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SEROPREVALENCE OF DENGUE VIRUS AMONG VOLUNTARY BLOOD DONORS IN CHENNAI –A CROSS SECTIONAL STUDY

Immunohaematology

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ABSTRACT

Background: Dengue is one of the common vectors borne viral infection with a serious threat of transfusion transmission particularly in dengue endemic areas.
Aim: To find the seroprevalence of dengue virus among voluntary blood donors in Chennai.
Materials and Methods: 110 blood samples from VBD were collected in 1 year period from August 2014 to July 2015 and were subjected to dengue NS1, IgM and IgG serological tests using InBios dengue ELISA kits.
Results: Among 110 VBD 91.8% of the donors were positive for anti- DENV IgG and none were positive for NS1 antigen or anti-DENV IgM.
Conclusion: There is a high seroprevalence of anti-DENV IgG (91.8%) in blood donors. All donor samples in this study were seronegative for dengue NS1 and IgM.

KEYWORDS

Blood donors, dengue, Voluntary Blood Donors, nonstructural protein 1 antigen, immunoglobulin M, immunoglobulin G, screening ELISA test

INTRODUCTION:

Blood transfusion is a life saving intervention for the patients in need of replacement of blood and blood products. Blood borne infections are common serious hurdles of blood transfusion.[1]Blood transfusion safety begins with good health of the donors. Blood transfusion has now become largely safer through continuous improvements in donor recruitment, screening, testing of donated blood with increasingly sensitive assays, and appropriate clinical use of blood.[2] WHO (World Health Organization) recommends that all blood donations should be screened for infection prior to use.[3] The national blood policy in India relies heavily on voluntary blood donors, as they are usually assumed to be associated with low levels of TTI.[4] In India, it is mandatory to test every unit of blood collected for hepatitis B (HBsAg), hepatitis C (Anti-HCV), human immuno deficiency virus (HIV1&2antibodies), syphilis (VDRL/RPR/TPHA) and malaria (antigen test). If donor test positive to any of the five infections, their blood is discarded.[5,2]

Dengue is one of the most common vector borne viral infections worldwide.[6] Asymptomatic individuals with dengue viremia in blood donors can represent a risk to the safety of the blood supply, especially in endemic countries.[7] At present DENV detection is not included in the mandatory donor screening tests for TTI. This study was conducted to observe and analyze the seroprevalence of DENV among voluntary blood donors. An estimate of the seroprevalence of DENV among voluntary blood donors may be of help to decide whether screening for DENV would eliminate transmission of infection to high risk groups. The current study was undertaken in an attempt to address this aspect. Such information may be of great value to health planners and policy makers.

AIM & OBJECTIVES:

The aim of the study is to find the seroprevalence of dengue virus among voluntary blood donors in Chennai.

1. To estimate the seroprevalence of dengue virus among the voluntary blood donors in Chennai.
2. To detect dengue NS1 antigen, anti - DENV IgM and IgG by ELISA.
3. To confirm dengue NS1 antigen, anti-DENV IgM seropositive samples by RT-PCR.

MATERIALS AND METHODS:

This Cross sectional study was conducted over 1 year period from August 2014- July 2015 in the Department of Transfusion Medicine, The Tamil Nadu Dr.MGR Medical University, Guindy, Chennai. The donors were classified as higher, middle and lower socioeconomic status based on Kuppusamy classification.[8]A total of 110 voluntary blood donors were selected as per DGHS guidelines. The total sample size was split month wise from August 2014 to July 2015 based on previous month wise reports of dengue cases in Chennai. 5 ml of blood was collected directly from VBD in a sterile plain test tube and allowed to clot; serum was separated and stored at -70^{0}C for ELISA and RT-PCR tests. The samples that were frozen earlier were thawed and used. Sera were tested for Dengue NS1 antigen, IgG and IgM by the enzyme-linked immunosorbent assay (ELISA) test. Since there are no FDA (Food and Drug Administration) licensed blood donor screening tests available worldwide,[9, 10]commercial diagnostic InBios DENV Detect IgG, NS1and commercial research InBios DENV Detect IgM Capture ELISA kits have been used in our study. All steps were done according to the manufacturer's instructions. Data analysis was done using SPSS software.

ETHICAL COMMITTEE CLEARANCE:

Ethical clearance was obtained from the Institutional Ethical Committee of The Tamil Nadu Dr. M.G.R. Medical University, Chennai.

RESULTS:

This cross sectional study showed age distribution among the blood donors were 10.0 % in 18-20 years, 52.7 % in 21-30 years, 25.5 % in 31-40 years, 10.0 % in 41-50 years, 1.8 % in >50 years(Figure 1). Demographic analysis showed, of the 110 donors, 96 (87.3%) were males and 14 (12.7%) were females. Most of our donors belong to Middle socioeconomic status (70%) followed by low (23%) and high (7%). Blood group distributions among the blood donors were 20.9 % of 'A' group, 31.8 % of 'B' group, 40.9 % of 'O' group, 6.4 % of 'AB' group. Rh distributions among donors were 96.4 % of Rh D positive group, 3.6 % of Rh negative group. Among 110 voluntary blood donors, only one was found to be reactive for Hepatitis B Surface Antigen (HBsAg).DENV IgG antibody screening by ELISA showed that 9 were negative and 101 were positive, giving an overall DENV prevalence rate of 91.8%. None of the 110 blood donors were reactive for DENV NS1 antigen and IgM antibodies by ELISA test. (Figure 4)

IgG seropositivity with donor demographic details

Donor demographic details		IgG seropositive (total donors)	P value
Age(years)	18-20	11(11)	P> 0.05
	21-30	52(58)	
	31-40	26(28)	
	41-50	10(11)	
	>50	2(2)	
Gender	Male	87(96)	P> 0.05
	Female	14(14)	
Socioeconomic status	High	5(8)	P=0.006
	Middle	71(77)	
	Low	25(25)	

Blood Group	A	20(23)	P> 0.05
	B	32(35)	
	O	42(45)	
	AB	7(7)	
Rh Type	Positive	97(106)	P> 0.05
	Negative	4(4)	

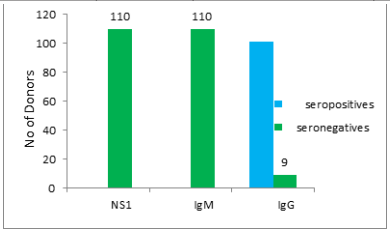

Figure 1

IgG, IgM, NS1 Seroprevalence of Dengue virus in various studies

STUDY	PLACE	IgG seropositivity	IgM seropositivity	NS1 antigen positivity
Present study	Chennai, India (Blood donors) (n=110)	91.8%	0%	0%
Mangwana S[10]	New Delhi, India (Blood donors) (n=1709)	Not done	Not done	0%
Yamashiro et al[12]	Dominican Republic (Blood donors) (n=1008)	98%	Not done	Not done
Mohammed et al[13]	Puerto Rico (Blood donors) (n=300)	92%	Not done	Not done
Rodriguez et al[14]	Northeast Mexico (blood donors) (n=800)	59%	16%	Not done
Ribas-Silva et al[15]	Brazil (blood donors) (n=213)	1.4%	0%	Not done
Harif et al[16]	North Malasiya (blood donors) (n=360)	39.16%	4.2%	Not done
Oruganti et al[17]	Andhra Pradesh India (Healthy individuals) (n=200)	10.5% by IgG Capture ELISA 89.5% by IgG Indirect ELISA	Not done	Not done

In the present study, the seroprevalence rate of dengue among 110 voluntary blood donors was 91.8%. This might be due to endemicity of dengue infection. This is in concordance with the study done by Yamashiro et al[12] in which 98% of the donors (n=1008) were positive for anti-DENV IgG antibody in Dominican Republic. Mohammed et al[13] reported 92% anti-DENV IgG seropositivity among blood donors in Puerto Rico. Rodriguez et al[14] reported 59% of blood donors (n=800) to be positive for anti-DENV IgG antibody in Northeast Mexico. Oruganti et al[17] reported 89.5% of the healthy individuals to be positive for anti-DENV IgG antibody by IgG indirect ELISA in Andhra Pradesh, India.

In the present study, none of the donors were positive for dengue NS1 antigen, indicating the absence of early acute infection. Our dengue NS1antigen seropositivity is similar to the study done by Mangwana S[10] in New Delhi, India.

In our study, none of the donors were positive for anti-DENV IgM antibody, indicating the absence of primary infection. This absence of seropositivity is because of stringent donor selection criteria followed in our study population. Our anti-DENV IgM seropositivity is similar to the study done by Ribas-Silva et al[15] in Brazil. In contrast, Rodriguez et al[14] reported 16% of the blood donors (n=800) to be positive for anti-DENV IgM antibody in Northeast Mexico. Harif et al[16] reported 4.2% IgM seropositivity in North Malaysia. These results reflect that the donors were with recent infection.

DENV RNA may be detected in asymptomatic blood donors whose sera is either positive for NS1 antigen, IgM or lack detectable levels of specific antigen and antibody to DENV.[18,19]

Donor demographic analysis of age, gender, blood group and Rh typing, seasonal variation have no statistically significance difference in IgG seropositivity but socioeconomic status has statistically significance (P=0.006) difference in IgG seropositivity. This is in concordance with the study done by Agravatet al[20] in Gujarat who reported that the seropositivity increases in lower socio economic group when compared to higher socioeconomic group.

The recent focus of most of the research studies is to evaluate the risk for TTI of dengue in both endemic areas as well as non endemic areas. In addition AABB's Transfusion Transmitted Diseases Committee had categorized dengue, along with Babesia and vCJD, as high priority agents to be transmitted through blood transfusion.[21]The National Heart, Lung, and Blood Institute, in collaboration with blood bank organizations and the U.S. FDA and CDC, are extending their support for the research studies to establish the need for screening the blood and blood products for dengue particularly in endemic areas where dengue epidemics are more likely.[22]

DISCUSSION:

The emerging and reemerging infectious agents remain to be a constant threat to the safety of the blood supply. Emerging blood borne pathogens are mostly asymptomatic in healthy individuals and are detected only when transfusion recipients show some clinical morbidity or mortality. Thus any new TTI is more significant. Arboviruses and in particular, Flaviviruses among the new emerging infectious agents are recent threat to the blood supplies globally.[11]

The present study was undertaken to define the seroprevalence of dengue infection among voluntary blood donor population, since voluntary blood donors are the major source of the most blood transfusion requirements. Our blood transfusion centre has 100% voluntary blood donation, hence the present study comprised only of voluntary blood donors. Voluntary blood donors with asymptomatic infection of DENV contribute to the risk of Transfusion Transmitted Dengue infection.

DENV transmission via transfusion of blood and blood products has been documented in humans. Detection of anti-DENV IgM antibodies and dengue viremia in asymptomatic blood donors suggests that DENV could be present in the blood supply.[23] Anti-DENV IgG positive blood bags are not an alarming factor to transmit the virus to the recipient through transfusion.[15] However, it should be stressed that transmission of anti-Dengue IgG antibodies may increase the susceptibility of recipient for greater risk of hemorrhagic dengue if they are infected by another dengue serotype within six months following blood transfusion. Further, the transmission of heterophile anti-DENV antibodies from infected blood donors may enhance viral infectivity if recipients get exposed to another DENV serotype later, by a phenomenon known as antibody-dependent enhancement (ADE).[15,19]

But prevention of transmission of dengue via blood transfusion seems to be of less concern in endemic countries like India where recipients are at greater risk of contracting the infection from the bite of the vector than through transfusion of blood and blood products.[22]

The preventive strategy to exclude viremic donors is a necessary precaution to maintain blood safety. Alternative approaches, such as implementation of stringent donor eligibility criteria and implementation of a suitable screening test or an effective pathogen reduction technology may offer a similar level of safety but implementation of pathogen reduction technology will be more cost effective.

At present in India there is no deferral period specified for dengue positive donors. According to WHO guidelines[23] the donors with history of dengue are deferred for a period of 6 months following full recovery from infection. It is considerable for endemic countries like India to follow these guidelines for deferral period, at least during the epidemics of dengue. And due to scarcity of seronegative donors in endemic countries like India, latest techniques like pathogen inactivation may be made practically available in few centers to cater high risk groups (infants, young children, patients in endemic areas and pregnant mother).

CONCLUSION:

In our study on seroprevalence of dengue among voluntary blood donors, though none of them were dengue NS1 or IgM positive larger proportions of blood donors were positive (91.8%) for anti-DENV IgG

Even though studies reveal that there is a possibility of dengue transmission by blood transfusion from asymptomatic donors, none of the donors in our study showed dengue NS1 and IgM positivity. However, to arrive at a definite conclusion, the study has to be conducted on larger number of donors.

Seronegative blood components are of utmost essential for high risk patients. Blood may be screened for both dengue antigen and antibodies atleast for high risk recipients (patients in endemic areas, pregnant women, infants and young children).

Even though all donor samples were seronegative for dengue NS1 and IgM, it is imperative to screen blood components at least for high risk patients in dengue endemic regions.

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