

Distribution pattern of ABO grouping and Rhesus typing among blood donors: a study from a tertiary care teaching hospital blood bank of Dr. BR Ambedkar Medical College, Bangalore

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Abstract

Background: Blood group system consists of antigens present on the surface of red blood cells. Up till now around 700 red cell antigens have been identified. The ABO grouping and Rhesus (Rh) typing are major systems and are inherited by means of Mendelian fashion. They are crucial for blood transfusions, parental testing and in certain forensic related medico legal cases. Also association of blood grouping systems can be attributed to gene associated studies in certain diseases among different population.

The distribution pattern of ABO blood grouping systems varies among people around the world and also in different regions of same country.

Aims: The study is aimed to determine the distribution pattern of the ABO grouping and Rh typing among blood donors in Dr. BR Ambedkar Medical College, Bangalore and to correlate it with the available data from studies inside India and other parts of the world.

Materials and Methods: The study included blood donors in blood bank of Dr. BR Ambedkar Medical College Hospital from July 2012 to May 2016. The study was done on 1959 blood donors. ABO grouping and Rh typing was done using slide agglutination method with antisera A, B, O and Rh. Doubtful cases were reconfirmed by tube agglutination method and reverse grouping using freshly prepared pooled A and B cells. The sex incidence of ABO and Rh blood groups were stated in simple percentages.

Results: Male donors were more than female donors, ratio being 77.3: 1.

The most common blood group was O (38.8%) and least common being AB (5%).

The distribution pattern of blood group O in our population was 38.8% (37.5% O Rh positive and 1.3% O Rh negative). The distribution pattern of blood group B in our population was 34.8% (33.9% B Rh positive and 0.9% B Rh negative) followed by blood group A which was 21.4% (21% A Rh positive and 0.4% A Rh negative) and blood group AB was 5% (4.7% AB Rh positive and 0.3% AB Rh negative) Rh positive were 97.1% and Rh negative were 2.9%.

Conclusion: Knowledge of distribution pattern of the different blood groups is very crucial for blood banks and blood transfusion services which significantly contribute to the Health System of the Nation. Knowledge of blood group distribution is important for clinical studies, geographical information and for forensic studies in the general population.

Keywords: Blood group, ABO, Rh

Introduction

Human red blood cells contain on their surface a series of carbohydrate structures of glycoproteins and glycolipids, which represent blood group antigens. These antigens are genetically controlled and are inherited in early fetal life by Mendelian manner and remain the same till death.⁽¹⁾ International Society of Blood Transfusion has identified 30 blood group system genes. The most important blood group systems are ABO and Rh.⁽²⁾

The first human blood group system to be discovered by Landsteiner was the ABO blood group system in 1901.⁽³⁾ Definition of blood group was given in 1941 by Landsteiner and Wiener.⁽⁴⁾ Both ABO and Rh type play a significant role in blood transfusions.

Discovery of ABO blood group system led to research in the field of immunohaematology, blood transfusion, unmatched pregnancy, forensic medicine, anthropology and the discovery of other blood group systems.⁽⁵⁾

In ABO system, the four main types of blood groups are A, B, O and AB. ABO blood grouping system is important because A and B are highly antigenic and anti A and anti B antibodies are always present in the serum of individuals who lack corresponding antigen (s) on their red blood cells. These antibodies can cause destruction of transfused red cells in case of incompatible transfusion.⁽⁶⁾

Rhesus antigens are most immunogenic. Out of 49 Rh antigens identified, expression of D antigen is most crucial. When D negative individuals encounter the D antigen they produce anti D which causes hemolytic transfusion reaction, or hemolytic disease of the newborn. For this reason, the status of Rh typing is determined in blood donors, recipients who receive blood transfusion, and in pregnant ladies.⁽⁷⁾

In addition to their significance in blood transfusion practice, the ABO grouping and Rh typing are also useful in clinical studies, genetic studies in population, and in solving medicolegal issues.⁽⁸⁾

All humans share the same blood group systems; although the frequencies of specific types are different. The incidence of ABO and Rh groups varies markedly in different ethnic groups, races, and socio-economic status in different parts of the world.⁽⁹⁾

In the present study distribution pattern of blood groups is studied in Bangalore of Karnataka state, India.

Materials and Methods

The present study was carried out at Dr. BR Ambedkar teaching hospital blood bank. The data of present study is from July 2012 to May 2016 and includes both voluntary and replacement donors. Replacement donors included persons who donated for close relatives, family members or friends of the recipients. The donors first filled up a donor re-question form, which has the information of personal details, occupation and medical history. Hemoglobin percentage estimation was estimated by cyanmethemoglobin method and donors with hemoglobin less than 12.5 gm% were deferred. The donors were then screened by blood bank medical officer according to criteria and guidelines of drug and cosmetics act and National Aids Control Organisation for blood donor selection. The donors included individuals with appropriate good health and those who were mentally alert and physically fit.

Total 1959 donors were considered medically fit and accepted for blood donation.

After blood donation, ABO grouping and Rh typing was done by antigen antibody slide agglutination test by commercially available standard anti-seras of anti A, anti B and Anti D of Tulip diagnostics limited, after validation at blood bank. Doubtful cases were reconfirmed by tube agglutination method and reverse grouping using freshly prepared pooled A and B cells. All weak D groups were considered as Rh positive. Data on distribution pattern of ABO and Rh blood groups were reported in simple percentages.

Results

Blood grouping of 1959 donors was done. Male donors were more than female donors, ratio being 77.3: 1 [Table 1].

The most common blood group was O (38.8%) and

least common being AB (5%).

The percentage frequency of blood group O in our population was 38.8% (37.5% O Rh positive and 1.3% O Rh negative). Blood group B frequency in our population was 34.8% (33.9% B Rh positive and 0.9% B Rh negative) followed by blood group A was 21.4% (21% A Rh positive and 0.4% A Rh negative) and blood group AB was 5% (4.7% AB Rh positive and 0.3% AB Rh negative) [Table 2].

Percentage of Rh D positive were 97.1% and Rh D negative were 2.9%. [Table 3]

Table 1: Sex wise distribution of donors

| Sex | Number of donors | Percentage |
|--------|------------------|------------|
| Male | 1934 | 98.7 |
| Female | 25 | 1.3 |

Table 2: Distribution of blood donors according to ABO blood groups

| Blood groups | Number of donors | Percentage |
|--------------|------------------|------------|
| O | 760 | 38.8 |
| B | 681 | 34.8 |
| A | 420 | 21.4 |
| AB | 98 | 5 |

Table 3: Distribution of blood donors according to Rhesus Phenotype

| Blood groups | Number of donors according to Rhesus phenotypes | | Total | Percentage |
|--------------|---|-------------|-------|------------|
| | Rh positive | Rh negative | | |
| O | 735 (37.5%) | 25 (1.3%) | 760 | 38.8 |
| B | 664 (33.9%) | 17(0.9%) | 681 | 34.8 |
| A | 411 (21%) | 9 (0.4%) | 420 | 21.4 |
| AB | 93 (4.7%) | 5 (0.3%) | 98 | 5 |
| Total | 1903 (97.1) | 56 (2.9) | 1959 | 100 |

Table 4

| SI No. | Within India | Location of study | A | B | O | AB | Rh positive | Rh negative |
|--------|---------------|--------------------------------|-------|------|------|-----|-------------|-------------|
| 1 | Sothern India | Present study | 21.4 | 34.8 | 38.8 | 5 | 97.1 | 2.9 |
| 2 | | Bangalore ⁽¹⁴⁾ | 23.8 | 29.9 | 39.8 | 6.3 | 94.2 | 5.8 |
| 3 | | Davangere ⁽¹⁵⁾ | 26.1 | 29.8 | 31.7 | 7.2 | 94.8 | 5.2 |
| 4 | | Shimoga Malnad ⁽¹⁶⁾ | 24.27 | 29.3 | 39.1 | 7.1 | 94.9 | 5.0 |
| 6 | Eastern India | Durgapur ⁽¹³⁾ | 23.9 | 33.6 | 34.8 | 7.7 | 94.7 | 5.3 |

| | | | | | | | | |
|----|----------------|-----------------------------------|------|------|------|-----|------|-----|
| 7 | Northern India | Lucknow ⁽¹⁷⁾ | 21.7 | 39.8 | 29.1 | 9.3 | 95.7 | 4.2 |
| 8 | | Amritsar ⁽¹⁸⁾ | 18.0 | 38.6 | 34.3 | 9.6 | 91.2 | 8.7 |
| 9 | Western India | Western Ahmedabad ⁽¹¹⁾ | 21.9 | 39.4 | 30.7 | 7.8 | 35.0 | 4.9 |
| 10 | | Eastern Ahmedabad ⁽¹⁹⁾ | 23.3 | 35.5 | 32.5 | 8.8 | 94.2 | 5.8 |
| 11 | Central India | Maharashtra ⁽¹²⁾ | 28.3 | 31.8 | 30.9 | 8.7 | 95.3 | 4.6 |
| 12 | Outside India | Nepal ⁽²⁰⁾ | 34 | 29 | 33 | 4 | 96.7 | 3.3 |
| 13 | | Britain ⁽²¹⁾ | 42 | 8 | 47 | 3 | 83 | 17 |
| 14 | | USA ⁽²²⁾ | 41 | 9 | 46 | 4 | 85 | 15 |
| 15 | | Australia ⁽²³⁾ | 38 | 10 | 49 | 3 | NA | NA |
| 16 | | Nigeria ⁽²⁴⁾ | 21.6 | 21.4 | 54.2 | 2.8 | 95.2 | 4.8 |
| 17 | | Saudi Arabia ⁽²⁵⁾ | 24 | 17 | 52 | 4 | 93 | 7 |

Discussion

In the present study male donors were more in number compared to female donors which is similar with other Indian studies.^(10,11,12)

In the present study, distribution pattern of ABO grouping and Rh typing in the blood donors are compared with the similar Indian studies, and also studies done in other parts of the world [Table 4].

Distribution pattern of blood groups of present study was compared with the studies done at Durgapur,⁽¹³⁾ Bangalore,⁽¹⁴⁾ Davangere⁽¹⁵⁾ and Shimoga Malnad.⁽¹⁶⁾ The commonest blood group was 'O' and least common was 'AB'.

Studies done at Lucknow,⁽¹⁷⁾ Amritsar⁽¹⁸⁾ Ahmedabad^(19,20) and Maharashtra⁽¹²⁾ found that the commonest blood group was 'O', which is in contrast to present study where B blood group is the commonest. So geographical distribution of Blood Groups in India shows that in central, Northern, and Western part of India, B is the commonest blood group where as in Eastern and Southern part of India, 'O' is the most frequently occurring blood group.

One study from Nepal⁽²⁰⁾ showed that the common blood group was A, in contrast to studies done in most parts of India in which commonest blood group was either B or O.

Other countries like Britain,⁽²¹⁾ USA,⁽²²⁾ Australia⁽²³⁾ Nigeria⁽²⁴⁾ and Saudi Arabia⁽²⁵⁾ showed that the frequency of blood group O is highest which is same as the the present study.

Rh negativity status was 2.9% in our study which is in contrast with western studies^(21,22) where it was reported it as 15-17%. Knowledge of frequency of ABO grouping and Rh typing is important in the maintenance of blood bank inventory and blood transfusion services to the patients. In addition to this it is also useful in clinical studies, genetic studies among population, as well as in solving medicolegal issues.⁽⁸⁾

Studies have confirmed that blood group A persons are more prone for coronary heart disease, ischemic heart disease, atherosclerosis and venous thrombosis, while individuals with O group are less prone.⁽²⁶⁾ Persons with O group are known to have 14% reduced risk of squamous cell carcinoma and 4% reduced risk of basal cell carcinoma when compared to non-O group.⁽²⁷⁾ It is also associated with a reduced risk of pancreatic cancer.^(28,19) Increased risk of ovarian cancer is associated with B Antigen.⁽³⁰⁾ Individuals with blood group A are more prone for gastric cancer than individuals with group 'O'.⁽³¹⁾

Conclusion

The present study concludes that most common blood group is "O" and AB is the least common amongst the blood donors at Bangalore of Karnataka state. Rh positive were 97.1% and Rh negative were 2.9%. Awareness about donation of blood has to be created in order to increase the number of female donors. The data obtained in the present study and several other studies of different regions of India will be useful to face the future health challenges in the state.

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