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Frequency of Major Blood Group Antigens among Blood Donors at a Tertiary Level Hospital in North-East India

Running Title: Frequency of Major Blood Group Antigens among Blood Donors

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Abstract: ***Background:*** ***Blood group antigens are integrated parts of the red cell membrane and they serve many essential functions. Of the many human blood group systems identified so far, the ABO and Rhesus 'D' blood group systems are of utmost importance. ABO blood groups show a wide geographical variation and vary both within and among ethnic groups. The distribution of blood groups among different population groups is important in health care and transfusion practices.*** ***Materials and Methods:*** ***ABO and Rh grouping was done in 3000 blood donors in the State of the Art Model Blood Bank, Gauhati Medical College and Hospital, Guwahati. Data on the frequency of ABO and Rh(D) blood groups was reported in simple numbers and percentages.*** ***Results:*** ***The study revealed blood group O to be the commonest at 37.23% followed by blood groups B at 31.0%, A at 24.83% and AB at 6.93%. It was also noted that 98.03% of the donors were Rh positive and the remaining 1.97% were Rh negative.*** ***Conclusion:*** ***The present study provides information about the distribution of the major blood groups in North-east India which may be helpful in planning for transfusion services, particularly in those patients requiring repeated blood transfusions.***

Keywords: Blood group, ABO and Rhesus, Blood transfusion, Antigen, Health care

1. Introduction

The human blood groups were first discovered by Karl Landsteiner in 1901. This discovery has revolutionized the direction of health care. Health care professionals began to look at health care from a completely different perspective. Blood groups are genetically determined and they exhibit polymorphism in different populations [1]. Of the different blood group systems, the
ABO and Rh blood group systems are of foremost importance in transfusion and organ transplant [2].

Blood group antigens are integrated parts of the red blood cell membrane and they have many essential functions (membrane transporters and protein canals, ligand receptors, adhesion molecules, enzymes and structural proteins). According to the International Society of Blood Transfusion (ISBT), there are a total of 33 blood group systems with 287 known antigens and 42 antigens in collections (low and high incidence antigens) [3].

Today, it is a well-established fact that the ABO blood groups show a wide geographical variation and vary considerably, both within and among ethnic groups [4].

So, the blood group distribution in different population groups is of importance in health care and transfusion practices [1,4]. Apart from this, ABO and Rh blood groups are also of importance in population genetic studies, researching population migration patterns, resolving certain medico-legal issues particularly those of parental dispute and also for proper management of blood bank inventory. Hence, the present study was undertaken with the aim of studying the prevalence of the major blood groups among the people of North-east India.

2. Materials and Methods

A total of 3000 blood donors, both voluntary and replacement, were recruited retrospectively into the present study at the Gauhati Medical College and Hospital, Guwahati during the month of January 2014. Most of the blood donors were from Assam and the neighboring states and represented the North-eastern population of India.

After phlebotomy, two milliliters of venous blood was collected in plain and anti-coagulant vaccutainers. The vials were clearly marked with the unique donor identification number. The red cells and serum was separated from the clotted vials. ABO and Rhesus 'D' blood group phenotypes were determined by tube tests, both cell grouping and serum grouping methods, using monoclonal anti-A, anti-B, anti-AB and monoclonal anti-D (Ig M) (Tulip Diagnostics Pvt. Ltd) respectively, according to the test procedure described in Dacie and Lewis and manufacturer's instruction [5]. The principle was based on the fact that human red blood cells possessing A and/or B antigen will agglutinate in the presence of antibody directed towards the antigen. Agglutination of red blood cells with anti-A, anti-B, anti-AB and anti-D (Rho) IgM reagents is a positive test result and indicates the presence of the corresponding antigen. Absence of agglutination of red blood cells with anti-A, anti-B, anti-AB and anti-D (Rho) IgM reagents is a negative test and indicates absence of the corresponding antigen.

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Appropriate controls of known blood groups were used concurrently with each batch of tests.

Table 1: Interpretation of Results of ABO AND Rh Blood Grouping -- Cell Grouping Method

ANTI-A	ANTI-B	ANTI-AB	Saline	Blood Group
+	O	+	O	A
O	+	+	O	B
+	+	+	O	AB
O	O	O	O	O

ANTI-D	Blood Group
+	D +ve
O	D –ve

+ = Agglutination. O = No agglutination.

Table 2: Interpretation of Results of ABO and Rh Blood Grouping -- Serum Grouping Method (With Pooled Cells)

A cells	*B cells*	*O cells*	*Blood Group*
O	+/H	O	A
+/H	O	O	B
O	O	O	AB
+/H	+/H	O	O

+ = Agglutination. O= No agglutination. H = Haemolysis.

3. Results and Observation

Out of the total 3000 blood donors that were enrolled in the present study, the blood group O was found to be the commonest with 1117 donors. Next followed blood group B with 930 donors, blood group A with 745 donors and blood group AB with 208 donors respectively as shown in figure 1.

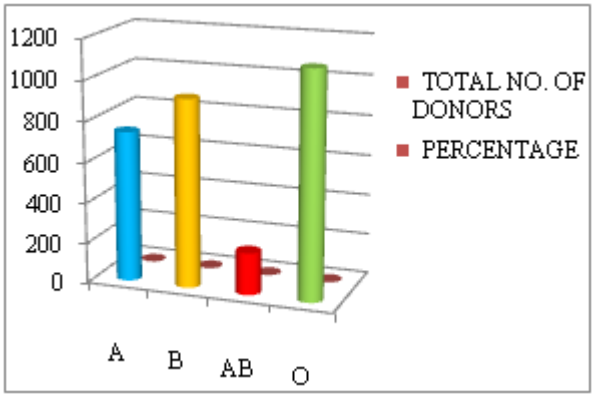


Figure 1: ABO Blood Group Distribution

Again, of the total number of blood donors, 2941 donors were found to be Rhesus 'D' positive and the rest 59 donors were Rhesus 'D' negative. The occurrence of Rhesus 'D' negative was highest in blood group B and lowest in blood group AB; while, Rhesus 'D' positivity was highest in blood group O, followed by blood group B, A and AB respectively.

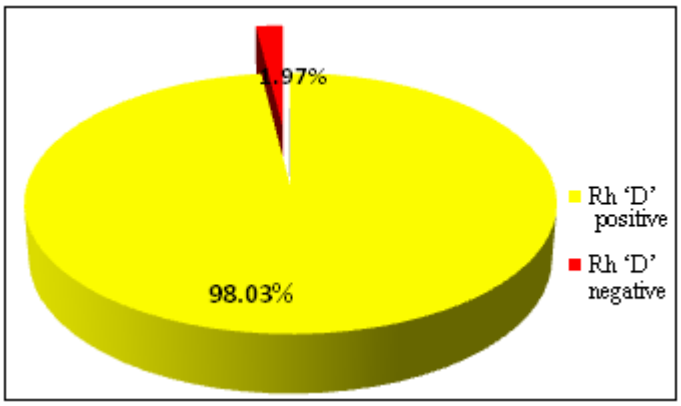


Figure 2: Rhesus Antigen Distribution

Table 3: ABO and Rhesus Blood Group Distribution

ABO Blood Group	*Rh 'D' Positive (%)*	*Rh 'D' Negative (%)*
A	735 (24.50%)	10(0.33%)
B	907 (30.23%)	23(0.77%)
AB	199 (6.63%)	9(0.30%)
O	1100 (36.67%)	17(0.57%)

4. Discussion

ABO and Rh genes and phenotypes show wide variation across different races and geographical boundaries. Few studies on the prevalence of ABO and Rh blood groups have been carried out in the Indian population, and, majority of these studies are limited to individual communities or to a particular region of the country. No such study has yet been reported from North-east India.

The present study revealed that blood group O was the most prevalent at 37.23%, followed by B at 31.0%, A at 24.83% and AB at 6.93%. These findings are in agreement with studies by Periyavan et al conducted in and around Bangaluru [6]. Other studies conducted in the National Institute of Mental Health and Neuroscience, Bengaluru and on the population of some parts of Andhra Pradesh also reveal similar trends [6,7].

However, studies in the North Indian population by Nanu & Thapliyal, Chandra & Gupta and Agarwal et al reported blood group B to be the most prevalent [8-10]. Similar results with predominance of blood group B have also been noted in a study conducted in Gujarat [11].

Some other studies from different parts of Europe, America and South-east Asia have reported blood group O to be the commonest blood group [12,13].

The Rhesus blood group is the most polymorphic and its clinical significance in transfusion medicine is only next to the ABO blood group system [14]. The present study showed that the prevalence of Rhesus 'D' antigen is 98.03%. This finding is in agreement with the results of other studies by Periyavan et al and Falusi et al [6,15]. The Gauhati Medical College and Hospital, Guwahati being a referral hospital caters to a wide population of patients in and around the state of Assam. Hence, the data revealed in the present study fairly reflects the prevalence of the major blood group antigens among the population of the north-eastern region of India.

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5. Conclusion

In conclusion, we observed that ABO and Rhesus 'D' blood group distribution differed in different parts of India. The North-eastern region of India shows blood group O to be the most prevalent along with Rhesus antigen. This information will be of help in planning for blood transfusion services in this part of the country. However, studies of larger magnitude are required and the other minor blood group antigens are also needed to be studied in order to plan for transfusion dependant patients and for those patients who require repeated blood transfusions.

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