

Seroprevalence of Transfusion Transmitted Infections in Blood Donors - A 6 Year Experience in Tertiary Care Hospital

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Abstract

Blood transfusion is a lifesaving tool for millions of patients. However, there is always a risk of transfusion transmissible infections (TTI) in the blood and its products if not properly screened. There is increasing incidence of transfusion transmitted infections (TTI including Hepatitis B virus (HBV), Hepatitis C virus (HCV), Human immunodeficiency virus (HIV), Syphilis and malaria in developing countries. Hence, it is essential to monitor safety of blood transfusion.

Aim: The aim of this study is to determine the Seroprevalence of transfusion transmitted infections in healthy blood donors in a tertiary care blood bank.

Materials and Methods: A retrospective study was based on records of voluntary blood donors over a period of 6 years from January 2016 to December 2021 in a tertiary care blood bank. The serum samples were screened for Hepatitis B surface antigen (HbsAg), antibodies to Human Immunodeficiency Virus (HIV) type 1 and 2, Hepatitis C virus (HCV) and syphilis using Enzyme Linked Immunosorbent assay and rapid plasma reagin screening test.

Results: Total of 57,777 donors were screened and their data were analysed. Majority of the donors were male (94.6%). The overall seroprevalence of HIV, HbsAg, HCV and Syphilis were 0.045%, 4.5%, 0.015%, 0.006%. The most common TTI prevalence was that of Hepatitis B followed by HIV.

Conclusion: In our study we found a low prevalence of TTIs among voluntary blood donors. This may be due to better selection of donors. There should be public awareness regarding voluntary blood donation. Careful donor screening and selection and the use of highly sensitive tests help to reduce the TTIs.

Keywords: Seroprevalence, Transfusion Transmitted Infections, Blood donors.

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Introduction

Blood transfusion is an integral component of medical care management and treatment. Blood products are an essential lifesaving element in certain conditions like hemolytic anemia, severe anemia, major trauma

causing severe blood loss and major life saving surgeries [1]. However, unsafe transfusion leads to many life threatening complications. According to world Health Organisation (WHO) 118.2 million

donations are collected globally with more than 58% of it is from developing countries [2]. Transfusion transmitted infection are those which are transmitted to the recipients through various blood and blood products. The causative organisms may be bacteria, viruses, prions and parasites. The major TTI are HBV (Hepatitis B), HIV (Human Immunodeficiency Virus), HCV (Hepatitis C Virus), Syphilis (*Treponema Pallidum*) and malarial mosquito (Parasite). The transfusion transmissible infections cause prolonged viremia and carrier state in the recipients. These infections can also be fatal and life threatening disorders.

The WHO strongly recommends that all blood donations must be screened for the above five infectious agents. Hence to achieve zero risk of transmitted infections, many stringent protocols are carried over like strict donor selection criteria, maintaining donor deferral registries, standardized laboratory testing and pathogen inactivation of collected blood, effective discarding techniques for reactive units.

But this is challenging because there is always a risk of transmission of TTI during immunological window period of early infectivity, during which the screening tests are unreactive. Factors like rare pathogens, laboratory testing manual errors, silent carriers, high cost of sensitive and specific kits add to the burden. In India, Hepatitis B is a major problem in blood transfusion practice because of low viral load and routine ELISA does not detect the mutant strains. [3]. TTI is also a threat to health care providers. One unit of blood carries 1% risk of transfusion associated problems which include TTI [4]. Hence the risk of transmission of infections is always present.

This study aims to estimate the prevalence of transfusion transmitted infection (TTI) in voluntary donors in a Government tertiary care hospital. It will roughly help us to find out the prevalence of TTI among general

asymptomatic population. This study also helps to monitor the efficiency of currently employed screening procedure and to assess the safety of blood products supply.

Material and Methods

This is a retrospective study carried out in a tertiary care government hospital blood bank over a period of 6 years from January 2016 to December 2021.

Study Population

All the donors (voluntary) were included in the study.

Inclusion Criteria

Blood donors aged between 18 and 60 years with hemoglobin concentration of 12.5% or more, body weight 45 kg or more, no history of fever in the past 5 days, no history of Hepatitis B, Hepatitis C, STDs and jaundice in the last one year.

Exclusion Criteria

Careful history taking helped to eliminate professional donors, donors who have received blood products in the past. All the reactive samples were subjected to repeat testing using another kit manufactured by different company. Confidentiality of reports was maintained as per standard guidelines.

Testing Techniques

The samples from all blood donors were collected in vacutainers at the time of blood donation and screened for HIV, Hepatitis B virus, Hepatitis C virus, syphilis and malaria.

Human Immunodeficiency Virus Serology

Microelisa test (J. Mithra and co Pvt. Ltd) to test HIV 1 and HIV 2. It is a fourth generation enzyme immunoassay method. A third generation kit was used till 2020. One step Rapid Immunochromatographic test is also available.

Hepatitis B Surface Antigen Serology

HBSAg third generation ELISA kits (VOXJUR Bio Ltd) were used to detect HbsAg. One step Rapid immunochromatographic test for quantitative detection of Hepatitis B surface Ag is also available.

Hepatitis C Virus Serology

A third generation ELISA kit (Transisia Biomedicals Ltd) was used to detect antibodies against HCV.

Syphilis Serology

In this Rapid Plasma Reagin RPR screening test is done (YUVRAJ BIOBIZ incubator India). It is a macroscopic flocculation card test for detection of antibody like substrate present in reactive donors.

Malaria

Malaria was detected by screening peripheral smear stained by Leishmann stain.

Quality Control

Internal and external quality controls were carried out.

All the reactive cases were retested before declaring as reactive and discarded according to standard biomedical waste disposable procedure.

Ethical approval was obtained from ethical committee. No study participants were included at any point. Informed consent was not sought as the study was performed on secondary data.

Results

The study included a total of 57,777 healthy donors. All of the donors were truly voluntary donors. Most of the donors in our study were males 54,659 (94.6%), while the female's donors constituted only 5.4% (3118) [Table 1]. The voluntary donor's ages ranged from 18 to 50 years.

Table 1: Total blood collection and sex distribution of donors.

Year	Male%		Female%		Total donors%	
2016	7684	92.7	601	7.3	8285	100
2017	10431	92.7	820	7.3	11251	100
2018	9937	94.8	544	5.2	10481	100
2019	9878	94.5	571	5.5	10449	100
2020	7669	97.1	224	2.9	7893	100
2021	9060	96.1	358	3.9	9418	100
TOTAL	54659	94.6	3118	5.4	57777	100

Prevalence of HIV was 0.045 % (26 cases). Seroprevalence of Hbs Ag in total donors was 4.5 % (260 cases). Seroprevalence of VDRL among all donors was 0.015% (9 cases). The seropositivity of HCV in total donors was 0.006% (4 cases). None of the donors were positive for malaria. The rates of seropositivity was highest for HBV followed by HIV, HCV and VDRL in descending order. [Table2] A High prevalence in males was observed, and the seropositivity is high in 18-30 years age group. [Table 3]

Table 2: Yearly seroprevalence of TTI in donors

Year	HIV	HBV	HCV	VDRL	Malaria	Total TTI
2016	5	42	1	0		48
2017	7	57	1	0		65
2018	7	35	1	0		43

2019	2	41	3	2		48
2020	2	34	1	1		38
2021	3	51	2	1		57
Total	26	260	9	4		299

Table 3: Age wise distribution of TTI

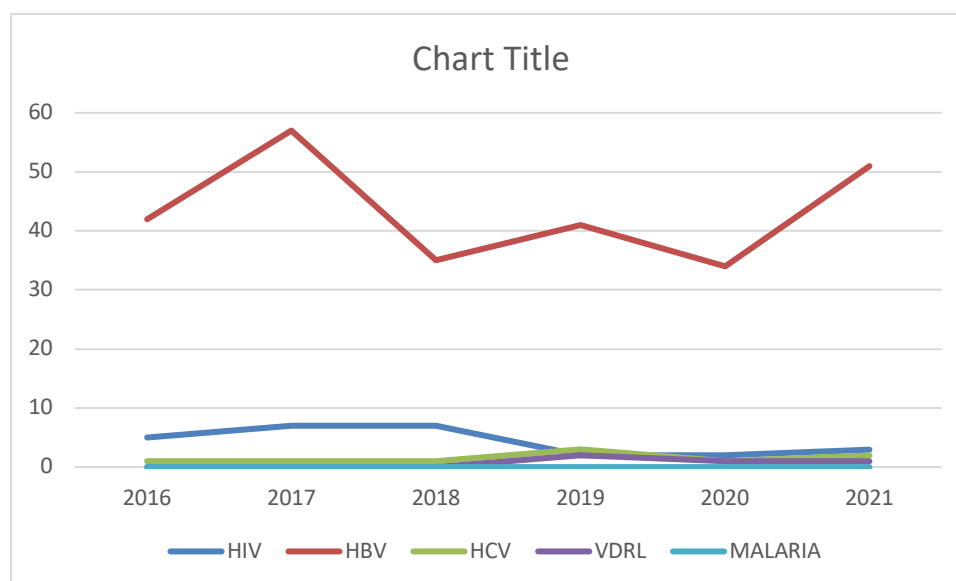
Year	18-30	31-40	41-50	Total
2016	34	13	1	48
2017	50	15	-	65
2018	28	12	3	43
2019	35	12	1	48
2020	32	15	1	38
2021	42	9	6	57

The prevalence of TTI is maximum in 2017 and lowest in 2018. The prevalence of HIV was highest in 2017, 2018 and has declined over the study period. HBV had highest prevalence rate in 2017 and lowest in 2020. There was no coinfection reported during the study period of 6 years. [table 2,3]. Prevalence of TTIs in different parts of India is depicted in table 4.

Table 4: Comparison of TTIS prevalence rate in different parts of India [5]

Place	HIV%	HBsAg%	HCV%	Syphilis %
Delhi	0.56	2.23	0.66	
Haryana	0.3	1.7	1	0.9
West Bengal	0.28	1.46	0.31	0.72
Karnataka	0.44	1.86	1.02	1.6
Present study	0.045	4.5	0.015	0.06

Figure 1: shows trends in seroprevalence of HIV, Hepatitis B surface Antigen, hepatitis C virus and syphilis over the 6 years period.

**Figure 1: Relative trend in seropositivity of TTI**

Discussion

Safe blood transfusion services are a cornerstone of an effective, high quality health care system. But as a double edged sword, contaminated blood products is a potential source of TTIs and can prove to be fatal [6].

American Association of blood banks has recently updated 77 organisms with a potential for transfusion transmission [7]. The relative prevalence and cost of detection prevents government institution as ours, from employing many screening tests. The risk of TTI has declined dramatically in developed countries .But in developing countries , still the prevalence of TTI are of great concern [3] HIV, Hepatitis B, Hepatitis C are major public concern in developing countries as ours. These infections can be transmitted parenterally, vertically or more commonly through high risk sexual behaviors. Blood transfusion is one among the above and is a potential route of transmission of TTIs [8]

We found that our donors are all voluntary donors. Increasing awareness about voluntary blood donation, organizing blood donation camps by various organizations may be the causes for voluntary donations. This finding is comparable to other studies done by Das. S. Harendra Kumar *et al*, Tambse *et al* [9-10]. But in contrary, few studies in India show predominance of replacement donors, which may be due to lack of awareness among people regarding voluntary blood donation. [11-12]

A total of 57,777 donors have donated blood during the study period of 6 years of (2016-2021). There was a slight decline of number of donors in 2019-2020. Covid-19 Pandemic and the resultant lockdown which led to decrease in voluntary blood donation camp may be main reason for this.

The overall seroprevalence of various TTIS among healthy voluntary donors is 0.5%.

Low seropositivity as compared to other studies may be due to increased public awareness, stringent proper donor counseling procedure.

Most of the seropositive donors in our study belong to 18-30 yrs age group. Our study is in concurrence with Koshy *et al* [13] and Karmakar *et al* [14]. This may be due to sexual transmission of diseases in this age group and pregnant females being in this age group requiring frequent transfusion for anemia or postpartum hemorrhage.

Most of the donors in our study were male 54,659 (94.6%) which is comparable to other studies. The number of female donors was 3118 (5.4%). This may be due to high incidence of anemia in Indian women who are most likely to be rejected while screening for blood transfusion and higher incidence of sexually transmitted infections in male [27].

The prevalence of TTIs among Indian population seem to be ranging as follows: HBV – 0.66% to 12%, HCV- 0.5% to 1.5%, HIV – 0.084% to 3.87 %, Syphilis 0.85% to 3% respectively [15]. Our concern for blood safety was mainly due to HIV infection, but hepatitis B was the most prevalent infection in our study. Our study showed seroprevalence of HBV at 4.5%. Variable results of 0.66% [16], 2.45% [17], 3.44% [18], 5.86% [19], 25% [20] have been reported in other studies. HBV incidence is higher in our population.

HBV positivity indicates a carrier state in active population. These seropositive donors may progress to develop chronic hepatitis, cirrhosis and even progress to hepatocellular carcinoma [21]. HBV is highly contagious and the course of the disease depends on many factors such as, HBV subtypes, subgenotypes and escape mutants. Hepatitis B virus is of public concern through reinfection and occult infection. Post

transfusion HBV infection rate is high due to the fact that HBV circulates at a very low and undetectable level for screening assays. Hence it is at most important to detect Hepatitis B during window period. Nucleic acid testing (NAT) assays are very useful in the above scenario. However, the cost of this assay is high which makes it unaffordable in many blood banks [22].

The HIV seroprevalence rate in our study was (0.045%). We observed a decreasing trend of HIV prevalence from (2019-2021) similar to other studies [23-24]. Some studies have shown an increasing trend like Sabhar *et al* [25] and Patel *et al* [26]. These discordances may be due to difference in study population, study period and study years.

According to WHO report, viral dose in HIV transmission through blood is so large than one HIV positive transfusion lead to death on an average after 2 years in children and 3-5 years in adults [4]. HIV transmission during window period can be minimized if blood is collected from low risk targeted general public. In a country like India with significant number of window period donations, NAT can be judiciously introduced to prevent seropositive cases.

The prevalence of hepatitis- C in our study was 0.015% similar to that reported by Dhruva *et al* [28]. Hepatitis C is a blood borne infection and the chances of progression to cirrhosis and hepatocellular carcinoma is more when compared to HBV.

The seropositivity for syphilis in our study was 0.006 % which is comparable to other Indian studies [29]. Syphilis, one among the sexually transmitted disease is most commonly associated with increasing risk of HIV infection.

According to the National AIDS control organization donor affected with malaria should be deferred for at least next 3 months [30]. In our study we had no seropositive

case for malaria. Proper history taking regarding fever and effective screening may be the reason behind non prevalence of malaria.

Conclusion

As blood donors are considered to represent a healthy population, the prevalence of TTIS in donor is a clear indication of these infectious agents in our population. World Health Organisation theme for 2000 AD was "BLOOD SAVES LIVES". To achieve the transmitted blood should be free of TTIs. To limit TTIs measures like promotion of voluntary blood donation sensitization, recruitment of more female donors, screening of donated blood by highly sensitive screening assay, and research utilizing nucleic acid technology must be implemented.

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