Original Article

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Pathology Section

Prevalance of ABO and Rhesus Blood Groups in Blood Donors: A Study from a Tertiary Care Teaching Hospital of Kumaon Region of Uttarakhand

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ABSTRACT

Backround: ABO and Rhesus (Rh) blood group antigens are hereditary characters and are useful in population genetic studies, in resolving medico-legal issues and more importantly for the immunologic safety of blood during transfusion.

Aims: This study is aimed to determine the distribution pattern of the ABO and Rh blood groups among blood donors in Kumaon region of Uttarakhand and compare it with other data from similar studies within the India and all over the world.

Design: It is a retrospective study carried out at blood bank of Shushila Tewari Hospital of Government Medical College, Haldwani from January 2012 to December 2013.

Materials and Methods: The study was conducted on 12,701 blood donors. ABO and Rh typing was done using slide agglutination method with antisera ABO and Rh (Tulip diagnostics ltd). Doubtful cases were confirmed by tube agglutination method and reverse grouping using known pooled A and B cells. The age group and sex of donors, frequency of ABO and Rh blood groups were reported in simple percentages.

Results: The predominant donors belonged to age group between 18-35years (84.28%). Male donors were more than female donors, ratio being 352:1. Replacement donors (99.71%) were much more than voluntary donors (0.91%). The most common blood group was B (32.07%) and least common being AB (10.53%). Blood group 'O' and 'A' had same frequency. The prevalence of Rhesus positive and negative distribution in the studied population was 94.49% and 5.51% respectively. Blood group frequency with respect to ABO and Rhesus positive was found to be shown by formula B> O>A >AB. The frequency for ABO and Rhesus negative was given by the formula B>A>O>AB.

Conclusion: Knowledge of frequencies of the different blood groups is very important for blood banks and transfusion service policies that could contribute significantly to the National Health System.

Keywords: ABO, Blood groups, Blood donors, Kumaon, Rhesus

INTRODUCTION

Human red blood cells contain on their surface a series of glycoproteins and glycolipids, which constitute blood group antigens. Development of these antigens are genetically controlled, inherited in a mandelian fashion and appear early in fetal life and remain unchanged till death [1]. Nearly 700 erythrocyte antigens are described and organized into 30 blood group systems by the International Society of Blood Transfusion of which ABO and Rh are most important [2].

The ABO blood group system was the first human blood group system to be discovered by Landsteiner in 1901 [3]. Later Landsteiner and Wiener defined the Rh blood group in 1941[4]. Together these two systems have proved to be the most important, for blood transfusion purposes.

Discovery of ABO blood group system opened the way for discoveries in the field of immunohaematology, blood transfusion among humans irrespective of their natives, unmatched pregnancy, legal medicine, anthropology and the discovery of other blood group systems [5].

The ABO blood group system is divided into four blood types on the basis of presence or absence of A and B surface antigens. The blood groups are ABO and AB. ABO blood group system is important because of the fact that A and B are strongly antigenic and anti A and anti B are naturally occurring antibodies present in the serum of persons lacking the corresponding antigen. These antibodies are capable of producing intravascular hemolysis in case of incompatible transfusion [6].

Rh antigens are highly immunogenic. Out of 49 Rh antigens identified till now, D antigen is most significant. D negative individuals produce anti-D if they encounter the D antigen through transfusion or pregnancy and causes hemolytic transfusion reaction, or hemolytic disease of fetus and newborn. For this reason, the Rh status is routinely determined in blood donors, transfusion recipients, and in mothers-to-be [7].

Apart from their importance in blood transfusion practice, the ABO and Rh blood groups are useful in clinical studies population genetic studies, researching population migration patterns as well as resolving certain medicolegal issues, particularly of disputed paternity cases [8].

All human populations share the same blood group systems; although they differ in the frequencies of specific types. The incidence of ABO and Rh groups varies markedly in different races, ethnic groups, and socio-economic groups in different part of the world [9].

Knowledge of availability of different Blood groups at various levels is need of the hour for more efficient delivery of blood bank services and so is the need of this study.

In the present study distribution of blood groups is studied in Kumaon region of Uttarakhand, India.

MATERIALS AND METHODS

The present retrospective study was carried out at blood bank of Dr. Shushila Tewari teaching hospital of Government Medical College, Haldwani, Nainital after due ethical clearance from the institutional ethic committee. The data of present study corresponds to period

Age group (in years)	Number of donors
18-25	5068
26-35	5636
36-45	1690
46-55	277
56 and above	30

[Table/Fig-1]: Distribution of age groups among study population (n=12,701)

Gender	No of donors	Percentage (%)
Male	12665	99.71%
Female	36	0.23%

[Table/Fig-2]: Distribution of donors according to gender

Type of donation	No of donors	Percentage (%)
Voluntary	116	00.91%
Replacement	12665	99.71%

[Table/Fig-3]: Distribution of Voluntary and replacement donors

Blood group	A(%)	B (%)	AB (%)	O (%)	Total (%)
Rh positive	3427 (26.98%)	3850 (30.31%)	1276 (10.05%)	3449 (27.15%)	12002 (94.49%)
Rh negative	218 (1.72%)	223 (1.76%)	61 (0.48%)	197 (1.55%)	699 (5.51%)
Total	3645 (28.70%)	4073 (32.07%)	1337 (10.53%)	3646 (28.70%)	12701 (100%)

[Table/Fig-4]: Distribution of ABO and Rhesus blood group among study population (n=12701)

for January 2012 to December 2013 and includes in house voluntary and replacement donors. Replacement donors were those who donated for their patients and were close relatives, family members or friends of the recipients. The donors were first required to fill up a registration form which carried all the information like personal details, demographic details, occupation and medical history. Haemoglobin estimation was performed and donors with haemoglobin less than 12.5 gm% were not selected. The donors were then screened by medical officer according to blood donor selection criteria and guidelines from drug and cosmetics act and NACO. Individuals with good health, mentally alert, physically fit were selected as blood donors. The donors were then asked to sign the donor questionnaire and informed consent form.

Total 12,701 donors were considered medically fit and accepted for blood donation. Records of blood groups of blood donors were checked and care was taken to eliminate any repeat donors.

After blood donation, ABO and Rh typing was done by antigen antibody agglutination test by commercially available standard antiseras i.e. anti A, anti B and Anti D (Tulip diagnostics ltd) after validation at blood bank. Blood groups were done by slide agglutination method. Doubtful cases were confirmed by tube agglutination method and reverse grouping using known pooled A and B cells. All weak D groups were considered as Rh positive. Data on frequency of ABO and Rh blood groups were reported in simple percentages.

OBSERVATIONS AND RESULTS

Blood grouping of 12701 donors was done. The predominant donors belonged to age group between 18-35years (84.28%) and least were of age group 56 and above (0.24%) [Table /Fig-1]. Male donors were more than female donors, ratio being 352:1 [Table/Fig-2]. Replacement donors (99.71%) were much more than voluntary donors (0.91%) [Table/Fig-3].

The most common blood group was B and least common being AB. Blood group 'O' and 'A' had same frequency. In the Rh blood group,

Sr No.	With in India	Location of study	A	B	AB	O	Rh+ve	Rh-ve
1.	Northern India	Present study	28.70	32.07	10.53	28.70	94.49	5.51
2.		Lucknow [10]	21.73	39.84	9.33	29.10	95.71	4.29
3.		Amritsar [11]	18.01	38.06	9.62	34.31	91.28	8.72
4.	Western India	Western Ahmedabad [13]	21.94	39.40	7.86	30.79	95.05	4.95
5.		Eastern Ahmedabad [17]	23.30	35.50	8.80	32.50	94.20	5.80
6.	Central India	Maharastra(Loni) [14]	28.38	31.89	8.72	30.99	95.36	4.64
7.	Eastern India	Durgapur [18]	23.90	33.60	7.70	34.80	94.70	5.30
8.	Southern India	Shimoga-Malnad [12]	24.27	29.43	7.13	39.17	94.93	5.07
9.		Devanagere [15]	26.15	29.85	7.24	31.76	94.8	5.2
10.		Bangalore [19]	23.85	29.95	6.37	39.82	94.2	5.8
11.	Outside India	Pakistan(Swat) [20]	27.92	32.40	10.58	29.10	90.13	9.87
12.		Nepal [21]	34	29	4	33	96.7	3.3
13.		Britain [22]	42	8	3	47	83	17
14.		USA [23]	41	9	4	46	85	15
15.		Australia [24]	38	10	3	49	NA	NA
16.		Nigeria [25]	21.60	21.40	2.80	54.20	95.20	4.80
17.		Saudi Arabia [26]	24	17	4	52	93	7

[Table/Fig-5]: Comparison of frequency percentage of ABO and Rhesus blood groups in different regions of India and with different countries

Rh positive donors (94.49%) were much more than Rh negative donors (5.51%) [Table/Fig-4].

Blood group frequency with respect to ABO and Rhesus positive was found to be shown by formula B> O>A >AB which is in accordance with other studies [10, 11]. The frequency for ABO and Rhesus negative was given by the formula B>A>O>AB [Table/Fig-4] which is in contrast to study done by Kaur et al., [11] ,in which it is given by the formula O>B>A> AB.

DISCUSSION

The present study showed large number of male donors compared to female donors which is comparable with other studies within India [12-14]. This is because of the fact that in developing country like India, because of social taboo, cultural habits, lack of motivation and fear of blood donation, female donors are very less. On Pre-donation screening, a large number of menstruating females found to be anemic with low body weight and hence declared unfit for blood donation. Hence, general health of females needs to be improved by good nutritional diet and iron supplements. Females need to be motivated and aware of advantages of Blood Donation, removing fears and myths from their mind.

The main work force of any of the society is of age group 18-35. So, this is the most common age group encountered donating blood. This is comparable with other studies [13, 15]. The least donors were of age group 56 and above because many of the people of this age group suffer from hypertension, diabetes mellitus, low hemoglobin and ischemic heart diseases and hence abstain from donating blood or are considered unfit during predonation counselling .Voluntary donors in present study were 0.91% which is in contrast to study done at Shimoga Institute of Medical Sciences, Shivamogga [12] where voluntary donations were 37.30%.

Number of voluntary donations need to be increased so that blood can be provided to all patients in emergency without waiting for the replacement donors. Also there is less risk of transmitting transfusion transmitted infections with voluntary donations [16]. So to get safe blood the voluntary donations has to be encouraged.

In the present study, frequency and distribution of ABO and Rh group in the blood donors in Kumaon region are compared with the similar studies carried out within and outside India [Table/Fig-5]. Frequency of blood groups of present study was compared to the studies done at Lucknow [10], Amritsar [11], Ahmedabad [13,17] and Maharastra [14]. Most common blood group was 'B' and least common was 'AB'. However the distribution of A and O blood group of our study varied from other studies. In our study A and O blood group showed equal frequency whereas in all other above mentioned studies O blood group donors were more than 'A' blood donors.

Studies done at Durgapur [18], Bangalore [19], Devanagere [15] and Shimoga-Malnad [12] found that the commonest blood group was 'O', which is in contrast to present study where B is the most common blood group. So geographical distribution of Blood Groups in India shows that in Northern, Western and Central 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.

Outside India, in Pakistan [20], the commonest blood group is B which is same as in our study. The study done at Nepal [21] found the commonest blood group was A, whereas in studies done in most parts of India the commonest blood group is either B or O.

Countries in other parts of the world like Britain [22], USA [23], Australia [24], Nigeria [25] and Saudi Arabia [26] showed the frequency of blood group O being highest which is in contrast to the present study.

Rh negativity status was 5.51% in our study and is in accordance with the studies conducted at other places in India and is in contrast with western studies [22,23] where it was reported it as 15-17%. Knowledge of frequency of ABO and Rh blood groups is important for management of blood bank inventory and transfusion services to the needy patients. It also help to determine the direction of recruitment of voluntary donors as required for each zone across the country. Apart from transfusion service, knowledge of ABO and Rh blood groups are useful in population genetic studies, researching population migration patterns as well as resolving certain medicolegal issues particularly disputed parentage and preventive measures against the diseases which are associated with different blood groups. Studies concerned about possible association between ABO blood group and cardiovascular diseases have confirmed that persons of group A are affected more frequently with coronary heart disease, ischemic heart disease, venous thrombosis and atherosclerosis, while its low in people with blood group 'O'.[8,27] 'O' group individuals are known to have a 14 % reduced risk of squamous cell carcinoma and 4 % reduced risk of basal cell carcinoma when compared to non-O group [28]. It is also associated with a reduced risk of pancreatic cancer [29,30]. The 'B' antigen is associated with increased risk of ovarian cancer [31].Gastric cancer is more common in blood group 'A' and least in group 'O' [32]. So Regional Blood Grouping studies are the need of hour to frame better National Transfusion Policy and efficient delivery of services especially during emergency situations, Natural Disastrous conditions and to know the future burden of Diseases.

CONCLUSION & SUGGESTIONS

The present study concludes that most common blood group is 'B' and least common is AB amongst the blood donors at Kumaon Region of Uttarakhand. Blood group A and O showed equal frequency. Regarding Rhesus blood group system, Rh positive donors were 94.49% and Rh negative were 5.51%. Blood donation by the females was very low and it needs to be increased by improving health status and awareness about blood donation. The data generated in the present study and several other studies of different geographical region of India will be useful to health planners to face the future health challenges in the region.

The blood group of every individual must be indicated on national identity cards, driving licenses and school/office identity cards. This will be of tremendous use in case of emergencies when urgent transfusion of yet to be cross matched blood is required. It is necessary to conduct similar well designed studies in other states of India in order to determine the blood group frequencies in them.

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