Prevalence of transfusion-transmissible hepatitis B infection among blood donors in Sokoto, North Western, Nigeria

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Abstract
Blood transfusion remains a substantial source of Hepatitis B Virus infection in sub-Saharan Africa. In this present study we investigated the prevalence of hepatitis B infection among 150 consecutively recruited blood donors aged 18 to 65 years and mean age 27.4 ± 6.6 made up of 133 (86.7%) male and 17 (11.3%) females. Among the donors tested, 14 (9.3%) were positive for hepatitis B while 136 (90.2%) were negative. The prevalence of hepatitis B was compared based on the gender and ABO blood group of blood donors. HBV infection was significantly higher among blood group O donors 8 (57.2%) compared to 3 (25.4 %), 2 (14.3%) and 1 (7.1%) respectively for group A, B and AB donors (p=0.01). The prevalence of hepatitis B was compared based on the age groups and type of blood donors. Hepatitis B prevalence was significantly higher among blood group O donors 8 (57.2%) compared to 3 (25.4 %), 2 (14.3%) and 1 (7.1%) respectively for group A, B and AB donors (p=0.01). The prevalence of hepatitis B was compared based on the gender and ABO blood group of blood donors. HBV infection was significantly higher among blood group O donors 8 (57.2%) compared to 3 (25.4 %), 2 (14.3%) and 1 (7.1%) respectively for group A, B and AB donors (p=0.01). The prevalence was highest among younger donors in the 18-28 years age group 10 (71.43%) compared to 3 (21.43%) and 1 (7.14%) respectively in the 29-38 and 39-48 years age groups. No infection was observed among older blood donors in the 49-58 and 59-68 years age groups (p=0.01). Married donors was significantly as risk for HBV 11(78.6%) compared to single 11(78.6%) blood donors (p=0.001). Hepatitis B prevalence was significantly higher among civil servants 6(42.9%) and farmers 4(28.6%) and lowest among traders and students 2(14.3%) (p=0.01). Hepatitis B infection was significantly higher among family replacement donors 13(92.9%) compared to voluntary non-remunerated blood donors 1(7.14%) (p=0.001). Blood donors should be routinely and mandatorily screened for hepatitis B to minimize the risk of transmission of HBV infection to the recipient. Effort
should be made to recruit and retain voluntary non
remunerated donors rather than high risk commercial and
family replacement donors. There is need for public
awareness, complete immunization against viral hepatitis B,
better sanitation facilities, safe drinking water, increased
availability of health care facilities for early detection and
well equipped hospitals for intensive care.

1. Introduction

Transmission of infectious diseases including Hepatitis B
through donated blood is a significant challenge to blood
safety particularly in SSA 1. The world health organization
estimates that over 2 billion people have been exposed to
hepatitis B virus and approximately 350 million people are
chronically infected with HBV 2. Infection with Hepatitis B
Virus (HBV) is a major cause of morbidity and mortality
globally, primarily because of the sequelae of chronic liver
disease including cirrhosis and hepatocellular carcinoma 3-4.

About a third of the world population has been infected
with HBV at one point in their life 5. The disease has caused
epidemics in parts of Asia and Africa, and it is endemic status
in China 6. The virus is transmitted by exposure to infectious
blood or body fluids such as semen and vaginal fluids, while
viral DNA has been detected in the saliva, tears, and urine of
chronic carriers. Other risk factors for developing HBV
infection include working in a healthcare setting, transfusions,
dialysis, acupuncture, tattooing, travel in countries where it is
endemic, and residence in an institution 6. Infection with the
Hepatitis B virus is a public health problem and is highly
endemic in the sub Saharan Africa 7. The prevalence of HBV
infection in Nigeria was estimated to be 2.4-18.4% of the
population 8-10.

There is paucity of data on the prevalence of HBV among
blood donors in Sokoto, Nigeria. The risk of transmission of
HBV through the transfusion of unscreened blood in the area
is not known. The aim of this present study was to establish
the prevalence and associated socio-demographic factors for
transfusion-transmissible HBV infection in Sokoto, North
Western region of Nigeria.

2. Materials and Method

2.1. Study Area

This present research work was carried out at the
Haematology and Blood Transfusion unit of Usmanu
Danfodiyo University Teaching Hospital in Sokoto in the
North West geo-political zone of Nigeria. The hospital is a
500-bed teaching hospital and a center of excellence in the
rendering of specialist medical care to people in Sokoto
metropolis and neighboring states of Zamfara and Kebbi
State. Sokoto State is located in the extreme North Western
part of Nigeria near to the confluence of the Sokoto River
and the Rima River. With an annual average temperature of
28.3 °C (82.9 °F), Sokoto is, on the whole, a very hot area.

However, maximum daytime temperatures are for most of the
year generally under 40 °C (104.0 °F). The warmest months
are February to April when daytime temperatures can exceed
45 °C (113.0 °F). The rainy season is from June to October
during which showers are a daily occurrence. There are two
major seasons, wet and dry which are distinct and are
characterized by high and low malarial transmission
respectively. Report from the 2007 National Population
Commission indicated that the state had a population of 3.6
million 11.

2.2. Subjects

The study was a case study and included 150
consecutively recruited blood donors visiting the blood
transfusion unit of Usmanu Danfodiyo University Teaching
Hospital in Sokoto, North Western Nigeria for blood
donation purpose.

2.3. Inclusion Criteria

The inclusion criteria included: age 18-65 years, willing to
offer verbal informed consent to participate in the study, pre-
donation haemoglobin of ≥ 13.5g/dl for males and ≥ 12.5g/dl
for females. All donors were offered pre and post donation
counselling.

2.4. Exclusion Criteria

Donors who did not meet the inclusion criteria of age 18-
65 years, those who did not offer a verbal informed consent
to participate in study, lactating, pregnant and menstruating
women, donors who did not meet the haemoglobin
requirements and donors with history of fainting attack and
those who have donated more than the prescribed 3 times in
the last 12 months were excluded from the study.

2.5. Statistical Analysis

The age, gender and other socio-demographic details of all
the blood donors were collected using a questionnaire. Data
was collected on excel spread sheet and analyzed using the
statistical software SPSS version 18. A p-value of <0.05 was
considered significant in all statistical comparisons.

2.6. Specimen Collection

Three milliliters of venous blood samples were taken from
each blood donor into a clean dry tube. Blood samples were
allowed to stand at room temperature for clotting and
retraction. Thereafter, the samples were centrifuged to give a
clear serum. The serum was separated and stored at -20c°
prior to testing.

2.7. Detection of HBsAg in the Serum

Qualitative detection of hepatitis C antibodies in the serum
was carried out using the OnSite HBsAg rapid test
(sera/plasma) manufactured and described by CTK Biotech
(USA). The test is a lateral flow chromatographic
immunoassay for the qualitative detection of HBsAg in human serum or plasma. HBsAg is the surface antigen of the hepatitis B virus (HBV). Its presence in serum or plasma indicates the presence of current hepatitis B infection. The manufacturer’s standard operating procedures were followed strictly.

3. Result

In this present study we investigated the prevalence of hepatitis B infection among 150 consecutively- recruited blood donors aged 18 to 65 years and mean age 27.4 ± 6.6 made up of 133 (86.7%) male and 17 (11.3%) female. Among the donors tested, 14(9.3%) were positive for hepatitis B while 136 (90.2%) were negative. Table 1 show the prevalence of Hepatitis B among blood donors.

Table 1. Prevalence of Hepatitis B among blood donors

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number Tested</th>
<th>Number (%) positive for HBV</th>
<th>Number (%) negative for HBV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis B</td>
<td>150</td>
<td>136 (90.2)</td>
<td>14 (9.3)</td>
</tr>
</tbody>
</table>

The prevalence of hepatitis B was compared based on the ABO blood group and gender of blood donors. HBV infection was significantly higher among blood group O donors 8 (57.2%) compared to 3 (25.4 %), 2 (14.3%) and 1 (7.1%) respectively for group A, B and AB donors (p=0.01). The prevalence of HBV was significantly higher among male compared to female donors (p=0.001). Table 2 show the distribution of hepatitis B virus among blood donors based on gender and ABO blood group.

Table 2. Distribution of hepatitis B virus based on the ABO blood group and gender of donors

<table>
<thead>
<tr>
<th>Blood Group</th>
<th>Number (%) of donor tested</th>
<th>Number (%) positive for HBV</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>92 (6)</td>
<td>8 (57.2)</td>
<td>0.01</td>
</tr>
<tr>
<td>A</td>
<td>24 (16)</td>
<td>3 (25.4)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>31 (20)</td>
<td>2 (14.3)</td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>3 (2)</td>
<td>1 (7.1)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>133 (88.7)</td>
<td>14 (100)</td>
<td>0.001</td>
</tr>
<tr>
<td>Female</td>
<td>17 (11.3)</td>
<td>0 (0)</td>
<td></td>
</tr>
</tbody>
</table>

The prevalence of hepatitis B was compared based on the age groups and type of blood donors. Hepatitis B prevalence was significantly higher among civil servants 6(42.9%) and farmers 4(28.6%) and lowest among traders and students 2(14.3%) (p=0.01). Hepatitis B infection was significantly higher among family replacement donors 13(92.9%) compared to voluntary non-remunerated blood donors 1(7.14%) (p=0.001). Table 3 show the distribution of Hepatitis B virus infection among blood donors based on age group and marital status.

Table 3. Distribution of Hepatitis B Virus infection among blood donors based on age group and marital status

<table>
<thead>
<tr>
<th>Age group (Years)</th>
<th>Number (%) of donor tested</th>
<th>Number (%) positive for HBV</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-28</td>
<td>102</td>
<td>10 (71.4)</td>
<td>0.01</td>
</tr>
<tr>
<td>29-38</td>
<td>39</td>
<td>3 (21.4)</td>
<td></td>
</tr>
<tr>
<td>39-48</td>
<td>7</td>
<td>1 (7.14)</td>
<td></td>
</tr>
<tr>
<td>49-58</td>
<td>2</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>59-68</td>
<td>0</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>57</td>
<td>3 (21.4)</td>
<td>0.001</td>
</tr>
<tr>
<td>Married</td>
<td>93</td>
<td>11 (78.6)</td>
<td></td>
</tr>
</tbody>
</table>

The prevalence of hepatitis B was compared based on the occupational groups and type of blood donors. Hepatitis B prevalence was significantly higher among civil servants 6(42.9%) and farmers 4(28.6%) and lowest among traders and students 2(14.3%) (p=0.01). Hepatitis B infection was significantly higher among family replacement donors 13(92.9%) compared to voluntary non-remunerated blood donors 1(7.14%) (p=0.001). Table 4 show the distribution of Hepatitis B virus infection among blood donors based on occupational groups and type of blood donors.

Table 4. Distribution of Hepatitis B virus infection based on occupational groups and type of blood donors

<table>
<thead>
<tr>
<th>Occupational groups</th>
<th>Number (%) of donor tested</th>
<th>Number (%) positive for HBV</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>48 (32)</td>
<td>4 (28.6)</td>
<td>0.01</td>
</tr>
<tr>
<td>Trader</td>
<td>24 (16)</td>
<td>2 (14.3)</td>
<td></td>
</tr>
<tr>
<td>Civil servants</td>
<td>35 (23.3)</td>
<td>6 (42.9)</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>43 (28.7)</td>
<td>2 (14.3)</td>
<td></td>
</tr>
<tr>
<td>Type of Donors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voluntary Non-remunerated</td>
<td>27 (18)</td>
<td>1 (7.14)</td>
<td>0.001</td>
</tr>
<tr>
<td>Family Replacement</td>
<td>123 (82)</td>
<td>13 (92.9)</td>
<td></td>
</tr>
</tbody>
</table>

The prevalence of hepatitis B was compared based on the age groups and type of blood donors. Hepatitis B prevalence was significantly higher among civil servants 6(42.9%) and farmers 4(28.6%) and lowest among traders and students 2(14.3%) (p=0.01). Hepatitis B infection was significantly higher among family replacement donors 13(92.9%) compared to voluntary non-remunerated blood donors 1(7.14%) (p=0.001). Table 3 show the distribution of Hepatitis B virus infection among blood donors based on age group and marital status.

4. Discussion

In this present study, we observed a high prevalence of transfusion transmissible HBV of 9.3% among our cohort of blood donors in Sokoto, Nigeria. Infection due to hepatitis B is a significant public health problem around the globe. The prevalence of HBV varies between 2% in developed countries where the prevalence is low compared to developing countries where infection is endemic with gender, age, and socioeconomic status as important risk factors for infection. The prevalence of 9.3% observed in this study is in agreement with a previous report by Dongdem and colleagues among Ghanaian blood donors which indicated HbsAg prevalence of > 10%. Our observed prevalence is consistent with a 10.4% prevalence reported by Mustapha and colleagues in Gombe, Nigeria and the 8.5 % reported in Abidjan, Ivory Coast, 8.8% in Tanzania and 10.4% reported by Glynn and colleagues in the United States of America. It is however lower than the 14.0% previously reported by Baba and colleagues in Maiduguri, 15% reported by Ampofo and colleagues in Ghana, 18.6% prevalence reported in a previous study in Osogbo and...
1.7% reported by Chikwem and colleagues in Maiduguri. The HBV prevalence obtained in this study is also higher than the 1.1% prevalence reported in Niger Delta region of Nigeria, 6% reported in Jos, 2.2% reported in Pakistan, 4% and 4.3% reported in Kenya and Egypt respectively. The HBV prevalence seems to differ by geography. In a previous study involving 1079 blood donors in the Central Blood Bank of Bukavu in Democratic Republic of Congo (DRC), a prevalence of 4.2% was obtained. A study of blood donors in Kisangani transfusion center in DRC indicated HBV prevalence of 5.4%. A previous report involving blood donors who were screened for HBV in a blood transfusion center of Maharaja Agrasen Medical College, Agroha Haryana, India observed HBV prevalence of 1.7%. The risks of becoming infected with HBV in subjects receiving units of blood from the Gabonese Blood Transfusion Centre are 534.53 per million donations. Out of a total of 24761 Namibian blood donors tested for HBV in a previous report, 316 (0.6%) of the donations were positive for HBsAg. Similarly, a previous report in Turkey observed serum HBsAg positivity in 3% of blood donors. A study in Argentina from 2004 to 2011 showed that the prevalence of HBsAg decreased from 0.336% to 0.198%. A study that investigated 66,311 donations between 2005 and 2010 from a central blood center in Western China indicated HBV prevalence of 0.87%. A previous report that estimated the risk of transfusion-transmitted HBV infection in blood donations collected in Korea from 2000 to 2010 indicated that the residual risks for HBV in 2000/2001 and 2009/2010 were 1 in 45,891 and 1 in 43,666 respectively.

In pursuit of global blood safety, the World Health Organization (WHO) recommends that all blood donations should be screened for evidence of infection including HBV prior to the release of blood and blood components for clinical or manufacturing use. Transfusion-transmissible HBV have been drastically reduced in countries where routine serologic screening of donors is implemented. However, despite screening of blood donations, the risk of transfusion-transmitted HBV infection persists. This risk is mainly due to blood donations collected particularly during the window period. Testing donations with advanced technologies such as Nucleic Acid Testing (NAT) and excluding donors at high risk of infection have reduced the risk of infectious donations entering the blood supply particularly in developed countries. However this is not the case in many developing countries in SSA where these advanced technologies are unavailable, screening of potential blood donors has historically relied on the use of less sensitive rapid immunoassay based rapid assays to detect viral antibodies or antigens and reliance on high risk family replacement and commercial remunerated donors. The resultant effect of this failure in the stewardship of blood is that the prevalence of transfusion-transmissible HBV continues to be high in SSA. The main advantage of NAT screening is that it facilitates the detection of cases during the window period. There is need for universal vaccination against HBV to be introduced in Nigeria. Best practices in Korea and other developed countries indicate that universal vaccination can produce a significant reduction in the residual risk of HBV infection. The residual risk of HBV in countries with low prevalence (<2%), such as the UK, was 1 in 296,736 in the 1990s, and 1 in 729,927 donations in the 2000s. The residual risk of HBV in countries with moderate to high prevalence declined from 1 in 10,700 to 1 in 340,000 during a similar period.

In this study, we observed a higher prevalence of HBsAg among blood donors in the 18-28 years age group. This is in contrast with the work of Mustapha and Jibrin, which reported that the highest rate of HBsAg seropositivity of 41.6% among donors in the 40-49 years age group. Our finding is in agreement with previous results reported by Baba and colleagues and Ejele and coworkers in which higher HBV prevalence were observed among youths. This observation portends a bad omen for the Nigerian Nation since the most productive and economically viable age group of the population is worst hit. There is the urgent need for renewed intensification of prevention programmes aimed at changing high-risk behaviors among Nigerian youths. The high prevalence of HBV among the youth could be as a result of the high risk behavior such as maintenance of multiple sex partners, tattooing, having unprotected sex, intravenous drug abuse and other unhygienic activities involving youths. The economic costs of the failure to control the transmission of infection among young Nigerians include increased requirement for medical care, higher level of dependency and the loss of productive labor force, thereby placing heavy burdens on the already overstretched health and social services and on the natural economy. Factors contributing to a high transfusion-related transmission in sub-Saharan Africa include; high rate of transfusion in some groups of patients (particularly, children and women), high prevalence of TTIs in the general population and blood donor population, inadequate screening facilities and lack of infrastructure and capacity to ensure sustainable operation.

The majority of donors tested in this study were family replacement donors (90.9%) rather than voluntary non remunerated donors of (9.1%). The amount of voluntary donated blood has continued to fall over the years in Nigeria due to logistic and organizational problems associated with the Nigeria national blood transfusion services. The net result is that commercial and family replacement donors persist. Family replacement donors accounted for a significant number of HBV infection compared to voluntary non-remunerated donors. This observation is consistent with the suggestion that the safest source of blood is from voluntary-non -remunerated donors. These are donors who donate blood due to altruism. Previous report indicated that no nation can meet the blood transfusion needs of her citizens by depending solely on family replacement donors. Not only is blood donated by family replacement donors unsafe, blood are often not replaced based on quantity and type. Also, the blood donated by certain family members can potentially put women particularly those of child bearing age at risk of Haemolytic Disease of the Foetus and Newborn (HDFN) and
Haemolytic Transfusion Reaction (HTR) particularly they are transfused with donor units containing a clinically significant red cell antigen which the woman lacks.

In this present study we observed a higher male gender predisposition to HBV infection. Our finding is consistent with a previous report among Namibian blood donors in which the prevalence of hepatitis B was significantly higher among male compared to female blood donors. The reason for this male gender predisposition may be due to the fact that polygamy and maintenance of multiple sex partners is prevalent in the area. Men are permitted on religious ground to marry up to 4 wives. This increased risk associated with the maintenance of multiple sex partners may play a role in the higher prevalence observed among men compared to women.

5. Conclusion and Recommendations

Blood donors should be mandatorily and routinely screened for hepatitis B to minimize risk of transfusion of HBV infection to the recipients. There is need for increased public awareness campaign, complete immunization against viral hepatitis B, better sanitation facilities, safe drinking water, increased availability of health care facilities for early detection and well equipped hospital for intensive care. This will go a long way in the reduction of viral hepatitis-related mortality and morbidity. It is recommended that effort be made to recruit and retain voluntary non-remunerated donors rather than risky commercial and family replacement donors.

References


