

Distribution of ABO, Rhesus Blood Groups, Transfusion Transmitted Diseases and Adverse Donor Reactions in a Blood Bank of a Tertiary Care Hospital: A Five Year Study

LEKHA MANDODAR, ARCHANA SHETTY, VIJAYA CHOWDAPPA

ABSTRACT

Introduction: Study of the distribution of A, B, O blood group systems is essential for genetic studies, medico – legal issues and importantly for efficient delivery of blood bank services. Also important is the immunologic safety of the donated blood and safety of the donor, hence the need for documentation of transfusion transmitted diseases and adverse donor reactions.

Aim: To study the distribution of A, B, O and Rh blood groups in donors from Jan 2011 to December 2015, in a blood bank of a semi – urban tertiary care teaching hospital. Document the frequency of various transfusion transmitted diseases (TTDS) and adverse donor reactions.

Materials and Methods: Total of 16455 donors was eligible for blood donation, fulfilling the NACO guidelines. A, B, O and Rh grouping were done by standardized commercially available kits. The blood was screened for TTDS – HIV, HBsAg, HCV and VDRL by standard procedures. A register was maintained to note the adverse donor reactions.

Results: Of the total 16455 donors male donors (15979 - 97.11%) outnumbered the female donors. Voluntary donors constituted

only 8.00% of the total donors the rest being replacement donors. When categorized according to the age, 8016 of donors were in the age group of 21- 30 years, and the least number of donors were seen above the age of 45 years. The commonest blood group was O with 6511 donors (39.57%), followed by B, A, the least being AB (6.8%). Rhesus positivity was seen in 94.12 % of donors. It was seen that the negative blood groups are the ones in which higher percentages of these transfusion transmitted diseases are documented. HIV was seen majorly in B-ve group, HBsAg in A –ve, HCV in group B –ve and VDRL most commonly in A –ve blood group. Adverse events were recorded in 371 (2.25%) of donors.

Conclusion: Updating Knowledge and awareness of the regional distribution of blood groups is essential for providing good transfusion services and better community care. Donor safety is of prime importance, thereby the staff must be aware of potential adverse reactions that can happen and be on alert to identify and attend them. Also, awareness of frequency of the various transfusion transmitted diseases helps in keeping an eye on potential high risk donors.

Keywords: HBsAg, HIV, Replacement donors

INTRODUCTION

Human blood groups are genetically inherited and exhibit varying degrees of polymorphism. There is significant difference in the frequency of distribution of the various blood groups in population. Of the various blood group systems, the ABO blood group system is the most important blood group system in health and disease [1].

There is some co-relation between various diseases like duodenal ulcer, diabetes mellitus, ovarian cancer, coronary artery disease (CAD) Rh incompatibility and ABO incompatibility of the new born, as documented in literature till date [2].

The incidence of ABO and Rh groups varies markedly in different parts of the world. Awareness of the distribution of ABO & Rh blood groups in various regions aids in the efficient and timely delivery of blood transfusion services. Hence, it is of vital importance to have information on the distribution of these blood groups in any given population [3].

Although of utmost importance in blood transfusion practices in blood banks, the ABO & Rh blood groups are also useful in population based studies, studying migration patterns as well as resolving certain medico legal issues, like disputed paternity case [3,4].

At the same time, blood donation carries with it the potential

risk of transfusion transmitted diseases, which can be minimized by effective donor selection and screening. Also many healthy donors get exposed to discomfort and rarely complications during blood donation.

In the present study we have documented the distribution of various blood groups in donors along with a note on the prevalence of donor adverse reactions and sexually transmitted diseases in our blood bank.

MATERIALS AND METHODS

A retrospective, cross sectional analytical study was carried out, at the blood bank of Sapthagiri Institute of Medical Sciences and Research Centre. Due ethical clearance from the institutional ethical committee was obtained before the study was taken up. The period of study was from January 2011 to December 2015 and included both voluntary and replacement donors.

Donors duly filled a questionnaire comprising of personal details, contact details, past and present significant medical history. Eligible donors belonged to age group between 18-55 years and more than 50 kg of weight and haemoglobin of more than 12.5gm%. The donor screening criteria followed were as per the NACO guidelines. Underweight donors, donors with low Hb, with history of recent illness, and those not fulfilling the above guidelines were deferred from donation. Written consent was also taken prior to donation regarding their acceptability for donation and for the tests that need to be carried out for the transfusion transmitted infections.

Blood samples were obtained by standard operative procedure of venipuncture and subjected to determination of ABO and Rh blood grouping using commercially available monoclonal antisera A,B,AB,H & Rh D antisera, monoclonal Tg M & monoclonal (Ig M&l g G) from Tulip Diagnostic Ltd India. ABO blood group was determined by forward grouping (cell grouping) & reverse blood grouping (serum grouping) by slide and test tube agglutination method with pooled known A,B & O cells that are freely prepared in blood bank. Rh negative blood groups were confirmed by Indirect antiglobulin test. Weak D positive results data were recorded on specially formed proforma, tabulated, analyzed and compared with similar studies by other authors. The donor samples were also tested for Anti -HIV 1 and 2, HbSAg and Anti - HCV using ELISA technique supplied by J.Mitra and Co LTD. The possibility of false positives or negative seropositive samples was ruled out by testing the borderline results again using ELISA kits of BIORAD. The Rapid Plasma Reagin test was used for detection of syphilis infection. A separate register was used for the documentation of any adverse reactions in the donor with necessary action taken to rectify the same.

Percentages and proportions for each variable was calculated and 95 % confidence intervals were taken to define normal range.

RESULTS

A total of 16455 donors were screened during the study period. As shown male donors constituted the majority 15979 (97.11%). When categorized in age groups, it was found that highest percentage of donors were in the age group of 21- 30 years, with the least donors being those above 50 years of age [Table/Fig-1].

The distribution of voluntary and replacement donors is as shown in [Table/Fig-2].

The commonest blood group in our study was found to be O with 6511 donors (39.57%) as shown in [Table/Fig-3], followed by B, A and the least being AB. Rh positive donors constituted a majority (15497), with the rest being Rh negative.

Among Rh positive male subjects blood group O was found to be the commonest (36.12%) followed by Group B (26.83%). Amongst Rh positive females also O was found to be the commonest blood group followed by group B (0.82%). Among Rh negative males, also the same pattern of O group dominance was observed both in males and females as shown in [Table/Fig-4]. The overall frequency of blood group in our study was O>B>A> AB.

AGE GROUPS	MALE DONORS	FEMALE DONORS	TOTAL
18 – 20	2332	139	2471
21- 30	7782	234	8016
31- 40	4776	73	4849
41- 50	833	29	862
51- 60	256	1	257
TOTAL	15979 (97.11%)	476 (2.89%)	16455 (100%)

[Table/Fig-1]: Distribution of donors according to sex and age groups.

Type of donation	No. of donors	Percentage
Voluntary	1317	8%
Replacement	15139	92%

[Table/Fig-2]: Type of donors.

BLOOD GROUP	TOTAL DONORS	PREVALENCE (%)	CONFIDENCE LIMITS
ABO BLOOD GROUP			
A	4026	24.46	23.8% to 25.12%
B	4800	29.17	28.48% to 29.86%
AB	1118	6.80	6.42% to 7.18%
O	6511	39.57	38.82% to 40.32%
Rhesus (Rh) GROUPING			
Rh + ve	15497	94.12	93.76% to 94.48%
Rh _ve	958	5.88	5.52% to 6.24%

[Table/Fig-3]: Distribution of abo blood groups.

BLOOD GROUPS	MALE	FEMALE	TOTAL DONORS	CONFIDENCE LIMITS
A +ve	3710 (22.54%)	91 (0.55%)	3801(23.10%)	21.76% to 24.44%
A -ve	216 (1.31 %)	9 (0.05%)	225 (1.37%)	0.15% to 2.89%
B +ve	4416 (26.83%)	135 (0.82%)	4551 (27.66%)	26.36% to 28.96%
B -ve	245 (1.49%)	4 (0.02%)	249 (1.51%)	0.3 % to 3.02%
AB +ve	979 (5.95%)	50 (0.30%)	1029 (6.25%)	4.77% to 7.73%
AB -ve	86 (0.52%)	3 (0.02%)	89 (0.54%)	0.98% to 2.06%
O +ve	5944 (36.12%)	172 (1.05%)	6116 (37.17%)	35.96% to 38.38%
O -ve	383 (2.33%)	12 (0.07%)	395 (2.40%)	0.89% to 3.91%

[Table/Fig-4]: Distribution of blood groups in the study population with regard to sex and rhesus groups.

The donor blood was screened for transfusion transmitted diseases (TTD), - HIV 1, 2, HbSAg, HCV and VDRL. It was found that the most common was HbSAg, being positive in 103 (0.63%) of the total donors, followed by HIV, HCV and VDRL. It was seen that the negative blood groups are the ones in which higher percentages of these TTDS occur. HIV was seen majorly in B-ve group, HBsAg in A -ve, HCV in group B -ve and VDRL most commonly in A -ve blood group. However no significant association was seen between the groups and the TTDS, the study findings are just a random documentation of their occurrence during the study period [Table/Fig-5].

Adverse reactions were categorized based on the classification scheme suggested by the American Red Cross

hemovigilance programme, classified as shown in the [Table/Fig-6]. Adverse events were recorded in 371 (2.25%) of total donors during the study period. Only one accidental arterial puncture was recorded. No severe adverse reactions to the extent of needing hospitalization were recorded during the study period. The distribution of the various adverse donor reactions is as given in the table below [Table/Fig-6].

DISCUSSION

One of the greatest contributions to medicine by Karl Landsteiner, a physician and a biologist in 1900, was the discovery of the ABO blood group types in 1900. He was awarded the Nobel Prize in 1930 for the same. It was later in 1941 that Landsteiner and Weiner defined the Rh blood

STD	A+ve	A-ve	B+ve	B-ve	AB +ve	AB-ve	O+ve	O-ve	Total
HIV	10 (0.26%)	1 (0.44)	19 (0.42%)	2 (0.80%)	5 (0.48%)	0 (0.00%)	29 (0.47%)	2 (0.50%)	68 (0.4%)
HbSAg	23 (0.60%)	2 (0.88%)	38 (0.83%)	1 (0.40%)	5 (0.49%)	0 (0.00%)	30 (0.49%)	3 (0.76%)	102 (0.63%)
HCV	10 (0.26%)	3 (1.17%)	14 (0.30%)	2 (0.80%)	4 (0.38%)	1 (1.12%)	18 (0.29%)	2 (0.50%)	54 (0.33%)
VDRL	5 (0.13%)	2 (0.88%)	8 (0.17%)	1 (0.40%)	4 (0.38%)	0 (0.00%)	6 (0.09%)	2 (0.50%)	28 (0.15%)

[Table/Fig-5]: Distribution of sexually transmitted diseases in the study population.

Adverse Event	Number of donors	Percentage
SYSTEMIC COMPLICATIONS		
Presyncopal	297	80.05%
Syncopal(Major)	39	10.51%
Syncopal (Minor)	3	0.80%
LOCAL COMPLICATIONS		
Haematoma	26	7.00%
Arterial puncture	1	0.27%
Other minor reactions	5	1.34%
TOTAL	371	100%

[Table/Fig-6]: Type and frequency of adverse events in blood donors:

group system [1].

Following Landsteiner's discovery wide spectrum of discoveries in the field of immune haematology, blood transfusion related diseases and reactions, unmatched pregnancy, legal medicine, anthropology were documented [5].

Our study showed a predominance of male donors, compared to a very small percentage of female donors, which is in comparison with other similar studies [5, 6]. Lack of motivation, social taboo, cultural habits on one hand and anaemia leading to underweight leading to donor deferral are some of the few reasons for the sparse percentage of female donors [5]. We would like to stress upon the fact that healthcare of our female population needs to be prioritized

specially in a developing country like ours as many females in our study although willing for donation were deferred due to reduced Hb and underweight.

Voluntary blood donation often overlooked due to various factors like ignorance of the need to donate blood, and advantages to health of the same. Voluntary blood donations also carry less risk of sexually transmitted diseases, hence the need for promoting the same [7]. In the present study replacement donors comprised a higher percentage of donors.

Among donors, the youth constitute the active and potential source of donors. The 18 – 30 years age group comprised majority of the donors in our study. The least donors were above age of 45. Increasing health issues like Diabetes, Hypertension, medications, systemic diseases etc. These donors, although willing to donate are often filtered during the pre screening session due to the above mentioned factors [6]. Our institution conducts motivational lectures and seminars at quarterly intervals to promote more young healthy donors.

We compared our study to other similar studies carried out in the various regions of India as shown in table below [Table/ Fig-7].

“O” blood group was the most common in our study, in accordance with above studies, followed by group B, A and AB. However many studies done in northern, western and

central parts of our country show “B” to be the commonest group among donors, followed by O, A and AB as shown in the table no. 5. Western studies show a higher percentage of Rh positivity, which is in contrast with Indian studies. Our study reports a 5.88% of Rh-ve donors, in accordance with Indian studies [9-16].

Studies have shown group B to be associated with higher frequency of diabetes. This awareness implies that people with blood group B can get themselves screened for sugar levels before being diagnosed as diabetics. Also, group A is known to be associated with venous thrombosis, and coronary heart diseases, gastric cancer, the O blood group at the same time being protective against these [2].

Although blood donation is generally safe, donors during the process of donating blood, often get exposed to discomforts, uneasiness and rarely health issues. Hence we also documented the adverse events in our donors. The present study documented the percentage of adverse reactions to be 2.4%, occurring in 371 of the total donors. Medical reports have reported percentages varying from 2.33% to as high as 21% [19, 20]. The commonest adverse reaction was the pre – syncopal or vasovagal reaction, upon which the bleeding was immediately discontinued, patients limbs were lifted and vital parameters like pulse and BP were monitored. Most of the donors in this category were first time donors. This is also the reason why we defer donors who come to donate blood on empty stomach without any food intake. The other adverse reactions were hematoma formation, which resolved following local ointment applications, an accidental arterial puncture, which was taken care of immediately.

With blood donation comes the risk of transfusion transmitted diseases, hence our study also recorded the prevalence of the same along with a note of the group affected. We conclude that negative blood groups are found to be more prone to transfusion transmitted infections, as proven by similar studies [21]. HIV was seen more in donors with blood group O while, HBsAg, HCV and VDRL were seen predominantly in donors with group A. Till date not much studies have confirmed an association between blood groups and the transfusion transmitted diseases [21, 22].

LIMITATIONS

The study represents only a purposive sampling, and also documents the distribution of blood groups in a semi – urban region, which may not be representative of the entire population in general.

CONCLUSION

Timely and efficient delivery of blood bank services in hospitals to a great extent depends on the knowledge of availability and distribution of blood groups in various regions. Donor safety is important as adverse donor reaction has a negative impact on blood donor return rates [BDRR], Blood banks today must working with high alert and vigilance to minimise them leading to better donor satisfaction, this being

Place of study	A	B	AB	O	Rh +ve	Rh –ve
Western India						
Western Ahmedabad [8]	21.94	39.40	7.86	30.79	95.05	4.95
Eastern Ahmedabad [9]	23.30	35.50	8.80	32.50	94.20	5.80
Surat [10]	24.10	34.89	8.69	32.32	94.18	5.82
Maharashtra [11]	23.38	31.89	8.72	30.99	95.36	4.64
Eastern India						
Durgapur [12]	23.90	33.60	7.70	34.80	94.70	5.30
South India						
Chittor [6]	18.95	25.79	7.89	47.37	90.6	8.42
Shivamogga-malnad [13]	24.27	29.43	7.13	39.17	94.93	5.07
Vellore [14]	18.85	32.69	5.27	38.75	94.5	5.47
Davangere1 [15]	26.15	29.85	7.24	36.76	94.8	5.52
Northern India						
Lucknow [16]	21.73	39.84	9.33	29.10	95.71	4.29
Punjab [17]	21.91	37.56	9.3	31.21	97.3	2.7
Jodhpur [18]	22.2	36.4	9.4	31.7	91.75	8.25
Present study	24.46	29.17	6.8	39.57	94.12	5.88

[Table/Fig-7]: Comparison of present study with other regional studies.

* Values given are in percentages

all the more crucial if we have to increase the percentage of voluntary donors. Although till date the literature has no proven association between the blood groups and transfusion transmitted diseases, large scale studies are needed in the near future to filter high prevalence group donors as high risk cases.

ACKNOWLEDGEMENT

We thank Mrs. Vijaya Joseph, our senior blood bank technician and all the staff of our blood bank for their patience and support throughout the study.

REFERENCES

- [1] Farhud DD, Zarifyeganeh M. A brief history of human blood groups. *Iranian Journal of Public Health*. 2013; 42(1):01-06.
- [2] SK. Mishra SK, Bajaj N, Singh P, Singh K, Indurkar P. Frequency and distribution of ABO and Rh factor blood groups among medical students of central India, Rewa, Madhya Pradesh. *International Journal Of Pharmaceutical, Chemical and Biological Sciences*. 2014;4(4):980- 84.
- [3] Agrawal A, Tiwari AK, Mehta N, Bhattacharya P, Wankhede R, et al. ABO and Rh (D) group distribution and gene frequency; the first multicentric study in India. *Asian J Transfus Sci*. 2014;8(2):121-25.
- [4] Mohammadali F, Pourfathollah A. Association of ABO and Rh blood groups to blood-borne infections among blood donors in Tehran-Iran. *Iran J Public Health*. 2014;43(7):981-99.
- [5] Garg P, Upadhyay S, Chufal SS, Hasan Y, Tayal I. Prevalence of ABO and rhesus blood groups in blood donors: a study from a tertiary care teaching hospital of Kumaon Region of Uttarakhand. *J Clin Diagn Res*. 2014;8(12):FC16-19.
- [6] Koram SK, Sadula M, Veldurthy VS. Distribution of ABO and Rh blood groups in blood donors at tertiary care centre. *International Journal of Research in Health Sciences*. 2014 31;2(1):326-30.
- [7] Singh B, Verma M, Kotru M, Verma K, Batra M. Prevalence of HIV and VDRL seropositivity in blood donors of Delhi. *Indian J Med Res*. 2005;122(3):234-36.
- [8] Patel PA, Patel SP, Shah JV, Oza HV. Frequency and distribution of blood groups in blood donors in western Ahmedabad - A hospital based study. *National J Med Res*. 2012;2:207-10.
- [9] Wadhwa MK, Patel SM, Kothari DC, Pandey M, Patel DD. Distribution of ABO and Rhesus D groups in Gujrat, India-a hospital based study. *Indian J Ped Oncol*. 1998;19:137-41.
- [10] Mehta N, Swadas B. Prevalence of ABO blood groups at Mahavir Heart Institute Surat. *Asian J Trans Sci*. 2012;6:74.
- [11] Giri PA, Yadav S, Parhar GS, Phalke DB. Frequency of ABO and Rhesus blood groups: A study from a rural tertiary care teaching hospital in India. *Int J Biol Med Res*. 2011;2:988-90.
- [12] Nag I, Das SS. ABO and Rhesus blood groups in potential blood donors at Durgapur steel city of the district of Burdwan West Bengal. *Asian J Transfus Sci*. 2012;6:54-55.
- [13] Girish CJ, Chandrashekar TN, Ramesh Babu K, Kantikar SM. ABO and Rhesus blood group distribution among Malnad region blood donors. *Research and reviews in Biomedicine and Biotechnology*. 2011;2:25- 30.
- [14] Das PK, Nair SC, Harris VK, Rose D, Mammen JJ, Bose YN, Sudarsanam A. Distribution of ABO and Rh-D blood groups among blood donors in a tertiary care centre in South India. *Trop Doct*. 2001;31:47-48.
- [15] Hemalatha N, Bhagya V. Frequency and distribution of blood groups among medical students in Davangere. *Journal Of Public health and Medical Research*. 2015;3(1):01- 04.
- [16] Tulika C, Gupta A. Frequency of ABO and Rhesus blood groups in blood donors. *Asian J Trans Sci*. 2012;6:52-53.
- [17] Sidhu S. Distribution of the ABO blood groups and Rh(D) factor among the scheduled caste population of Punjab. *Anthropologist*. 2003;5:203-04.
- [18] Behra R, Joshi YR. Distribution of ABO blood group and RH(D) factor in western Rajasthan. *National J Medical Res*. 2013; 3:73-75.
- [19] Gupta A, Madan A, Dhar R and Borkar D. A retrospective study of adverse events in blood donors from Navi Mumbai. *Journal of evolution of medical and dental Sciences*. 2013;2(11):1575-80.
- [20] Bolton-Maggs PH, Cohen H. Serious Hazards of Transfusion (SHOT) haemovigilance and progress is improving transfusion safety. *Br J Haematol*. 2013;163:303-14.
- [21] Tyagi S, Tyagi A. Possible correlation of transfusion transmitted diseases with Rh type and ABO blood group system. *Journal of Clinical and Diagnostic Research*. 2013;7(9):1930-31.
- [22] KV SB, Bandi S, Kondareddy S, Madithadu A. Association of ABO and Rh blood groups to HBV, HCV infections among blood donors in a blood bank of tertiary care teaching hospital in Southern India: A retrospective study. *Int J Res Med Sci*. 2015; 3(7): 1672-76. [cited March 24, 2016].

AUTHOR(S):

1. Dr. Lekha Mandodar
2. Dr. Archana Shetty
3. Dr. Vijaya Chowdappa

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Pathology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, India.
2. Assistant Professor, Department of Pathology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, India.
3. Professor and Head, Department of Pathology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Archana Shetty,
Mythili, FF3, Sai Durga Apartments, Padmavathi Meenakshi Kalyana Mantapa Road, Rajarajeshwari Nagar, Bangalore 560098, India.
E-mail: archanashetty2924@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS:

None.

Date of Online Ahead of Print: **May 19, 2016**
Date of Publishing: **Jul 01, 2016**