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A Study of Seroprvalence of Transfusion Transmitted Infections (TTIs) Amongst Blood Donors in a Tertiary Care Centre of North Maharashtra: An 8.5 Years Study

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ABSTRACT
Blood transfusion is an important lifesaving and integral part of medical care and treatment. It poses a potential threat of transmission of infections to recipients. Various screening tests are conducted to minimize the risk of TTIs. We assessed the seroprvalence in blood donors in our blood bank for five major infections like Human Immunodeficiency virus (HIV), Hepatitis B, Hepatitis C, Syphilis and Malaria. The aim of this study is to determine the seroprvalence in healthy blood donors in a tertiary care blood bank. Total number of 34948 units of blood were collected from healthy voluntary donors and tested for HIV, Hepatitis B surface Antigen (HBsAg), Hepatitis C, Syphilis and Malaria. This study was done for a duration of 8.5 years, during the period of January 2016 to June 2024 at Government Medical College and General Hospital Blood Bank, Jalgaon. It was observed that amongst 34948 donors, 20 (0.06%) tested positive for HIV, 232 (0.66%) were positive for HBsAg and 26 (0.07%) were positive for HCV. Total 278 Units (0.8%) of blood were discarded due to presence of infectious agents. Strict quality control, selection of donors by proper counselling and training of blood transfusion personnel including deferring of suspected donors may help in improving the blood safety.

INTRODUCTION

Transfusion of blood and blood products is one of the important life saviour amongst all the interventions in medical and surgical management. It carries a potential risk of transmitting infections like Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Syphilis, malaria and infrequently Toxoplasmosis, Brucellosis, Cytomegalo Virus (CMV), Epstein Barr Virus and Herpes. The American Association of Blood Banks (AABB) guidelines show that TTIs involve diversity of pathogens[1]. Transfusion Transmitted Infections (TTIs) detection before blood transfusion limits if not eliminate the spread of infective diseases. Infections such as HIV, HBV, HCV are of great concern because of their prolonged viraemia and carrier or latent state. Countries are classified on the basis of the endemicity of the infections, like HBV into high (8% or more), intermediate (2-1%) or low (less than 2%) incidence countries[2]. Blood transfusion safety and infectious risk is divided between HICs (High income countries) and LMICs (low-and middle income countries)[3]. TTI risk is relatively high in low-income countries compared to high-income countries[4]. According to Ministry of Health and Family Welfare (Government of India) guidelines under the Drugs and Cosmetics Act, 1945 (Amendments 2020), all blood donors should be screened for five major infections including HIV, HBV, HCV, syphilis and malaria[5,24]. This helps in measuring their severity and to hold back the transmission to minimum. Approximately 30% of the world's population or about 2 billion persons have serological evidence of either a current or past infection with HBV. Preventing the TTI in developing countries is difficult as the resources required are not always available even when policies and strategies are in place. These strategies are effective but transmission of diseases still occurs, because of the inability of the tests to detect the disease in the pre-seroconversion or 'window' phase of their infection. Continuous improvement in procedure, careful donor selection, proper use of the sensitive screening tests, adequate quality control measures and effective inactivation procedures can ensure the elimination, or reduction to some extent, of the risk of acquiring transfusion transmitted infections. The present study is aimed to estimate the prevalence of HIV, HBV, HCV, Syphilis and malaria infections among blood donors, helping in increasing the awareness of infection related complications of blood transfusion in the community.

MATERIALS AND METHODS

Our study is a cross-sectional observational study carried for 8.5 years between January 2016 to June 2024. Strategy I used for screening of donors as per NACO and SBTC guidelines. In strategy I, we use single test which is highly sensitive i.e ELISA

Inclusion Criteria:

- Physically fit donors including non-pregnant non-lactating females.
- Age group of 18-65 years.
- Weighing more than 45 kg.
- Hemoglobin levels <or equal to 12.5 g/dL.

Criteria was taken into account according to the Standard Operating Procedure in the Blood Centre as per the criteria listed in Blood Donor Selection and Referral[21].

Exclusion Criteria:

- Current history of taking any antibiotic, antiviral, antimalarial or antiretroviral therapy.
- High-risk behaviour, asthmatics on medication, patients on anticoagulants, history of epilepsy, etc. Criteria was taken into account according to the Standard Operating Procedure in the Blood Centre as per the criteria listed in Blood Donor Selection and Referral[21].

Study Population: The present study was conducted in Government Medical College and Hospital Blood Bank, Jalgaon, North Maharashtra, India. A total of 34948 donors were analysed for the prevalence of TTI over a period of 8.5 years from January 2016 to June 2024. It included voluntary donors from various blood donation camps organized by blood bank from time to time in and around the city, walk in donors, students, doctors, faculties, nursing staff, employees of the institution and neighboring colleges. The donors were screened by trained medical officers for detailed medical history and physical examination.

Study Procedure: Detailed pre-donation questionnaire in English as well as vernacular Marathi language was included in the registration form to assess the health status of the donor. Information included name, age and gender, date of birth, marital status, occupation and address for communication. This also included general well-being, time of last meal, sleep adequacy, history of jaundice, heart diseases, renal diseases, sexually transmitted diseases, high risk behaviours, current febrile illness, tattooing, alcohol intake, drug history, past history of surgery, prior hospitalization, history of blood transfusion and donation, history of vaccination was recorded. Pre-donation counselling regarding procedure of blood donation, post donation care and the outcome of donation was also done. Those found fit and willing gave their written consent and a unique identification number was allotted to each unit of blood bag. Under aseptic conditions, blood was collected in blood bag, 2ml in plain vacationer and 2ml in EDTA collected.

Serological Analysis: The blood samples were screened for detecting infection of HIV, HBV, HCV all by 3rd and 4th generation ELISA methods using NACO approved commercially available kits. Screening for syphilis was done by Rapid Plasma Reagin (RPR) method. Test for malaria was performed by Rapid antigen test and peripheral blood smear examination. Tests were performed according to the manufacturing guidelines. All reactive samples were subjected to repeat testing before labelling them as seropositive. The donated blood was discarded as per the protocol whenever the pilot donor sample and blood bag segment both were found positive for any TTI.

RESULTS AND DISCUSSIONS

Of the 34948 consecutive blood donors included in the study, 33942 (97.12%) were male while 1006 (2.88%) were female donors. The gender distribution of donors who were positive for TTI is summarized in (Table 1). Number of positive male donors were more than female donors in all 8.5 years (Table 2). Out of the 34948 blood donors, 278 (0.8%) were tested reactive for TTI (Table 3). The overall seroprvalence of HIV, HBV, and HCV were found to be 0.06%, 0.66%, 0.07% respectively (Table 4, Fig. 1). Trends of annual prevalence are shown in (Fig 2 and 3). (Table 5) shows co-infection of seropositive donors. In the present study HBsAg positive cases were the most common TTI among the positive donations. Fluctuations were seen in prevalence of HIV, HBV and HCV. Prevalence of syphilis and malaria was nil in our study.

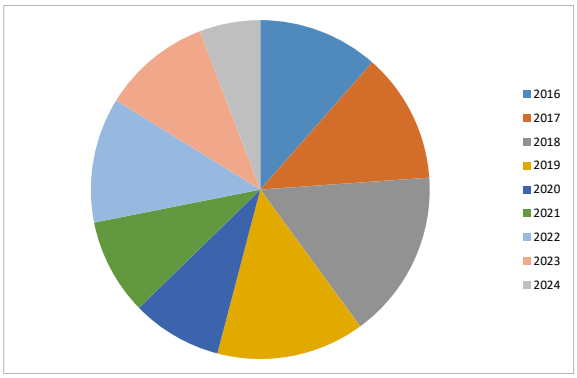

Fig 1: Year-Wise Blood Unit Collection

Table 1: Distribution of Male and Female Donors Among Total Blood Donors

Year	Total no. of Donors	Male Donors No.	Male Donors %	Female Donors No.	Female Donors %
2016	4013	3906	97.33	107	2.67
2017	4334	4231	97.62	103	2.38
2018	5619	5457	97.12	162	2.88
2019	4931	4748	96.29	183	3.71
2020	3015	2922	96.92	93	3.08
2021	3206	3138	97.88	68	2.12
2022	4170	4095	98.20	75	1.80
2023	3632	3546	97.63	86	2.37
2024	2028	1899	93.64	129	6.36
Total	34948	33942	97.12	1006	2.88

Table 2: Distribution of male and Female Donors Among Positive Cases

Year	No. of Positive Cases	Male Donors No.	Male Donors %	Female Donors No.	Female Donors %
2016	35	35	100	00	00
2017	55	55	100	00	00
2018	54	52	96.30	02	3.70
2019	40	40	100	00	00
2020	27	27	100	00	00
2021	21	21	100	00	00
2022	23	23	100	00	00
2023	16	16	100	00	00
2024	07	07	100	00	00
Total	278	276	99.28	02	0.72

Table 3: Prevalence of TTI Among Blood Donors During January 2016 To June 2024

Year	Total No. Of Donors	Total No. Positive Cases	HIV Positive Cases No.	HIV Positive Cases %	HBsAg Positive Cases No.	HBsAg Positive Cases %	Hcv Positive Cases No.	Hcv Positive Cases %
2016	4013	35	05	14.29	30	85.71	00	00
2017	4334	55	06	10.91	46	83.64	03	5.45
2018	5619	54	02	3.70	39	72.22	13	24.07
2019	4931	40	02	5.00	33	82.5	05	12.5
2020	3015	27	00	00	24	88.89	03	11.11
2021	3206	21	01	4.76	18	85.71	02	9.52
2022	4170	23	01	4.35	22	95.65	00	00
2023	3632	16	02	12.5	14	87.5	00	00
2024	2028	07	01	14.29	06	85.71	00	00
Total	34948	278	20	7.19	232	83.45	26	9.35

Table 4: Total Seroprvalence in 8.5 Years (January 2016 TO June 2024)

Year	Number of Donors	Number of Seropositive Donors	Seropositivity (%)
2016	4013	35	0.87
2017	4334	55	1.27
2018	5619	54	0.96
2019	4931	40	0.81
2020	3015	27	0.90
2021	3206	21	0.66
2022	4170	23	0.55
2023	3632	16	0.44
2024	2028	07	0.35
TOTAL	34948	278	0.80

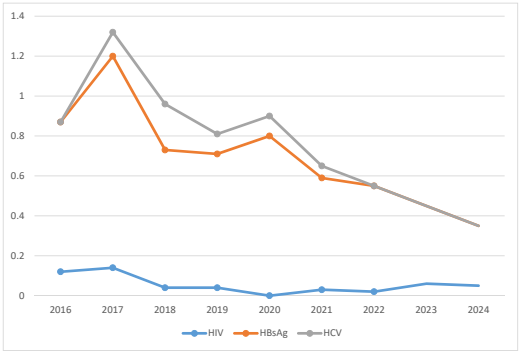

Fig. 2: Trends of Annual Prevalence Of TTI's Over 8.5 Years

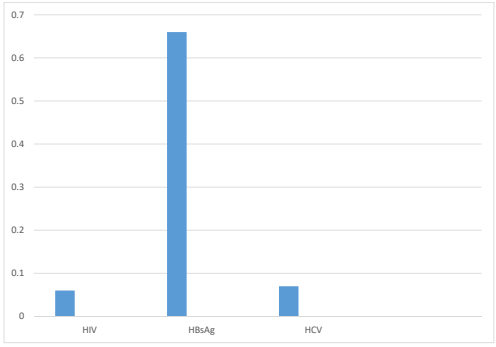

Fig. 3: Trends of Annual Prevalence of TTI's Over 8.5 Years

Table 5: Co-Infection of Seropositive Donors

Serial No.	Co-Infection	No. Of Combination Seropositive Donors	Total No. of Seropositive Donors
1.	HIV and HBsAg	252	278
2.	HBsAg and HCV	258	278
3.	HCV and HIV	46	278

Blood transfusion is an important therapeutic procedure that can be life-saving. It can replace blood lost through injury, surgery and Thalassemia major patients. Transfusion of blood holds a potential risk to transmission of diseases such as HIV, Hepatitis B, Hepatitis C, syphilis, malaria, Epstein-Barr virus, cytomegalovirus and many more. Our study included 34948 blood donors over a period of 8.5 years from January 2016 to June 2024, tested for HIV, HBsAg, HCV, syphilis and malaria. Overall prevalence of TTI in our study was 278 out of 34948 (0.80%)., of which 20 cases were HIV reactive (0.06% of total donors), 232 cases were HBsAg reactive (0.66% of total donors), 26 cases were HCV reactive (0.07% of total donors) and no cases positive for syphilis and malaria. HIV causes Acquired Immune Deficiency Syndrome (AIDS) which was first identified in 1983[19]. The reports in 1980 suggested that about 50% of Hemophilia A patients had HIV antibodies[20]. In 1985, USA introduced HIV antibody test as screening test for blood donations[22]. The National AIDS Control Organization (NACO) estimated 3.14 million cases in India in the year of 2023[18]. Our study shows HIV seropositivity of 0.06% that is comparable with other studies[7,16,17]. Blumberg discovered HBV in 1964[23]. Before 1970s, significant number of multiple transfusions had transfusion transmitted HBV. Our study shows HBsAg positivity of 0.66% comprising the highest amongst all transmitted diseases. Other studies[7,17] reported seropositivity ranging from 1.25-1.96% and significantly high studies by Sawke[25] and Dayal[26]. In our study, HBV was most prevalent indicating the need for organized programme for hepatitis B vaccination. Our study shows HCV seropositivity of 0.07% , comparable with the study done by Shejwal[14]. Various studies conducted in India shows wide range of prevalence lowest been 0.06% in study by Hilda Fernandes[15] and highest 1.09% in study by Gupta[16]. Number of female donors was consistently low throughout 8.5 years. Similar trend has been noted in previous reports. This could be due to high incidence of anaemia in the Indian women especially in the child bearing age. Spreading awareness of importance of nutrition among female population can help in increasing the number of female donors. Our study has 1006 female donors (2.88% of total blood donors) and 33942 male donors (97.12% of total blood donors) comparable with studies done by Qureshi[27] (2.2% female), Mukherjee[11] (1.87% female) but not consistent with Sushma[9] (8.21% female), Panda[28] (8.3% female) and Karmakar[29] (15% female). Declining HBs Ag and HIV prevalence probably reflects greater awareness and wider acceptance of health care measures and use of disposable syringes. A total number of 278 units (0.80% of total) of blood were discarded due to seropositivity. Certain studies have used more sensitive methods such as Polymerase chain reaction (PCR) and Nucleic Acid Testing (NAT) which detects latent infections in the window period. Whereas serological methods remain the best of choice for large-scale screening of TTIs1.

Limitations: The study has certain limitations to reflect the prevalence due to the donor selection process. If excludes population below 18 years and above 65 years. Also excludes the minimally fit population. There might be underestimation of the frequency due to window period. Diagnostic tests used here are serological, whereas nuclei acid based techniques are better.

CONCLUSION

In our study, the overall prevalence of TTIs was 0.80% over the period of 8.5 years. Individual seroprvalence for 8.5 years duration was 0.06% for HIV, 0.66% for HBV and 0.07% for HCV, with HBV having the highest incidence. 'Blood saves lives' was the theme of World Health Organization (WHO) in 2000[30]. Safe blood transfusion is necessary to avoid transmission of infections. Priority should be given on epidemiological research focused on the identification of risk factors and well-targeted sensitization campaigns.

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