

Seroepidemiology of transfusion-transmitted infections among blood donors at a tertiary care center in Navi Mumbai, Maharashtra

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ABSTRACT

Background: Blood is precious as well as scarce lifesaving medication. Proper screening of transfusion-transmitted infections (TTIs) such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), syphilis, and malarial parasite (MP) with appropriate methods is needed to ensure that the donated blood is made innocuous for transfusion. **Objective:** The aim of the study was to estimate the prevalence of TTI and their epidemiological aspects in blood donors in a hospital-based blood bank in Nerul, Navi Mumbai. **Materials and Methods:** A retrospective study of the total of 4708 donors was carried out from January 2015 to December 2018 year. Screening of HIV was done using the fourth-generation enzyme-linked immunosorbent assay (ELISA) and for hepatitis B surface antigen (HbsAg) and HCV by the third-generation ELISA kit. Testing for syphilis was done with rapid plasma reagin and MP was tested with rapid card test. **Results:** Voluntary donors were 4702 (99.9%) while replacement constituted for 6 (0.12%) number of cases. Among 4708 donors, 4079 (96%) were male and 629 (4%) were female. Among 66 (1.4%) transfusion transmitted diseases (TTD)-positive donors, the highest number of donors 28 (42%) belongs to 18–27 years of age group while the lowest 5 (2%) belonged to 48–57 years. Overall prevalence of HIV, HbsAg, HCV, syphilis, and MP was 0.08%, 1.1%, 0.2%, 0.04%, and 0.02%, respectively. **Conclusion:** The prevalence of TTD was more in males, in 18–27 age groups, and in voluntary donors. The most common TTI was HBV, followed by HCV, HIV, syphilis, and MP, respectively.


KEY WORDS: Human Immunodeficiency Virus; Hepatitis B Surface Antigen; Hepatitis C Virus; Malaria; Syphilis; Transfusion-transmitted Infections

INTRODUCTION

Blood transfusion has been saving millions of lives daily. Every year more than 5 million die due to violence and injury and around 536,000 women die due to pregnancy-related complications. The most common cause of death, in this case, is hemorrhage, while road traffic accidents are the second leading

cause of death worldwide.^[1,2] The blood products are mainstay as well as only prime option for therapeutics in this scenario and in other conditions such as surgery, trauma, obstetrics, anemias, and many other diseases. Although a lifesaving medication, it can also prove to be hazardous due to the risk of transmission of transfusion-transmitted infections (TTIs). TTIs can be caused by a varied organism such as viruses, bacteria, spirochetal, and parasites. However, the viruses are the most common cause for TTI. Therefore, stringent screening of donated blood for human immunodeficiency virus (HIV), hepatitis B surface antigen (HbsAg), hepatitis C virus (HCV), syphilis, and malarial parasite (MP) is needed.^[3-6]

Detecting the TTIs still remains a challenge due to limitations and errors related to test method/procedure, window period

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of the infectious disease, and variant viruses. Selection of a TTI free or healthy donor poses great challenges, especially in situations where they conceal medical history, history of high-risk behavior, asymptomatic carriers, and donate blood during window period. Voluntary donors are those who donate blood on compassionate ground, are responsible citizen having social awareness and donate without any inducement.^[7-9]

Estimating prevalence of TTI can give an idea of epidemiology and burden of disease in the population. Therefore, the aim of our study was to find out the prevalence, trends of TTI, and also the epidemiology of donors donating blood in tertiary care setup located in urban region.

MATERIALS AND METHODS

A retrospective study was conducted in blood bank attached to Terna Specialty Hospital and Research Center, Nerul, Navi Mumbai, Maharashtra. The study included 4708 number of blood donors from April 2015 to December 2018. Permission was taken from the ethics committee of our institution for collecting retrospective data of donors. All donors were screened according to the Donor Selection Criteria as per the Food and Drug Administration (FDA), National AIDS Control Organization, and Drugs and Cosmetics Act, 1940.^[9,10] Blood was collected from selected donors and screened for TTD.

Blood collected from blood bag in ethylenediaminetetraacetic acid tube was used for testing of MP. Blood collected from blood bag of donor in plain tube was centrifuged and the serum was tested for TTI as per standard operating procedures. Enzyme-linked immunosorbent assay was used for testing for antibodies to HIV 1, HIV 2, and p24 antigen (MERILISA HIV Gen 4, Meril Diagnostics Pvt. Ltd., Gujarat, India), HbsAg (MERILISA HbsAg, Meril Diagnostics Pvt. Ltd., Gujarat, India), and HCV (MERILISA HCV, Meril Diagnostics Pvt. Ltd., Gujarat, India). The reactive samples were retested with similar methods. Syphilis was tested with rapid plasma reagin method (CARBOGEN, Coral Clinical System, Uttarakhand, India). MP was tested with rapid detection card test (Malaria Ag P.f/Pan, Standard Diagnostics Inc., Republic of Korea). All reactive donor's data were collected and analyzed.

RESULTS

A total of 4708 donors' blood were screened for TTI from April 2015 to December 2018. Among 4708 donors, 4079 (86.6%) were male donors while 629 (13.4) were female donors and 4702 (99.9%) were voluntary donors, and 6 (0.1%) were replacement donors. Proportion of replacement donors was low compared to voluntary donors and it was statistically significant ($P < 0.001$). Overall prevalence of TTI was 1.40% [Table 1]. Majority of TTI-positive blood donors belong to younger age group between 18 and 27 years constituting 0.59% and least in older age group, 48–57 years which was about 0.11%. TTI prevalence was more in the 1st time donors (1.01%) compared to repeat donors (0.38%) [Table 2]. The prevalence of HIV was 0.08%, HbsAg was 1.1%, HCV was 0.2%, syphilis was 0.04%, and MP was 0.02%. In the present study, decreasing trend of the prevalence of TTI from 2.04% to 1.17% from 2014 to 2018 was observed.

DISCUSSION

TTIs are the most important threat for safe blood transfusion practices.^[11,12] Despite the development of various sensitive and specific methods for the detection of TTI is coming in market, but still, the problem of “window period,” asymptomatic carrier, viral strain with genetic mutation, technical errors, and false-negative results is unsettled.^[13-15] There is 1% chance of transmitting TTI with every unit of blood transfused.^[16]

The prevalence of TTD in our study was 1.40%, similar result was found in the study conducted by Kalpana *et al.*,^[17] Sundaramoorthy *et al.*,^[18] Sunderam *et al.*,^[19] Dobariya *et al.*,^[20] and Baruah *et al.*^[21] while higher prevalence of TTI was observed in other studies conducted by various authors in different geographic locations in India, as shown in Table 3. In our study, voluntary donation was almost 99.9%, since early 2015, we have stopped taking replacement donors. Overall prevalence of TTI in males (1.33%) was more compared to female donors (0.08%).

In our study, HIV prevalence was 0.08%, similar results were found in the study conducted by Sunderam *et al.*,^[19] Jaiswal,^[22] Dobariya *et al.*,^[20] and Baruah *et al.*^[21] The prevalence of HIV showed decreasing trend from 0.13% to 0.8% from 2015 to 2019.

Table 1: Year-wise distribution of the total number of donors and seroreactive donors

Years	Total donors	HIV (%)	HbsAg (%)	HCV (%)	RPR (%)	MP (%)	Total (%)
2015	830	2 (0.2)	11 (1.3)	3 (0.4)	1 (0.1)	0	17 (2.04)
2016	1153	0	14 (1.2)	5 (0.4)	0	1 (0.01)	20 (1.73)
2017	1193	0	11 (0.9)	0	0	0	11 (0.92)
2018	1532	2 (0.13)	14 (0.9)	1 (0.1)	1 (0.06)	0	18 (1.17)
Total	4708	4 (0.08)	50 (1.1)	9 (0.2)	2 (0.04)	1 (0.02)	66 (1.40)

HIV: Human immunodeficiency virus, HbsAg: Hepatitis B surface antigen, HCV: Hepatitis C virus, RPR: Rapid plasma reagin, MP: Malarial parasite

Table 2: Seroepidemiological distribution of transfusion-transmitted infections among seroreactive donors

Donor characteristics	HIV (%)	HbsAg (%)	HCV (%)	Syphilis (%)	MP (%)	Total (%)
Sex						
Male	4 (0.08)	48 (1.01)	9 (0.19)	1 (0.02)	1 (0.02)	63 (1.33)
Female	0	2 (0.04)	0	1 (0.02)	0	3 (0.08)
Age group (years)						
18–<27	3 (0.08)	23 (0.45)	2 (0.04)	0	0	28 (0.59)
28–<37	0	14 (0.30)	5 (0.11)	2 (0.04)	1 (0.02)	22 (0.45)
38–<47	1 (0.02)	8 (0.17)	2 (0.04)	0	0	11 (0.23)
48–<57	0	5 (0.11)	0	0	0	5 (0.11)
Occupation						
Student	1 (0.02)	14 (0.30)	1 (0.02)	0	0	16 (0.33)
Working (employed)	1 (0.02)	10 (0.21)	5 (0.11)	1 (0.02)	0	17 (0.36)
Missing	2 (0.04)	26 (0.55)	3 (0.08)	1 (0.02)	1 (0.02)	33 (0.70)
Donor status						
First time	1 (0.02)	38 (0.80)	7 (0.15)	2 (0.04)	0	48 (1.01)
Repeat	3 (0.08)	12 (0.25)	2 (0.04)	0	1 (0.02)	18 (0.38)

HIV: Human immunodeficiency virus, HbsAg: Hepatitis B surface antigen, HCV: Hepatitis C virus, RPR: Rapid plasma reagin, MP: Malarial parasite

Table 3: Transfusion-transmitted infection's data in different states in India

Number of donors	HIV (%)	HbsAg (%)	HCV (%)	RPR (%)	MP (%)	Total (%)	Years	Author	Region
16,152	0.24	1.15	0.11	0	0	1.5	2013–2017	Kalpana <i>et al.</i> ^[17]	Sangli, Maharashtra
9027	0.13	0.42	0.56	0	0.01	1.12	2015–2016	Sundaramoorthy <i>et al.</i> ^[18]	Tamil Nadu
180,477	0.24	1.18	0.43	0.23	-	2.08	2005–2013	Makroo <i>et al.</i> ^[23]	New Delhi
42,439	0.6	1.7	0.8	0.7	-	3.8	2001–2005	Kaur <i>et al.</i> ^[24]	Punjab
41,942	0.7	2.3	0.4	0.05	0.02	3.5	2009–2014	Babu <i>et al.</i> ^[25]	Andhra Pradesh
63,803	0.08	1.01	0.14	0.03	0.33	1.59	2008–2012	Sunderam <i>et al.</i> ^[19]	Jharkhand
2015	0.15	0.84	0	1.29	0.09	2.38	2014–2016	Agrawal <i>et al.</i> ^[26]	Rajasthan
12,001	0.09	1.44	1.11	0.53	-	3.2	2014–2015	Jaiswal ^[22]	Uttar Pradesh
40,971	0.08	0.98	0.09	0.16	0.02	1.33	2011–2015	Dobariya <i>et al.</i> ^[20]	Gujarat
18,279	0.13	0.82	0	0.11	0.3	1.36	2011–2015	Baruah <i>et al.</i> ^[21]	Assam
4708	0.08	1.1	0.2	0.04	0.02	1.4	2014–2018	Our study	Navi Mumbai, Maharashtra

HIV: Human immunodeficiency virus, HbsAg: Hepatitis B surface antigen, HCV: Hepatitis C virus, RPR: Rapid plasma reagin, MP: Malarial parasite

The overall prevalence of HbsAg in our study was 1.1%, similar findings were seen in the study conducted by Kalpana *et al.*^[17] Makroo *et al.*^[23] Sunderam *et al.*^[19] Jaiswal^[22] and Dobariya *et al.*^[20] The prevalence of HbsAg decreased from 1.3% to 0.9% from 2014 to 2019. The overall prevalence of HbsAg was high compared to other TTI. This is in line with the higher prevalence of HbsAg in population.

The prevalence of HCV in our study was 0.2%, similar result, i.e., 0.14% was seen in the study conducted by Sunderam *et al.*^[19] HCV prevalence was higher in other studies conducted by Jaiswal^[22] (1.11%) and Kaur *et al.*^[24] (0.8%). Decreasing trend of HCV from 0.4% in 2014 to 0.1% in 2019 was observed.

The malaria prevalence in our study was 0.02%, more or less similar findings were observed in other studies conducted by Sundaramoorthy *et al.*^[18] Babu *et al.*^[25]

Agrawal *et al.*^[26] Dobariya *et al.*^[20] and Baruah *et al.*^[21] The prevalence of TTD varies depending on the endemicity and geographical location and the quality of kit used for screening.

In our study, the prevalence of TTI in replacement donors was low compared to voluntary donors. Our blood bank has stopped taking replacement donors due to strict guidelines issued by the FDA and other government agencies. Hence, the prevalence of TTI in replacement donors might not be representative or in line with other studies. This was our limitation of our study. We conducted camps in Navi Mumbai region both in rural areas such as gram panchayats and in various locations in city such as colleges, railway stations, government, private, and corporate and non-corporate institutions/companies/agencies. Hence, the prevalence of TTI might be proper representation of the population.

Overall trend of the prevalence of TTI was decreasing as 2.04–1.17% from 2015 to 2019. The decreasing trends might be due to increasing awareness, highly sensitive screening methods, stringent blood donor screening policy, and other measures. Comprehensive blanket study should be performed to find out the exact cause, which was limitation of our study.

CONCLUSION

The prevalence of TTD was more in males, 18–27 years age group, and in the 1st time donors. Proper screening of donors using questionnaires and deferral guidelines should be followed to prevent transmission of TTI. Thorough investigation is needed to monitor risk of TTD in socioeconomic strata.

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