

Seroprevalence of transfusion-transmitted infections (TTIs) in blood donors: a study from central India

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Abstract

Background: Transmission of infectious diseases such as HIV, hepatitis, syphilis, and others through donated blood needs a serious monitoring to provide safe blood for transfusion, which forms an integral part of medical and surgical therapy.

Objective: To access the seroprevalence of transfusion-transmitted infections (TTIs) in Malwa region and assess the level of blood safety.

Material and Methods: A prospective observational study was conducted for the duration of 12 months. The known seropositive donors for any of these infections (HIV, HBV, HCV, syphilis, and malaria) and hemoglobin less than 12.5 g% were excluded. All donor samples were screened for HIV, HBsAg, and anti-HCV by ELISA methods; syphilis and malaria screening was done by card test.

Result: Among the total 4,007 donors, 92% were replacement donors while 8% were voluntary donors. Female donors comprised only 1.62%; the remaining 98.38% were male donors. The donor population was mostly in the young age group of 18–30 years (69.1%). Totally, 2.05% ($n = 83$) blood bags were seropositive for TTI. HBV was the most common TTI (1.77% bags); HIV was the second most common TTI (0.14% bags); HCV was detected in 0.099% bags, whereas syphilis was the least common TTI (0.04% bags).

Conclusion: Two to 3% of healthy donors are seropositive for TTI and reveal potential of transmitting them through transfusion. Thus, strict and proper donor selection criteria and screening with higher-generation ELISA kits can help to identify and avoid transfusion of infectious blood products.

KEY WORDS: blood banking, transfusion-transmitted infection, screening, HIV, HBV

Introduction

Safe blood transfusion is of utmost importance as an unsafe blood transfusion bears lot of burden on human and economy. Morbidity and mortality associated with transfusion-transmitted infections (TTIs) reveal long-term effects on the recipients, their families, along with the community.

Apparently healthy donor can transmit an infection during asymptomatic phase, further increasing the prevalence of various infections in general population. In terms of economy, the additional transmission of infections through blood transfusions puts burden on medical care services, decreases productivity of society, and increases number of dependents to be taken care of. It aggravates crisis of providing good health and social services to large population with financial burden on the nation's economy.^[1]

Blood transfusion is an integral part of medical treatment, and transmission of infectious diseases through donated blood is an alarming situation. Blood transfusion carries the risk of transmitting major infections such as hepatitis, HIV, syphilis, and malaria. In minority cases, viral infections such as cytomegalovirus, herpes virus, and Epstein–Barr virus along with toxoplasmosis and brucellosis may be transmitted.^[2]

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Over the period of time, availability of newer and more-sensitive screening tests with strict implementation of testing rules has significantly reduced incidence of TTIs in most developed countries, on the other hand the scenario in developing countries has not changed much. Poor health infrastructure, lack of health awareness among people, and failure to implement strict norms of screening result in increasing prevalence and incidence of these infections in the population.^[3]

Thus, this study was conducted to assess the seroprevalence of HIV, HBV, HCV, and syphilis in Malwa (central India) region and to assess the level of blood safety.

Materials and Methods

The study was a prospective observational study conducted at Blood Bank SAIMS, Indore, Madhya Pradesh, India, for a duration of 12 months from June 2012 to May 2013. All the potential blood donors were requested to fill questionnaire prepared as per NACO guidelines for donor eligibility. The questionnaire also included information about socioeconomic status of donor. Donors with hemoglobin (Hb) less than 12.5 g% or known seropositive for TTI were deferred and excluded from the study group. Informed consent was taken from all donors before blood donation.

The Hb level was measured by copper sulfate method, after which we bleed the donors with Hb > 12.5 g%. Few milliliters of each donor's blood was dispensed in two small clean test tubes (one tube with EDTA and, another, a plain tube) for mandatory screening of the TTI and hemogram, which was done using the automated cell counter.

Serum samples were screened for:

- For anti-HIV IgG and IgM antibodies, by ELISA method using fourth-generation Microlisa HIV Ag and Ab detection Kit by Transasia, Pvt., Ltd.
- For HBsAg, using Hepalisa Microwell ELISA by Transasia, Pvt., Ltd.
- For anti-HCV IgG and IgM, using third-generation HCV Microlisa Microwell ELISA by Transasia, Pvt., Ltd.
- For *Treponema pallidum*—card test by Transasia, Pvt., Ltd.
- For malaria, using malaria card test by SD, Pvt., Ltd.

Results

Totally, 4,007 replacement and voluntary donors donated blood in SAIMS hospital, Indore, Madhya Pradesh, India, blood bank in 1 year, of which, the female donors comprised only 65 (1.62%); the remaining 3,942 (98.38%) were male donors. As shown in Figure 1, our donor population was mostly in the young age group of 18–30 years (2,770 donors), while 997 donors were in 31–40 years age group. Only seven donors were aged above 50 years.

Among the total donors, 92% (n = 3,686) were replacement donors, while 8% (n = 321) were voluntary donors. Totally, 2.05% (n = 83) bags were seropositive for TTI. The distribution

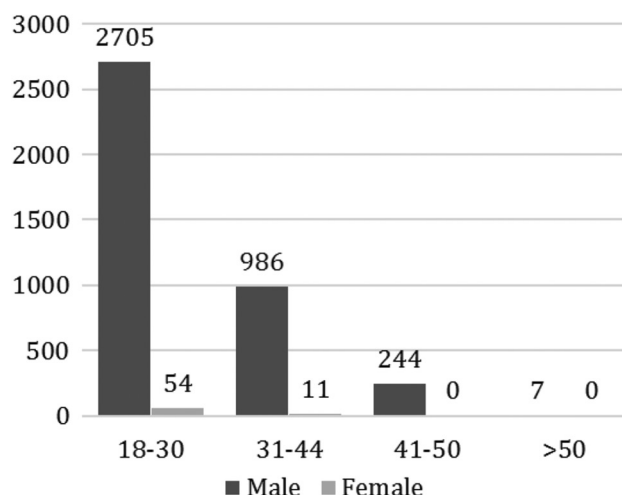


Figure 1: Age-wise distribution of male and female donors (total number of donors = 4,007).

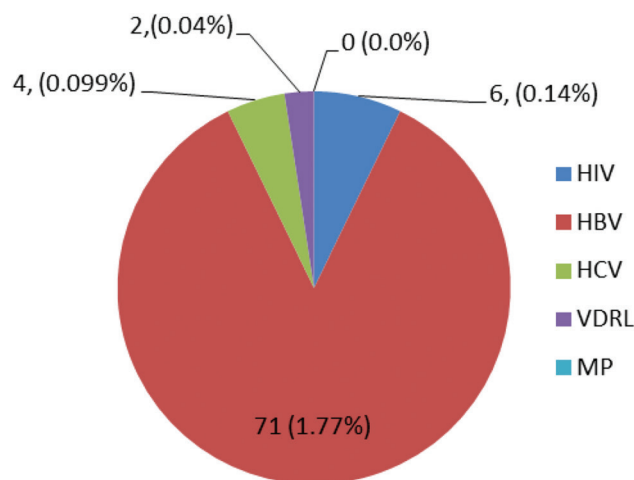


Figure 2: Prevalence of different TTIs among donors shown as number (%) (total number of donors = 4,007).

of various TTI positive blood bags is shown in Figure 2. Of 83 seropositive bags, HBV was the most common TTI with 1.77% (n = 71) of total bags seropositive; HIV was the second most common TTI; total 0.14% (n = 6) of total bags; anti-HCV was detected in 0.099% (n = 4) of total bags, whereas syphilis was the least common TTI, with 0.04% (n = 2) of total bags being seropositive. No case of malaria positivity was detected among the total screened blood bags. Thus, of 83 seropositive blood bags for various TTI, the commonest was HBV accounting for 85.5% of all seropositive bags. HIV constituted 7.23% of seropositive bags.

As shown in Table 1, most of donors positive for TTI were below 40 years age except one donor positive for syphilis (50%) was 41 years old. HBV-positive donors were highest in 18 to 30 years age group (81.54%).

Table 1: Age-wise distribution of different TTIs

TTI	Age (years), n (%)			
	18–30	31–40	41–50	>50
HBV	53 (81.54%)	18 (18.46%)	0	0
HIV	3 (50%)	3 (50%)	0	0
HCV	2 (50%)	2 (50%)	0	0
Syphilis	1 (50%)	0	1 (50%)	0
Malaria	0	0	0	0

Table 2: Prevalence of TTIs in different states of India

States	HBV %	HIV %	HCV %	VDRL %	Malaria %
Present study (Indore, MP)	1.77	0.14	0.099	0.04	0
Eastern part of India ^[9]	2.27	0.64	1.62	1.62	—
Kolkata ^[10]	1.55	0.32	0.35	0.35	—
Haryana ^[3]	1.7	0.30	1.0	0.9	—
Baroda ^[11]	0.85	0.30	0.21	0.25	—
Delhi ^[5]	2.33	0.56	0.66	—	—
Mysore ^[12]	1.27	0.49	0.23	0.2815	—
Ludhiana ^[13]	0.66	0.084	1.0	—	—
Lucknow ^[14]	1.96	0.23	0.85	0.01	—
Bhopal ^[15]	2.9	0.51	0.57	0.23	—
Mangalore ^[16]	0.34	0.06	0.06	0.11	—
Bareilly ^[17]	1.93	0.27	1.02	0.16	—
Central Karnataka ^[18]	2.12	—	0.1	—	—

Table 3: Prevalence of different TTIs in different country

Country	HBV %	HIV %	HCV %	VDRL %	Malaria %
Present study (India)	1.77	0.14	0.099	0.04	0
United States ^[19]	1/270,000	1/2,135,000	—	—	—
Europe ^[19]	1/70,000-1,00,000	1/1–5 million	—	—	—
Philippines ^[20]	4.2	0.006	0.3	—	—
Thailand ^[21]	4.61	0.69	2.90	—	—
Nigeria ^[22]	8.1	3.1	6.0	1.1	—
Nepal ^[23]	0.46	0.12	0.64	—	—
Mongolia ^[24]	8.1	0	8.7	2.0	—

Discussion

TTIs threaten the safety of recipients and the community as a whole and are a subject of real concern worldwide. Prevalence of HBV, HCV, and HIV among the healthy donors indicates the gravity of disease in the community. It also estimates the risk or chance of acquisition of these infections during blood transfusion.

The majority of the blood donors in this study were male, which is comparable with the studies done by others. We observed that, of the total 4,007 donors, the female donors comprised only 1.62%; the remaining 98.38% were

male donors. Arora *et al.*^[3] in southern Haryana, Singh *et al.*^[4] in coastal Karnataka, and Pahuja *et al.*^[5] and Singh *et al.*^[6] in Delhi observed more than 90% male donors of the total donor population.

In this study, a predominance of replacement donors was noted (92%), as also observed by Singh *et al.* (82.4%),^[6] Kakkar *et al.* (94.7%),^[7] Pahuja *et al.* (99.48%),^[5] and Arora *et al.*^[3] (68.6%). In the study by Gupta *et al.*,^[8] 39.71% donors were voluntary and 60.22% were replacement donors. This could partly be contributed to FDA norms of country that does not permit private hospitals and institutes to conduct voluntary blood donation camps in outside premises. This indicates

that a lot has to be done in motivating and getting home the message to our donors about the benefits of promoting voluntary donors, which are shown to have a much lower seroprevalence of TTIs.

As shown in Table 2, prevalence of HBV among blood donors in most of the Indian studies conducted at eastern part of India,^[9] Kolkata,^[10] Haryana,^[3] Delhi,^[5] Mysore,^[12] Lucknow,^[14] Bhopal,^[15] Bareilly,^[17] and central Karnataka^[18] ranges from 1.27% to 2.99%, which is quite comparable with 1.77% of our study. A lower prevalence (0.34%–0.85%) was seen in few studies conducted at Mangalore,^[16] Ludhiana,^[13] and Vadodara.^[11] Worldwide prevalence of HBV is very diverse [Table 3] ranging from 1/270,000 in United States^[19] to 8.1% in Nigeria^[22] and Mongolia^[24]. Studies conducted at United States^[19] and Nepal (0.46%)^[23] showed prevalence less than that of our study (1.77%), while studies conducted at Philippines,^[20] Thailand,^[21] Nigeria,^[22] and Mongolia^[24] showed prevalence more than that of our study, as shown in Table 3.

Prevalence of HIV infection in this study was 0.14%, which is lower than that of most of the studies conducted in India^[3,5,9–12,14,15,17], which showed prevalence ranging from 0.23% to 0.64%, except for studies conducted at Mangalore (0.06%)^[16] and Ludhiana (0.084%)^[13]. On comparing with global prevalence of HIV, it ranges from 1/2,135,000 in a study conducted in United States^[19] to 3.1% in Nigeria.^[22] A higher prevalence can be attributed to high-risk behaviors such as multiple sex partners, intravenous drug abuse, and unprotected sexual intercourse. HIV prevalence in blood donors in study conducted at Nepal (0.12%),^[23] which is comparable with this study.

Prevalence of HCV in our study was 0.099%, which was comparable with a study conducted at Mangalore (0.06%)^[16] and central Karnataka (0.1%).^[18] Prevalence of HCV in different studies^[3,5,9–15,17] in India ranges from 0.21% to 1.62%, which is higher than that of this study. As shown in Table 3, global prevalence of HCV in different studies ranges from 0.3% to 8.7%, which is higher than that of this study. Prevalence of HCV in this study was much lower again owing to strict selection of donors and a lower HCV prevalence in the study population.^[15] The wide variations of HCV seroprevalence found in different studies from India might be result of using ELISA kits of different generations that have variable sensitivity and specificity of detecting TTIs.

As shown in Table 2, prevalence of syphilis as TTIs in different studies across India ranges from 0.11% to 1.62%,^[3,9–12,15,17] which was higher than that of this study, except that of one study conducted at Lucknow (0.01%),^[4] which is comparable with our results. A few studies are available to be compared with global scenario where prevalence was found to be 1.1% and 2.0% in studies conducted at Nigeria and Mongolia, respectively,^[22,24] [Table 3] and was higher than that of this study.

We were unable to find a single case of malaria in 4007 cases, which is comparable with a 5-year study by Pallavi *et al.*^[12] on seroprevalence of TTIs among blood Donors. A study from Yaoundé, Cameroon, found 16.5% donors positive for *Plasmodium* species infection.^[25] The prevalence of malaria

parasitemia in blood donors in a Nigerian teaching hospital was 30.2%.^[26] In Mangalore (India), prevalence of malaria was 0.01%.^[16]

Thus, this study gives the status of transfusion-transmitted disease incidence mainly in replacement donors as 92% blood bags were of replacement donors. Similar study is needed in voluntary donors with larger number of bags screening to find the incidence of TTI in central India.

Conclusion

Thus, to conclude, HBV is the commonest TTI among apparently healthy donors, followed by HIV and HCV; 2% to 3% of healthy donors are seropositive for TTI and reveal potential of transmitting them through transfusion. Strict and proper implementation of donor selection criteria and thorough history and examination should be followed. Screening with higher-generation sensitive ELISA kits and avoiding rapid screening methods can help to identify seropositive bags accurately. This may help to avoid transfusion of infectious whole blood and blood products, especially in patients requiring repeated transfusions as part of therapy.

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