

Seroprevalence of Dengue Virus Antibodies Among Blood Donors from Karachi: A Single Center Study

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ABSTRACT

Background: The risk of dengue virus transmission through blood transfusion has been dramatically raising a worry to ensure the safe blood supply. Each of the four serotypes is endemic in Pakistan. The aim of study is to determine the seroprevalence of dengue virus antibodies among blood donors.

Materials and methods: This was cross-sectional study performed in department of hematology, Sindh institute of urology and transplantation in Karachi. Four hundred and ten consecutive eligible blood donors participated in the study. All study participants were asked to fill the informed consent. The blood samples that were negative for infections with human immunodeficiency virus (HIV), Syphilis, hepatitis C virus (HCV), hepatitis B virus (HBV) and Malaria were analyzed for the detection of anti-dengue IgG and anti-dengue IgM using a highly sensitive ELISA kit as well as for dengue NS1 antigen detection.

Results: A total of 410 healthy blood donors were enrolled in the study. 406 (99%) were males and 4 (1%) were female with the mean age being 28.8 ± 7.2 years. Anti-dengue IgG was found to be positive in 61.4 % (252) of the study subjects while anti-dengue IgM was positive in 12.8% (53). Of them, 8.7% (36) showed dual positivity to both IgG and IgM while 4.1% (17) showed positivity for IgM alone. DENV-NS1 antigen was found to be positive in 3.6% (15) of the study subjects.

Discussion: Our results demonstrated high seroprevalence of dengue virus in potential asymptomatic blood donors and depicted the disease true burden. It is therefore necessary to implement the vigilant preventive strategies for ensuring safe blood transfusion and reducing the dissemination of dengue virus in an endemic region.

Key Words: Dengue, Seroprevalence, Blood donors, Blood transfusion, Dengue virus IgG antibodies, Dengue NS1 antigen

Introduction

Dengue is the most eventful mosquito-borne viral disease around the globe. It is an endemic disease involving more than 128 nations leading to 50,000 deaths every year and infecting cases occurring over 100 million worldwide¹. Dengue outbreaks in the vulnerable population can gain extremely shrill attack rates. More than 500,000 dengue cases were reported in the 2011 Lahore epidemic (in a city of 5 million) and very next year when it was not endemic, 67.9% demonstrated a high dengue IgG seroprevalence from the same area^{2,3}.

The dengue infection (DENV) is categorized to the Flavi virus genus of the Arbo virus family, which likewise comprises more pathogenic virus, for example, West Nile (WNV), Yellow Fever (YFV), Tick-Borne Encephalitis (TBEV) and Japanese Encephalitis (JEV) which cause conceivably fatal disease. Dengue virus infection is caused by a single-stranded RNA virus with four serotypes (DENV-1, DENV-2, DENV-3, and DENV-4). Dengue clinical spectrum goes from generally mild fever to severe dengue fever and shock syndrome. Most presentation of dengue virus infection is asymptomatic with one dengue serotypes but can lead to the extreme disease on secondary infection by another DENV serotype^{4,5,6}.

Disease burden may ascend with the increase in its direct vectors, *Aedes aegypti* and *A. albopictus*, due to environmental change and expanding urbanization. Since vector control has made just restricted progress so far in lessening the transmission of dengue, a

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powerful plan needs to be executed in districts with sub-tropical and hot climates by combining vector control and dengue infection screening in potential blood donors. The reason behind this implication that 50-85% of cases subsequently stay undiagnosed and thus show up as asymptomatic blood donors. Serological diagnostic workup of dengue depends on the identification of elevated levels of anti-dengue IgM or anti-dengue IgG and Dengue NS1 antigen^{7,8}. Blood collection units constantly incorporate the different combined approaches to deal with emerging transfusion transmitted agents. This includes vigilant preventive techniques having strict donor deferral policies and screening tests, implementing pathogen inactivation methods and close monitoring of already known and ineffectively described, unknown new transfusion transmitted infections. Lately, numerous infectious agents have met the wide meaning of arising diseases through blood transmission, including West Nile infection, Plasmodium spp, Trypanosoma cruzi, Babesia spp, Dengue infection (DENV), parvovirus B19 and prions^{9,10,11}. Transfusion transmitted dengue cases were reported in Hong kong in a Promed concise report. After carefully documented the increased risk of transmission of dengue virus through blood transfusion, American Red Cross has implemented a deferral policy for 120 days in blood donors who repeatedly test reactive for dengue. Most regions have implemented a deferral policy for up to 6 months if a donor has been infected with dengue infection^{6,11}. One study in Saudi Arabia demonstrated seroprevalence of dengue IgG antibodies 7% in healthy blood donors as compared to Singapore that demonstrated 50.8% seroprevalence of dengue IgG antibodies among blood donor^{5,8}. Considerable vigilance is required in improving the safety of transfusion and its accessibility at all levels in the community. Blood administrations in regions encountering dengue epidemics should choose whether more grounded measures are required to secure the blood supply. More Studies on a larger scale are needed to evaluate the risk of transmission of dengue virus through asymptomatic blood donors in endemic areas. This investigation planned to demonstrate the seroprevalence of dengue virus infection among healthy blood donors.

Materials and Methods

This was cross-sectional study conducted by department of Hematology in SIUT hospital, Karachi, Pakistan from July 25 to December 25, 2017. Four

hundred and ten eligible blood donors participated in the study. All study participants were asked to fill the informed consent. Inclusion criteria included all consecutive adults 18-60 years both male and female with a hemoglobin level of twelve or more and negative for infections with hepatitis C virus (HCV), hepatitis B virus (HBV) and human immunodeficiency virus (HIV) on ELISA. Serum was then used for the detection of anti-dengue IgM and anti-dengue IgG with a highly sensitive ELISA kit as well as for the detection of dengue NS1 antigen.

Results

Of 410 healthy blood donors enrolled in the study, 406 (99%) were males and 4 (1%) females. The mean age was 28.8 ± 7.2 years [Table-1]. In study subjects, mean Hb level was 13.8 ± 0.99 . Of them, 34.1% were blood groups O, 34.2% of blood group B, 25.4% of blood group A and 6.3% of AB blood group.

Dengue virus IgG antibodies were positive in 61.5% (252) of the study subjects while anti-dengue IgM was positive in 12.8% (53). Of them, 8.7% (36) demonstrated dual positivity to IgG and IgM while 4.1% (17) demonstrated positivity for IgM alone. DENV-NS1 antigen was found to be positive in 3.6% (15) of the study subjects [Table-2].

In this study, 168 were positive for dengue IgG antibodies in aged group 18-30 years while remaining 74 were positive in aged group 31-40 years and 10 were positive in aged group 41-60 years. 38 were positive for dengue IgM antibodies in aged group 18-30 years while remaining 13 were positive in aged group 31-40 years and 2 were positive in aged group 41-60 years. 11 were positive for DENV-NS1 antigen in aged group 18-30 years while remaining 4 were positive in aged group 31-40 years and none in aged group 41-60 years.

According to blood groups, 54 were positive for dengue IgG antibodies in blood group A, 92 in blood group B, 18 in blood group AB and 88 in blood group O. 7 were positive for dengue IgM antibodies in blood group A, 13 in blood group B, 5 in blood group AB and 28 in blood group O. 9 were positive for dengue NS1 antigen in blood group O while 4 in blood group B, 2 in blood group A.

Table 1: General characteristics of blood donors

Characteristic of donor	Total sample n (%)
GENDER	
Male	406 (99)
Female	4 (1)
AGE	
18-30	254 (62)
31-40	126 (30.7)
41-60	30 (7.3)
TYPE OF DONOR	
Voluntary	51 (12.4)
Family	301 (73.4)
Replacement	58 (14.2)
RESIDENCE	
Rural area	76 (18.5)
Urban area	334 (81.5)

Table 2: Age wise distribution of anti-dengue antibody and dengue NS1 antigen positivity in blood donors

Age group (years)	Total number of donor tested	Anti-Dengue antibody positivity			DENV-NS1 Positivity
		IgM only (%)	IgG only (%)	IgG+IgM (%)	
18-30	254	15	168 (66.1)	23 (9)	11
31-40	126	2	74 (58.7)	11 (8.73)	4
41-60	30	0	10 (33.3)	2 (6.6)	0
overall	410	17 (4.1)	252 (61.4)	36 (8.7)	15(3.6)

Discussion

Dengue infection has occurred in more than 128 countries. Transmission of dengue virus has been reported in Singapore, Hong Kong, Brazil and Puerto Rico through blood transfusion since 2002. The positivity of Dengue NS1 antigen in 3.6% of blood donors in this study reflects that at the time of donations, they were asymptomatic but active carriers of dengue virus.

Having a high seroprevalence of dengue IgG antibodies of 61.5% reflects the need for constructing a reaction strategy, preparedness and surveillance for dengue infections in endemic regions. It very well is deciphered that the prevalence of DEN infection is high and nearly immersed among grown-up occupants of Karachi, likely describing the fact of presence of dengue virus in high magnitude in this area for quite a while. Since this region didn't report any instances of epidemics brought about by arbovirus other than dengue that could lead to an issue in interpreting due to crossreacting antibody, IgG detected was linked as specific for dengue in this realm^{12,13}.

The emphasis for evaluation needs to be built in cases where recipients with immunology conditions develop a greater risk for hemorrhagic dengue fever and shock on re-infection by another serotype inside a half year after blood transfusion. Moreover, the presence of heterophile antibodies to past contamination may ease the entry of additional viral serotypes. The second infection by different serotypes leads to an increase in IgG antibodies titers while IgM antibody titer remains in the undetectable range.

Four significant studies from Brazil and Puerto Rico, the regions having outbreaks of dengue, are reported for assessing the dengue virus in the blood supply. One of them documented high rates of viremia when conducted in more than 15,000 potential blood donors^{14,15}. Another study was conducted in Mexico to demonstrate dengue IgM and IgG antibodies in healthy blood donors. IgG antibodies were identified positive in 59% of donors while IgM antibodies were positive in 2% of asymptomatic blood donors¹⁶.

Regions with similar socio-demographic backgrounds have shown higher dengue virus seroprevalence. In this respect, high IgG seroprevalence was found in India, Singapore and Malaysia (58%, 52% and 42% respectively) while 7% was reported from Saudi Arabia^{17,5,18,8}. Since vector control has made just restricted progress so far in lessening the transmission of dengue and disease consequences, a powerful tetravalent vaccine against every one of the four dengue serotypes might be the solitary way to successfully control dengue.

Regarding Dengue NS1 antigen positivity, it was reported 1% from Saudi Arabia, 4.8% from Cameroon and 0% from India compared to our findings which showed 3.6%^{8,19,20}. The outcomes from the current study revealed that the decision regarding screening dengue infection in endemic areas through blood transfusion should be set up by incorporating serological methods so that the safety of blood transfusion remains ensured. Significant exertion is currently being conveyed to further assess the transmission risk and results of transfusion transmitted dengue virus.

Notwithstanding, prior to reaching firm determinations, a couple of impediments should be depicted. Initial, a high proportion of study subjects were male revealing the fact that fewer women donate blood, an outcome of the social conviction that ladies are more fragile due to blood losses during menstruations and pregnancies. Second, we didn't endeavor to identify RNA detection in this study. Blood administrations in nations encountering dengue

epidemics should choose whether more grounded measures are expected to secure the blood supply.

Conclusions

Our data showed a high seroprevalence of dengue virus among healthy asymptomatic blood donors. Our information comprises the initial move toward better characterizing the flow of DENV in an endemic area and toward developing readiness and reaction intend to battle DENV transmission. More studies on large scale are needed to authenticate this study finding.

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- B. Active Participation in Active Methodology
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