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Seroprevalence of transfusion -transmitted infections among blood donors in a tertiary care hospital in and around Koodapakkam, Puducherry, India

Abstract

Introduction: Even though blood transfusion safety has come a long way, Transfusion-Transmitted Infections (TTI), which include bacterial, viral, parasitic, and prions, can still spread with each transfusion. The main goal of this study was to determine the seroprevalence of the five TTIs that are required to be tested in India among blood donors at our facility. Accurate estimates of the risk of TTIs are essential for monitoring the safety of the blood supply.

Methodology: This was a retrospective descriptive study conducted in the blood centre of a tertiary care teaching hospital in Puducherry, from 2017 to 2023. Records from blood banks were reviewed to collect data on all donors who underwent appropriate testing for HIV, hepatitis C, Hepatitis B, syphilis, and malaria. Enzyme-linked immunosorbent assay was done for HIV, HCV, HBsAg/hepatitis B surface antigen, and rapid card testing was done for syphilis and malaria.

Results: There was a total of 2570 donors during the study period. In the present study, the overall seroprevalence of TTIs was 1.40%. The individual seropositivity rates were 0.03% for HIV, 0.93 % for HBsAg, and 0.43 % for syphilis. There were no cases of malaria and HCV detected in the study period. The highest percentage of prevalence was observed for HBV, followed by Syphilis and HIV.

Conclusion: The overall seroprevalence of TTI in Puducherry was smaller than those reported elsewhere in the country. It was comparatively lesser than the national average for HIV, HCV, and HBV and much higher for syphilis.

Keywords: Puducherry, seroprevalence, transfusion-transmitted infections

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Abbreviations: TTI, transfusion-transmitted infection; EIA, enzyme immunoassay; NAAT, nucleic acid amplification test, ELISA, enzyme-linked immunosorbent assay

Introduction

Blood donation is a voluntary procedure that can help save many lives. The provision of safe blood and meeting the requirements is an integral part of any blood transfusion services. With each donation, there is a chance of transmission of infections despite the stringent screening policy to exclude high-risk donors. Infections caused by viruses, bacteria, parasites, and prions are referred to as transfusion-transmitted infections. To get transmitted through the blood, the infectious agent should possess certain characteristics such as:

- Prolonged presence of the organism or infectious agent in the blood.
- Stability in stored blood (≤4°C)
- The long clinical incubation period
- mild symptoms or asymptomatic phase in the blood donor

For every unit of blood transfused, there is a 1% risk of transfusion-related issues, such as transfusion-transmitted infections. However, only five infections are screened because all other infections cannot be screened, and there are no screening tests available for some infections. All blood donations in India are required to undergo screenings for HIV I and II, HBsAg, HCV, syphilis, and malaria under the Drugs and Cosmetics Act.[1]

Patients in need of continuous blood transfusions or blood products are more susceptible to infection, which rises with the volume of red blood cells or blood products transfused. The risks of TTI vary globally and are influenced by multiple factors including the prevalence of TTI in the donor population, types of donors, methods of testing the donated blood and pathogen reduction techniques for donated blood. TTI risk can be decreased by using a standard donor screening questionnaire and laboratory tests. Over, the past three decades, several different types of assays have been created for use in blood screening.[2] The most frequently used tests are intended to detect antibodies, antigens, or nucleic acid. The 2 main types of assays used are Immunoassay which includes enzyme immunoassay, chemiluminescent immunoassay, rapid test and particle agglutination assay, and nucleic acid amplification technology (NAAT) assays. This study was carried out to oversee the trend of TTI in our community. It also provides insight into the community's infectious epidemiology for various infections. The results may also be utilized to revise intervention plans that target TTI control and prevention. Additionally, this study will help us know the prevalence of TTIs and compare them with the national average.[3]

Materials and methods

This study was done in the blood centre of a tertiary care teaching hospital in Puducherry, India. It was a retrospective descriptive study among eligible blood donors from 2017 to 2023 in our centre. Data was retrieved from the records of the blood bank. All the blood donors who donated at the blood bank during the study period were included

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in the study. Only 1 test was performed for all TTI including, ELISA for HIV, HCV, and HBV and rapid card test for syphilis and malaria. Since our centre follows strategy 1 for donor blood testing, all bags yielding positive or equivocal results were autoclaved and discarded. All the data were entered in a Microsoft Excel sheet. The categorical data such as gender, age, education, occupation, blood group and TTIs were expressed as frequencies and percentages. The association among various study parameters was assessed with the help of the Chi-square test. $P < 0.05$ is considered as statistically significant.

Results

There were a total of 2570 donors during the study period. Out of 2570 donors, 36 were positive for TTs. In the present study, the overall seroprevalence of TTIs was 1.40%. The individual seropositivity rates were 0.03% for HIV, 0.93 % for HBsAg, and 0.43 % for syphilis. There were no cases of malaria and HCV detected in the study period. There were no co-infections of TTIs among each other. The distribution of transfusion-transmitted infections and the year-wise trend is shown in Figures 1 & 2 respectively. All the reactive donors were male. The mean age of the reactive donor was 30.71±7.13 years. The maximum age was 52 while the minimum was 20 years. Blood group O (63%) had the highest seroreactivity followed by groups B and A respectively. More than 80% of the reactive donors were Rh-positive. The seropositivity was more prevalent among the blood donors in the age group 18 to 25 (50%) followed by 26 to 35 (30.5%) and 36 to 45 (14%). 70 % of the reactive donors were family replacements and 30% were voluntary donors. The year-wise distribution of total and reactive donors is shown in Table 1. The sociodemographic characters of the seropositive donors are summarized in Table 2.

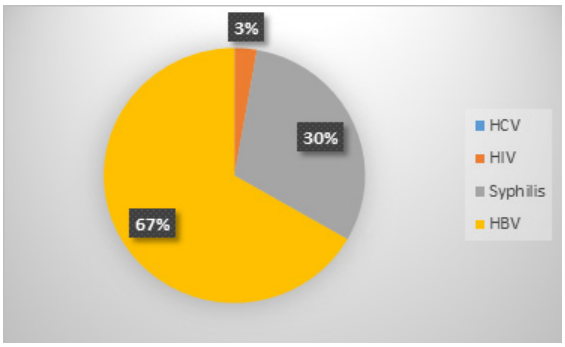

Figure 1 Distribution of transfusion-transmitted infections.

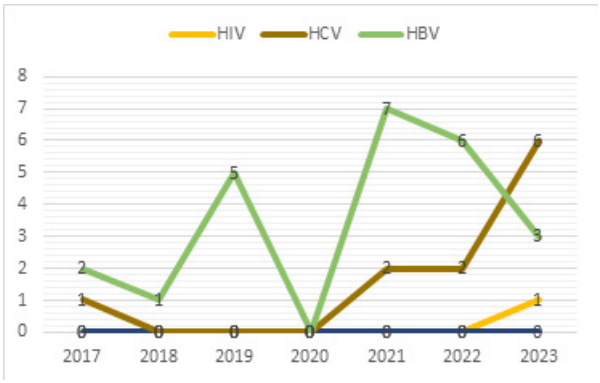

Figure 2 Year-wise trend of TTI.

Table 1 Year-wise distribution of the TTI-reactive donors

Years	Donors	HCV	HIV	Syphilis	HBV	Malaria	Total
2017	251	0	0	1	2	0	3
2018	223	0	0	0	1	0	1
2019	287	0	0	0	5	0	5
2020	152	0	0	0	0	0	0
2021	397	0	0	2	7	0	9
2022	587	0	0	2	6	0	8
2023	668	0	1	6	3	0	10
Total	2570	0	1	11	24	0	36

Table 2 Sociodemographic characters of the TTI reactive donors

Participant's characteristics	HBV	Syphilis	HIV	Frequency, n (%)
Age				
18-25 years	14	4	0	18 (50)
26-35 years	6	4	1	11 (30.5)
36-45years	4	1	0	5 (14)
>= 46 years	0	2	0	2 (5.5)
Education				
Bachelor	10	3	0	13 (36.1)
High School (12th standard)	7	3	1	11 (30.5)
School education only	3	3	0	6 (16.7)
No formal education	4	2	0	6 (16.7)
Occupation				
Student	8	4	0	12 (33.3)
Business	6	4	1	11 (30.6)
Farmer	5	3	0	8 (22.2)
Unemployed	5	0	0	5 (13.9)

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Table 2 Continued...

Participant's characteristics	HBV	Syphilis	HIV	Frequency, n (%)
Blood group-ABO				
A	2	0	0	2 (5.6)
B	6	4	1	11 (30.6)
O	15	7	0	22(61.1)
AB	1	0	0	1 (2.7)
RH Group				
Positive	20	8	1	29 (80.6)
Negative	4	3	0	7 (19.4)
Types of donors				
Replacement	16	8	1	25 (69.4)
Voluntary	8	3	0	11(30.6)

Discussion

Transfusions of blood are vital and life-saving procedures in patient care, but they also carry a danger of transmitting potentially fatal transfusion-transmitted diseases. The prevalence of TTI in the Indian population is as follows:

HBV – 0.66% to 12%, HCV -0.5% to 1.5%, HIV – 0.084% to 3.87%, and syphilis 0.85% to 3% respectively.[4] The seroprevalence of TTIs in our study was 1.40 % (HIV – 0.03%; HBsAg – 0.93 %; syphilis – 0.43 %; malaria and HCV – 0). This is similar to other studies that have demonstrated a much lower seroprevalence rate –1.35% in the study by Leena et al.[5] 1.47% in the study by Adhikari et al.[6] and 1.4% by Verma et al.[5-7] On the contrary, other studies have demonstrated a higher prevalence of TTI- 3% by Cherukat et al.[8] and 3.05% by Chandra et al.[9] The reasons behind these variations in seroprevalence may be due to the endemicity of the infection, Genotype of HIV, window period donations, type of donors (voluntary/replacement), donor selection process, differences in the screening strategies, and also differences in the tests that are used for testing samples. In our study, the prevalence of HBsAg was 0.93%. It is less in comparison to most other studies. Studies from most parts of the nation indicate that hepatitis B is the most frequent TTI, except one from Thiruvananthapuram, which revealed nearly the same seroprevalence of HCV.[8] The lower prevalence of hepatitis B in our study could be due to a smaller donor pool and better donor screening methods due to which high-risk donors are deferred before donation.

The prevalence of syphilis was 0.43% which is higher compared to most other Indian studies. This could be because of the younger donor pool in our area who would have engaged in any high-risk behaviour and failed to reveal it during pre-donation counselling. It could also be due to technical errors because one-time positive samples were not subjected to other testing for confirmation. There were no cases of HCV in our study which is contrary to most other studies. However, there have been few reports of no HCV infection in some studies. In a study from Mozambique by Stokx et al.,[10] there were no reported cases of HCV.[10] Thus, it may be inferred that the seroprevalence of HCV varies significantly by geography. Another reason could be the small donor pool in our study. Similarly, the present study tested no positives for malaria. This agrees with most of the studies in India. Many studies have connected various illness issues and blood group systems with regions worldwide. It has been demonstrated that some infectious and non-infectious disorders and susceptibility to specific infections are associated with certain ABO blood groups. Few blood types can act as ligands and receptors for specific bacteria, parasites, and viruses. Numerous studies have been carried out to investigate the association between the Rh and ABO blood types and the risk of TTIs, but the conclusions from these investigations are inconsistent. Varied kinds of results have been found in India and other parts of the world regarding blood groups and TTI association. A study by Hasan et al. showed an increased prevalence of HCV and HIV with AB-negative donors.[11] Another study by Tyagi et al.[12] also showed A negative blood group was more susceptible to infections with HIV, HBsAg, and Syphilis. Additionally, they discovered that people with blood type B negative were more likely to contract HCV.[12] They demonstrated that TTIs favour negative blood groups however, a significant correlation was not observed. It might be because fewer people have negative blood types, which has led to a proportional increase in the percentage.

In contrast, A study conducted by Siransy et al in Côte d'Ivoire in 2015 showed no correlation between the ABO and Rh blood groups and viral infections (HIV and hepatitis B).[13] However, blood group O donors were found to have the highest frequency of infection. In our study, most of the reactive donors were Group O followed by Group B. A similar finding has been described in a study by Karmakar et al. from Kolkata.[14] This corresponds to the general prevalence of ABO phenotypes in our donor pool O-positive blood group (40.10%), followed by B-positive (32.23 %). Therefore, it is difficult to say that blood group antigens are either protective of or predisposed to TTI infection. This suggests that blood group antigens do not intrinsically expose a person to any infection. Blood group antigens of an individual cannot alter because of any infection. The majority of seropositive donors were in the age group 18-25 years. Similarly, all reactive donors were male. This may be because of fewer female donor pool in our surroundings and also among them, fewer are eligible to donate. The age predilection may be seen because the majority of our donor population are college students. The majority of research has not looked at the relationship between TTI seroprevalence and the donor's educational attainment. A Chinese study by Song et al.[15] found that a higher incidence of TTIs was linked to a lower educational status. However, in our study, most of the reactive donors had a bachelor's level of education which reflects the pattern of our donor population. Given that the majority of the donors in our study were bachelor students, the results may have been skewed. With regards to donor types, 70% of the reactive donors were replacements and the remaining 30% were voluntary. Many studies have shown a high seropositivity rate in replacement donors compared to voluntary donors. Similar findings were reported by Cherukat et al.[8] in a study from Puducherry, where replacement donors were seen to have more prevalence of TTIs (68% replacement donors vs 32% voluntary donors). Another study from Andhra Pradesh by Begum et al. also showed a higher association of TTI positivity among replacement donors.[16] This is because the majority of blood donors in India are replacement donors, which highlights the lack of understanding among the public about the situation.

Conclusion

The overall seroprevalence was lesser compared to other studies for HBV and HIV. In contrast, it was higher than average for syphilis. And none was reported for HCV and malaria. This could be due to the false positivity of rapid card tests for syphilis. Comprehensive screening for blood donors is still necessary to further reduce patient-related morbidity and mortality from blood transfusions. The high-risk categories identified in this study should be the focus of adult hepatitis B vaccination campaigns, public health education campaigns about HBV infection, and social standards.

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Conflicts of interest

The author declares that there is no conflict of interest.

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