

## ABO/RH DISTRIBUTION PATTERN AND PREVALENCE OF IRREGULAR ANTIBODIES IN HEALTHY BLOOD DONORS OF UTTARAKHAND

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### ABSTRACT

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#### BACKGROUND

Blood group plays a vital role in transfusion safety, understanding genetics, inheritance pattern and disease susceptibility. This study is aimed to determine distribution pattern of ABO and Rh blood group, incidence and identification of irregular antibodies among blood donors of Uttarakhand.

#### METHOD

ABO/Rh blood grouping was performed by test tube agglutination method (both cell and serum grouping) using antisera A, B and Rh from Tulip and Orthodiagnosics. Donors' plasma were screened for irregular antibodies by indirect antiglobulin technique using Bio-Rad ID-Card "LISS/Coombs" and test cell reagents "ID-DiaCell" via gel centrifugation.

#### RESULTS

Out of total 4573 included blood donors, 88.2% were males. The maximum blood donors (77.6%) were in 18-25 years of age group. The commonest ABO blood group present was B (36.1%) followed by O (29.1%), A (24.8%) and AB (10%) in blood donors; while in Rhesus system, 95.0% donors were Rh-positive and 5.0% donors were Rh negative. Screening of donors' plasma did not reveal any detectable irregular antibody.

#### CONCLUSION

The study has a significant implication in suggesting the distribution pattern of ABO/Rh blood group typing in the region, but routine irregular antibody screening in healthy blood donors may not be fruitful in this region keeping cost effectiveness and absence of previous sensitization in mind.

#### KEYWORDS

Transfusion, Irregular, Antibody, ABO/Rh, Donor.

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#### INTRODUCTION

It was recorded in the Bible that the "life of the flesh was in the blood." Many lives are saved throughout the world each year through the use of blood transfusions, by preventing death from loss of blood due to trauma and by allowing performance of surgical procedures which would otherwise be impossible. Knowledge about the distribution of ABO-Rh blood groups in a region is helpful in effective management of blood banks inventory. Also irregular erythrocyte antibodies can cause transfusion reactions resulting in fever, chills, destruction of RBC's and haemolysis in recipients. The present study aimed to determine the distribution pattern of ABO/Rh blood grouping and incidence as well as identification of irregular antibodies in healthy blood donors of Uttarakhand region.

#### MATERIAL AND METHODS

The present study included the blood donors who donated blood in the hospital blood bank as well as at various blood donation camps from January 2013 to June 2014. The study had been approved by Institutional Ethical Committee. A pretested proforma was used which included donor's name, age, sex, religion, occupation, educational status, socioeconomic status, marital status, family history and routine physical examination findings. Inclusion criteria includes age of donor ranging from 18-65 years, weight >45 kgms and haemoglobin equal or more than 12.5 gm/dL. Individuals suffering from the diseases like cancer, epilepsy, heart disease, bleeding disorder, diabetes, hepatitis, AIDS and TB were excluded as donors from the study. Donors with recent history of abortions, blood transfusion, tattooing, surgery, typhoid, malaria or vaccination were temporarily deferred from blood donation. Professional donors, drug addicts or individuals with multiple sex partners were excluded from the study.

Screening tests for HIV, HCV, HbsAg using Tri-Dot card test, VDRL using Transasia TP card test and MP-antigen using SD Rapid test kit for Malaria Ag Pf/Pan (HRP-II/pLDH) were performed. The ABO and Rh blood grouping of blood donors were performed by test tube method (Both forward and

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reverse) using antisera A, B and Rh from Tulip. Donors' plasma were screened for irregular antibodies by indirect anti-globulin technique using Bio-Rad ID-Card "LISS/Coombs" and test cell reagents "ID-DiaCell" via gel centrifugation. Known positive and negative controls for blood grouping as well as irregular antibodies were run in parallel with tests.

**RESULTS**

Out of total 4661 blood donations, 88 donors who tested positive during screening tests were excluded. The prevalence of seropositivity for HIV, HCV, HbsAG, VDRL and MP-AG among blood donors was 0.19%, 0.47%, 0.77%, 0.45% and 0% respectively. The study included total 4573 healthy blood donors. Out of these 434 (9.5%) donated blood at hospital as a replacement and 4139 (90.5%) donated at camps voluntarily.

During the study, younger age group (18-25 years) contributed about 77.6% (3548/4573) of the total blood donations followed by 25-35, 35-45 and >45 years of age groups accounting for 12% (549/4573), 09% (412/4573) and 1.4% (64/4573) respectively. Male predominance in blood donation accounting for 88.1% (4033/4573) was observed as compared to the females contributing only 11.9% (540/4573) of the total donations. Male:Female ratio was approx. 7.5:1.

In the present study (Table 1), the overall commonest blood group was 'B' contributing 36.1% (1653/4573) followed by blood group 'O' in 29.1% (1329/4573), 'A' in 24.8% (1134/4573) and 'AB' in 10% (457/4573) of the total included donors. In male donors, ABO grouping followed the same frequency pattern (B>O>A>AB). Although, also in female

donors 'B' was most common blood group contributing for 4% (181/4573); however, blood groups 'O' and 'A' showed insignificant difference in their frequency accounting for 3.5% and 3.15% respectively.

Blood group 'AB' was least common in both genders contributing 8.9% and 1.0% of the total donors. The overall positivity of Rh blood group was 95.0% (4345/4573), while Rh negative blood group accounted for 5.0% (228/4573) of the total donors. Male donors accounted for 83.92% (3838/4573) of this positivity, while female donors for 11.08% (507/4573). Screening of donors' plasma did not show any positive clinically significant irregular antibodies.

ABO Blood Group	Male		Female		Total	
	Rh + (%)	Rh - (%)	Rh + (%)	Rh - (%)	Rh + (%)	Rh - (%)
A	928 (20.3)	51 (1.1)	148 (3.2)	07 (0.15)	1076 (23.5)	58 (1.25)
B	1396 (30.5)	76 (1.7)	170 (3.7)	11 (0.2)	1566 (34.2)	87 (1.9)
AB	394 (8.6)	17 (0.4)	45 (1.0)	01 (0.02)	439 (9.6)	18 (0.42)
O	1120 (24.5)	51 (1.12)	144 (3.2)	14 (0.31)	1264 (27.7)	65 (1.43)
<b>Total</b>	<b>3838 (83.9)</b>	<b>195 (4.32)</b>	<b>507 (11.1)</b>	<b>33 (0.68)</b>	<b>4345 (95.0)</b>	<b>228 (5.0)</b>

*Table 1: Sex-Wise Distribution of ABO & Rh Blood Group Systems in Donors (n= 4573)*

Place of Study	A (%)	B (%)	AB (%)	O (%)	Rh + (%)	Rh - (%)
<b>Within India</b>						
Ahmedabad. <sup>1</sup>	21.94	39.40	7.86	30.79	95.05	4.95
Jammu. <sup>2</sup>	24.77	34.85	9.73	30.64	94.52	5.48
Latur. <sup>3</sup>	24.89	37.98	9.47	27.64	95.19	4.81
U.P. <sup>4</sup>	21.94	35.66	9.73	32.67	95.75	4.25
Jaunpur (U.P.). <sup>5</sup>	24.6	33.0	7.9	34.5	99.01	0.99
Uttaranchal. <sup>6</sup>	33.80	23.0	7.98	35.21	96.71	3.28
West Bengal. <sup>7</sup>	22.65	34.87	6.68	35.8	97.7	2.3
Jodhpur. <sup>8</sup>	22.2	36.4	9.4	31.7	91.75	8.25
Amravati. <sup>9</sup>	27.02	33.06	8.33	31.04	95.74	04.26
Karnataka. <sup>10</sup>						
Male	19.87	36.86	7.05	36.22	94.57	5.13
Female	23.6	33.00	5.9	37.50	94.44	5.66
Vellore. <sup>11</sup>	18.85	32.69	5.27	38.75	94.53	5.47
Indore. <sup>12</sup>	24.15	35.25	9.10	31.50	95.43	4.57
Present Study	24.8	36.2	10.0	29.0	95.01	04.99
<b>Outside of India</b>						
Pakistan. <sup>13</sup>	21.92	36.95	7.33	33.8	92.17	7.83
Bangladesh. <sup>14</sup>	23.5	39.8	9.2	27.6	97.4	2.6
Nepal. <sup>15</sup>	34	29	4.0	33	96.7	3.3
Nigeria. <sup>16</sup>	26.9	16.1	4.2	52.9	91.7	8.3
Sudan. <sup>17</sup>	23.3	13.2	10.8	52.7	98.0	2.0
Turkey. <sup>18</sup>	44	16.2	6.5	33.3	88.2	11.8
Iran. <sup>19</sup>	27	30.6	12	30.4	85.9	14.1
USA. <sup>20</sup>	41	09	04	46	85	15
Britain. <sup>21</sup>	41.7	8.6	03	46.7	83	17

*Table 2: Comparison of Frequency (%) of ABO and Rh Blood Groups in Different Areas of India and Different Countries of the World as Reported by Other Authors*

Study Done by	Study Group	Incidence
Pahuja et al <sup>22</sup>	Healthy blood donors	0.05%
Sallander et al <sup>23</sup>	Healthy blood donors	0.7%
Bojadzieva et al <sup>24</sup>	Blood donors and hospitalised patients	9.37%
	Multiple transfused patients	1.28%
Makroo et al <sup>25</sup>	Volunteer donors in donors' serum	4.24%
Myhre et al <sup>26</sup>	in hospitalised patients	0.52 %
Richard et al <sup>27</sup>	Alloimmunized subject	0.46 %
	Blood Donors	1.9 %
Winters et al <sup>28</sup>	Transfused patients	<1 %
Giblett et al <sup>29</sup>	Military veterans	0.32 %
	Random donors	1.58%
Tormey et al <sup>30</sup>	Blood donors	2.4 %
Zhu et al <sup>31</sup>	Donors population	0.28%
Yeela et al <sup>32</sup>		0.99%
Garcia et al <sup>33</sup>	Pregnant females	0.72% (AA)
	Hyperbilirubinaemic Neonates	0.23% (CSAA)
Andersen et al <sup>34</sup>	Antenatal women	0.5%
Wu et al <sup>35</sup>	Pregnant women	.01% (MA)
Varghese et al <sup>36</sup>		9.43%
Jeremiah et al <sup>37</sup>		3.4%

**Table 3: Incidence of Irregular Antibodies Reported by other Authors in Different Populations**

AA: Alloantibody, CSAA: Clinically significant alloantibody, MA: Maternal antibodies

## DISCUSSION

The Landsteiner's discovery opened the door to the birth of a wide spectrum of 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 as well. Today, there are more than 600 antigenic structures among the 30 defined blood groups of which ABO/Rh blood grouping is most important and commonly used. Determination of the frequency of blood groups in a particular region facilitates safe and timely provision of blood and blood products. Blood groups are also known to have some association with diseases like duodenal ulcer, diabetes mellitus, urinary tract infection, Rh and ABO incompatibility of newborn.

As in our study, maximum number of blood donors belonged to younger age group; similar results were reported by other studies.<sup>[1-2]</sup> Basically, the younger age groups are main work force for any of the society. So, they are the most common age group encountered in donating blood. Also many of the older people suffer from hypertension, diabetes mellitus, low haemoglobin and ischaemic heart diseases and hence may abstain from donating or considered unfit during pre-donation counselling.

Similar to the present study, male predominance was also documented by some other authors also.<sup>[1-3]</sup> In developing countries because of social taboo, cultural habits, lack of motivation and fear of blood donation, female donors may be very less. In addition, large numbers of females from the menstruating age groups are anaemic with low weight, so declared unfit for blood donation and eliminated by the pre-donation screening. Another reason is deferral of females because of the overall prevailing prevalence of anaemia among the females all over India.

An individual blood group today is as important as the national identity card. Blood groups are genetically determined and the incidence of ABO and Rh genes and their phenotypes vary widely across races and geographical boundaries, despite the fact that the antigens involved are stable throughout life. Many studies have been conducted to know the distribution pattern of ABO/Rh grouping, the most common blood group system, in various regions or populations within India as well as all over the world (Table 2). Most of the studies from northern, western and central part of India showed predominance of blood group 'B', while in southern and eastern parts blood group 'O'. Other countries like Britain, USA, Nigeria and Sudan showed the highest frequency of blood group 'O', while some countries like Pakistan, Bangladesh and Iran showed the highest frequency of blood group 'B'. A few studies like in Turkey and Nepal reported the maximum frequency of blood group 'A' in contrast to our study (Table 2).

Irregular antibodies are all non-ABO antibodies, although the main use of the term is for non-ABO isoantibodies that may cause incompatibility in blood transfusions. These antibodies can also cause a series of immunologic effects in recipients, commonly being alloimmunisation, allergic reactions and haemolytic transfusion reactions. Greater prevalence of irregular antibodies has been documented in pregnancy, multiple transfusions, haemolytic diseases of newborn and previously sensitized individuals (Table 3). Importance of irregular antibody screening in females may be explained by immunization through pregnancy, greater immune response and more exposure through transfusion. Except Anti-D in females, other antibodies can also cause a significant proportion of alloimmunisation of women and haemolytic disease of new born. There is paucity of literature on the prevalence of irregular antibodies in general population. Although in the present study, no positive result during

irregular antibody screening of healthy blood donors; however, considerable effort has been done to detect as many different "irregular" antibodies as possible and some studies have shown a very low incidence of irregular antibodies in general population and healthy blood donors (Table 3).

In conclusion, distribution pattern of ABO/Rh blood group typing in a particular population or region is important in safe transfusion, but routine irregular antibody screening in healthy blood donors may not be fruitful in this region keeping cost effectiveness, increased laboratory workload and absence of previous sensitization in mind. However, further larger well designed studies are needed for elaboration of importance of antibody screening of healthy blood donors, which may be necessary for better use of donor blood, more efficient services as well as safe and compatible blood transfusion, especially for previously alloimmunised individuals.

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