89 to 98% and Rh D negativity from 2 to 11%. In our study, 95.16% donors were Rh+ve whereas only 4.84% donors were Rh-ve.

CONCLUSION

In conclusion, this study generates a simple database of blood groups at regional level which can be helpful in case of calamities. The present study concludes that "B" blood group is the most common blood group among the blood donors in this region, followed by "O", "A", and "AB" blood groups. Regarding Rh blood group system, Rh-positive donors were 95.16% and Rh-negative were 4.84%. Blood

donation by females was low and it needs to be increased by improving health status and awareness about blood donation. The blood grouping of every individual should be done at birth and blood group of individuals must be indicated on identity cards, which will be of great use in cases of emergencies when urgent transfusion of blood is required.

Blood Group	Male	Female	Total %
A	3362 (28.96)	102 (22.87)	3464 (28.73)
B	3543 (30.52)	155 (34.76)	3698 (30.68)
O	3549 (30.56)	136 (30.49)	3685 (30.56)
AB	1156 (9.96)	53 (11.88)	1209 (10.03)
Total	11610 (100)	446 (100)	12056 (100)

Table 1. Distribution of Blood Donors According to Gender

Blood Group	Rh +ve	Rh -ve	Total
A	3296 (27.34)	168 (1.39)	3464 (28.73)
B	3526 (29.25)	172 (1.43)	3698 (30.68)
O	3504 (29.06)	181 (1.50)	3685 (30.56)
AB	1146 (9.51)	63 (0.52)	1209 (10.03)
Total	11472(95.16)	584 (4.84)	12056 (100)

Table 2. Distribution of Blood Donors According to Rhesus Phenotype

Study	A	B	O	AB	Rh +ve	Rh -ve
North India						
Lucknow, UP (Chandra et al) ¹²	21.33	39.84	29.10	9.33	95.71	4.29
Uttarakhand (Garg et al) ¹³	28.70	32.07	28.70	10.53	94.49	5.51
Haryana (Singh et al) ¹⁴	22.90	38.83	28.70	9.54	90.72	9.28
Himachal Pradesh (Singh et al) ¹⁵	28.82	38.16	21.82	11.82	93.83	6.17
West India						
Pravara, Maharashtra (Giri et al) ¹⁶	28.38	31.89	30.99	8.72	95.36	4.64
Jodhpur, Rajasthan (Behra et al) ¹⁷	22.2	36.4	31.7	9.4	91.75	8.25
Bikaner, Rajasthan (Arya et al) ¹⁸	22.52	36.72	31.63	9.13	91.35	8.65
Present Study	28.73	30.68	30.56	10.03	95.16	4.84
Central India						
Bhopal, MP (Chaurasia et al) ⁶	22.52	35.92	30.99	10.55	95.42	4.58
South India						
Tirupati, AP (Suresh et al) ¹⁹	20.0	32.2	41.7	6.1	92.8	7.2
South kerala (John et al) ²⁰	26.27	29.10	37.86	6.77	90.48	9.52
East India						
Durgapur, WB (Nag et al) ²¹	23.90	33.60	34.80	7.70	94.70	5.30
Chhattisgarh (Badge et al) ¹¹	24.95	30.44	31.09	13.52	99.42	0.58
Other Countries						
Pakistan (Hammed et al) ²²	23.26	38.0	28.75	9.98	89.1	10.8
Nepal (Pramanik et al) ²³	34.17	20.17	32.50	4.17	96.67	3.33
South West Ethiopia (Zerihun et al) ²⁴	31.9	21.5	43.1	3.5	92.8	7.20
Sudan (Shahata et al) ²⁵	29.5	16	51.5	6	93	7
Tanzania (Johanpour et al) ²⁶	26	19	52	3	98	2

Table 3. Frequency of ABO and Rhesus Phenotypes in Different Studies from India and Other Countries (%)

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