Original Article

Blood Donor Screening: Experience from a Remote Part of North-East

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Abstract

Background: Transfusion of blood and blood products saves millions of lives across the world. Although pre-transfusion routine screening and testing are done, there is a substantial risk of transfusion-related problems, including transfusion-transmitted infections (TTI). The risk increases when the donor is in the asymptomatic period.

Materials and Methods: A retrospective analysis was done on 18,177 units of blood collected during six years of the study period at the Blood Centre, Diphu Medical College, Karbi Anglong, a remote hilly district of Assam, to evaluate the prevalence of transfusion-transmitted infections (TTI).

Results: The total number of seropositive cases detected during the study period was 394 (2.16%), of which 157 donors (0.86%) were positive for HBsAg, 183 donors (1.00%) were positive for anti-HCV, 47 donors (0.25%) were positive for HIV, while 7 donors (0.03%) were positive for syphilis. No single case of malaria was detected in our study.

Conclusion: Accurate estimates of the risks of TTI are essential for monitoring the safety of the blood supply and evaluating the efficacy of currently employed screening procedures. This will help reduce both morbidity and the development of chronic, life-threatening diseases in recipients, as well as the wastage of valuable resources. Strict donor criteria and the recruitment of non-remunerated voluntary blood donors can substantially reduce the risk of TTI.

Keywords:

Blood, donor, transfusion-transmitted infections, blood supply, voluntary blood donors.

Introduction

Transfusion of blood and blood products saves millions of lives across the world. The objective of transfusion is to provide a safe and adequate amount of blood from healthy donors. Although transfusion of blood is considered safe, the risk of transfusion-transmitted infections (TTI) increases when the donor donates blood during the asymptomatic period of infections.

Despite pre-transfusion routine screening and testing, there is a 1% chance of transfusion-associated problems, including transfusion-transmitted diseases, with every unit of blood [1]. According to WHO reports in 2018, the prevalence of HIV, HBV, HCV, and syphilis infections among blood donations collected globally varies from 0.003% to 1.08%, 0.03% to 3.70%, 0.02% to 1.03%, and 0.05% to 0.90%, respectively, with lower prevalence in high-income countries [2].

In developing countries with limited resources and manpower, the incidence could be higher. This can lead to significant morbidity

and the development of chronic, life-threatening diseases in recipients, along with the wastage of valuable resources. Accurate estimates of the risk of TTIs are essential for monitoring the safety of the blood supply and evaluating the efficacy of currently employed screening procedures [3].

The present study was conducted in the Blood Centre, Diphu Medical College, to estimate the prevalence of TTI over a period of six years.

Materials and Methods

A retrospective observational study was undertaken in the Blood Centre, Diphu Medical College, Karbi Anglong, a remote hilly district of Assam. The data and records were retrieved from the Blood Centre registers. The Blood Centre questionnaire forms were evaluated for history and demographic profile. Patient consent was obtained in the donor questionnaire forms, and anonymity was maintained during data analysis.

After a detailed history and physical examination by the blood bank medical officer, around 5 ml of venous blood was collected in a plain vacutainer from all eligible donors. The blood obtained for serological testing was kept at room temperature, and the serum was separated after centrifugation of the vacutainer at 2000 rpm for 5 minutes. The venous blood collected was tested for Hepatitis B surface antigen (HBsAg), Human Immunodeficiency Virus (HIV), Hepatitis C Virus (HCV), Syphilis, and Malaria.

The screening test for HBsAg was done by Standard Q [SD Biosensor Healthcare (P) Ltd], HIV by Standard Q [SD Biosensor Healthcare (P) Ltd], and HCV by Standard Q [SD Biosensor Healthcare (P) Ltd]. The blood was screened for Malaria by Medsource O^3 [Medsource Ozone Biomedicals (P) Ltd] and for Syphilis by the Rapid Plasma Reagin Test kit [Arkray Healthcare (P) Ltd]. Reactive cases of HBsAg, HCV, and HIV were further confirmed by third-generation ELISA, ALERE AM 2100 [Alere™ Medical Pvt. Ltd].

Both positive and negative controls were performed for each reagent lot used for serological testing and during the ELISA procedure. A total of 18,177 units of blood were collected during the six-year study period. Institutional Ethical Committee permission was obtained prior to the study. The data were evaluated using Microsoft Excel and Statistical Package for the Social Sciences (SPSS) software.

Results

A total of 18,177 blood donors were screened from January 2016 to December 2022. Out of the total, 12,139 (66.7%) were replacement donors and 6,038 (33.2%) were voluntary donors [Fig. 1]. Among the donors, 16,032 (88.1%) were males and 2,145 (11.8%) were females. The total number of seropositive cases detected during the study period was 394 (2.16%). Of these, 157 donors (0.86%) were positive for HBsAg, 183 donors (1.00%) were positive for anti-HCV, 47 donors (0.25%) were positive for HIV, while 7 donors (0.03%) were positive for syphilis. No cases of malaria were detected in our study [Table 1]. The overall prevalence of HCV, HBsAg, HIV, and syphilis was 1.0%, 0.86%, 0.25%, and 0.03%, respectively [Fig. 2].

The majority of the donors were young and middle-aged adults in the age group of 20–40 years. Chi-square test results indicate that there was no association between donor types and their lifestyle patterns at the 95% confidence interval ($\chi^2 = 11.035$; $df = 3$; $p = 0.012$) [Table 2]. Among the seropositive cases, replacement donors (93.4%) were predominant compared to voluntary donors (6.6%). Seropositivity was highest among first-time male replacement donors (80.2%).

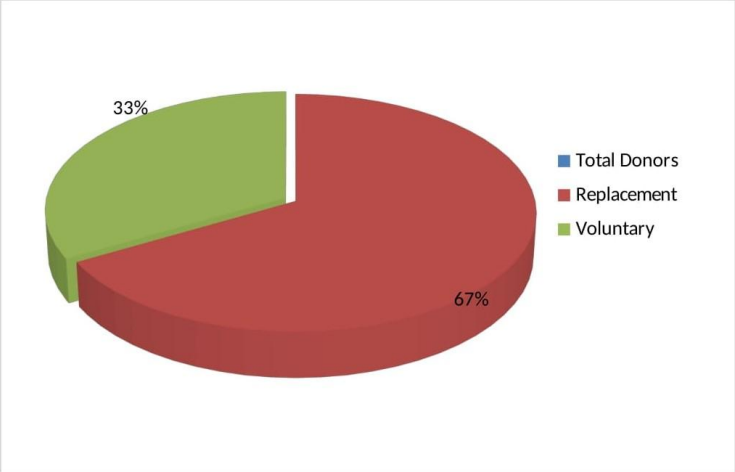

Figure 1: Type and distribution of blood donors

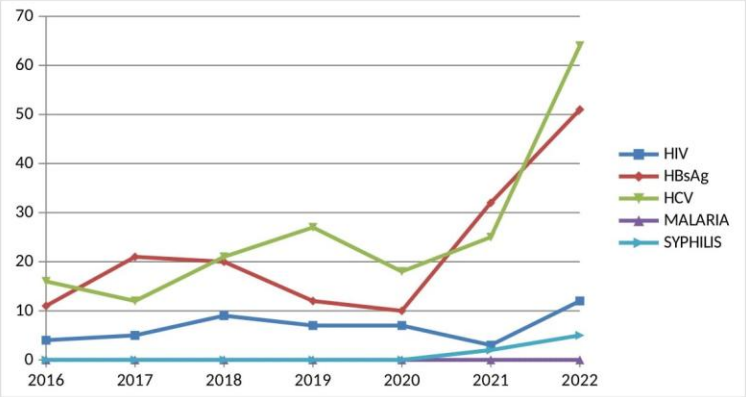

Figure 2: Figure showing the trend of seropositivity

Table 1: Total number of reactive donors in the study period

	2016	2017	2018	2019	2020	2021	2022	TOTAL
HIV	4(0.09%)	11(0.23%)	9(0.19%)	7(0.15%)	7(0.15%)	15(0.32%)	35(0.74%)	47
HBV	11(0.07%)	13(0.08%)	20(0.13%)	12(0.08%)	10(0.06%)	32(0.20%)	51(0.32%)	157
HCV	16(0.09%)	12(0.07%)	21(0.11%)	27(0.15%)	18(0.1%)	36(0.2%)	74(0.4%)	183
SYPHILIS	0	0	0	0	0	2(0.29%)	5(0.71%)	7
MALARIA	0	0	0	0	0	0	0	0

Table 2: Table showing comparison of life style with donor types

Life_style (Count % in row)	**Donor_Type**		**Total**
	Replacement	Voluntary	
Alcohol	270	47	317(100%)
Smoking	15	1	16(100%)
No any habits	26	12	38(100%)
Alcohol + Smoking	16	7	23(100%)
Total	327	67	394(100%)

Table 3: Comparison of transfusion transmitted infection prevalence rates with other studies

Studies	HIV %	HbsAg %	HCV %	Syphilis %
Adhikari et al. **(2010), Sikkim**, India [22]	0.32	0.78	0.27	0.27
Arora et al. (2010), Southern Haryana, India [24]	0.3	1.2	1	0.9
Bhattacharya et al. **(2007), West** Bengal, India [23]	0.28	1.46	0.31	0.72
Pallavi et al. **(2011), Mysore**, India [6]	0.44	1.27	0.23	0.28
Anjali et al. **(2012), Kerala**, India [32]	0.6	1.5	0.4	0.1
Pahuja et al. **(2007), Delhi**, India [33]	0.56	2.23	0.66	
Srikrishna et al. **(1999), Bangalore**, India [16]	0.44	1.86	1.02	1.6
Present Study	0.25%	0.86%	1.0%	0.03

Discussion

The present study was undertaken to estimate the seroprevalence of HIV, HBsAg, HCV, syphilis, and malaria among healthy blood donors. In our study, the majority of donors were males 16,032 (88.1%) between the age group of 18 to 40 years. Our result is comparable with other studies by Pailoor K et al. [4], Fernandes et al. [5], and Pallavi et al. [6].

A voluntary non-remunerated blood donor gives blood, plasma, or cellular components of his or her own free will and receives no payment, either in the form of cash or in kind, which could be considered a substitute for money. In contrast, replacement donors (RD) are usually one-time blood donors who donate blood only when a relative is in need. Usually, the patient's party provides some benefits in the form of money. Patients may prefer direct donation by family members or friends rather than "strangers" because they believe this will eliminate the risk of transfusion-transmissible infections. However, prevalence rates of transfusion-transmissible infections are generally found to be higher among family/replacement donors than voluntary donors [7-13].

In the study, replacement donors constituted 12,139 (66.7%) of the total donors. Voluntary donors were mainly from outdoor blood donation camps, college students, and non-related healthy donors from society. Increased awareness among the public and the involvement of government bodies like NBTC (National Blood Transfusion Council) and NACO (National AIDS Control Organisation) have led to a steady increase in voluntary blood donors.

Seropositivity was observed in 394 donors (2.16%), the majority being replacement donors with no high-risk behavior. Most donors were from in and around Diphu, with no significant geographical variation. However, they are vulnerable to social habits such as alcohol consumption, tobacco chewing, and smoking. There are no previous studies from the region, so no data comparison could be conducted. Various Indian studies show prevalence rates for HIV—0.51–3.87%, HCV—0.12–4%, HBV (HBsAg)—1.2–3.5%, and syphilis—0.3–0.82% [14-21]. However, in our study, the seroprevalence of HIV, HBsAg, HCV, and syphilis were 0.25%, 0.86%, 1.0%, and 0.03%, respectively. The results of our study are comparable with those of Adhikari et al. [22], Arora et al. [23], and Bhattacharya et al. [24].

The prevalence of HBV, HCV, and syphilis in this study were 0.86%, 1%, and 0.03%, respectively, which was lower than the prevalence rates of 3.7%, 1.03%, and 0.9% in low-income countries but higher than the prevalence rates of 0.03%, 0.02%, and 0.05% in high-income countries, except for syphilis [2]. However, according to a report published by NBTC (2015), there is an increased incidence of HBV and HCV compared to the state average of 0.53% and 0.24%, respectively [25]. The reasons could be the increased prevalence of blood-borne infections and proper donor screening. The decline in malaria cases can be attributed

to the combined effect of newer and effective drugs (artemisinin), effective diagnostic systems like bivalent rapid diagnostic tests (RDTs), and effective mosquito control strategies such as long-lasting insecticidal nets (LLINs). Climate change, deforestation, urbanization, and migration have greatly impacted the current habitat of established malaria vectors [26].

According to the WHO report, the viral dose in HIV transmission through blood is so large that one HIV-positive transfusion leads to death on average after two years in children and 3–5 years in adults [6]. In the case of HIV, transmission during the window period is possible even if each unit is tested for HIV antibodies. The possibility of window period transmission is minimized if blood is collected from low-risk targeted general public [27].

Sexually transmitted infections constitute a major public health problem and are widespread in developing countries. Syphilis has also acquired a new potential for morbidity and mortality through its association with an increased risk of HIV infection, making safe blood more difficult to obtain. The residual transmission risk of HBV infection through transfusion is higher due to a long window period between initial HBV infection and the detection of HBsAg, during which the virus is transmissible [3,28].

Nucleic acid testing (NAT) is very useful in this situation, considerably shortening the window period. NAT is a molecular technique that is highly sensitive and specific for detecting viral ribonucleic acid (RNA) or deoxyribonucleic acid (DNA) much earlier than other screening methods, thus narrowing the window period for human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) infections [10]. NAT has reduced the window period of HBV to 10.34 days, HCV to 1.34 days, and HIV to 2.93 days [29,30]. However, the high cost of this assay makes it unaffordable for many centers.

Although donors are required to fill out a questionnaire before donation, there is always a possibility that they may mislead and hide important information even after proper counseling. The importance of extensive counseling should be emphasized. In remote areas, recruiting healthy and safe donors is challenging. Donors should be appreciated and encouraged to donate periodically after proper counseling and understanding the importance of safe blood donation.

A pleasant environment in the blood bank, good donor care, and polite, effective communication between staff and donors are essential for retaining voluntary non-remunerated blood donors [31]. The health benefits of blood donation should be widely promoted, especially among young and middle-aged adults, through awareness camps about the importance of non-remunerated voluntary blood donors.

Conclusion

The primary goal of blood transfusion is to provide safe and adequate blood to the recipient. Although voluntary blood donation is crucial for recruiting healthy and safe donors, retaining donors for future donations is equally important. The behavior of technical and nursing staff, along with certificates of appreciation, can encourage donors. Adhering to strict criteria such as proper donor counseling, screening, and selection, along with recruiting non-remunerated voluntary blood donors from outdoor blood donation camps, can help reduce the seroprevalence of TTIs. Furthermore, training blood bank staff, ensuring adequate quality control, and employing advanced screening methods can contribute to achieving this goal.

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