IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 3 Ser.4 (March. 2020), PP 22-25
www.iosrjournals.org

Prevalence of seroreactivity among blood donors - A hospital based study in West Bengal

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Abstract:
Background: *Transfusion of blood is a life saving procedure.Transfusion-transmitted infections (TTI)continue to be a threat to safe transfusion practices. We analysed the prevalence of such infections among voluntary and replacement donors.*
Objectives: *The present retrospective study done to asses the prevalence of TTI amongst the donors in tertiary health institution in West Bengal helping us to target population subset for enhancing donor pool.****Methods.*** *Blood donations collected over a 4-year period (2016-2019)were studied for the type of donation (voluntary or replacement), number of seroreactive cases and their distribution . The tabulated seropositive cases compared with available profiles in literature.*
Results. *Of the 1,06,907 units of blood collected over a 4-year period, 75,787 (70.89%) were from voluntary and 31,120 (29.11%) from replacement donors. There were 726 seroreactive cases (0.68%). These included 44 with HIV (0.04%), 526 with hepatitis B surface antigen (HBsAg; 0.49%), 79 with hepatitis C virus (HCV; 0.07%) and 77 (0.07%) with VDRL (Venereal Diseases Research Laboratory) reactivity. 1 of these had co-infections of HIV and HBsAg. The seroreactive cases were more in replacement donors in comparison to voluntary donors.*
Conclusion. *Deployment of exclusion criteria helps us in safe transfusion practice****.*** *Voluntary donations are safer as compared with replacement ones and need to be encouraged.*
Key Words*: Donor, voluntary, replacement, infection,seroreactive.*

Date of Submission: 25-02-2020 Date of Acceptance: 09-03-2020

I. Introduction

Blood transfusion is a life-saving procedure but at the same time it carries the risk of transmission of several infectious agents. Despite stringent donor screening and testing practices, safe blood free from transfusion-transmitted infections (TTIs) remains an

elusive goal.[1] Although technological advancements have led to the development of more sensitive methods to detect markers of TTIs, the problems of 'window period', false-negative results, prevalence of asymptomatic carriers, genetic variability in viral strains and technical errors remain. Although there are many studies on the prevalence of TTIs in blood donors, data on the presence of co-infection with more than one TTI is sparse.[1,2]

In the developing countries, non-remunerated voluntary blood donors play a major role in safe blood supply as most of these countries cannot afford to utilize the latest nucleic acid testing (NAT) for blood screening.[2,3] Although the NAT screening reduces the window period of viral infection, in India, the conventional enzyme linked immunosorbent assay (ELISA) remains the most common screening test for transfusion transmitted infections (TTIs).[2,3] The risk of TTIs is estimated to be 1 in 677,000 units for human immunodeficiency virus (HIV), 1 in 103,000 for hepatitis C virus (HCV) and 1 in 63,000 for hepatitis B virus (HBV), so the importance of blood donor counseling could not be under-estimated.[2,3,4]

Our national blood policy has given major attention towards blood donor motivation, recruitment and retention to achieve 100% voluntary blood donation, but the role of blood donor education could not be ignored to bring the sense of true altruism among the voluntary blood donors.[2,3,4] As a fundamental part of preventing TTIs the role of notification and counseling donors about their seroreactivity is of major importance in blood safety.[3,4,5] As per objective 4.16 of the Indian action plan for blood safety, the blood donors are counseled about TTIs prior to donation and are offered the option of knowing their sero-reactive status provided they give their consent.[5,6]

II. Methods

The study was done at the blood bank of a tertiary hospital, West Bengal over a period of 4 years (2016–19). All blood donations collected over this period were included. The donors were either voluntary or replacement donors. Voluntary donations were taken in blood donation camps. Replacement donors were either relatives or friends of patients, as elicited from patient party's end. All samples were screened for hepatitis B surface antigen (HBsAg; Merilisa for detection of hepatitis B surface antigen), anti-human immunodeficiency virus antibodies (HIV Ab; Bhat Bio-Tech India (P) Ltd. 3rd generation Elisa test kit for detection of antibodies to HIV1 and HIV2), anti-hepatitis C virus antibodies (HCV Ab; 3rd generation ELISA test kit for detection of antibodies to HCV , Bhat Bio-tech India (P) Ltd.) and Venereal Diseases Research Laboratory (VDRL) reactivity (Carbogen kit, Bio lab Diagnostics). The total number of seroreactive cases and their distribution were noted. Further, within the seroreactive group,cases with a combination of >1 TTIs were labelled as co-infection.The number, type and distribution of infections were noted and the findings were analysed.

III. Results

A total of 1,06,907 blood units were collected over the 4-year period.Of these, 75,787 (70.89%) were voluntary and 31,120 (29.11%) were replacement donors. There was a change in the trend of the type of donors towards the later years with an increase in the number of voluntary donors, from 66.8 % in 2016 to 67.9% in 2019 (statistically significant as p was <0.05) (Table I).

TABLE:1 Distribution of type of donors

YEAR	TOTAL COLLECTION	VOLUNTARY COLLECTION	REPLACEMENT COLLECTION
2016	25,849	17,274 (66.8 %)	8,575 (33.2 %)
2017	26,101	19,752 (75.6 %)	6,349 (24.4%)
2018	27,018	19,778 (73.2 %)	7,240 (26.8 %)
2019	27,939	18,983 (67.9 %)	8,956 (32.1 %)

Of the 75,787 voluntary donations, there were 477 seroreactive cases (0.63 %). These included 31 cases of HIV (0.04 %), 349 HBV (0.46 %), 48 HCV (0.06 %) and 49 (0.064 %) of VDRL reactivity; which was found to be statistically significant (p<0.001). (Table – 2).

TABLE : 2 Prevalence of TTI in voluntary donors

YEAR	HIV	HBV	HCV	VDRL
2016	02 (0.01 %)	82 (0.47 %)	25 (0.14 %)	16 (0.09 %)
2017	09 (0.04 %)	118 (0.59 %)	16 (0.08 %)	08 (0.04 %)
2018	11 (0.06 %)	81 (0.41 %)	05 (0.03 %)	07 (0.04 %)
2019	09 (0.05 %)	68 (0.36 %)	02 (0.01 %)	18 (0.09 %)
TOTAL – 477	31 (0.04 %)	349 (0.46 %)	48 (0.06 %)	49 (0.064 %)

Of the 31,120 replacement donations, there were 249 seroreactive cases (0.80 %) . These included 13 cases of HIV (0.04 %) , 177 HBV (0.56 %), 31 HCV (0.099 %) and 28 VDRL (0.09%) ; which was statistically significant (p<0.001)(Table – 3).

TABLE : 3 Prevalence of TTI in replacement donors

YEAR	HIV	HBV	HCV	VDRL
2016	06 (0.03 %)	50 (0.58%)	09 (0.10 %)	10 (0.11 %)
2017	02 (0.03 %)	50 (0.78 %)	10 (0.16 %)	03 (0.05 %)
2018	03 (0.04 %)	37 (0.51 %)	09 (0.12 %)	05 (0.07 %)
2019	02 (0.02 %)	40 (0.45 %)	03 (0.03 %)	10 (0.11 %)
TOTAL – 249	13 (0.04%)	177 (0.56 %)	31 (0.099 %)	28 (0.09 %)

The comparative seropositivity of voluntary and replacement donors is shown in Table 4. Only one had coinfection (>1 TTIs) . The infection rate showed an overall decreasing trend over the years .

TABLE : 4 Prevalence of TTI according to type of donation

SERO-REACTIVE	Donation type	2016	2017	2018	2019
TOTAL	Voluntary	125 (0.72 %)	151 (0.76%)	104 (0.53%)	97 (0.51%)
	Replacement	75 (0.87 %)	65 (1.02 %)	54 (0.74 %)	55 (0.61%)
HIV	Voluntary	02 (0.01%)	09 (0.04 %)	11 (0.06 %)	09 (0.05 %)
	Replacement	06 (0.03 %)	02 (0.03 %)	03 (0.04 %)	02 (0.02 %)
HBsAg	Voluntary	82 (0.47 %)	118 (0.59 %)	81 (0.41 %)	68 (0.36 %)
	Replacement	50 (0.58 %)	50 (0.78%)	37 (0.51 %)	40(0.45%)
HCV	Voluntary	25 (0.14 %)	16 (0.08 %)	05 (0.03 %)	02 (0.01%)
	Replacement	09 (0.10 %)	10 (0.16 %)	09 (0.12 %)	03 (0.03 %)

VDRL	Voluntary	16 (0.09 %)	08 (0.04 %)	07 (0.04 %)	18 (0.09 %)
	Replacement	10 (0.11 %)	03 (0.05 %)	05 (0.07 %)	10 (0.11 %)

IV. Discussion

The aim of this study was to determine the seroprevalence of HIV, HBV, HCV, and syphilis among healthy blood donors and to look for their distribution in voluntary and replacement donors. The reason for the quite lower prevalence of TTI could be due to the reason that this study was carried in the academic institute where before donating blood awareness about TTI were given to donors.

HBV incidence is higher in our population. HBV positivity indicates a carrier state or an active infection. These seropositive donors may progress to develop chronic hepatitis, cirrhosis, and even progress to hepatocellular carcinomas.[6,7,8]Patients requiring blood transfusion are more prone to acquire HBV, HIV, HCV, and syphilis.[9,10,11]HBV is highly contagious and easily transmitted from one individual to another by transfusion during birth, by unprotected sex and by sharing needles.[12,13] Syphilis can be spread by sexual contact, blood transfusion and by vertical transmission. Due to the nature of blood born virus, HCV is widely recognized as a major causative agent for posttransfusion non-A, non-B hepatitis.[14] Other less common routes of transmission are sexual intercourse and mother to child transfer.[14,15,16]

In case of HIV, transmission during window period is possible even if each unit is tested for HIV antibodies.[17] The possibility of window period transmission would be minimized if blood is collected from low risk targeted general public.[18]However, blood safety remains an issue of major concern in transfusion medicine. HBV and HIV can also be transmitted from person to person contact, especially HBV which is transmittable from tears, urine, etc., Seroprevalence of HBsAg ranges from intermediate (2%–7%) to high (>8%) levels in India.[18,19] The course of HBV infection depends on many factors that can influence the immune system including age at infection and host genetic factors and genetic variability of viruses.[19]

There are various HBV subtypes, subgenotypes, and escape mutants which cause public health concern through reinfection and occult infection. This is particularly true in Asia with its intermediate to high rates of chronic infection. These HBV isolates may escape detection and enter the blood supply. To lower the seroprevalence, there should be stringent donor selection criteria, blood donation by regular volunteer donors, effective donor education and counseling of seropositive donors.[19,20] To make aware the general public about the highly infectious nature of these infections and its mode of transmission, special intervention programs should be planned. Similarly, posttransfusion HBV infection rate is high due to the fact that HBV circulates at very low and undetectable level for screening assays. It is, therefore, necessary to find out the tests which detect the presence of Hepatitis B during the window period. Nucleic acid testing (NAT) assays are very useful in this situation which has considerably shortened the window period. However, the cost of this assay is high which makes it unaffordable for many centers.[19,20]

According to the WHO report, viral dose in HIV transmission through blood is so large that one HIV-positive transfusion leads to death on an average after 2 years in children and 3–5 years in adults.[21,22] HBsAg seroprevalence in India is high in spite of a safe and effective vaccine has been available. Sexually transmitted infections constitute a major public health problem and are widespread in developing countries.[23,24]

Syphilis has also acquired a new potential for morbidly and mortality through association with increased risk of HIV infection, thus making safe blood more difficult to get. The residual transmission risk of HBV infection through a transfusion is higher due to a long window period between initial HBV infection and the detection of HBsAg during which the virus is transmissible.[24]The present study shows more prevalence of HBsAg reactivity among all the transmissible infections similar to study by Garg et al, Sharma et al and Kaur et al whereas Singh et al found HCV predominance. Similar results are found with respect to predominance of infections in replacement donors in comparison to voluntary donors in the present study and other authors[25,26,27,28,29] (Table : 5)

TABLE : 5 Comparative study between present one and available in literature

Name	HIV		HBV		HCV		VDRL	
	Volun-tary	Replace-ment	Volun-tary	Replace-ment	Volun-tary	Replace-ment	Volun-tary	Replace-ment
Singh et al[25]	0.8	0.8	1.2	1.9	1.3	3.0	-	-
Garg et al[26]	0.2	0.4	2.6	3.5	0.13	0.23	-	-
Sharma et al[27]	0.32	0.45	0.91	1.26	0.23	0.52	0.26	0.57
Kaur etal[28]	0.15	0.44	0.65	1.07	0.3	0.5	0.19	0.48
Present study	0.04	0.04	0.46	0.56	0.06	0.099	0.064	0.09

The present study shows quite lower prevalence of TTI compared to that in previous reports.
Limitation of our study is that all TTI tested by ELISA method; the scope for testing byNAT was not there.

V. Conclusion

The study reflects the seroprevalence of the general population in our area which may be helpful in planning public health interventional strategies. Selection of donors with low TTI risk and effective laboratory screening is the very important part in blood bank processing which has reduced the risk of transmission to very low levels.Methods to ensure a safe blood supply should be encouraged. Screening with a better selection of donors and use of sensitive screening tests including NAT assay will definitely reduce the risk of TTI.

Voluntary donations are safer as compared to replacement ones and should be encouraged. Efforts should be made to increase the number of voluntary donors and reduce replacement donations to a minimum.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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