



Original Research Article

Association of ABO and RH blood group with transfusion transmitted infections (TTI) among blood donors in north India

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ABSTRACT

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

Materials and Methods: A retrospective study was conducted at the blood bank of our hospital over a period of two years. A total of 36,614 healthy donors were included in the study. All the donor blood bags were screened for HbsAg, HIV, HCV, Syphilis and Malaria. The most common blood group was B positive (34.91%) while the least common was AB negative (0.61%). The total seroreactivity of TTI was 5.59%. Out of the total, 2.38% cases were reactive for HBsAg, 1.27% for anti HCV, 0.35% for HIV, 1.29% for syphilis and 0.29% for Malaria. Maximum seroreactivity was seen in blood group B positive (1.79%) followed by O positive (1.54%) and then A positive (1.28%). A significant association was seen between Rh positive blood group and HBsAg seropositivity (P value of 0.0459). In syphilis positive donors, there was significant association between syphilis infection and AB blood group with a P value of 0.0331.

Conclusion: This study provides the prevalence of ABO and Rh blood group and also their association with the transfusion transmitted infections (TTI). This study shows a significant association between Rh positive blood group and HBsAg and also significant association was seen between AB positive blood group and syphilis infection.

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1. Introduction

Of the 33 Blood Group Systems outlined by the International Society of Blood Transfusion, ABO is the most important.¹ The distribution and prevalence of ABO and Rh varies in different population groups and an understanding of their distribution helps in an efficient delivery of transfusion services.²

Blood transfusion is an essential part of medicine. It is vital, noble and necessary as it is used in the treatment and management of various life threatening illnesses. However, it carries with it the risk of transfusion transmitted diseases. This Transfusion Transmitted Infection's (TTI) can be broadly classified as viral, parasitic, bacterial,

and spirochaetal. Amongst the viral infections are those transmitted by Hepatitis B virus (HBV), Hepatitis C virus (HCV), Human Immunodeficiency Virus (HIV 1 and 2), Cytomegalovirus (CMV) and Human T Cell Lymphoma virus (HTLV 1 and 2). Malaria, Filariasis, Babesiosis, Chagas disease, Leishmaniasis and Toxoplasmosis form the main bulk of parasitic infections. Among bacterial infections, brucellosis is transmissible by blood while spirochaetal infections causing TTI include Syphilis, Lyme's disease, and Leptospirosis.³

The risk of transmission of transfusion transmitted diseases (TTD) is 1% per transfusion.⁴

Some of the diseases, like ABO and Rh incompatibilities of new born, duodenal ulcer, gastric carcinoma, diabetes mellitus and venous thromboembolism shows association

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with a particular type of blood group; whereas few diseases are directly transmitted as a result of transfusion.⁵ The later ones are mostly infectious diseases which occur because the blood group antigens function as a receptor for the attachment of microorganisms.⁶

Since a lot of studies and literature have mentioned association of various diseases with ABO and Rh blood group, hence this study was carried out with the aim to see if there was also any possible association of TTIs with ABO and Rh blood group.

2. Materials and Methods

The study was conducted at the tertiary care centre, Jawaharlal Nehru Medical College and Hospital (JNMCH), AMU, Aligarh, Uttar Pradesh, India. It was a two-year retrospective study starting from January 2017 to December 2018. A proper detailed history and general examination of all the donors including voluntary as well as replacement, was done. The information was collected from the archives of blood bank. All relevant information like personal, demographic and occupation details along with medical and surgical history regarding risk factors like history of previous surgery, hospitalisation, blood transfusion, dog bite, recent medical illness, history of exposure etc was obtained from blood bank records. Eligible donors belonged to the age group between 18- 55 years and those who were more than 50 kg of weight and with a haemoglobin of more than 12.5gm%. Underweight donors, donors with low Hb, with history of recent illness, and those not fulfilling the above guidelines were deferred from donation.

A total of 36,614 donors had donated blood in the blood bank during this period, out of which 34,783 were males (95%) and 1831 were females (5%). Blood samples were obtained by venipuncture and ABO and Rh blood grouping was done using commercially available monoclonal A, B & Rh D antisera supplies by Meril Diagnostics Pvt. Ltd. India. ABO blood group was determined by forward grouping (cell grouping) by tube technique. Rh negative blood groups were confirmed by Gel card technique.

All the donated blood bags were screened for transfusion transmitted infections (TTI). Serological tests were performed for HBV surface antigen (HBsAg), HCV antibodies (anti-HCV), anti-HIV -1 and 2 antibodies, Venereal disease research laboratory test (VDRL), and Malaria parasite (MP) antigen. Samples for HBsAg, HCV antibodies and anti HIV 1 & 2 antibodies were run on Vitros 3600 Immunodiagnostic system which uses the principle of enhanced chemiluminescence using MicroWell technology. In case of syphilis, rapid plasma reagin (RPR) card test was used whereas for malarial antigen rapid diagnostic kit of AlereTrueline was used.

3. Results

Out of the total 36,614 donors, 34,783 (95%) were males and 1831 (5%) were females. The most common blood group was B positive (34.91%) while the least common was AB negative (0.61%) (Table 1). The prevalence of Rh positive blood group was 94.52% whereas Rh negative blood group was only 5.48% (Table 2). Overall seroreactivity of TTI was 5.59%. Out of the total seroreactive cases, 93.7% had Rh positive blood group and remaining 6.3% had Rh negative blood group (Table 2). Among the seroreactive donors, 2.38% cases were reactive for HBsAg, 1.27% for anti HCV, 0.35% for HIV, 1.29% for syphilis and 0.29% for MP (Table 3). Overall maximum seroreactivity was seen in blood group B positive (1.79%) followed by O positive (1.54%) and then A positive (1.28%). The prevalence of TTI in relation to ABO blood group including Rh is shown in Table 3.

On statistical analysis a significant association was seen between Rh positive blood group and HBsAg seropositivity (P value of 0.0459). Also in syphilis positive donors, there was significant association between syphilis infection and AB blood group with a P value of 0.0331. (Table 4)

4. Discussion

Association of ABO blood group with various diseases has been commonly observed. The aim of our study was to determine the prevalence of ABO and Rhesus blood groups among blood donors and their possible association with TTIs.

There were a total of 36,614 donors, of which 95% (34,783) were males and 5% (1831) were females. This result is comparable to the studies done by Chandekar et al., Mandodar et al., Almainan et al., Hazmi et al. and Giri et al. in which the majority of donors were males.^{7–11} This gender disparity can also be attributed to the fact that women have a higher rate of deferral, either because of low haemoglobin levels or underweight.

The most common blood group in our study was B positive which was similar to the observation made by Anumanthan et al., Nigam et al. and Tyagi and Tyagi.^{12–14} However, the studies done by Talib et al., Bashwari et al. and Abdullah found blood group O to be the most common.^{15–17}

Rh positive donors constituted the majority, while only 5.48% comprised the Rh negative blood donors. This was also in concordance with many similar studies.^{12,13} The least common blood group in our study was AB negative (0.61%) which was similar to the study by Ngassaki-Yoka et al.¹⁸

Overall seroreactivity of TTI was 5.59% which was slightly more than the study by Sinha et al., Nigam et al. and Sharma et al.^{4,13,19}

The maximum number of seroreactive cases were seen in blood group B positive (1.79%), similar to the observation

Table 1: Prevalence of different blood groups during 2017 and 2018

Blood group	2017	2018	Total	% of Total
A+	3982	4258	8240	22.50
A-	253	235	488	1.33
B+	6167	6614	12,781	34.91
B-	343	384	727	1.98
AB+	1772	1786	3558	9.71
AB-	103	122	225	0.61
O+	4961	5069	10,030	27.39
O-	277	288	565	1.54
Total	17,858	18,756	36,614	100

Table 2: Prevalence of TTI among Rh positive and RH negative blood groups

	Total (%)	HBSAg (%)	HCV (%)	HIV (%)	Syphilis (%)	Malaria (%)	Total (%)
RH +ve	34,609 (94.52)	811 (2.34)	435 (1.25)	119 (0.34)	452 (1.30)	101 (0.29)	1918 (93.7)
RH -ve	2005 (5.48)	61 (3.04)	32 (1.59)	8 (0.40)	22 (1.09)	6 (0.30)	129 (6.3)
Total	36,614	872 (2.38)	467 (1.27)	127 (0.35)	474 (1.29)	107 (0.29)	2047 (5.59)

Table 3: Prevalence of TTI among different blood groups

Blood group	HBSAg (%)	HCV (%)	HIV (%)	Syphilis (%)	Malaria (%)	Total (%)
A +ve (8240)	208 (2.52)	104 (1.28)	21 (0.25)	108 (1.31)	29 (0.35)	470 (1.28)
A -ve (488)	17 (3.48)	9 (1.84)	3 (0.61)	2 (0.04)	1 (0.02)	32 (0.08)
B +ve (12,781)	279 (2.18)	143 (1.12)	39 (0.31)	161 (1.25)	35 (0.27)	657 (1.79)
B -ve (727)	16 (2.20)	12 (1.65)	2 (0.27)	10 (1.37)	2 (0.27)	42 (0.11)
AB +ve (3558)	82 (2.30)	55 (1.54)	15 (0.42)	60 (1.68)	14 (0.39)	226 (0.61)
AB -ve (225)	6 (2.67)	5 (2.22)	4 (1.78)	3 (1.33)	1 (0.44)	15 (0.04)
O +ve (10,030)	242 (2.41)	133 (1.32)	44 (0.44)	123 (1.22)	23 (0.23)	565 (1.54)
O -ve (565)	22 (3.89)	6 (1.06)	3 (0.53)	7 (1.23)	2 (0.35)	40 (0.10)
Total	872 (2.38)	467 (1.27)	127 (0.35)	474 (1.29)	107 (0.29)	2047 (5.59)

Table 4: Significant association (P value) between TTI and blood groups

TTI	No. of Reactive Bags	P Value					RH Positive	RH Negative
		A	B	AB	0			
HBSAg	872	0.1681	0.0578	0.8134	0.3778	0.0459	0.0548	
HCV	467	0.8546	0.0951	0.0722	0.6915	0.1883	0.2250	
HIV	127	0.1376	0.1836	0.1161	0.0793	0.0633	0.0960	
Syphilis	474	0.7455	0.7106	0.0331	0.4653	0.646	0.4824	
Malaria	107	0.3073	0.6194	0.2096	0.2030	0.9523	0.9523	

made by Sinha et al.⁴ However, this finding differed from few other studies that found a higher seroprevalence of TTI in blood group O positive.^{20,21}

World Health Organization has placed India in the intermediate zone i.e. 2-7% prevalence rates for hepatitis B infection.²² Similarly in our study also the prevalence rate of HBsAg infection among the seroreactive donors was within this range i.e. 2.38%. HBsAg infection was the most common TTI in our study. Our study was in concordance with the study conducted by Sinha et al., Nigam et al., Tyagi and Tyagi, Deshpande et al. and Bobde et al.^{4,13,14,20,23}

Since hepatitis B virus infection was the most prevalent TTI in our study, it must be emphasised that proper preventive measures such as hepatitis B vaccination, public

awareness programmes and also early detection by highly sensitive test such as nucleic acid testing (NAT) should be judiciously done.

However, Memon et al. found HCV to be the most prevalent infection amongst blood donors.²⁴

We also observed that the highest number of HBsAg reactive cases were Rh positive showing a significant association with a P value of 0.0459. Sinha et al., Sharma et al. and Sreedhar et al. also showed a significant association between Rh positive blood group and HBsAg.^{4,19,25}

However, in our study the maximum seroreactive cases for HCV and HIV were seen in AB negative blood group which was consistent with the study undertaken by Tyagi et al. that observed that negative blood groups were more

prone to TTI.¹⁴ Sharma et al. also showed increased seropositivity for Hepatitis C among AB negative blood group which was again correlating with our study.¹⁹ Our study showed preference of negative blood groups for TTIs however significant association was not seen. It may be due to the lower prevalence rate of negative blood groups, hence relative increase in the percentage.

In the present study, 1.29% of the total donors tested positive for syphilis. Amongst syphilis positive donors, there was a significant association between syphilis infection and AB blood group with a P value of 0.0331. Rawat et al. observed a similar prevalence rate of syphilis among blood donors, which was 1.62%.²⁶ Till now no study has shown any association of syphilis positivity with any blood group. More similar studies of longer duration are required to show if really any association can be there between syphilis and a particular blood group.

A total of 107 cases (0.29%) were positive for malarial parasite. However, this finding differed from many studies where there was not a single case of malarial parasite positivity.^{4,19,27} Increased positivity in our study might be due to the fact that Aligarh city of Uttar Pradesh is an endemic zone for Malaria. So for prevention of malaria infection, public awareness programmes at national level, improvement in hygiene and sanitation, time to time spraying of antimalarial drugs and various other preventive measures are required.

Lastly we would like to conclude that this study has tried to correlate any association between blood group antigens and the transfusion transmitted infections. However, as there is no authentic literature suggesting any proven association between blood group and transfusion transmitted infections, random population studies of longer duration are required to find the definite association between blood groups and TTIs. This study also highlights the importance of proper history taking and routine screening of blood and its components for safe transfusion and prevention of blood borne transmitted infection. Donor safety is crucial as adverse transfusion reactions tend to have a negative impact on blood transfusion rates. And in order to promote voluntary blood donation, donor safety is a must. Therefore, this study also highlights the importance of safe blood transfusion.

5. Source of Funding

None.

6. Conflict of Interest

The authors declare that there is no conflict of interest.

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