

ORIGINAL RESEARCH

Seroprevalence and trends of transfusion transmitted infections in blood donors in blood center of an associated hospital of Northern India-a road map towards blood safety

¹Dr. Shazia Bashir Khatana, ²Dr. Ibrar Ahmed, ³Dr. Irm Yasmeen

¹Senior Resident, Department of Pathology, GMC and AH Rajouri, Jammu and Kashmir, India

²Senior Resident, Department of Pediatrics, GMC and AH Rajouri, Jammu and Kashmir, India

³Lecturer, Department of Blood Transfusion Medicine, GMC and AH Rajouri, Jammu and Kashmir, India

Corresponding Author

Dr. Irm Yasmeen

Lecturer, Department of Blood Transfusion Medicine, GMC and AH Rajouri, Jammu and Kashmir, India

Email: irm14yasmeen@gmail.com

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ABSTRACT

Background: Advanced techniques like Chemiluminescence and NAT are being used to eliminate the risk of TTIs. Safety measures starts right from the donor screening and donor history questionnaire by which individuals who are infected with pathogens having acute symptoms are likely to self defer that will reduce the chance of TTIs among the recipient population during window period. **Objectives:** To determine the seroprevalence and trends of major transfusion transmissible infections in blood donors. **Material and Methods:** A cross-sectional retrospective study (2019-2022) was conducted in the Department of Blood Transfusion Medicine (Blood Centre), Government Medical college and associated hospital, Rajouri, Jammu and Kashmir, India. Serum samples were tested by enzyme-linked immunosorbent assays (ELISA) for the presence of hepatitis B surface antigen (HBsAg), and antibodies to human immunodeficiency virus (HIV-1/2), hepatitis C virus (HCV). Syphilis and Malaria screening was done by rapid card method. **Results:** A total of 5682 apparently healthy blood donors were tested. Out of which 4119 (72.49%) were replacement donors and 1563 (27.50%) were voluntary donors. The majority of them were males 5648(99.4%) and aged between 31 -40 years(46.4%). A total of 49 (0.86%) donors had serological evidence of infection with at least one pathogen. Among them 4(8.16%) were voluntary donors donated in outdoor camps out of which 2 were females having HCV positive.3 had responded to the call and after confirmation, were referred to the concerned department for treatment. 45(91.8%) were replacement donors, 10 had responded to the calls, 4 were confirmed and were referred for treatment rest all were non responders. Bivariate analysis of gender- wise prevalence of HCV was statistically significant ($p < 0.001$) but HBV has no statistical significance($p = 1$). Year-wise seroprevalence and trend of TTIs shows a high significance($p < 0.001$). The positivity rates of HBV, HCV and HIV, syphilis and malaria were 17(0.29%), 32(0.56%) and 0%, 0% and 0% respectively. Trends for TTIs (Hepatitis) showed a significant increase for the year 2020 (0.18%) to 2022(1.58%) with the increase in the number of donations. **Conclusion:** A significantly high prevalence of TTIs was detected and it remains to be the greatest threat to the safety of blood. Chemiluminescence and NAT testing should be adopted to detect the virus within shortest possible incubation time.

Key Words: Transfusion Transmitted Infections(TTIs), Hepatitis B Virus(HBV), Hepatitis C Virus(HCV), Human Immunodeficiency Virus(HIV 1/2)

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INTRODUCTION

Blood donation saves millions of lives, however the recipients of blood are at a higher risk of exposure to transfusion transmissible infections(TTIs). Therefore, the likelihood of TTIs such as HIV, HBV, HCV,

Syphilis are still remain a sustainable threat for blood centres and transfusion facilities[1].

Transfusion transmissible infections are the infections that are transmissible from person to person through parental administration of infected blood or blood products. more deadly viruses that are capable to cause

these infections are HIV, HBV, HCV, Syphilis and less commonly are malaria, toxoplasmosis, brucellosis and other viral infections. These infections carry long term consequences for the recipients, families and communities since the infected person represents a pool for the infection and can transmit the disease during its incubation period[2].

Safe blood supply begins with the proper donor selection by taking detailed donor history and physical examination, screening of donors for high risk behaviour by the expert counsellor that gives the donors a chance of self exclusion. Implementation of advanced screening techniques and procedures that can detect the virus genetic material with in the shortest possible time can eliminate the risk of acquiring TTIs[3].

Infections due to Hepatitis B virus(HBV), Hepatitis C Virus(HCV) and Human Immunodeficiency Virus (HIV) are the major health concerns[4]. Chronic hepatitis, cirrhosis and hepatocellular carcinoma have been associated with blood borne hepatitis C viruses[5]. This virus is widespread worldwide, ranging from 0.2% to 40% in different regions[6]. HCV infections are believed to affect nearly 170million people worldwide[7]. Approximately 3.5 million new cases occur annually and about 21.3 million people are estimated to be carrying the HCV virus in the eastern Mediterranean region[8]. Additionally, recent data have indicated that hepatitis B and C kill about 1.1 million people and infect another 3.0 million annually[9].

The prevalence of TTIs among blood donors varies between high and low income countries. It was reported that the prevalence of HIV, HBV, HCV and Syphilis in high income countries are 0.003%, 0.03%, 0.02% and 0.05% respectively. While in low income countries, prevalence of these infections is higher; 1.08%, 3.70%, 1.03% and 0.90% respectively. These differences reflect the variation in the prevalence of developed and underdeveloped countries and health status of the population of these countries[10].

The prevalence of TTIs can reveal the problem of inapparent and unnoticeable infections in healthy looking members of general population and also provide data that is important in formulating the strategies for improving the management of a safe blood supply[11].

AIMS AND OBJECTIVES

This study was conducted to determine the seroprevalence and trends of major transfusion transmissible infections in blood donors.

MATERIAL AND METHODS

A cross-sectional retrospective study was conducted in the blood centre of GMC and Associated Hospital Rajouri, a tertiary care teaching hospital in Jammu and Kashmir, India. This study was done on the apparently healthy looking blood donors who donated blood in both indoor and outdoor camps and data were

collected for a period of 4 years from January 2019 to December 2022. Socio-demographic and general health information of the blood donors registered at the blood centre were extracted. All the donors were given donor questionnaire form which has information about the socio-demographic profile of the donors, previous donation history, type of donor either voluntary or replacement. General health checkup of the donor in terms of any long term disease or history of any medication or any high risk behaviour had been done by the trained doctor. Trained staff collected 5ml of blood from the diversion pouch attached with the blood bag following all standard aseptic techniques. Blood specimen collected in the red clotted vial were centrifuged and were analyzed for antibodies to HIV 1 and 2, HBsAg and HCV by ELISA. Test for syphilis was done by VDRL. The ethics committee of the institute approved the study.

Inclusion criteria for blood donation were those donors who fulfill the eligibility criteria, given informed consent for testing their blood for these major TTIs and were replacement and voluntary non-remunerated blood donors.

Exclusion criteria for blood donation were current history of medication, recent history of having undergone a surgical procedure, serious illness, previous blood transfusions, weight <45 kg, age <18 and >60 years for first time donor and >65 for repeated donor, pregnant and lactating women. No professional donor was bled.

Two kits are used based on WHO recommendation for two different testing strategies involved in ELISA and simple or rapid essays for surveillance. In house positive and negative controls are performed for each serological test.

***HIV screening is done using Erba Lisa 3rd generation and Merilisa HIV generation 4 from the year 2022 onwards.(ELISA)**

*HBsAg screening is done using Erba Lisa HBV generation 3 and Merilisa HBsAg. (ELISA)

*HCV screening is done using Erba Lisa HCV and Merilisa HCV generation 3. (ELISA)

*Malarial parasite screening is done using Angstrom and Malascan malaria rapid card.

*Syphilis screening is done using Serocheck Tp VDRL rapid card.

Patients suffering from any of infections are referred to the concerned departments for the necessary treatment.

STATISTICAL ANALYSIS

The data was extracted from the records and entered in microsoft excel. frequencies and percentage were used for the description of blood donors. Infections positivity rate was calculated for each year to identify the trends throughout 4 years. p value was obtained using bivariate analysis of categorical variables. Data was presented in tabulated format. A p value less than 0.05 was considered as significant level.

RESULT

A total of 5682 apparently healthy blood donors were tested during a period of four years. The results were interpreted and following details were drawn.

Table 1: Blood collection during study period

Study Year	Blood units collected
2019	664
2020	1087
2021	1729
2022	2202
Total collection	5682

Table 1 showing the year wise collection of blood units, year 2019 show the lowest collection (664), and the highest collection was found in 2022(2202). The number of donations has increased from 664 in 2019 to 2202 in 2022.

Table 2: Gender-wise distribution of Voluntary and Replacement donor

Year	Voluntary Donor			Replacement Donor			Grand Total
	Male	Female	Total	Male	Female	Total	
2019	384	2	386	278	0	278	664
2020	171	3	174	909	4	913	1084
2021	551	0	551	1171	7	1178	1729
2022	445	7	452	1739	11	1750	2202
Total	1551	12	1563	4097	22	4119	5682

Table 2 shows that out of total blood donors, 4119 (72.49%) were replacement donors and 1563 (27.50%) were voluntary donors. The majority of them were males 5648(99.4%) and 34 (0.59%) were females blood donors. The highest voluntary donation was seen in 2021(551). The overall voluntary blood donation has decreased and replacement blood donation has increased. The year wise distribution of voluntary and replacement donations was considered as significant having p value <0.001. The distribution of males and females among voluntary and replacement donations was not considered as significant as the p value is 0.3 which is more than 0.05.

Table 3: Year wise prevalence of TTIs among blood donors

Year	Total collection	HBV Positive	HCV Positive	Total positive (%age)
2019	664	1(0.15%)	1(0.15%)	2(0.3%)
2020	1087	1(0.09%)	1(0.09%)	2(0.18%)
2021	1729	03(0.17%)	07(0.4%)	10(0.57%)
2022	2202	12(0.54%)	23(1.04%)	35(1.58%)
Total	5682	17(0.29%)	32(0.56%)	49(0.86%)

Table 3 the

shows overall

positivity rates of HBV, HCV and HIV, syphilis and malaria were 17(0.29%), 32(0.56%) and 0%, 0% and 0% respectively as no case of HIV, Malaria or syphilis was detected.

Fig1. Year wise trend of total TTIs prevalence among blood donors

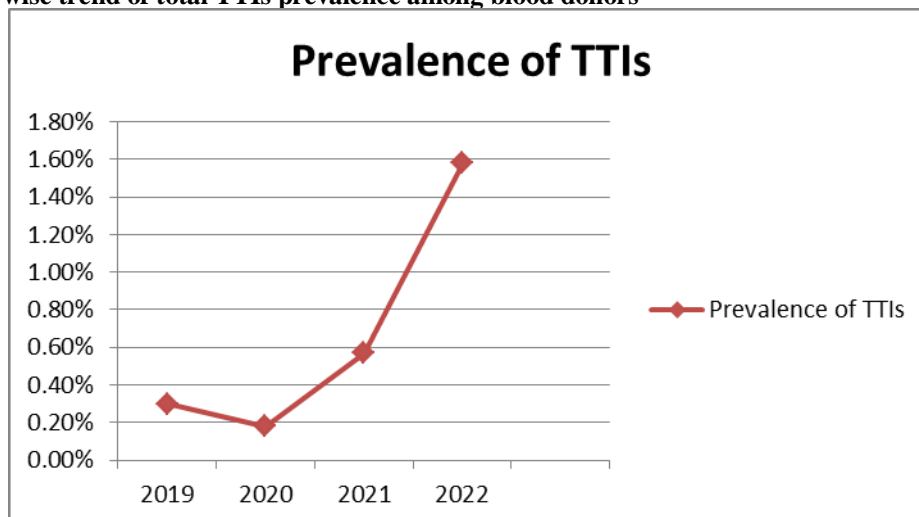


Fig. 1 shows the year wise trends for TTIs (Hepatitis) showed a significant increase for the year 2020 (0.18%) to 2022(1.58%) with the increase in the number of donations.

A total of 49 donors had serological evidence of infection with at least one pathogen. Seropositivity distribution in the study with an average prevalence of 0.86% showed highest trends of prevalence in the years 2022 (1.58%) followed by 2021(0.57%), 2019(0.3%) and 2020(0.18%) with the increase in the number of blood donations. Among them 4(0.25%) were voluntary donors donated in outdoor camps out

of which 2 were females having HCV positive. 3 had responded to the call and after confirmation, were referred to the concerned department for treatment. 45(1.09%) were replacement donors, 10 had responded to the calls, 4 were confirmed and were referred for treatment rest all were non responders. One donor has dual infection of HCV and HBV detected in 2022.

Table 4: Gender-wise Prevalence of Transfusion Transmitted Infections among blood donors

Gender	Total donations	HBV	p value= 1	HCV	p value<0.001
Male	5648	17(0.29%)		30(0.52%)	
Female	34	0		2(0.03%)	
Total	5682	17		32	

Table 4 depicts that bivariate analysis of gender-wise prevalence of Hepatitis C infection was more among both males and females and was considered as statistically significant (p<0.001) whereas no case of hepatitis B infection was seen among females and was not considered as statistically significant as p value is more than 0.05.

Table 5: Age-wise Prevalence of Transfusion Transmitted Infections among blood donors

Age Group(years)	HBV	HCV	Total	Percentage(%)
18-30	4(0.07%)	6(0.10%)	1578	27.7%
31-40	8(0.14%)	17(0.29%)	2639	46.4%
41-50	5(0.08%)	8(0.14%)	1352	23.7%
>50	0	1(0.017%)	113	1.98%
Total	17(0.29%)	32(0.56%)	5682	

Table 5 shows that age group between 31-40 years has maximum number of donors and prevalence of TTIs is also very high among them (46.4%).

DISCUSSION

Blood transfusion saves millions of lives every year but these are not without risk. Unsafe and untested blood always remains a threat to the spread of transfusion transmissible infections. Prevalence of TTIs varies from region to region depending on the units of blood transfused in that particular population[12]. There were long list of pathogens, which can be transmitted through blood transfusions [13][14]. This was found to be an important issue due to high prevalence of asymptomatic carriers in the society which happens because of concealing medical history by paid professional blood donors, blood donations during the window period of infections and quality systems[15].

It is important to address the fact that safe blood is considered a universal right and it should not cause any harm. Thus, it should be fully screened and ensured not be contaminated by any transmissible infection[16]. Blood donors represent the healthy members of the community and prevalence of TTIs among blood donors differs throughout the world and it can indirectly reflect the burden variations among these population[17].

In this study, the predominance of blood donations was by males (99.4%) which is consistent with the studies conducted by Alharazi T et al [18], Valerian DM et al[19], Siraj N et al [20]. Prevalence of

transfusion transmitted infections is more among male donors(0.82%) than female donors(0.03%). The higher deferral rates among women were due to medical unsuitability, anemia, pregnancy and breastfeeding. The majority of blood donors in this study were replacement donors(72.94%) compared to 27.50% who were volunteers which is similar to the study conducted by Alharazi T et al[18]. Our study is inconsistent with the study conducted by Heyredin I et al[21] which reports that 30.8% were replacement donors and 69.2% were volunteers. These variations are due to public awareness of the importance of blood donation. The present study illustrated that 0.25% of volunteers and 1.09% of replacement donors had transfusion transmitted infections. More donors were in the age group of 31-40 years and the prevalence of TTIs were more among this age group which is consistent with the study conducted by Aabdien et al[17] but inconsistent with the study conducted by Chauhan SC et al[2] which showed prevalence is more among 18-30 age group.

In this study, the overall prevalence of TTIs was 0.86% which is consistent with the studies conducted by Dhruva GA et al(0.93%), Yasmeeen I et al(0.43%)[22,23] but lower than the studies conducted by Vinit A et al(1.1%), Bhawna S(1%)[24,25]. prevalence of HCV and HBV infection in our study was 0.56% and 0.29% respectively which is consistent

with the studies conducted by Yasmeen I et al [23], Aabdien M et al[17], Qureshi MZ et al[26] but lower than the study conducted by Farooqi et al[27]. Studies showing prevalence of different TTIs conducted in various parts among blood donors are shown in table 6.

Table 6: Prevalence of TTIs among different studies

Studies	HCV	HBV
Aabdien M et al[17]	0.60%	0.30%
Chauhan SC et al[2]	0.16%	0.68%
Farooqi et al [27]	3.21%	2.54%
Yasmeen I et al[23]	0.17%	0.24%
Raina S et al[28]	0.21%	0.49%
Shrivastav A et al[29]	0.16%	0.3%
Bhawna S et al[25]	-	0.63%
Handoo S et al[30]	0.16%	-
Makroo et al[31]	0.43%	1.18%
Malik S et al[32]	-	0.51%
Present Study	0.56%	0.29%

The overall positivity rate of transfusion transmissible infections among blood donors was assessed through the serological tests only and results revealed a gradual increase in trends over the years due to increase in the number of blood donations. However, this study also reveals the fluctuating trends of HBV and HCV. No cases were detected for HIV, Malaria and syphilis during the study period. Our blood center used ELISA 3RD generation kits for HBV (Merilisa HBsAg) which cannot detect HBV before 59 days, and HCV(Merilisa HCV) which cannot detect HCV before 82 days . The 3rd generation assays of HCV demonstrate significant improvements in sensitivity, particularly with regard to increased reactivity with the NS3 antigen and earlier detection of seroconversion. ELISA 4th generation kit were used (Merilisa HIV Gen 4) for HIV. Antibodies levels can be detected within 3 to 4 weeks after infection. This window period can be shortened to about 2 weeks by detecting p24 antigen. The majority of the events occurs when the donors donate blood during window period of infection which poses a great threat to the safety of blood. Replacement donations are more in our set up and they carry a relatively higher risk of Transfusion transmitted infections. Recruitment and retention of voluntary donors is must for availability of safe blood for transfusion to the recipients as well as for community and can be achieved by vigorous and cautious screening of donors along with testing of donated blood with more advanced laboratory screening tests and promoting voluntary non-remunerated blood donations.

CONCLUSION

For safe supply of blood to the patients, it is necessary to upgrade the existing screening techniques to more advanced techniques i.e chemiluminescence and NAT (nucleic acid testing) which helps in detecting very low levels of viral RNA or DNA that may be present in the blood.

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CONFLICT OF INTEREST

None declared

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee

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