

Distribution of ABO and Rh types in voluntary Blood donors in Jharkhand area as a study conducted by RIMS, Ranchi

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ABSTRACT

Background: This study was done to know the distribution and frequencies of blood groups among blood donors attending voluntary blood donation camps organized by the Rajendra Institute of Medical Sciences (RIMS), Ranchi, Jharkhand so that demand and supply ratio of the four blood groups can be maintained so that no patient dies due to lack of a particular blood group. **Context:** Up till now about 400 red cells antigen have been identified. The majority follow Mendelian inheritance. The ABO and Rhesus (Rh) blood group system are most important for blood transfusion purposes, parental testing, legal medicine, and in population genetic study. **Aims:** This study was conducted to determine and compare the frequency and distribution of ABO and Rh blood groups among voluntary blood donors attending blood donation camps in Jharkhand organized by RIMS. The aim is to know the demand and supply ratio of a particular blood group in light of their distribution in the society so that no patient dies due to the deficient supply of blood. **Settings and Design:** It is a retrospective study carried out at blood bank. **Materials and Methods:** A study was conducted at Blood bank, RIMS, Ranchi, Jharkhand, over a period of 4 years from January 1, 2012, to December 31, 2015. Blood group of the blood donors was determined by commercially available standard monoclonal antisera by test tube agglutination technique accompanied by reverse grouping. **Results:** Out of 20,455 subjects, 18,717 (91.73%) were male and 1738 (8.27%) were female subjects. The ABO blood group present was B (35.15%) followed by O (34.73%), A (22.09%), and AB (8.03%) in blood donors while in Rh system, (96.46%) donors were Rh +ve and (3.54%) donors were Rh -ve. The study has a significant implication regarding the inventory management of blood bank and transfusion services for the indoor patients of RIMS and for emergency supply to other hospitals of Jharkhand in dire need of blood. **Conclusions:** The knowledge of distribution of blood group is very important for blood banks and transfusion services which play an important role in the patient's health care. This study will also throw light on the reasons of deficiency of a particular group in a particular area so that deficient group donors may be encouraged to donate more frequently.

Keywords: ABO, blood bank, Rhesus, Rajendra Institute of Medical Sciences, voluntary donors

Introduction

Blood group antigens are hereditary determined and play a vital role in transfusion safety, understanding population genetic studies, researching population migration patterns, inheritance pattern,

medicolegal issues, disputed paternity cases, and disease susceptibility. Nearly, 700 erythrocyte antigens are described and organized into 30 blood group systems by the International Society of Blood Transfusion of which ABO and Rhesus (Rh) are important.^[1]

The Landsteiner's discovery opened the door to the birth of a wide spectrum of discoveries in the field of immunohematology,

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blood transfusion among humans irrespective of their natives, unmatched pregnancy, legal medicine, anthropology, and the discovery of other blood group systems, all are deemed as an applications or as a result of Karl's discovery.^[2,3]

The discovery of the ABO blood groups by Karl Landsteiner was an important achievement in the history of blood transfusion for which he received the Noble Prize that was followed by his and Wiener discovery of Rh (D) antigen.^[4,5] Alfred Von Decastello and Adriano Sturli discovered the fourth type AB, in 1902.^[3] Blood groups are known to have some association with diseases such as duodenal ulcer, diabetes mellitus, urinary tract infection, Rh incompatibility, and ABO incompatibility of newborn. The knowledge of the distribution of ABO and Rh blood groups at local and regional levels are imperative in the effective management of blood banks and safe blood transfusion services.

Knowledge of the distribution of ABO and Rh blood group is essential for effective management of blood banks inventory, be it a facility of a smaller local transfusion service or a regional or national transfusion service. This study specifically emphasizes on the rural population in periphery areas.

Objective

This study is aimed to determine the frequency and distribution of ABO and Rh blood group patterns and participation of female donors among voluntary blood donors attending blood camps in Jharkhand area organized by the Rajendra Institute of Medical Sciences (RIMS) and compare with other data from similar studies within the India and all over the world and to know the relative deficiency of a particular group at the time of need. This study included a large number of voluntary donors from both urban and rural population.

Materials and Methods

This study was carried out at blood bank, RIMS, Ranchi, Jharkhand, during the last 4 years period from January 2012 to December 2015. The blood collections were taken from the voluntary donors at blood donation camp organized by RIMS. Total 20,455 donors were considered medically fit and accepted for blood donation during the study period.

All were of age between 18 and 60 years. After blood donation, blood group was determined by forward blood grouping (cell grouping) by test tube agglutination method. Commercially available standard antisera A, antisera B, and antisera D were used after validation at blood bank. Reverse blood grouping (serum grouping) was performed by test tube agglutination method with pooled known A, B, and O cell that are being prepared daily at the blood bank. Final blood group is confirmed only if both forward group (cell group) and reverse group (serum group) are identical. Rh -ve blood groups were confirmed by antiglobulin technique (Du Test). All Du positive groups, blood were considered as Rh +ve. The donor blood group

data were recorded on specially formed pro forma, tabulated, analyzed, and compared with the similar studies by other authors.

Discussion

The aim of this study is to know the distribution and frequencies of blood groups among blood donors attending voluntary blood donation camps organized by RIMS, Ranchi, Jharkhand. This study covered Ranchi and surrounding periphery areas. The motive of the study is to know demand and supply ratio of the four blood groups so that no patient dies due to lack of a particular blood group. This study was specifically conducted among voluntary blood donors representing a cross-section of society attending blood donation camps in various localities of Jharkhand organized by RIMS, Ranchi. Replacement donors were excluded from the study since mostly they replace the specific blood group which they demand. In our area, there is a relative deficit of Blood group "A" supply compared to the demand.

In this study, total no of subjects (20,455) included in the study, the ABO blood group typing in the total sample showed the same trend of prevalence as in the general Indian population ($B \geq O > A > AB$). In ABO system, our study shows the highest frequency of blood group "B" (35.15%), followed by "O" (34.73%), "A" (22.09%), and "AB" (8.03%) as cited in Tables 1 and 2. In Rh system, our study shows frequency of Rh +ve was 96.46% while only 3.54% was Rh -ve. As mentioned in Table 3, these figures are similar to the other studies carried out in different part of India [Northern^[6-11] Eastern,^[15] Western India^[1,12-14], and Pakistan.^[21] Remarkably, in Southern India, "O" Rh +ve blood group is the most common one followed by "B" Rh +ve.^[1,16-18] It is mentioned in Table 4 that outside India, "A" group is much more common than "B." The most common blood group in the studies conducted in Britain, the USA, Australia, Nigeria, and Saudi Arabia^[1,20,23-25] is "O" group followed by "A," "B," and "AB." It is necessary to remark on a study conducted in Nepal by Pramanik and Pramanik, where "A" group was the most common followed by B, O, and AB.^[12]

Rh +ve groups are predominant group, and the frequency is more or less the same. Internationally, the distribution and frequency of the Rh +ve group and Rh -ve group is different, especially in Britain and USA where the frequency of Rh -ve group is reasonably high (17% and 15%, respectively) compared to other regions.^[20,23]

It is worth reporting that awareness about blood donation has increased among blood donors as observed in the study from 2012 to 2015 (in 2012 it was 3499, which increased to 7075 in 2015). However, it is surprising that female donors are very low. It has been observed that female donors (8.27%) are very less compared to male donors (91.73%) as cited in Table 5. As shown in Table 6, it is female donors are very less compared to male donors in all studies conducted in India^[1,6,11,14,28,29] excluding a study conducted by AIIMS in which female donors are more (12.6%).^[27] A similar pattern is observed in Iran and Africa.^[30,31,34] This is because of the fact that in developing country like India, there is social taboo,

cultural habits, lack of motivation and fear of blood donation, and increases deferral in female donors. Female donors show significant participation in developed countries.^[29,32-37] with highest participation level in Finland and Great Britain.^[29,34]

The prime significance of this study for a physician to have an idea about availability of a particular blood group so that a patient can be managed at the time of emergencies such as trauma, Rh incompatibility, and postoperative care. It is necessary to know

Table 1: Distribution of ABO blood groups and rhesus types

Blood groups	2012	2013	2014	2015
A positive	743	1061	1057	1490
A negative	23	46	38	61
B positive	1173	1674	1660	2442
B negative	50	69	41	104
O positive	1164	1576	1784	2317
O negative	49	70	57	74
AB positive	288	359	377	572
AB negative	9	10	2	15
Total	3499	4865	5016	7075

Table 2: Percentage distribution of various blood groups

Blood groups	2012 (%)	2013 (%)	2014 (%)	2015 (%)
A positive	21.23	21.80	21.07	21.06
A negative	0.66	0.94	0.75	0.86
B positive	33.52	34.40	33.09	34.51
B negative	1.42	1.41	0.81	1.46
O positive	33.26	32.39	35.56	32.74
O negative	1.40	1.43	1.13	1.04
AB positive	8.23	7.38	7.51	8.08
AB negative	0.28	0.25	0.08	0.25
Rhesus positive	96.24	95.97	97.23	96.39
Rhesus negative	3.76	4.03	2.77	3.61

blood group profile of the society where the patients are to be treated by general physicians. The availability of different blood groups depends on donor of that particular blood group in that territory. Even in the antenatal care if the mother has AB negative blood group, her attendants should be warned from beforehand to arrange identical blood group at the time of delivery when she might need cesarean section, especially in complicated pregnancy. However, the patient with blood group B positive may not be so apprehensive about the availability of her group in blood bank. This helps in building confidence among treating physicians and patients since they have a documented idea of the availability of blood groups in their blood bank. It also helps in children born with congenital hemolytic diseases.

Apart from this, the physicians need to have the knowledge of the distribution of blood groups among a certain population in which they are practicing. There is a known genetic association of specific blood groups to certain diseases in certain population. The studies 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" which stated to have protective effect against these diseases.^[38-40] "O" group individuals are known to have a 14% reduced risk of squamous cell carcinoma and 4% of reduced risk of basal cell carcinoma when compared to non-O group.^[41] It is also associated with a reduced risk of pancreatic cancer.^[42,43] The "B" antigen links with increased risk of ovarian cancer.^[13] According to a few research studies, "O" group is more prone to duodenal ulcer and mosquito bite. Hence, they are more prone to mosquito bite transmitted infections. This also plays a very important role in finding out disease preponderance in a particular society which adds to the physician knowledge and spread the preventive measures among general public. It is

Table 3: Distribution of ABO and rhesus blood groups inside India

Within India	Location of study	A	B	AB	O	Rhesus positive	Rhesus negative
Northern India	Kumaon, Uttarakhand ^[6]	28.70	32.07	10.53	28.70	94.49	5.51
	Lucknow ^[7]	21.73	39.84	9.33	29.10	95.71	4.29
	Amritsar ^[8]	18.01	38.06	9.62	34.31	91.28	8.72
	Punjab ^[9]	21.9	37.6	9.3	9.3	97.3	2.7
	Jodhpur ^[10]	22.2	36.4	9.4	31.7	91.75	8.25
	Haryana ^[11]	22.90	38.83	9.54	28.70	90.72	9.28
Western India	Western Ahmedabad ^[1]	21.94	39.40	7.86	30.79	95.05	4.95
	Eastern Ahmedabad ^[12]	23.30	35.50	8.80	32.50	94.20	5.80
	Surat ^[13]	24.10	34.89	8.69	32.32	94.18	5.82
	Maharashtra (Loni) ^[14]	28.38	31.89	8.72	30.99	95.36	4.64
Eastern India	Durgapur ^[15]	23.90	33.60	7.70	34.80	94.70	5.30
	Present study (RIMS Ranchi)	22.09	35.15	8.03	34.73	96.46	3.54
Southern India	Shimoga-Malnad ^[6]	24.27	29.43	7.13	39.17	94.93	5.07
	Davangere ^[17]	26.15	29.85	7.24	31.76	94.8	5.2
	Bengaluru ^[18]	23.85	29.95	6.37	39.82	94.2	5.8
	Chittoor ^[1]	18.95	25.79	7.89	47.37	90.6	8.42
	Vellore ^[19]	18.85	32.69	5.27	38.75	94.5	5.47
	Mangalore ^[20]	25.8	27.3	4.8	42.0	94.64	5.35

Table 4: Distribution of ABO and rhesus blood groups outside India

Country	A	B	AB ⁺	O	Rhesus positive	Rhesus negative
Pakistan (Swat) ^[21]	27.92	32.40	10.58	29.10	90.13	9.87
Nepal ^[22]	34	29	4	33	96.7	3.3
Britain ^[20]	42	8	3	47	83	17
USA ^[23]	41	9	4	46	85	15
Australia ^[1]	38	10	3	49	NA	NA
Nigeria ^[24]	21.60	21.40	2.80	54.20	95.20	4.80
Saudi Arabia ^[25]	24	17	4	52	93	7
Iran ^[26]	45	11	4	40	92.40	7.60

NA: Not available

Table 5: Sex distribution among blood donors

	2012	2013	2014	2015
Male donors	3247	4510	4573	6387
Female donors	252	355	443	688
Male donors (%)	92.80	92.70	91.16	90.27
Female donors (%)	7.20	7.30	8.84	9.73
Total donors	3499	4865	5016	7075

Table 6: Percentage of female donors in and outside India

Inside India	Male donors (%)	Female donors (%)
Present study	91.73	8.27
Uttarakhand ^[6]	99.71	0.23
Western Ahmedabad ^[1]	95.05	4.95
AIIMS, New Delhi ^[27]	87.4	12.6
Maharashtra (Loni) ^[14]	95.75	4.25
Haryana ^[28]	94.79	5.21
Hyderabad ^[29]	97.73	2.27
Kashmir ^[29]	95.56	4.44
Outside India		
Nigeria ^[30]	90.1	9.9
Ghana ^[31]	90	10
Burkina Faso ^[32]	71.2	28.8
Togo ^[33]	70	30
Iran ^[34]	95	5
Italy ^[35]	67	33
Greece ^[35]	67	33
USA ^[36]	54.5	45.5
Great Britain ^[34]	45	55
Finland ^[36]	45	55
Spain ^[37]	50.3	49.7
Belgium ^[36]	54.6	45.4
Netherlands ^[36]	50	50
France ^[36]	50	50

also 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.

Conclusions

- This study concludes that “B” Rh +ve (33.88%) blood

group is the most common blood group among the voluntary blood donors attending blood donation camps in Jharkhand area organized by RIMS. This is closely followed by “O” Rh +ve (33.48%) > “A” Rh +ve (21.29%) > “AB” Rh +ve (7.80%) > “B” Rh -ve (1.27%) > “O” Rh -ve (1.25%) > “A” Rh -ve (0.80%) > “AB” Rh -ve (0.23%) blood groups, respectively

- Regarding Rh blood group system, Rh +ve donors were 96.46% and Rh -ve were 3.54%
- Blood donation by the females was very low (8.27%) compared to males (91.73%) and it needs to be increased by improving health status of females and awareness about blood donation
- Every individual should be ABO grouped at birth since the antigens are naturally occurring. Groups of individual indicated on national identity cards, driving licenses, and school/office identity cards will be of tremendous use in case of acute hemorrhage or anemia in children or in cases of maternal need at time of delivery when urgent transfusion is required
- It is necessary to conduct similar well-designed studies in other states of India to determine the blood group frequencies in them. The data generated in the present study and knowledge of blood group distribution is also important for other studies of different geographical regions of India which will be useful to health planners while making efforts to face the future health challenges in the particular region, clinical studies, for reliable geographical information, and for forensic studies in the population. Besides, these studies will help a reducing the maternal mortality rate
- The knowledge of the distribution of blood group is very important for blood banks and transfusion services which play an important role in the patient’s health care. This study will also throw light on the reasons of deficiency of a particular group in a particular area so that deficient group donors may be encouraged to donate more frequently.

Any discrepancy between the supply and demand of a particular group will be taken care of and deficient blood group donors will be encouraged to donate more frequently, i.e., in our case “A” Rh +ve persons are required to donate more frequently than other blood groups to meet the demands.

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Conflicts of interest

There are no conflicts of interest.

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