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SHORT COMMUNICATION OPEN ACCESS

A cross sectional study on seroprevalence of transfusion-transmitted infections among blood donors at tertiary care hospital

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Abstract

Background: Transfusion transmitted infections (TTIs) are the major problem associated with blood transfusions, and accurate projections of TTI risk are essential for tracking the safety of the blood supply. This research recognized the seroprevalence trends and shifting patterns of TTIs, in a multispecialty hospital. The aim of the study was to assess the prevalence of TTI infections among blood donors and to compare the changing seroprevalence trends in blood donors.

Materials and methods: A cross sectional study was conducted from January 2017 to December 2022 at KIMS Blood Centre, Secunderabad, India. All donors reporting to the blood centre during the period were screened for human immunodeficiency virus (HIV) 1 & 2, hepatitis C viruses, hepatitis B surface antigen (HBsAg), total hepatitis B core antibody (aHBC) and hepatitis B surface antibody (aHBs), malaria and syphilis. Screening of HIV, hepatitis B and hepatitis C viruses were done by chemilumiencies, while syphilis and malaria were screened by RPR method.

Results: A total of 69741 voluntary blood donors were screened, of which 68857 were males and 1083 were females. Seropositivity of HIV, hepatitis B, hepatitis C viruses, malaria, syphilis were 0.36 %, 0.59%, 0.48%,0.01% and 0.07% respectively. Addition tests were aHBC and aHBs which showed among all the potential donors, the most common TTI prevalence at our centre was hepatitis B followed by HCV, HIV, syphilis and malaria.

Conclusion: Public awareness, careful donor selection, vigilance, and adoption of newer techniques for early detection are needed to reduce the incidence of TTIs.

Keywords: human immunodeficiency virus; HIV; hepatitis B; hepatitis C; seroprevalence; transfusion transmitted infections

Introduction

Knowing the prevalence of transfusion transmitted infections (TTIs) is critical for monitoring blood transfusion safety by ensuring improved collection and processing of blood components [1].

In India, it is mandatory to screen blood donors for HIV, hepatitis B, hepatitis C, syphilis and malaria. The etiological agents responsible for acquired immune deficiency syndrome (AIDS), hepatitis B, and hepatitis C infections are HIV, HBV, and HCV respectively. The aforementioned infections have the potential to induce extended carrier states, persistent viraemia and infectivity, chronic ailments, and elevated levels of morbidity and mortality as a result of chronicity. Additionally, they may lead to liver cirrhosis, hepatocellular carcinoma (HCC), and opportunistic infections [2, 3]. The transmission of these viruses can occur via various means such as direct

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exposure to infected blood and blood derivatives, organ transplantation, hemodialysis, intravenous drug use, blood transfusion, tattooing, and sexual contact [4, 5].

A retrospective record based study was conducted at our blood centre on blood donors. This blood centre is one of the largest blood centre in Telangana supporting a 1000 bedded multispeciality hospital.

Materials and methods

A total number of 69741 samples of blood were collected from donors from January 2017 to December 2022 at KIMS Blood Centre, KIMS Hospital, Secunderabad. Donors were chosen by collecting a history, performing a clinical examination, and adhering to strict donor selection criteria in order to avoid professional donors.

Samples were screened by Chemilumience method (Ortho vitros) for HIV-1 and HIV-2 antibody, anti-HCV, and HBsAg. The blood donors were screened for aHBC and aHBs by the same Chemilumience equipment. Rapid syphilis antibody test kits (AbChek) are used for screening syphilis and Abcheck rapid malaria/ PAN antigen test kits for screening malaria parasite. All reactive samples were labeled as seropositive, and were discarded as per standard operating procedure (SOP).

Results

In the present study, a total of 69741donation were done, 68857 (98.7%) were males and 887 (1.2%) were females (Table-1). Gender is also linked to blood donation deterrents. Women more often are cited to have medical issues like low hemoglobin and hormonal deficiencies or problematic veins as impediments to blood donation (Table 1).

Table 1: Donor sex distribution.

Year	*Total*	*Male n(%)*	*Female n(%)*
2017	12220	12092(98.6)	128(1.1)
2018	12072	11932(99.1)	140(1.2)
2019	12737	12621(99.1)	119(0.9)
2020	9373	9220(98.4)	153(1.6)
2021	11578	11411(98.6)	167(1.4)
2022	11761	11581(98.5)	180(1.5)
Total	69741	68857	887

The prevalence of HIV, HBsAg, HCV, syphilis and malaria was 249(0.4%), 412 (0.6%), 338 (0.5%), 54(0.08%), 7(0.01%) respectively (Table 2). Highest prevalence observed was HBV (HBsAg combined with aHBC positivity and aHbS negativity) followed by HCV, HIV, syphilis and malaria. Anti Hbc and Anti Hbs was 1633 (2.3%) out of 69741 total donors, which was the highest among the total seropositivity (Table 2).

Table 2: Year wise distribution of TTI's in blood donors.

TTI's	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*Total (%)*
HIV	20(0.2)	43(0.4)	50(0.4)	25(0.3)	57(0.5)	54(0.5)	249(0.4)
HbsAg	91(0.7)	75(0.6)	81(0.6)	42(0.4)	65(0.5)	58(0.5)	412(0.6)
HCV	71(0.6)	64(0.5)	57(0.4)	59(0.6)	51(0.4)	36(0.3)	338(0.5)
Syphilis	2(0.02)	1(0.01)	27(0.2)	19(0.2)	5(0.04)	0(0)	54(0.08)
Malaria	0(0)	1(0.01)	3(0.03)	3(0.03)	0(0)	0(0)	7(0.01)
Total reactive	184(1.5)	184(1.5)	218(1.7)	148(1.5)	178(1.5)	148(1.3)	1060(1.5)
Total donors	12220	12072	12737	9373	11578	11761	69741

The similar study was conducted at our centre from January-2009 to December-2013, a total of 39780 voluntary blood donors were screened and the 5 year prevalence in that study was HIV, HBsAg, HCV and syphilis were 0.26%, 1.28%, 0.51% and 0.03% respectively. In the present study, prevalence of seropositivity of HIV, hepatitis B, hepatitis C viruses, malaria, syphilis were 0.357%, 0.59%, 0.48%,0.01% and 0.07% respectively (Table 3). Seroprevalence of anti-HbC and anti-HbS was on average 2.3%.

Discussion

Blood transfusion is thought to be a risk factor for the spread of life-threatening infections [6]. Among them HCV, HBV and HIV are the most concerning.

According to NACO technical report on HIV estimates 2021, prevalence of HIV is 0.47% in Telangana and there was a 71% decline in ANI at national level from 2010–2021 [7]. At our institute there HBV, syphilis infections also showed a decrease over the years, whereas there is consistency in the seroprevalence of HIV and HCV infection in the blood donors.

During acute or chronic infection, there is a high concentration of a virus protein, hepatitis B surface

antigen (HBsAg) in the bloodstream. HBsAg suggests infection. Normal immunological response to infection creates HBsAg antibodies, whereas anti-HBs indicate hepatitis B viral recovery and immunity. Hepatitis B vaccines also create anti-HBs.

Table 3: Observations on seroprevalance of blood donors.

Observations	*Jan 2009 - Dec 2013*	*Jan 2017 - Dec 2022*
Total no. of donors	39780	69741
Male donors	38697 (97.2%)	68857 (98.7%)
Females donors	1083 (2.73%)	887 (1.2%)
HIV prevalence	0.26%	0.37%
HBsAg prevalence	1.28%	0.59%
HCV prevalence	051%	0.48%
Syphilis prevalence	0.03%	0.08%
Malaria	Nil	0.01%

Acute hepatitis B causes the development of total hepatitis B core antibody (anti-HBc), which persists for the rest of one's life. Anti-HBc indicates unspecified hepatitis B virus infection [8].

The seroprevalence of TTIs in the present study was highest for HBV infection (0.59%). This finding was almost similar to study conducted by Meena et al (0.71%) [9], and Nalini et al (0.66%) [10]. It was higher than Biswal et al (0.394%) [11], but lower than study done by Cherukat et al (2.15%) [12] (Table 4).

Table 4: Comparison of various studies on seroprevalence of blood donors.

Study	*HIV*	*HBV*	*HCV*
Meena et al. [9]	0.07	0.71	0.06
Nalini et al. [10]	0.08	0.66	1.09
Biswal et al. [11]	0.128	0.39	0.12
Cherukat et al. [12]	0.30	2.15	0.51
Our study	0.35	0.59	0.48

The seroprevalence of anti Hbc positive with anti Hbs negativity is 2.3%. Discarding HBcAb reactive blood provides more safety, but it's a double-edged sword. It causes around 2.3% of blood units to be wasted.

The occurrence of HCV among blood donors worldwide ranges from 0.4-19.2%, while in India, voluntary blood donors have an HCV incidence of 0.12-4% [13, 14]. There is currently no vaccine or effective treatment for this disease, and it spreads widely, becomes chronic quickly, and has a high acute-to-chronic conversion rate [15]. At our institute HCV prevalence was 0.48% in this study (2017-2022), previously it was 0.51% (2009-2013), showing slight reduction in the prevalence rate.

The prevalence of risk factors and the incidence of cirrhosis determine the prevalence of HCC in various geographic regions; in actuality, 70-90 percent of HCC cases are caused by liver cirrhosis. Infection with the hepatitis B and/or C virus and extensive alcohol consumption are two major risk factors for HCC. Chronic HBV and HCV infections are believed to be responsible for at least 75% of liver cancer cases. In addition, it has been reported that HBV is responsible for 50–80% of HCC cases, whereas HCV is responsible for 10–25% of HCC cases. Additional environmental and familial risk factors for HCC include diabetes, obesity, nonalcoholic steatohepatitis, dietary aflatoxins, and hereditary hemochromatosis [16, 17].

RPR test provides an extra layer of protection by preventing the transfusion of blood from people with high risk behaviour. In terms of diagnosing syphilis, the detection of anti-cardiolipin antibodies is neither specific nor sensitive.

Malaria detection was seen in 7 cases, which might be false positive as donors did not have any symptoms and repeat peripheral smear examination for malaria was negative.

Conclusion

Despite the success of these strategies, disease transmission still occurs, primarily due to the inadequacy of diagnostic tests to detect disease during the 'window' period of infection, immunologically variant viruses, immune-silent carriers, and laboratory testing errors. TTIs continue to be a significant concern for patients, physicians, and policymakers. Public awareness, careful donor selection, vigilance, and adoption of newer techniques for early detection are needed to reduce the incidence of TTIs.

Conflicts of interest

Authors declare no conflicts of interest.

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