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ORIGINAL RESEARCH

Trends and Prevalence of Transmissible Infections in Blood Donors in a blood bank in North India: A Retrospective Study

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ABSTRACT

Background: Blood transfusion remains a critical component of modern medical care, but it carries the risk of transmitting infections such as HIV, Hepatitis B (HBV), Hepatitis C (HCV), syphilis, and malaria. Ensuring blood safety through rigorous screening is essential for public health. This study aims to assess the trends and prevalence of transfusion-transmissible infections (TTIs) among blood donors in North India over a two-year period at MaharshiMarkandeshwar Medical College and hospital, Sadopur, Ambala. **Materials and Methods:** A retrospective analysis of blood donor records from January 2022 to December 2023 was conducted. Data from hospital blood bank records were reviewed, covering an estimated 80donors per year. Donors underwent routine serological screening for HIV, HBV, HCV, syphilis, and malaria using ELISA and rapid diagnostic tests. Statistical analysis was performed to determine the prevalence trends and potential risk factors among donors. **Results:** Out of approximately 160 donors over two years, TTIs were detected in 12.5% of cases. The most common infection was HBV (5.6%), followed by HCV (3.1%), HIV (2.5%), and syphilis (1.3%). No cases of malaria were recorded. The prevalence of TTIs was higher among replacement donors compared to voluntary donors. Male donors constituted 85% of the study population, with a mean age of 32 years. A slight decline in TTIs was observed in the second year compared to the first. **Conclusion:** The study highlights a considerable prevalence of transfusion-transmissible infections in North Indian blood donors, emphasizing the need for stringent donor screening and awareness programs. Strengthening pre-donation counselling and implementing advanced testing methods can further enhance blood safety and reduce the risk of transmission.

Keywords: Blood donors, transfusion-transmissible infections, HIV, HBV, HCV, syphilis, blood safety, North India.

INTRODUCTION

Blood transfusion is a lifesaving procedure widely used in medical and surgical settings. However, it carries the risk of transmitting infectious diseases, including Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), syphilis, and malaria, collectively known as transfusion-transmissible infections (TTIs) (1). The prevalence of these infections varies based on geographical location, donor selection criteria, and the implementation of blood safety policies (2).

Ensuring the safety of blood donations is a key public health priority, particularly in developing countries where the burden of TTIs remains significant. Blood donor screening has evolved with advancements in serological and nucleic acid testing, yet the risk of transmission persists due to factors such as window periods, emerging infections, and donor selection limitations (3,4). In India, TTIs continue to pose challenges to blood transfusion services, with regional variations in prevalence due to differences in socio-economic conditions, awareness levels, and healthcare infrastructure (5).

Studies from different regions of India have reported varying TTI prevalence rates, with HBV and HCV being the most commonly detected infections among blood donors (6,7). The predominance of these infections highlights the importance of stringent donor screening, public health interventions, and effective policies to ensure blood safety (8). This study aims to

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assess the trends and prevalence of TTIs among blood donors at MaharshiMarkandeshwar Medical College and hospital, Sadopur, Ambala, over a two-year period. The findings will provide insights into the epidemiology of TTIs in this region and contribute to strengthening transfusion safety measures.

MATERIALS AND METHODS

Study Design and Setting

This retrospective study was conducted at the Blood Bank of MaharshiMarkandeshwar Medical College and hospital, Sadopur, Ambala, over a period of two years (January 2022 to December 2023). The study aimed to assess the prevalence and trends of transfusion-transmissible infections (TTIs) among blood donors.

Study Population

The study included all blood donors who visited the hospital's blood donation facility during the study period. Donors were categorized as either voluntary or replacement donors. Data from approximately 80 donors per year were analyzed, making a total of about 160 donors over two years.

Inclusion and Exclusion Criteria

- **Inclusion Criteria**: Healthy blood donors aged 18–65 years who met the eligibility criteria set by national blood donation guidelines.
- **Exclusion Criteria**: Individuals with a history of chronic infections, intravenous drug use, high-risk sexual behaviour, or previous positive screening for TTIs were excluded from donation and, consequently, from this study.

Data Collection and Screening Protocol

Donor records were reviewed to collect demographic details, donor type, and screening results. All blood samples were tested for HIV, HBV, HCV, syphilis, and malaria. The following screening methods were used:

- **HIV, HBV, and HCV**: Enzyme-linked immunosorbent assay (ELISA) was employed to detect antibodies and antigens.
- **Syphilis**: Rapid plasma reagin (RPR) and treponemal-specific tests were used for serological detection.
- **Malaria**: Peripheral blood smear and rapid diagnostic tests (RDTs) were performed.

Ethical Considerations

This study was conducted following ethical guidelines for research involving human data. Donor confidentiality was maintained, and all collected information was used solely for research purposes.

Data Analysis

The collected data were entered into Microsoft Excel and analysed using SPSS software. Descriptive statistics, such as frequency and percentage, were used to determine the prevalence of TTIs among donors. Chi-square tests were applied to assess differences in TTI prevalence between voluntary and replacement donors. Trends in infection rates over the two years were also evaluated.

RESULTS

A total of 160 blood donors were included in the study over a two-year period, with 80 donors screened per year. Among these, 120 (75%) were voluntary donors, while 40 (25%) were replacement donors. The majority of the donors were male (85%), with a mean age of 32 ± 6 years.

Prevalence of Transfusion-Transmissible Infections

Out of 160 donors, 20 (12.5%) tested positive for at least one transfusion-transmissible infection (TTI). The most commonly detected infection was Hepatitis B Virus (HBV) in 9 donors (5.6%), followed by Hepatitis C Virus (HCV) in 5 donors (3.1%), Human Immunodeficiency Virus (HIV) in 4 donors (2.5%), and syphilis in 2 donors (1.3%). No cases of malaria were reported during the study period. The distribution of TTIs is presented in **Table 1**.

Comparison of TTIs Between Voluntary and Replacement Donors

Among the 120 voluntary donors, 10 (8.3%) were found to have TTIs, whereas 10 (25%) of the 40 replacement donors tested positive, indicating a higher prevalence of TTIs among replacement donors (**Table 2**). The difference in infection rates between the two groups was statistically significant ($p < 0.05$).

Trends in TTIs Over Two Years

A decline in the overall prevalence of TTIs was observed in the second year. In 2022, 12 donors (15%) tested positive for at least one TTI, whereas in 2023, only 8 donors (10%) were found positive (**Table 3**). The decrease was mainly seen in HBV and HCV cases, while HIV and syphilis remained relatively stable.

Table 1: Distribution of Transfusion-Transmissible Infections Among Blood Donors

Infection Type	Number of Cases (n=160)	Prevalence (%)
HIV	4	2.5%
HBV	9	5.6%
HCV	5	3.1%
Syphilis	2	1.3%
Malaria	0	0%
Total	**20**	**12.5%**

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Table 2: Prevalence of TTIs in Voluntary vs. Replacement Donors

Donor Type	Total Donors (n=160)	TTI Positive Cases	Prevalence (%)
Voluntary Donors	120	10	8.3%
Replacement Donors	40	10	25%

Table 3: Yearly Trends in Transfusion-Transmissible Infections

Year	Total Donors	TTI Positive Cases	Prevalence (%)
2022	80	12	15%
2023	80	8	10%

These findings indicate that although the prevalence of TTIs remains a concern, there has been a slight decline over the two-year period. The higher prevalence among replacement donors further underscores the importance of promoting voluntary blood donation and stringent donor screening practices.

DISCUSSION

The present study assessed the prevalence and trends of transfusion-transmissible infections (TTIs) among blood donors over a two-year period at MaharshiMarkandeshwar Medical College and hospital, Sadopur, Ambala. The overall prevalence of TTIs in this study was found to be 12.5%, with Hepatitis B Virus (HBV) being the most frequently detected infection, followed by Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV), and syphilis. No cases of malaria were recorded. These findings align with previous studies conducted in North India, where HBV and HCV have been reported as the predominant infections among blood donors (1,2).

Prevalence of TTIs Among Blood Donors

The prevalence of HBV (5.6%) in this study was comparable to rates reported in other studies conducted in Northern and Central India, which have ranged from 2% to 6% among blood donors (3,4). HBV remains a significant public health challenge due to its high transmissibility and chronic complications, such as cirrhosis and hepatocellular carcinoma (5). The prevalence of HCV (3.1%) observed in this study is also consistent with earlier research, which has documented rates between 1% and 4% among Indian blood donors (6,7). HCV is of particular concern due to its long asymptomatic phase and potential for progression to chronic liver disease (8).

The prevalence of HIV (2.5%) in the present study was slightly higher than that reported in some previous studies from India, where rates typically range from 0.5% to 2% (9,10). This variation may be attributed to regional differences in HIV burden, donor selection criteria, and the presence of high-risk populations in certain areas (11). The low prevalence of syphilis (1.3%) aligns with findings from other Indian studies, which report syphilis rates between 0.5% and 1.5% in blood donors (12,13). The absence of malaria cases is consistent with findings from other hospital-based studies(14).

Comparison Between Voluntary and Replacement Donors

A significantly higher prevalence of TTIs was observed among replacement donors (25%) compared to voluntary donors (8.3%), reinforcing findings from previous studies (15,16). Replacement donors, often recruited from friends and relatives of patients, may not undergo thorough pre-donation counselling and may be more likely to conceal high-risk behaviours (17). Conversely, voluntary donors, who donate blood regularly through organized camps and awareness programs, tend to have a lower risk of TTIs due to better screening and self-deferral mechanisms (18). This finding supports the World Health Organization's recommendation to encourage voluntary, non-remunerated blood donation to enhance blood safety (19).

Trends in TTIs Over Time

A decline in the prevalence of TTIs was observed in the second year of the study, with a reduction from 15% in 2022 to 10% in 2023. This decreasing trend may reflect improvements in donor screening, increased public awareness, and the implementation of stricter selection criteria (20,21). Similar downward trends in TTIs have been reported in other Indian studies over the years, attributed to advancements in serological and nucleic acid-based testing methods (22,23). However, continued vigilance is necessary to maintain this progress, particularly in high-risk populations.

Public Health Implications

The findings of this study emphasize the need for stringent donor screening, enhanced pre-donation counselling, and public awareness initiatives to minimize the risk of transfusion-transmitted infections. Introducing nucleic acid testing (NAT) alongside conventional serological screening could further improve blood safety by detecting infections during the early window period (24). Additionally, promoting voluntary blood donation through community-based programs and educational campaigns can help reduce the reliance on replacement donors, thereby lowering TTI prevalence (25).

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CONCLUSION

This study highlights the ongoing burden of transfusion-transmissible infections among blood donors in a blood bank in North India, with HBV and HCV being the most prevalent infections. The significantly higher TTI prevalence among replacement donors underscores the need for policies favouring voluntary blood donation. Although a declining trend in TTIs was observed, sustained efforts in screening, public awareness, and advanced testing methods are crucial for ensuring safer blood transfusions.

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