

STUDY OF SERO-PREVALENCE AND PROBABLE ASSOCIATION OF TRANSFUSION TRANSMITTED INFECTIONS WITH ABO AND RH BLOOD GROUP SYSTEM AMONG BLOOD DONORS AT TERTIARY CARE CENTRE OF RAIPUR, CHHATTISGARH

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ABSTRACT

Background: To Study the Sero-Prevalence and Probable Association of Transfusion Transmitted Infections with ABO and Rh Blood Group System among Blood Donors at Tertiary Care Centre of Raipur, Chhattisgarh. **Materials and Methods:** The present study is a Descriptive Observational (Cross-Sectional) study done at MODEL BLOOD BANK, Department of Pathology, Pt. Jawaharlal Nehru Memorial Medical College, Raipur (Chhattisgarh), from July 2023 to July 2024 (1 year) on a total of 16149 healthy blood donors. All the donor blood units were screened for HBsAg, HIV, HCV, Syphilis and Malaria and data was collected. **Results:** Among 16,149 donors, the most common blood group was O positive (34.36%) followed by B positive (33.6%) while the least common was AB negative (0.22%). Overall seropositivity in studied population was 1.55% (251/16149). Out of total blood donors who were TTI positive, most of them were VDRL positive i.e. 119(47.41%) followed by HbsAg positive donors i.e. 82(32.66%). Among total Seropositive donors, Replacement donors were 207/251 (82.4%), and Voluntary donors were 44/251 (17.52%). Majority of study subjects were male i.e. 242(96.41%) and remaining were female i.e. 9(3.58%). Majority of the donors 107(42.6%) were of age-group 18-30 Years. There was no significant association observed with any specific blood group type. Blood group O Positive showed highest seropositivity i.e. 0.51% (83/16149) but not statistically significant. **Conclusion:** This study reflects seroprevalence of TTIs among blood donors in a tertiary care setup. In contrast to other studies, the most common TTI in our study was Syphilis. No significant association of Transfusion transmitted infections with ABO blood groups was noted in this study. Hence, comprehensive large-scale nation-wide studies are needed to further evaluate the association of TTIs with ABO blood groups.

INTRODUCTION

Infections that come from pathogens like bacteria, viruses, prions, and parasites spread when blood is transfused. These are known as Transfusion Transmitted Infections (TTIs). In India, many people are dealing with these infections: about 43 million have Hepatitis B (HBV), 15 million have Hepatitis C (HCV), and roughly 2.5 million are HIV positive.^[1] Literature suggests that TTIs are a serious threat to safe transfusion practices. To keep blood safe, it's very important to screen for certain

infections in India. These infections include Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Treponema pallidum (Syphilis), & Malaria.

Blood Banks play an important role in ensuring a safe blood supply when necessary. However, with the ever-changing socio-economic environment and human factors involved, healthy donor recruitment and retention is a challenge that faces the health industry today. With every unit of blood, there is a 1% chance of transfusion associated problems including transfusion transmitted diseases.^[2] For

monitoring the safety of blood donation and to evaluate the efficacy of currently employed screening tests, correct estimates of risk of TTIs are essential.^[3] Further development of techniques for the development of more accurate methods has led to the detection of various TTI markers, but issues exist such as erroneous negative results, genetic variation in pathogen trunks, disease window stage, prevalence of asymptomatic carriers, and technical errors.^[4] Estimating the burden of TTI is important to develop targeted interventions. Transfusion-transmitted infections (TTI) extent varies from country to country depending on load of disease in that particular population. After assessing the severity, WHO (World Health Organization) recommends mandatory pre-transfusion testing for Human immunodeficiency virus (HIV), Hepatitis B virus (HBV), Hepatitis C Virus (HCV) and Syphilis. As per a preliminary report by NACO (National AIDS Control Organization) in the year 2016, the prevalence of HBV, HCV, HIV and Syphilis among blood donors in India for the year 2015 was reported to be 0.94%, 0.32%, 0.13% and 0.18% respectively.^[5] Screening of the blood and blood products is important to reduce the risk of transfusion transmitted infections (TTIs) as unscreened or inadequately screened blood and blood products transfusions are the major source of TTIs.

According to NACO 2016-17 reports, the annual requirement of blood for transfusion is estimated to be 12.8 million units of blood. India ranks third in harbouring HIV infected individuals.^[5]

Transfusions are an important part of a clinician's treatment plan. However, there is a risk of infection with blood transfusion. Some of these infections, like ABO and Rh incompatibilities of newborn, duodenal ulcer, gastric carcinoma, diabetes mellitus and venous thromboembolism are associated with specific blood groups, while other infections are directly transferred as a result of blood transfusions.^[6]

More than 33 blood type systems have been identified in humans and out of them the main important major blood group systems are ABO, Rh/Hh, MNS, and P system, among which ABO and Rh-systems are clinically significant. The distribution of ABO and Rh groups differs and is dependent on geographical location, ethnic group, and socioeconomic status.^[7]

It has been found that genetically determined ABO blood group antigen which is present in blood may block binding of possible (TTIs) causative organism to polysaccharide on cell but non-secretors are lacking in their antigen and so are at risk to variety of infections (TTIs).

It has been previously found that ABO blood group antigens are to be associated with the risk of infections and several malignancies.^[8] The present study was undertaken with the aim of investigating the prevalence of TTIs among blood donors and also, if possible, to find any association of ABO and

Rh blood groups with TTIs at the Blood Bank in Model Blood Bank in the study duration of one year.

Aims and Objective

Aim

To Study the Sero-Prevalence and Probable Association of Transfusion Transmitted Infections with ABO and Rh Blood Group System among Blood Donors at Tertiary Care Centre of Raipur, Chhattisgarh.

Objective

Primary objective

- To study the Sero-prevalence of TTI (HIV, HBsAg, HCV, Syphilis, Malaria) with ABO and Rh blood groups among blood donors.
- To study probable association of TTI with ABO blood group system among blood donors.
- 2. Secondary Objectives
- To estimate frequency of TTIs in various age-groups.
- To estimate frequency of TTIs among different genders.
- To estimate frequency of TTIs among voluntary donors and replacement donors..

MATERIALS AND METHODS

A Prospective, observational time bound study for a period of 1 year was carried out at our institution where data were analysed from blood bank records. Blood was collected from apparently healthy individuals after detailed history and examination as per NBTC criteria. Blood group was determined by forward grouping and reverse grouping. All the donor blood bags were screened for Transfusion transmitted infections (HBsAg, HIV, HCV, Syphilis & Malaria). For HIV fully automated 4th generation ELISA system, for HBsAg, HCV and Syphilis 3rd generation ELISA system and Rapid card test for Malaria were performed. Any sample found reactive was retested for further confirmation. Data was entered in MS Excel sheet and statistical analysis was done. The study was approved by the ethical committee of the institution.

Statistical Analysis:

Data was analysed for quantitative variables like age (years), gender, type of donor. Mean, median and standard deviation were calculated. For qualitative variables like frequency of TTI, frequency and percentage were calculated. Data was stratified for variables as age group, gender and type of donor. Chi square test and Fischer test was applied to observe the frequency of variables and association. P-value <0.05 was regarded as significant.

RESULTS

Among Sero-positive donors, most of study subjects had blood group as O positive 83(33.06%) followed by B positive blood group 75(29.88%) and then A positive blood group 65(25.89%). Study subject

with AB negative blood group and O negative blood group were not found. Overall seropositivity in studied population was 1.55% (251/16149). Out of total blood donors who were TTI positive, most of them were VDRL positive i.e. 119(47.41%) followed by HbsAg positive donors i.e. 82(32.66%). Donors were categorized into Replacement donors (RD) and Voluntary donors (VD) among which 12138(75%) were replacement donors and 4011(25%) were voluntary donors. Among total seropositive donors, Replacement donors were 207/251 (82.4%) and Voluntary donors were 44/251 (17.52%). Majority of study subjects were male i.e. 242(96.41%) and remaining were female i.e. 9(3.58%). Majority of the participants in Seropositive Replacement donors (204/207; 98.5%), as well as voluntary donors (38/44; 86.3%) were Males. However, among total seropositive Female donors (09/44; 20.4%), majority were voluntary donors (06/09; 66.7%). The mean age was 34.22 ± 9.30 years. Majority of the donors 107(42.6%) were of age-group 18-30 Years. There was no significant association observed with any specific blood group type. Blood group O Positive showed highest seropositivity i.e. 0.51% (83/16149) but not statistically significant.

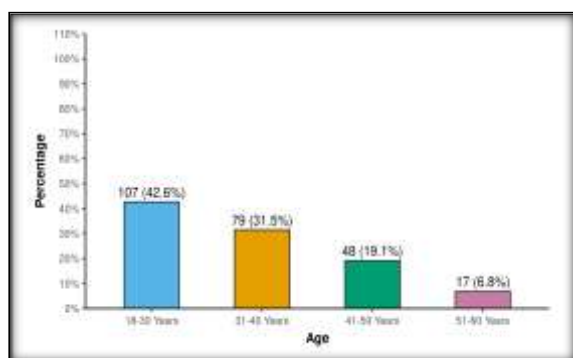


Figure 1: Age wise distribution of study subjects

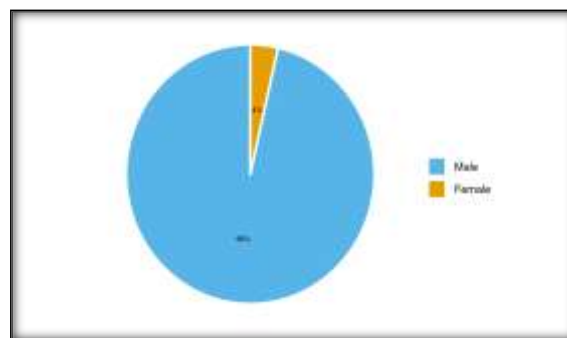


Figure 2: Gender wise distribution of study subjects

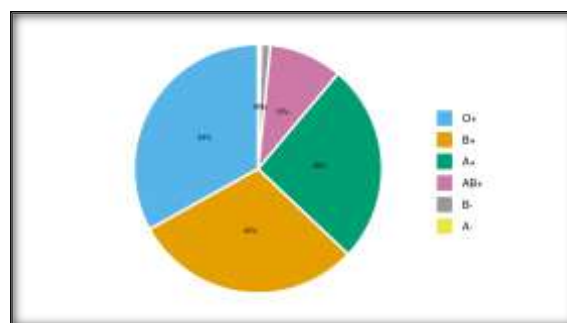


Figure 3: Blood group wise distribution of study subjects

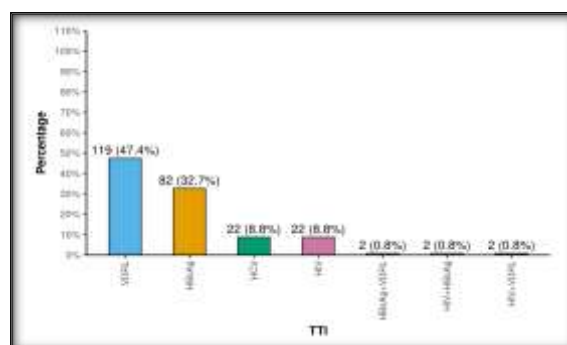


Figure 4: Transfusion transmitted disease wise distribution of study subjects

Table 1: Characteristics of study population

Variable	Groups	Frequency	Percentage (%)
ABO and Rh Blood group	A Positive	3489	21.6%
	B Positive	5430	33.6%
	AB Positive	1244	7.7%
	O Positive	5550	34.36%
	A Negative	102	0.63%
	B Negative	131	0.81%
	AB Negative	36	0.22%
	O Negative	167	0.99%
ABO group	A	3591	2.22%
	B	5561	34.4%
	AB	1280	7.92%
	O	5717	35.36%
Rh group	Positive	15713	97.2%
	Negative	436	2.69%
Gender	Male	15340	94.9%
	Female	810	5.01%
Type of donor	Voluntary	12138	75.15%
	Replacement	4011	24.38%

Table 2: Comparative data of Transfusion transmitted Infections rate with other studies

STUDIES	HIV	HCV	HBsAg	Syphilis	Total
Leena M S et al. (2012), ^[13]	0.27%	0.14%	0.71%	0.10%	1.35%
Tyagi & Tyagi (2013), ^[14]	0.18%	1.28%	1.58%	0.43%	3.47%
Karmakar PR et al. (2014), ^[29]	0.60%	0.59%	1.41%	0.23%	2.79%
J.S. Nigam et al. (2014), ^[8]	0.05%	0.63%	0.97%	0.46%	2.25%
Bhardava S et al. (2016), ^[22]	0.10%	0.05%	0.57%	0.05%	0.77%
Chandekar et al. (2017), ^[11]	0.26%	0.25%	1.30%	0.28%	2.09%
Sharma et al. (2017), ^[17]	0.14%	0.62%	2.13%	1.30%	4.20%
Rawat et al. (2017), ^[15]	0.32%	0.73%	1.61%	1.62%	4.36%
Sinha & Dey (2017), ^[23]	0.19%	0.38%	1.12%	0.015%	1.71%
Anita Omhare et al. (2018), ^[20]	0.068%	0.33%	1.45%	0.15%	2.01%
Asha Kiran et al. (2018), ^[10]	0.23%	0.59%	0.96%	00	2.30%
Arif SH et al. (2019) (2021), ^[6]	0.35%	1.27%	2.38%	1.29%	5.59%
Naik VSS et al. (2019), ^[1]	0.23%	0.31%	1.82%	0.04%	2.43%
Patel et al. (2019), ^[2]	0.14%	0.50%	0.87%	0.20%	1.71%
Quraishi Zubair Md. Et al (2020), ^[4]	0.009%	0.16%	0.22%	0.01%	0.94%
Shailesh Ku. Mishra et al. (2020), ^[9]	0.29%	0.56%	2.88%	0.013%	3.80%
Sushma kumari et al. (2020), ^[19]	0.15%	0.68%	0.84%	0.002%	1.70%
Sharma et al. (2022), ^[31]	0.075%	0.20%	1.03%	0.37%	1.67%
Shah & Patel et al. (2022), ^[2]	0.047%	0.036%	0.31%	0.19%	0.58%
Present Study (2025)	0.16%	0.13%	0.53%	0.76%	1.58%

TTI: Transfusion transmitted Infections, HIV: Human Immunodeficiency Virus, HBsAg: Hepatitis B surface antigen, HCV: Hepatitis C virus.

DISCUSSION

Blood transfusion is an integral part of medical care and treatment. Adequate and safe transfusions save millions of lives; however, unsafe transfusion leads to many life-threatening complications and increases the possibility of transfusion-transmitted infections (TTIs).^[16] Transfusion transmitted Infections (TTIs) can cause serious health consequences and economic burden to country. Timely blood transfusion of blood can save lives, but unsafe transfusion practices can put millions of people at risk of Transfusion transmitted infections.^[1] Patients requiring blood transfusion are more prone to acquire HBV, HIV, HCV, and syphilis.^[17] HBV is highly contagious and easily transmitted from one individual to another by transfusion during birth, by unprotected sex and by sharing needles. Syphilis can be spread by sexual contact, blood transfusion and by vertical transmission. HCV is widely recognized as a major causative agent of infection following transfusion.^[17] In case of HIV, transmission during window period is possible even if each unit is tested for HIV antibodies. The possibility of window period transmission would be minimized if blood is collected from low risk targeted general public. However, blood safety remains an issue of major concern in transfusion medicine.^[11] Various studies to determine Sero-prevalence of TTIs among blood donors and to associate TTI with ABO blood groups have produced conflicting results due to differences in sample size, methods of screening, social and geographical factors.^[18]

The aim of this study was to determine the seroprevalence of HIV, HBV, HCV, Syphilis and Malaria among healthy blood donors and their probable association with blood groups. There was a total of 16149 donors, among which Male

population was 15340(94.9%) and 810 (5.01%) were females. This result is comparable to the studies done by Chandekar et al. (2017), Sharma et al. (2017) and Sinha & Dey (2017) in which also the majority of donors were males. This gender disparity can also be attributed to the fact that the women have a higher rate of deferral, either because of low haemoglobin levels or underweight.^[6] Among Sero-positive cases 207(82.5%) of the participants were Replacement donors, while 44(17.5%) participants were Voluntary donors. Similar findings were observed in studies done by Rawat et al. (2017),^[15] Asha Kiran et al. (2018),^[10] Quraishi Zubair Md. Et al. (2020),^[4] However, in studies done by Chandekar et al. (2017),^[11] Naik VSS et al. (2019),^[1] Shah & Patel et al. (2022),^[2] voluntary donors were the most common type. The most common blood group in our study was "O" Positive 5550/16149(34.36%), similar to the observation made by Sushma et al. (2020),^[19] Omhare et al. (2018),^[20] Asha Kiran et al. (2018),^[10] where the most common blood group was also O Positive. However, the studies done by Nigam et al. (2014),^[8] Sharma et al. (2017),^[17] and Arif et al. (2021),^[6] found blood group "B" to be the most common. The least common blood group in our study was AB negative 36/16149(0.22%) which was similar to the study by Sreedhar Babu KV et al. (2015),^[12] Sharma et al. (2017),^[17] Nagasaki-Yoka et al. (2018).^[21] Among Sero-reactive population, majority of the participants i.e. 107 (42.6%) fall between the age-group 18-30 Years. 79(31.5%) were of age 31-40 Years and 48(19.1%) of the participants were of age-group 41-50 Years. Only 17(6.8%) of the Sero-reactive donors had age-group of 51-60 Years. Mean of age $\pm$ sd of study subjects was 34.22 $\pm$ 9.30 years. Hence implying that majority of the Sero-positivity was observed in reproductive or sexually active age-group. Results

show a significant preponderance of TTI in Rh positive blood groups 247(98.4%) as compared to Rh negative blood groups 4(1.59%). This is consistent with results of Bhardava S et al. (2016),^[22] and Arif SH et al. (2021).^[6] However, results of some other studies (Tyagi & Tyagi, J.S. Nigam et al.) showed that the negative blood groups were more prone to TTIs. Overall seroreactivity of TTI was 251/16149 (1.55%) which was more than the study by Leena M S et al. (2012),^[13] Bhardava S et al. (2016),^[22] Patel et al (2022),^[2] However, the seroreactivity was much less than the study done by Sharma et al. (2017),^[17] Rawat et al. (2017),^[15] which showed 4.30 % as the total percentage of TTIs. Overall maximum seroreactivity was seen with blood group “O” 83/16149(0.51%), similar to the observation made by Sharma et al. (2022), followed by “B” 78/16149(0.48%). However, this finding differed from many studies that found a higher seroprevalence of TTI in blood group “B” positive.^[6,16,18] In our study, among the Sero-reactive donors, maximum cases 119/16149(0.7%) were reactive for Syphilis, in contrast to study done by Sinha et al. (2017),^[23] where most common TTI was HBsAg. Several other studies by Omhare et al. (2018),^[20] Shailesh Ku. Mishra et al. (2020),^[9] Tyagi and Tyagi (2013),^[14] and Nigam et al. (2014),^[8] also showed maximum seropositivity for HBsAg. The Spectrum-STI database for 2016 estimated 0.5% global prevalence of syphilis.^[24] Our study shows a comparable overall prevalence of 0.7% over a period of 1 year. Many studies from India have reported latent syphilis as the most common presentation of syphilis, accounting for up to 80%–90% of the cases.^[25,26] A recent study from Karnataka reported latent syphilis as the most common presentation (48.6%), and 20–29 years as the most frequently tested age group.^[27] Syphilis infection is often asymptomatic, and therefore detection is often delayed and depends on the initiative of the individual and the capacity of the health system to promote and facilitate testing for early detection. There were no cases positive for malarial parasite in present study. It was also found that among 251(1.55%) seropositive donors, 6 (0.037%) donors had dual infections. Among which, 2(0.012%) had HIV and HBsAg coinfection, 2(0.012%) with HBsAg+VDRL co-infection, followed by 2(0.012%) with HIV and syphilis coinfection. In India, variable syphilis-HIV coinfection rates have been described.^[28] However, in our study the prevalence rates of co-infection is insignificant as compared to other studies.^[29] The ABO and Rh blood group systems have proved to be the most important, for blood transfusion purposes. ABO was the first human blood group system to be discovered by Landsteiner in 1901 while Rh blood group was defined by Landsteiner and Weiner in 1941.^[30] Association between blood groups and diseases has been studied before. Diseases like peptic ulcer, gastric carcinoma, erythroblastosis fetalis, coronary artery diseases and

venous thromboembolism, neuroendocrine tumours in MEN type 1, have shown their association with various blood groups.

Fisher's exact test was used to explore the association between 'Type' and 'Blood Group' as more than 20% of the total number of cells had an expected count of less than 5. There was no significant difference between the various groups in terms of distribution of Blood Group ($\chi^2 = 3.149$, $p = 0.685$). There was no significant association observed with any specific blood group type. Blood group O Positive 83/16149(0.51%) showed highest seropositivity but not statistically significant. This is consistent with results of Sharma et al. and Das et al.^[17,30] All the blood groups showed distribution of TTI consistent with pattern of their seroprevalence in all the donors.^[31]

CONCLUSION

Blood donors being highly selective population with motivation for social works, apparently comprises the healthy population of community. This study reflects seroprevalence of Transfusion Transmitted Infections among blood donors in our area which may be helpful in planning public health interventional strategies. Also, it highlights the importance of routine screening with a better selection of donors and need of implementation of sensitive screening tests including NAT assay to reduce the risk of TTI. In contrast to other studies, the most common TTI in our study was Syphilis. This is in concordance with the finding that overall seropositivity was more in sexually active blood donors. Hence, this study recommends a three-step approach towards safety of blood transfusion including stringent donor screening, use of better screening and confirmatory tests for syphilis and advertence of awareness programs. Majority of the donor population was comprised of males, which is similar to several other studies. Female donor population was significantly less which may be because of being unfit for blood donation as a result of anaemia, being underweight, malnourishment and social ignorance. Apart from this, low awareness regarding effects and benefits of blood transfusion may also be a reason behind this. Seropositivity was higher in Replacement Donors as compared to the Voluntary Donors further reflecting the importance of increasing public awareness regarding voluntary donation and its benefits. Result obtained from donors cannot be generalized to general population. However, it can be used to monitor the trend of infection in apparently healthy adult population. No significant association of Transfusion transmitted infections with ABO blood groups was noted in this study. Hence, comprehensive large-scale nationwide studies are needed to further evaluate the association of TTIs with ABO blood groups.

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