

Distribution of blood groups in blood donors in the blood bank of Acharya Shri Chander College of Medical Sciences & Hospital, Jammu

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Type of Publication: Original Research Article

Conflicts of Interest: Nil

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 Jammu, Jammu and Kashmir.

Materials And Methods: A retrospective data-based study was conducted at the blood bank of Acharya Shri Chandar College of Medical Sciences and Hospital, Sidra, Jammu over a period of three years. A total of 12,056 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 12,056 donors were studied. All patients aged between 18-60 years. Most of the donors were from 21-40 years. Out of these, 11610 (96.30%) were males and 446 (3.70%) were females. Rh +ve donors were predominant constituting 95.16% whereas only 4.84% donors were Rh-ve.

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.

Introduction

The ABO blood group system was first discovered by the Austrian scientist Karl Landsteiner, who found three different blood types in 1900.¹ 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 1902.² The Landsteiner's discovery opened the door to

the birth of a wide spectrum of discoveries in the field of immunohematology, blood transfusion among humans irrespective of their natives, unmatched pregnancy, legal medicine, anthropology, and the discovery of other blood group systems.³ Blood groups are genetically determined. The vast majorities are inherited in a simple Mendelian fashion and are stable characteristics, which are useful in paternity testing.⁴ Blood groups are known to have some association with diseases such as duodenal ulcer, diabetes mellitus, urinary tract infection, and rhesus (Rh) incompatibility and ABO incompatibility of newborn.⁵The 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 is helpful in the effective management of blood banks and safe blood transfusion services. Blood donation is a crucial part of worldwide healthcare. It includes blood collection, testing, storage, and transfusion to the patient. Among tests performed on collected blood for transfusion includes blood grouping and screening for transfusion transmissible infectious diseases. The term blood group refers to the entire blood group system comprising red blood cell (RBC) antigens and a series of genes controlled the specificity of the blood group, which can be allelic or linked closely on the same chromosome. Blood type refers to a particular pattern of reaction to testing antisera within a given system. About 38 blood group system genes have been recognized and all known alleles sequenced.^{6,7}Among blood group systems identified, BO (with blood types A, B, AB, and O) and Rhesus (with Rh D-positive or Rh D-negative blood types) are the most important in transfusion medicine. ABO blood group antigens are the most immunogenic of all the blood group antigens followed by Rh (D antigen).⁸ The present study was undertaken with an objective to study the distribution of ABO and Rh blood group systems among blood donors. This study will document a blood group database as well as create social awareness among them, allow safe blood transfusion, and prevent hemolytic disease of new born and foetus by knowing ABO and Rh typing.

Materials And Methods

This was a retrospective study carried out at Acharya Shri Chandar College of Medical Sciences and Hospital, Sidra, Jammu during the 3-year period from January 2019 to December 2021. 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. Totally 12,852 donors were considered medically fit and accepted for blood donation during the study period. All were of age between 18 and 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 cells that are being prepared daily at the blood bank. Final blood group is confirmed only if both forward (cell group) and reverse groups (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 pro forma, tabulated, analysed, and compared with the similar studies by other authors.

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.

TABLE 1: Distribution of Blood Donors according to Gender

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 2: Distribution Of Blood Donors According to Rhesus Phenotype

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)

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.⁹ 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. 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.¹⁰ 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.¹¹ 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.¹² 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.

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.¹³ In our study, blood group B was the commonest. Most of the studies in Northern India, (Chandra et al,¹⁴ Garg et al,¹⁵ Singh P et al,¹⁶ Singh S et al,¹⁷), Western India (Giri et al,¹⁸ Behra et al,¹⁹ and Arya et al,²⁰) and Central India (Chaurasia et al²¹), showed B blood group as the commonest blood group, similar to our study. (Table 3) Incontrast, studies done in Southern India (Suresh et al,²² John et al²³) and Eastern India (Nag et al,²⁴ Badge et al¹³) 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,²⁵ the commonest blood group is B which was similar to our study. The study done at Nepal by Pramanik et al²⁶ found the commonest blood group was A. The study done in South west Ethiopia,²⁷ Sudan,²⁸ and Tanzania 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.

Table 3. Frequency of ABO and Rhesus Phenotypes in Different Studies from India and Other Countries (%)						
Study	A	B	O	AB	Rh+ve	Rh-ve
North India						
Lucknow, UP (Chandra et al) ¹⁴	21.33	39.84	29.10	9.33	95.71	4.29
Uttarakhand (Garg et al) ¹⁵	28.70	32.07	28.70	10.53	94.49	5.51
Haryana (Singh et al) ¹⁶	22.90	38.83	28.70	9.54	90.72	9.28
Himachal Pradesh (Singh et al) ¹⁷	28.82	38.16	21.82	11.82	93.83	6.17
Present Study	28.73	30.68	30.56	10.03	95.16	4.84
West India						
Pravara, Maharashtra (Giri et al) ¹⁸	28.38	31.89	30.99	8.72	95.36	4.64
Jodhpur, Rajasthan (Behra et al) ¹⁹	22.2	36.4	31.7	9.4	91.75	8.25
Bikaner, Rajasthan (Arya et al) ²⁰	22.52	36.72	31.63	9.13	91.35	8.65
Central India						
Bhopal, MP (Chaurasia et al) ²¹	22.52	35.92	30.99	8.72	95.36	4.64
South India						
Tirupati, AP (Suresh et al) ²²	20.0	32.2	41.7	6.1	92.8	7.2
South kerala (John et al) ²³	26.27	29.10	37.86	6.77	90.48	9.52
East India						
Durgapur, WB (Nag et al) ²⁴	23.90	33.60	34.80	7.70	94.70	5.30
Chhattisgarh (Badge et al) ¹³	24.95	30.44	31.09	13.52	99.42	0.58
Other Countries						
Pakistan (Hammed et al) ²⁵	23.26	38.0	28.75	9.98	89.1	10.8
Nepal (Pramanik et al) ²⁵	34.17	20.17	32.50	4.17	96.67	3.33
South West Ethiopia (Zerihun et al) ²⁷	31.9	21.5	43.1	3.5	92.8	7.20
Sudan (Shahata et al) ²⁸	29.5	16	51.5	6	93	7
Tanzania (Johanpour et al) ²⁹	26	19	52	3	98	2

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.

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