



Original Research Article

Correlation of ABO-Rh blood group and transfusion transmitted infections (TTI) among blood donors

Ripal J Shah¹, Disha Patel^{1,*}¹Dept. of Transfusion Medicine, Prathama Blood Centre, Ahmedabad, Gujarat, India

ARTICLE INFO

Article history:

Received 19-10-2022

Accepted 03-11-2022

Available online 30-11-2022

Keywords:

Transfusion transmitted infections

ABO

Rh

Blood group

blood donor

ABSTRACT

Aim: The present study was conducted with the aim to determine the pattern of distribution and to detect association of transfusion transmitted infections (TTI) with ABO and Rh blood groups.

Materials and Methods: A retrospective study was conducted at the Prathama blood centre, Ahmedabad, India over a period of five years from 01/01/2016 to 31/12/2020. A total of 1,43,687 healthy voluntary donors were included in the study. At the time of donation, blood samples are collected in plain and EDTA vacuttes for TTI testing. Along with blood group and antibody screening, all the donor blood units were screened for HbsAg, HIV, HCV, Syphilis and Malaria. All testing was done with fully automated ELISA system (Bio-rad) and majority of the samples were subjected to NAT testing also. In the current study, sero-reactive samples from ELISA testing are included.

Results and Conclusion: The most common blood group was B positive (33.62%) while the least common was AB Negative (0.52%). The total sero-reactivity of TTI was 0.58%. Out of the total 1,43,687, 0.31% donors were reactive for HbsAg, 0.047% for HIV, 0.036% for HCV, and 0.19% for syphilis. Maximum sero-reactivity was seen in blood group B positive (0.19%) and O positive (0.17%) followed by A positive (0.13%). A significant association was seen between Rh Positive and Rh-negative blood group and HbsAg seropositivity. In TPHA positive donors, there was also significant association between TPHA infection and Rh-positive and Rh-negative blood group. Seropositivity for TTI was found more in Rh positive donors. Blood group B positive showed highest seropositivity for TTI (0.19%). There was no significant association of TTI with any other blood group. However, only one B negative blood group revealed seropositivity for HCV. Therefore, more studies are required for association of blood groups with TTI.

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprint@ipinnovative.com

1. Introduction

The antigens of ABO blood group system (A, B and H) are present on the surface of Red Blood Cells. These antigens are mainly polysaccharide and protein in nature.¹ According to International Society of Blood Transfusion (ISBT), there are more than 40 blood group systems including ABO and Rh blood group system. Among all blood group systems, ABO and Rh blood group system is the most important system among all systems.² The clinical

significance of the ABO blood group system extends beyond routine immunohematology and serology. Several studies have suggested an important association between blood group type and risk of development of cardiovascular, oncological and other diseases.^{3,4} According to a hypothesis presence of genetically determined ABO blood group antigen may block binding of causative organism to the cell surface. Risk to a variety of transfusion transmitted infections (TTI) can be associated with blood group type.⁵ Various studies have been done regarding association of ABO and Rh blood group and TTI; but due to different methods adopted, difference in sample size, social

* Corresponding author.

E-mail address: dripaljshah@yahoo.co.in (D. Patel).

factor and geographic locations, the results obtained were conflicting. Hence, present study was conducted with an aim to determine the distribution of TTI in different ABO and Rh blood groups and for determining the association of TTI with specific blood group type.

2. Materials and Methods

This is a retrospective study which was conducted at Prathama blood centre, Ahmadabad for a period of five year from January 2016 to December 2020. During this period were 1,43,687 donors donated blood voluntarily. All the information of donors like personal details, demographic details, occupation details and medical history including risk factor, history of previous surgery, hospitalization, blood transfusion were obtained from blood bank software records. Blood grouping was done by Fully automated system from Immucor NEO Gamma (NEO, Immucor Inc.) and QWALYS Diagast EVO (Diagast, France). Both forward grouping (cell grouping) and reverse grouping (serum grouping) were done. Final group was confirmed only when both cell type and serum type was identical. Weak D technique by gel card method was used to confirm Rh negative status of donor. All weak D groups were considered Rh positive. And all the unit were screened for antibody screening by Fully automated Immucor (NEO) and QWALYS Diagast EVO using commercial pooled O cells. As per D & C Act, all the units were screened for the five mandatory TTIs like HIV I & II, HbsAg, HCV, syphilis and malaria. Tests for Hepatitis B Surface antigen (HbsAg), anti-HIV antibody and anti-HCV antibody were done by Enzyme Linked Immuno Sorbent Assay by BIO-RAD (ELISA) test. Syphilis was tested by TPHA method by BIO-RAD and Omega and rapid by aspen card method. Malaria was tested by rapid by Fast Vue card method (Micro-gene diagnostic systems (P) Ltd.). Any sample found reactive was retested with other kit which works on different principle for confirmation. Analysis was done correlating seropositive units with the blood group of the donor.

3. Results

In the present study, a total of 143,687 healthy donors were screened out of which 138,049 (96.076%) were males and 5638 (3.924%) were females. The overall seropositivity for TTI (HBV, HCV, Syphilis and HIV) among Voluntary donors is 0.58%. Most common Transfusion Transmitted Infection is HBV with a seropositivity of 0.31% (448/1,43,687) while seropositivity is lowest for HCV 0.036% (52/1,43,687) in all the donors. No donor is found to be positive for Malaria during the study period.

Among all groups, seropositivity for TTI is slightly more in B positive blood group (0.19%) while its significantly low in AB negative (0.0035%) blood groups [Table 1]. It was observed that HBV infection is more prevalent in

Table 1: Seropositivity for TTI in ABO blood groups.

Blood Group	TTI reactive	%
A+	187	0.13
A-	12	0.10
B+	275	0.19
B-	24	0.02
AB+	73	0.05
AB-	5	0.0035
O+	249	0.17
O-	14	0.01
TOTAL	839	0.58

Table 2: Seropositivity for HIV in ABO blood groups.

Blood Group	HIV %
B+	0.07
B-	0.07
AB+	0.06
O+	0.04
O-	0.03
A+	0.02
A-	0.00
AB-	0.00
TOTAL	0.05

Table 3: Seropositivity for HBV in ABO blood groups.

Blood Group	HBSAG %
AB-	0.41
A+	0.37
B-	0.36
A-	0.35
AB+	0.35
O+	0.30
B+	0.28
O-	0.20
TOTAL	0.31

Table 4: Seropositivity for HCV in ABO blood groups

Blood group	HCV %
O+	0.05
AB+	0.04
A+	0.03
B+	0.03
B-	0.03
A-	0.00
AB-	0.00
O-	0.00
Total	0.04

Table 5: Seropositivity for syphilis in ABO blood groups

Blood group	TPHA %
B-	0.33
AB-	0.27
A+	0.22
B+	0.19
A-	0.18
AB+	0.18
O-	0.17
O+	0.16
Total	0.19

Table 6: Seropositivity of TTI according to Rh status

	Total %	HBSAG %	HIV %	HCV %	TPHA %	Total reactive %
RH+	134044	0.29	0.04	0.04	0.17	0.55
RH-	9643	0.02	0.002	0.001	0.02	0.04
Total	143687	0.31	0.05	0.04	0.19	0.58

AB negative (0.41%) and significantly less in O negative (0.20%) blood group [Table 3]. HCV positivity is more prevalent in O positive (0.05%) and not observed with A, AB and O negative (0.00%) blood groups [Table 4]. Prevalence for VDRL is significantly more in B negative (0.33%) and less in O positive (0.16%) blood groups [Table 5]. Seropositivity for HIV infection among B positive and negative (0.07%) is more, prevalence was absent in A negative and AB negative (0.00%) blood groups [Table 6]. Seropositivity for all TTI is significantly less in Rh negative blood groups (0.04%) [Table 6].

4. Discussion

Strict and precise screening of donors for transfusion transmissible infections is performed by all blood centres to ensure safe supply of blood and blood.⁶ It was observed by Das S et al that frequency of HBsAg antigen and anti-HCV among blood donors had maximum association with blood group O positive but not statistically significant. However highly significant difference was observed for anti-HCV with RhD positive and RhD negative blood group types by Das S et al.⁷ It was observed that RhD negative blood group donors and RhD positive group donors has almost equivalent prevalence rates of HBsAg but HBsAg is more prevalent in blood group B donors and less prevalent in AB blood group donors. In the present study HBsAg is more prevalent in RhD negative blood group AB donors and observed least in RhD negative blood group O. Many similar studies have observed that blood group B and O positive has higher seroprevalence of HBsAg, anti HCV, HIV and VDRL.^{8–11} Tyagi S et al have observed that the negative blood groups are more disposed to TTIs and blood Group A negative donors are more affected with HIV, HBsAg and VDRL while blood Group B negative was more commonly

affected by HCV.¹² Similarly in present study RhD Positive blood donors (55/134044) had higher percentage of seroreactivity than RhD negative blood donors (784/9643). Observed that 0.05% and 0.04% of O and AB Rh D-positive and 0.03% of A Rh D-positive and B Rh D-Positive and negative are HCV-positive.¹³ Jeremiah et al. observed that 25%, 10% and 4.1% of the AB positive, A positive and O positive respectively are HCV-positive.¹³ In present study, HBsAg was predominantly observed in Rh D negative blood group AB donors, anti-HCV in Rh D positive blood group O and absent in A, AB and O Rh D negative groups, VDRL in Rh D negative blood group B and HIV was sero-reactivity both in Rh D negative and positive blood group B and not observed in A and AB Rh D negative groups. Observed that there is no evidence of any association between seropositivity for syphilis and ABO blood groups.¹⁴ Sero-reactivity of these TTI shows that routine screening is a must for blood and blood product for safe transfusion.

5. Conclusion

The results of the present study show that TTI are more commonly associated with Rh positive blood groups. Blood group B positive showed highest seropositivity for TTI. Blood group AB negative showed lowest seropositivity for TTI and shows less number of seropositivity for HCV and HIV in Rh negative blood groups.

6. Source of Funding

None.

7. Conflicts of Interest

There is no conflict of interest.

References

- Mengoli C, Bonfanti C, Rossi C, Franchini M. Blood group distribution and life-expectancy: a single-centre experience. *Blood Transfus.* 2015;13(2):313–7.
- Bharadva S, Vachhani J, Dholakiya S. ABO and Rh association to transfusion transmitted infections among healthy blood donors in Jamnagar. *J Res Med Den Sci.* 2016;4(1):58–62.
- Franchini M, Capra F, Targher G, Montagnana M, Lippi G. Relationship between ABO blood group and von Willebrand factor levels: from biology to clinical implications. *Thromb J.* 2007;5:14. doi:10.1186/1477-9560-5-14.
- Franchini M, Favalaro EJ, Targher G, Lippi G. ABO blood group, hypercoagulability, and cardiovascular and cancer risk. *Crit Rev Clin Lab Sci.* 2012;49(4):137–49. doi:10.3109/10408363.2012.708647.
- Das S, Kumar M. Association of blood group types to hepatitis B and hepatitis C virus infection among blood donors: a five years institutional based study. *Int J Basic Appl Med.* 2012;2:191–5.
- Bhawani Y, Rao PR, Sudhakar V. Seroprevalence of transfusion transmissible infections among blood donors in a tertiary care hospital of Andhra Pradesh. *J Family Med Prim Care.* 2010;2(4):45–8.
- Das S, Kumar MLH. Association of blood group types to hepatitis B and hepatitis C virus infection among blood donors: a five years institutional based study. *Int J Basic Appl Med Sci.* 2012;2:191–5.
- Banu A, Ahmed SM, Shastri S. Distribution of Abo and Rh blood groups in HIV seropositives at an integrated counseling and testing centre in Karnataka, India. *SAARCTB.* 2011;8(2):42–5.
- Omar AAA, Al-Hayan NN, Mohammed MJ. The infection with HBV and HCV and their relationship to ABO blood group among blood donors. *J Fac Med Baghdad.* 2012;54(1):52–6. doi:10.32007/jfacmedbagdad.541771.
- Kumar MR, Rao MS, Pulicherla KK. Studies on the distribution of hepatitis B (HBV) and human immunodeficiency virus (HIV): their relation to blood groups and rhesus (Rh) factor in Guntur district of Andhra Pradesh, India. *Asian J Pharm Clin Res.* 2013;6:109–11.
- Joshi SK, Ghimire GR. Serological prevalence of antibodies to human immunodeficiency virus (HIV) and hepatitis B virus (HBV) among healthy Nepalese males—a retrospective study. *Kathmandu Univ Med J (KUMJ).* 2003;1(4):251–5.
- Tyagi S, Tyagi A. Possible correlation of transfusion transmitted diseases with Rh type and ABO blood group system. *J Clin Diagn Res.* 2013;7(9):1930–1. doi:10.7860/JCDR/2013/6002.3360.
- Jeremiah ZA, Koate B, Buseri F, Emelike F. Prevalence of antibodies to hepatitis C virus in apparently healthy Port Harcourt blood donors and association with blood groups and other risk indicators. *Blood Transfus.* 2008;6(3):150–5. doi:10.2450/2008.0053-07.
- Behal R, Jain R, Behal KK. Seroprevalence and risk factors for hepatitis- B virus infection among general population in northern india. *Arq Gastroentrol.* 2008;45(2):137–40.

Author biography

Ripal J Shah, Medical Director  <https://orcid.org/0000-0001-9473-4088>

Disha Patel, Technical Coordinator

Cite this article: Shah RJ, Patel D. Correlation of ABO-Rh blood group and transfusion transmitted infections (TTI) among blood donors. *IP Arch Cytol Histopathology Res* 2022;7(4):229–232.