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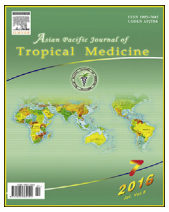

Original research http://dx.doi.org/10.1016/j.apjtm.2016.05.011

High seroprevalence of asymptomatic viral haemoparasites among prospective blood donors in Nigeria

David Olusoga Ogbolu*, Oyebode Terry Alli, Itunu Odeleye, Adeolu S. Oluremi

Department of Medical Laboratory Sciences, College of Health Sciences, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

ARTICLE INFO

Article history:
Received 15 Apr 2016
Received in revised form 16 May 2016
Accepted 23 May 2016
Available online 30 May 2016

Keywords:
Blood donor
Hepatitis
HIV
Serology

ABSTRACT

Objective: To determine the prevalence of viral haemoparasites in prospective Nigerian blood donors.

Methods: Ethical clearance was obtained and informed consent questionnaires were distributed to blood donors to obtain their demographical data. A total of 186 blood donors from LAUTECH Teaching Hospital, Osogbo were tested for hepatitis A virus (HAV), hepatitis B virus (HBV) and hepatitis C virus (HCV) using rapid test kit and enzyme linked immunosorbent assay.

Results: The highest prevalence of blood transmitted infections was 182 (97.85%) while the prevalence of HIV, HAV, HBV and HCV were 6.45%, 97.85%, 14.52% and 3.23%, respectively. Highest seroprevalence for hepatitis A, B and C occurred among low risk occupation. There was no significant association between all the hepatitis viruses and demographic factors except occupation with P value of 0.002 7. Hepatitis A, B and C seropositive blood donors on average tend to have PCV within the normal reference range. Out of the 27 hepatitis B positive blood donors, 22 were donating blood for the first time while 5 were repeat donors. None of the hepatitis C seropositive donors have been exposed to blood or any form of its products and were all donating blood for the first time. However, the distribution of donor type for HAV is random.

Conclusions: The prevalence of HAV, HBV, HCV and HIV among prospective donors in Nigeria is alarming particularly HAV. These infections can be transmitted to recipients if proper screening is not carried out, hence they should be included as a routine test for blood donors.

1. Introduction

Transfusion of blood and its product is a life saving measure for anemic patient but transfusion-transmitted infections are the most setback of transfusion practice. Infectious agents such as hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), HIV and syphilis are among the utmost threats to blood safety for transfusion recipients and proffer serious public health challenges [1]. HAV is a member of the *Hepatovirus* genus of the family Picornaviridae and is a non-enveloped single-stranded RNA virus [2]. HAV replicates in hepatocytes and interferes with liver function, sparking an immune response that causes liver inflammation. Four of the seven genotypes of HAV affect humans (genotypes I and III are the most common), but only one serotype exists [3].

Infection with any of the genotypes usually results in lifelong immunity against all strains of HAV. HAV is transmitted via the fecal-oral route either by direct contact with an infectious person or by ingestion of contaminated food or water. The risk of disease increases with age [4]. The vast majority of hepatitis A patients make a full recovery, and the case fatality rate is low. The estimated mortality rate is 0.1% for children less than 15 years old, 0.3% for adults ages 15–39, and 2.1% for adults ages 40 and above [5]. Several complications may occur; about 15% of patients experience prolonged jaundice and/or relapses over several months. Some develop cholestatic hepatitis, in which the bile duct leading from the liver to the intestine becomes blocked.

A few suffer from fulminant (acute) liver failure that may require a transplant or cause death. Although liver failure is more likely to occur in patients suffering from chronic liver disease prior to the onset of hepatitis A, it can occur in anyone with HAV infection [5].

*Corresponding author: David Olusoga Ogbolu, Department of Biomedical Science, College of Health Sciences, Ladoke Akintola, University of Technology, Ogbomoso, Nigeria.
Tel: +234 7055776547.
E-mails: olusogadave@yahoo.com, doogbolu@lautech.edu.ng

Peer review under responsibility of Hainan Medical College.

Serological markers for hepatitis of HBV and HCV are screened in blood banks routinely but HAV is not routinely done. Due to their mode of transmission, it has made the provision of safe blood difficult and the screening of blood absolutely necessary [6]. Individuals with viral hepatitides chronic infection have high risk of liver cirrhosis and hepatocellular carcinoma. HBV and HCV have similar routes of transmission namely through blood and its products, intravenous drug abuse, unsafe injections and sexual activity [7].

Detection of hepatitis B surface antigen and antibodies to HCV in blood bank is routinely carried out for detection of hepatitis infection [8]. Globally, 320–350 million peoples are chronic carriers of HBV and mortality of 1.5 million are being recorded annually from HBV infection. In Nigeria, 12% of the total populations are chronic carriers of HBV; Anti-HCV antibody prevalence rate of 5.7% in Plateau, 8.4% in Lagos and 9.2% in Osun among blood donors, pregnant women and HIV patients, respectively has been reported [9]. Chronic hepatitis C is a progressive disease that leads to death through hepatocellular carcinoma and also predisposes to renal cell carcinoma [10]. In Nigeria, HCV infection is still endemic and the prevalence of hepatitis C and its mode of transmission among Nigerians are unidentified, but latest studies across the country among blood donors showed a prevalence ranging between 0.4% and 12.3% [7]. This study aimed to determine the prevalence of viral haemoparasites (HAV, HBV and HCV) among Nigerian blood donors.

2. Materials and methods

The study was carried out at the Blood Transfusion Unit of Department of Hematology, LAUTECH Teaching Hospital, Osogbo, Nigeria. A total of 186 blood donors (141 males and 45 females) with age range 18–56 years were enrolled in this study. Prospective donors were initially sorted using a structured questionnaire on risk behaviors and were physically examined. The study was approved by the ethical review committee of the hospitals.

Blood donors were bled by venipuncture into EDTA bottle and processed in Hematology and Microbiology Laboratory, LAUTECH, Osogbo, Nigeria.

Blood donors were screened for HIV, HAV, HBV and HCV antibodies. HIV 1/11 screening was done using Determine Kit (Abbott Diagnostic Division, Hoofddorp, The Netherlands) and later confirmed with Unigold (Trinity Biotech, Ireland). Hepatitis A virus assay was done using competitive enzyme immunoassay (ELISA); reagent sourced from PRO Diagnostic Bio probes Srl via Columella NO 31 20128 Milano, Italy while HBV and anti-HCV assay were done using clinotech diagnostic test kit (manufactured by Clinotech® Diagnostics, Canada). Both positive and negative control sera were included.

Data were analyzed using Statistical Package for Social Sciences software. Chi square was used to determine the effect of sex, age, and other social demographic factors, including the level of hemoglobin on HAV, HBV and HCV. The P value <0.05 was considered to be significant.

3. Results

The overall prevalence of blood transmitted infections in this study was 182 (97.58%). The prevalence of HIV, HAV, HBV and HCV were 6.45%, 97.85%, 14.52% and 3.23%, respectively. Table 1 showed age distribution in relation to viral hepatitis which showed significant association (P = 0.005). Prevalence of HAV, HBV and HCV infection in relation to social demographical factors were shown in Table 2. Fourteen (7.69%), 7 (25.9%) and 1 (16.7%) prospective blood donors had HIV–HAV, HIV–HBV and HIV–HCV coinfection, respectively. Coinfection of HBV and HCV was found in 2 (1.08%) patients while 4 (2.15%) were non-reactive to any of the hepatitis viruses. Highest seroprevalence for hepatitis A, B and C occurred among low risk occupation. There was no significant association between all the hepatitis viruses and demographic factors except occupation with (P = 0.027).

The hematocrit level showed that hepatitis A, B or C seropositive blood donors on average tends to have PCV within the normal reference range as shown in Table 3. Hematocrit level, when compared with sex was not significant. Out of the 27

Table 1
Age distribution in relation to viral hepatitis (P = 0.005).

Age group	Number	HAV (%)	HBV (%)	HCV (%)
18–24	49	45 (24.90)	7 (3.76)	1 (0.54)
25–31	62	62 (33.34)	12 (6.45)	3 (1.61)
32–38	37	37 (19.89)	5 (2.69)	1 (0.54)
39–45	26	26 (13.98)	1 (0.54)	0 (0.00)
49–52	7	7 (3.76)	2 (1.08)	0 (0.00)
53–60	5	5 (2.69)	0 (0.00)	1 (0.54)
Total	186	182 (97.85)	27 (14.52)	6 (3.23)

Table 2
Social demographic factors in relation to viral hepatitis.

Factors	Number	HAV (%)	HBV (%)	HCV (%)	P
Education level					0.081
Primary school	20	20 (100.00)	3 (15.00)	0 (0.00)	
Sec. school	74	73 (95.50)	11 (14.86)	5 (5.41)	
Diploma	41	41 (100.00)	7 (17.70)	1 (2.44)	
Undergraduate	16	13 (81.25)	1 (6.25)	0 (0.00)	
Graduate	35	35 (100.00)	5 (14.29)	1 (2.86)	
Sex					0.734
Male	141	139 (74.77)	23 (12.37)	5 (2.69)	
Female	45	43 (23.12)	4 (2.15)	1 (0.54)	
Occupation					0.027
High risk	37	37 (19.89)	6 (3.23)	2 (1.08)	
Low risk	146	142 (76.35)	21 (11.29)	4 (2.15)	
Unemployed	3	3 (1.61)	0 (0.00)	0 (0.00)	
Donor type					0.059
Family donor	153	152 (81.72)	21 (11.29)	5 (2.69)	
Voluntary donor	30	27 (14.56)	5 (2.69)	1 (0.54)	
Commercial donor	3	3 (1.61)	1 (0.54)	0 (0.00)	
Prevalence		182 (97.85)	27 (14.52)	6 (3.22)	

Table 3
Hematocrit levels in relation to viral hepatitis infection.

Sex	PCV (%)	HAV (%)	HBV (%)	HCV (%)	P
Male					0.094
Within	40–54	135 (72.58)	22 (11.83)	5 (2.69)	
Below	<40	1 (1.61)	1 (0.54)	0 (0.00)	
Above	>54	1 (0.54)	0 (0.00)	0 (0.00)	
Female					0.187
Within	36–46	42 (22.58)	3 (1.61)	1 (0.54)	
Below	<36	1 (0.54)	1 (0.54)	0 (0.00)	
Above	>46	2 (1.08)	0 (0.0)	0 (0.00)	

hepatitis B positive blood donors, none admitted to have been exposed to blood or its products; 22 were donating blood for the first time while 5 were repeat donors. None of the hepatitis C seropositive donors have been exposed to blood or any form of its products and were all donating blood for the first time. However, the distribution of donor type for HAV is random. Family donors tend to be the most common type of donor (82.26%) followed by Voluntary donor (16.13%); commercial donors carried the lowest percentage (1.61%). HAV, HBV and HCV seroprevalence among family donor are 81.72%, 11.29% and 2.69%, respectively.

4. Discussion

The seroprevalence of HAV in this study was 97.85%, this is very high compare to previous studies done by Ikobah *et al.* [11] in rural part of southern Nigeria. Four of HAV negative donors out of 186 sera tested for antibody to HAV are not rarely Osun indigenes, three were student of University College Hospital and the remaining one lives in Lagos State which indicate that Osun state could have a HAV prevalence of 100%. Also, the four negative blood donors do not react positively to any other blood transmissible viruses which could imply that they have been living healthy, hygienic and cautious life. Hepatitis A has been documented by Nainan *et al.* [12] to have a worldwide distribution and very high incidence in developing countries and rural areas; with this, Osun justifies this high prevalence in that it is still a developing state with very poor environmental sanitation and unhygienic personal hygiene compared to other states in the south western region of Nigeria.

The major route of transmission for hepatitis A virus is feacal-oral route and arises from ingestion of contaminated food and water [13], hence the endemic outbreak of hepatitis A in Osun is most likely to have resulted from the fact that water is being supplied throughout the state from a single source (Ede) which could have been infected with HAV. This is in agreement with the study of Alter [14] posited that drinking water contaminated by hepatitis A virus infected faeces is a problem in communities with poor sewage treatment facilities which is a major route of transmission of HAV.

The assay procedure for HAV in this study did not distinguish between immunoglobin M (IgM) anti-HAV and IgG anti-HAV. IgM anti-HAV is an antibody to the capsid proteins of HAV which is required to confirm a diagnosis of acute HAV infection and appears (5–10) d before the onset of symptoms and can persist in the body system for only up to 6 month after infection; while IgG appears earlier and remain detectable throughout the person lifetime confirming protection to the disease. With this, it is difficult to tell whether this tested population has a current ongoing infection or only an evidence of past infection in their early childhood because HAV affects mainly children [15]. No emerging risk factors for hepatitis A have been pointed out as hepatitis A seroprevalence shows neither preference for occupation nor any other risk behavior. No varied distribution with regards to age, sex, literacy, and donor type, existence of immunocompromising disease, exposure to blood or blood products.

For HBV, the prevalence was estimated to be 14.45% which is below value reported by Musa *et al.* [10] with a prevalence of 13.6% among family blood donors. From this study, it was observed that males (12.37%) were more affected with viral hepatitis B than their female counterparts (2.15%), which is similar to report of Diwe *et al.* [16]. Of all the hepatitis B positive donors, none had previously received a blood or blood products transfusion and were mostly donating bloods for the first time signifying to an extent, hepatitis B is not Hospital acquired. Seven (25.93%) of the 27 HBV positive donors had a co-infection with HIV infection while 5 (3.14%) of the 159 HBV negative donors had HIV infection; with this, HIV can be considered as a major immunocompromising diseases that predisposes donor to viral hepatitis B infection. Presence of viral hepatitis B does not have effect on donors' hematocrit level and the two donors with reduced hematocrit level had a co-infection with HIV most likely to be the underlie cause of reduced hematocrit level. Liaw *et al.* [17] in their study posited that the hematocrit of patients with HCV were significantly higher than the (9.9 ± 1.4) g/dL and 29.7% ± 4% of non-hepatitis B and C positive patients ($P = 0.002$ and $P = 0.001$). It was also observed that those within the age bracket of 19–31 years are most affected with high record of HBV prevalence, this may be due to the fact that these age groups are more sexually active [18]. It was also observed that donor's with low skill occupation have the highest viral hepatitis B prevalence; this may infer that occupational exposure is not a predisposing factor for acquiring viral hepatitis B infection. Considering donor's educational status, secondary school qualified donors had the highest HBV prevalence of 5.92% and it is possible that most seropositivity in this group is a result of recent vaccination considering the immunization pattern in Nigeria.

The seroprevalence of viral hepatitis C was estimated to be 3.23% this is very low compared with previous findings by Ejiofor *et al.* [19] who reported that hepatitis C virus infection is increasing in Nigeria, from 4.7% to 5.0% in Ilorin, to 5.3%–6.6% in Enugu, to 11% in Ibadan and 20% in Benin. All the HCV positive donors were donating blood for the first time which implies that there is no difference in the prevalence of HCV between repeat donors and first time donors. Paradoxically, HCV seropositivity was lowest in blood donors who had received blood transfusion (33.33%) compared to those who has never been exposed to transfusion (66.67%). Published data for hepatitis C prevalence in Mauritania, Benin and Ghana were 1.1, 1.4% and 2.8%, respectively [20]. With all these existing facts, the prevalence of HCV among blood donors in Osogbo estimated in this study is alarming. Among those infected with HCV, 16.72% had a co-infection with HIV, it can be concluded that immunocompromising (HIV) infection is one of the predisposing factors of donors to viral hepatitis C infection in Osogbo.

In conclusion, this study showed the presence of HAV, HBV, HCV and HIV among prospective donors in Nigeria is alarming particularly HAV. High prevalence of HAV is alarming and therefore it should be included as a routine test for blood donors.

Conflicts of interest statement

We declare that we have no conflict of interest.

Acknowledgments

The authors would like to thank the staff (Laboratory Scientists) of Biomedical Science department, LAUTECH and Blood Transfusion Unit of Department of Hematology, LAUTECH Teaching Hospital, Osogbo for their unflinching support during the study.

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