

DISTRIBUTION OF ABO AND RH BLOOD GROUPS IN WESTERN REGION OF NEPAL

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ABSTRACT

INTRODUCTION

Determination of ABO and Rh blood group types are clinically important for various purposes including blood transfusion. There is a wide regional, racial, and ethnic variability among these blood groups. We aim to determine the ABO and Rh blood group patterns in patients attending a tertiary care center of Western Nepal.

MATERIAL AND METHODS

This hospital-based cross-sectional study involved 600 patients visiting Universal College of Medical Sciences (UCMS), Bhairahawa undergoing blood group determination. The study was conducted for six months from 1st January to 30th June 2017. Ethical clearance for the study was taken prior to the study. Written and verbal consent were taken from each participant before the study.

Blood group was determined using open slide test method and reverse grouping was performed via tube method. Finally, Rh-DU test was performed in Rh-negative samples to test for weak D antigen.

RESULTS

Among the ABO blood group, most common blood group was O (34.2%) followed by B (29.2%) and A (25.3%). Sub-group analysis showed only one A2 sub-group, the remaining being A1. Majority of the patients were Rh positive (95.8%). All the Rh negative patients tested negative for Du as well. The overall distribution pattern of combined ABO-Rh blood group was O+ > B+ > A+ > AB+ > O- > A- = B- > AB-.

CONCLUSION

In the current study, O positive was the most common blood group in Western Nepal followed by B positive, and A positive respectively. AB-negative was the rarest blood group. The study can provide insight for future hematological studies.

KEYWORDS

ABO, Blood group, Rh, Western Nepal

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INTRODUCTION

The International Society of Blood Transfusion (ISBT) has recognized 43 blood group systems containing 345 red cell antigens so far. Of these only few antigens are specific to red blood cells (RBCs)^{1,2} The ABO and Rh blood group systems are the most clinically important.² The ABO blood group system comprises four blood types based on the presence or absence of A and B antigens on the surface of RBCs: A, B, AB, and O. Correspondingly, the lack of A or B antigens increases the titer of antibodies against that antigen in the serum. Among the various Rh antigens, the D-antigen is most significant. The Rh blood group system can be divided into two groups, Rh-positive and Rh-negative, where Rh-positive implies the presence of D antigen.^{3,4} The fact that D negative individuals produce anti-D antibodies when they encounter the D antigen (through transfusion or pregnancy) provides an important clinical caveat. The antibodies produced against A, B, and D antigens form the basis of majority of acute and delayed hemolytic transfusion reactions, and the hemolytic diseases of the fetus or newborn.^{2,3} Therefore, it is imperative to determine blood group status for compatibility testing routinely, especially in blood donors, transfusion recipients, organ transplants, and mothers-to-be.^{5,6} Furthermore, blood group identification is helpful during population genetic studies, researching population migration patterns, and resolving medico-legal issues, particularly disputed paternity cases.⁷

The incidence of ABO and Rh groups varies markedly among geography, races, ethnic groups, and socio-economic groups.⁸⁻¹² The data regarding the blood group distribution system of a particular region is helpful and essential for safer and more efficient clinical practice. Knowledge of the distribution of ABO and Rh blood groups is also necessary for effective management of blood bank inventories, be it a local, regional, or national transfusion service. The present study aimed to document the distribution of ABO and Rh blood groups in patients who attended a tertiary care center in Western Nepal.

MATERIAL AND METHODS

The ethical approval for this hospital-based cross-sectional study was taken from the Institutional review committee of the Universal College of Medical Sciences and Teaching Hospital (UCMS-TH), Rupandehi, Nepal (IRC Number UCMS/IRC/022/17). A total of 600 blood specimens from the patients attending UCMS-TH undergoing ABO-Rh blood grouping were considered for the study. The study was conducted from January 1 to June 30, 2017 for a period of six months. A conventional sampling technique was used. The patients in the age group less than one year were excluded from the study. Both written and verbal consent were taken from each participant before the study.

The blood grouping was performed in the department of Pathology of UCMS-TH. EDTA-plasma samples were used for the determination of ABO and Rh blood grouping by forward-grouping by using open slide test method. In this method, a glass slide is divided into three parts. For each part, a drop of patient's red cell suspension is mixed with anti-A, anti-B and anti-D separately. The cells and the reagents are

then mixed with a clean stick and the agglutination or blood clumping pattern is observed from which the ABO and Rh-D type of blood can be determined.^{6,13}

We then performed reverse grouping in the patient's serum sample to determine the ABO -groups using tube test method. Furthermore, the Rh-Du test was performed on all Rh-negative samples to rule out the presence of a weaker Du variant. Figure 1 summarizes the overall tools and techniques of data collection.

Data were entered into Microsoft excel and analyzed using Statistical package for social sciences (SPSS vs. 16). Data were presented in a tabulated form using frequency and percentage. A bar diagram was used to show the overall percentage of combined ABO-Rh blood group pattern. Descriptive statistics was used.

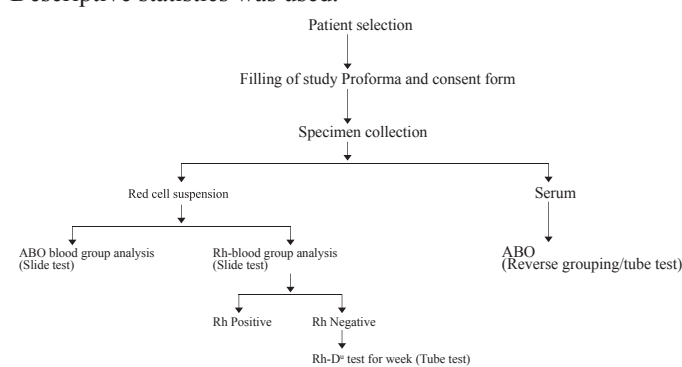


Figure 1. Summary of the tools and techniques of data collection

RESULTS

All the patients (N=600) included in the study were from Lumbini province and 351 (58.5%) were females and female to male ratio being 1.4. The age of the study group ranged from 1 to 89 years of with mean age 38.29 years. The majority (205; 34.2%) had blood group O, followed by B (175; 29.2%) and A (152; 25.3%). The AB blood group was the least prevalent (68; 11.3%). Reverse grouping showed only one A2 subgroup variant of blood group A. Rest were of variant A1.

Most of the participants (575; 95.8%) had Rh-positive blood. The Rh-negative individuals were further analyzed by the Rh-Du test, and all were Du negative. Similar pattern of distribution was found between males and females. Sex-wise distribution of the ABO and Rh blood group system are shown in Table 1 and Table 2 respectively.

Figure 2 shows the overall distribution of ABO-Rh blood group system of the participants. The most common blood groups were O-positive (32.7%) followed by B-positive (28.2%), and A-Positive (24.3%). The least common blood group was AB negative (0.5%). Both A-negative and B-negative blood groups were present on one percent of the study population. O-negative was found in nine (1.5%) participants.

Table 1. ABO blood group distribution pattern of the study participants

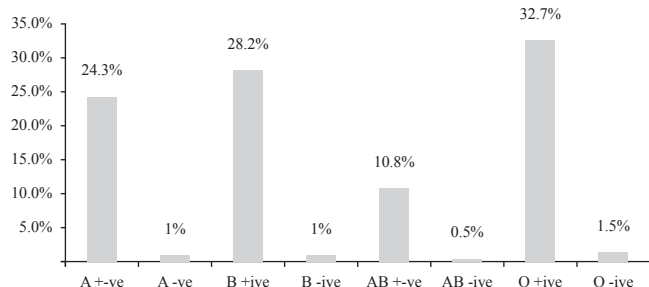
ABO blood group	Total participants (N=600,%)	Sex Male (N=249)	Female (N=351)
A	152 (25.3%)	56 (22.5%)	96 (27.4%)
B	175 (29.2%)	68 (27.3%)	107 (30.5%)
AB	68 (11.3%)	30 (12%)	38 (10.8%)
O	205 (34.2%)	95 (38.2%)	110 (31.3%)

Note: Column percentages are shown (both total and sex-wise). In patients with blood group A, only one patient had sub group A₂, rest belonged to sub-group A₁.

Table 2. Rh blood group distribution pattern of the study participants

Rh blood group	Total participants (N=600)	Sex Male (N=249)	Female (N=351)
Rh positive	575 (95.8%)	241 (96.8%)	334 (95.2%)
Rh negative	25 (4.2%)	8 (3.2%)	17 (4.8%)

Note: Column percentages are shown (both total and sex-wise). All the Rh negative patients had negative Rh-D^u.

**Figure 2.** Percentage distribution of the ABO-Rh blood groups of the participants (n = 600)

DISCUSSION

Identification of blood group is an essential component of various clinical (e.g. blood transfusion), medico-legal (e.g. disputed paternity cases), and research (e.g. population genetic studies) settings. ABO-Rh blood group distribution varies widely with regions and ethnicities. More urgently, the knowledge of ABO-Rh blood group distribution of a particular region helps in effective management emergencies requiring blood transfusion. In this research we studied the ABO-Rh blood group data of 600 patients attending UCMS-TH, a tertiary care centre located in Western Nepal.

The ABO blood group pattern in our study was O (34.2%) > B (29.2%) > A (25.3%) > AB (11.3%). The Rh blood group pattern was Rh-positive (95.8%) > Rh-negative (4.2%). Sex-wise distribution was similar for both ABO and Rh blood pattern. Similar findings were observed in studies from Western Nepal.^{14, 15} In contrast, the studies from Kathmandu and Eastern region showed the overall prevalence of ABO blood group in the following order: O>A>B>AB.^{8, 16}

The distribution pattern of combined ABO-Rh blood group system is of more important medical concern. The ABO-RH distribution pattern of our study was O+ > B+ > A+ > AB+ > O- > A- = B- > AB-. This pattern is similar in other studies from Nepal, with minor difference in prevalence of A+ and B+ blood groups,^{8,14-16} however this pattern is not similar when worldwide pattern is observed. Table 3 illustrates the ABO-Rh blood group distribution across various nations and continents. O+ was the most common blood group in most parts of the world,^{8,10,12,14-18} with the exception of China¹⁹ (A+), Germany¹¹ (A+) and northern India⁹(B+). The highest prevalence of O+ blood group were found in Mexico¹⁸ (59.3%), Uganda²⁰ (49.3%), and Argentina²¹ (48.9%). This is quite high compared to Nepal,^{8,14-16} where only 34±2% of the population had this blood group. AB- was the rarest blood group worldwide.

Another interesting finding is that Nepal along with various Asian and African nations have higher prevalence of B+ blood group.^{8,9,12,14-16,19,20} In contrast, European, North American, and South American people rarely (below 10%) have this blood group.^{10,11,17,18,21} Similarly, the distribution pattern of O- is also quite diverse. The distribution of O- is less than 2% population of Asian nations,^{9,19} including Nepal^{8,14-16} have this blood group, its distribution is quite higher in United Kingdom¹⁷ (13%), Caucasians of United States¹⁰ (8%), and Germans¹¹ (6%). Ethnic and racial diversities across the geography might have contributed to such variations. It can also be due to heterogeneity in genetic and environmental factors.

CONCLUSION

The present study done in patients attending UCMS-TH showed that O+ was the most common blood group present in the population of this region followed by B+ and A+. The rarest blood group was AB- as expected. Only 4.2% of the patients had Rh-negative blood group. Larger multi-centric studies with consideration for geography and ethnicity are warranted and highly recommended as it can be helpful in creating a blood group directory, which can be used in calling the donor at the time of need.

LIMITATIONS

Relatively small sample size was the major limitation of our study.

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Table 3. Geographical variations in the percentage of ABO-Rh blood group distribution.

Country/Continent	A ⁺	B ⁺	AB ⁺	O ⁺	A ⁻	B ⁻	AB ⁻	O ⁻	Pattern of distribution	
Asia	Nepal (present study)	24.3	28.2	10.8	32.7	1	1	0.5	1.5	O+ > B+ > A+ > AB+ > O- > A- = B- > AB-
	Nepal (eastern) ¹⁶	27.8	26.8	6.8	35.5	0.8	0.9	0.1	1.3	O+ > A+ > B+ > AB+ > O- > B- > A- > AB-
	Nepal (kathmandu) ⁸	29	26.2	8	34.1	0.7	0.8	0.2	1	O+ > A+ > B+ > AB+ > O- > B- > A- > AB-
	Nepal (western) ¹⁴	24.9	30	6.9	34.9	0.8	0.7	0.3	1.5	O+ > B+ > A+ > AB+ > O- > A- > B- > AB-
	India (Uttarakhand) ⁹	28.4	29.8	11	24.3	2	1.9	0.6	1.9	B+ > A+ > O+ > AB+ > A- > O- = B- > AB-
	China ¹⁹	30.2	29.1	9.6	30.1	0.4	0.3	0.1	0.3	A+ > O+ > B+ > AB+ > A- > O- = B- > AB-
Europe	UK ¹⁷	30	8	2	35	8	2	1	13	O+ > A+ > O- > B+ = A- > AB+ = B- > AB-
	Germany ¹¹	37	9	4	35	6	2	1	6	A+ > O+ > B+ > A- = O- > AB+ = B- > AB-
North America	US (Caucasian) ¹⁰	33	9	3	37	7	2	1	8	O+ > A+ > B+ > O- > A- > AB+ > B- > AB-
	Mexico ¹⁸	26	8.5	1.7	59.3	1.4	0.4	0.1	2.6	O+ > A+ > B+ > O- > AB+ > A- > B- > AB-
South America	Argentina ²¹	31.5	8	2.5	48.9	3.2	0.8	0.3	4.8	O+ > A+ > B+ > O- > A- > AB+ > B- > AB-
Africa	Ethiopia ¹²	27.2	21.4	5	37.9	2.6	1.8	0.5	3.6	O+ > A+ > B+ > AB+ > O- > A- > B- > AB-
	Uganda ²⁰	24.5	20	4.2	49.3	0.5	0.4	0.1	1.1	O+ > A+ > B+ > AB+ > O- > A- > B- > AB-

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