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

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Citation

Abstract
Transfusion-transmissible human immunodeficiency virus is the greatest threat to blood transfusion safety and pose a serious public health problem in Nigeria. In this present study we investigated the prevalence of HIV infection among 150 consecutively recruited blood donors aged 18 to 65 years and mean age 27.4 ± 6.6 made up of 133 (88.7%) male and 17 (11.3%) females. Among the blood donors tested, 7(4.67%) were positive for HIV while 143(95.3%) were negative. HIV infection was significantly higher among male donors 7(52.6%) compared to female donors (p=0.001). The prevalence of HIV was significantly higher among blood group A donors 5 (33.3%) followed by group B donors 2 (6.5%) (p=0.01). HIV prevalence was significantly higher among donors in the 18-28 years age group 6 (8.7%) male and 17 (11.3%) females. Among the blood donors tested, 7(4.67%) were positive for HIV while 143(95.3%) were negative. HIV infection was significantly higher among male donors 7(52.6%) compared to female donors (p=0.001). The prevalence of HIV was significantly higher among blood group A donors 5 (33.3%) followed by group B donors 2 (6.5%) (p=0.01). HIV prevalence was significantly higher among donors in the 18-28 years age group 6 (5.9%) followed by the 29-38 years age group 1 (2.6%) (p=0.01). Of the donors who tested positive for HIV, 6 and 7 (85.8%) were in the 18-28 years age group. Single blood donors 6 (10.5%) had a higher HIV prevalence compared to married blood donors 1 (1.1%), p=0.01. HIV prevalence was significantly higher among Farmers 3 (6.25%) followed by Civil servants 2 (5.71%) and Students 2 (4.7%) respectively (p=0.01). HIV was higher among family replacement donors 7 (5.7%). No case of HIV infection was observed among voluntary non-remunerated blood donors (p=0.35). This study demonstrates a substantial risk of transfusion-transmissible HIV infections in Sokoto, North Western, Nigeria. We recommend that effort be made to recruit and retain low risk voluntary non-remunerated donors. There is also the need to routinely
screen all blood donors in the area for HIV. We recommend that evidenced-based best practice of inclusion of nucleic acid testing in the donor screening menu be implemented to reduce the risk of transfusing HIV-infected donor blood during the window phase of infection. Public awareness and prevention programme for HIV needs to be intensified with the aim of changing high-risk behaviour among youths.

1. Introduction

Globally, 35.3 million [32.2–38.8 million] people are living with Human Immunodeficiency Virus (HIV), 32 million under the age of 15. In 2013 an estimated 2.1 million people were newly infected with HIV and everyday more than 5,700 people contract HIV nearly 240 every hour. Since the epidemic, nearly 78 million people have contracted HIV and close to 39 million have died of AIDS-related causes1. HIV/AIDS has become the leading cause of premature death in Sub-Saharan Africa and the fourth largest killer worldwide2. In sub-Saharan Africa, where the majority of new HIV infections continue to occur, an estimated 1.8 million people became infected in 2009. Nigeria currently has about 3.4 million people living with HIV3.

HIV is a lentivirus (slowly replicating retrovirus) that causes Acquired Immunodeficiency Syndrome (AIDS) a condition in humans in which there is progressive failure of the immune system allowing life-threatening opportunistic infections and cancers to thrive. HIV can be transmitted from person to person by sexual relationships (homosexual or heterosexual), blood transfusions and vertically from an infected mother to her child during pregnancy, delivery or breast-feeding4.

Donated blood has lifesaving potential and universal screening of donor blood for HIV help to reduce the risk of transmission of HIV through blood transfusion and by extension help maximize safety of blood transfusion. There is paucity of data on the prevalence of HIV among blood donors in Sokoto, Nigeria. It is not known the risk of transmitting HIV through the transfusion of unscreened blood in the area. This present study was undertaken to determine the seroprevalence of human immunodeficiency virus infection and its associated socio-demographic factors among blood donors living in the Sokoto, North Western Nigeria.

2. Materials and Method

2.1. Study Design

This case study 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 purposes. Donors was tested for the presence of antibody to HIV.

2.2. Study Area

The selected area for this study is Usmanu Danfodiyo University Teaching Hospital (UDUTH) which is located in Wamakko Local Government within Sokoto Metropolitan city in Sokoto State. Sokoto State is located in the extreme Northwest of Nigeria, near the confluence of the Sokoto River and 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 day time 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 May 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 million5. This study was carried out in Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto State. The teaching hospital is based in Sokoto town, Sokoto state and was established in May 1980 as a second generation teaching hospital along with Port-Harcourt, Ilorin, Calabar, Jos and Maiduguri. The teaching hospital provides high quality tertiary health care services to the entire North-Western region and neighboring Niger Republic. The health institution is aimed at providing efficient tertiary care services which are affordable, accessible and equitable to the general public as well as offering of training in medical education and conducting of relevant researches.

2.3. Study Subjects

A total of 150 consecutively-recruited blood donors aged 18 to 65 years and mean age 27.4 ± 6.6 years visiting the blood banks in Usmanu Danfodiyo University Teaching Hospital in Sokoto North Western Nigeria for blood donation purpose constituted the subjects for this case study.

2.4. Inclusion Criteria

Inclusion criteria included; age (18-65), no history of long-term medication use, no history of blood transfusion within the last 3 months, willingness to give oral informed consent after counseling and non-menstruating (women).

2.5. Exclusion Criteria

All consecutively recruited blood donors who did not meet the inclusion criteria (<18 years, > 65 years, history of long-term medication use, history of blood transfusion in the last 4 months, unwillingness to give oral informed consent and menstruating women) were excluded from study.
2.6. Sample 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 -20°C prior to testing. The manufacturer’s standard operating procedures was followed strictly.

2.7. Methods

Qualitative detection of HIV antibodies in the serum was carried out using the Alere Determine HIV-1/2 antibody test manufactured and described by Alere (USA). The Determine HIV 1/2 test is a rapid immunochromatographic invitro and visually read qualitative immunoassay test for the detection of antibodies to HIV types 1 and 2 in human serum or plasma. The kit has a 99.6% specificity and 99.4% sensitivity. The manufacturer’s standard operating procedures was followed strictly. For over a decade the Alere Determine™ HIV-1/2 antibody test has been the screening test of choice in many of the world’s HIV prevention and control programs. By detecting all known subtypes of HIV, Alere Determine™ HIV-1/2 helps healthcare workers across the world diagnose individual infection, prevent mother-to-child transmission, monitor HIV prevalence and screen blood donations. With its simple one-step procedure for serum/plasma or two-step procedure for whole blood, the Alere Determine™ HIV-1/2 test is quick and easy to use, delivering clear, dependable results in just 15 minutes. The test is an immunochromatographic test for the qualitative detection of antibodies to HIV-1 and HIV-2 in human serum, plasma and whole blood specimens.

2.8. Statistical Analysis

The data collected was recorded on an Excel spreadsheet and later subjected to statistical analysis using a statistical software SPSS Version 18.0 (Chicago Illinois). Statistical analysis included descriptive statistics of percentages, mean and bivariate analysis of t-test and Fisher’s exact test. Correlation was compared using linear regression analysis. Differences were considered significant when \( p \leq 0.05 \).

3. Result

In this present study we investigated the prevalence of HIV among 150 consecutively-recruited blood donors aged 18 to 65 years and mean age 27.4 ± 6.6 made up of 133 (88.7%) male and 17 (11.3%) females. Among the donors tested, 7 (4.67%) were positive for HIV while 143 (95.3%) were negative.

The prevalence of HIV was compared based on the gender and ABO blood group of blood donors. HIV infection was significantly higher among male donors (7(100%) compared to female donors (p=0.001). The prevalence of HIV was significantly higher among blood group A donors 5 (33.3) followed by group B donors 2 (6.5%) (p=0.01). Table 1 show the distribution of HIV among blood donors based on gender and ABO blood group.

Table 1. Distribution of HIV based on the ABO group blood and gender of donors

<table>
<thead>
<tr>
<th>Blood Group</th>
<th>Number (%) of donor tested</th>
<th>Number (%) positive for HIV</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>92 (6)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>24(16)</td>
<td>5 (33.3)</td>
<td>0.01</td>
</tr>
<tr>
<td>B</td>
<td>31(20)</td>
<td>2 (6.5)</td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>3(2)</td>
<td>0 (0)</td>
<td></td>
</tr>
</tbody>
</table>

Gender

| Male        | 133 (88.7)                | 7(52.6)                     | 0.001   |
| Female      | 17 (11.3)                 | 0 (0)                       |         |

The prevalence of HIV was compared based on the age groups and marital status of blood donors. HIV was significantly higher among donors in the 18-28 years age group (6.5%) followed by the 29-38 years age group (1.26%) (p=0.01). Of the donors who tested positive for HIV, 6 of 7 (85.8%) were in the 18-28 years age group. Single blood donors 6(85.7%) had a higher HIV prevalence compared to married blood donors 1(14.3%), p=0.01. Table 2 show the distribution of HIV among blood donors based on age group and marital status.

Table 2. Distribution of HIV 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 HIV</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-28</td>
<td>102 (68)</td>
<td>6(5.9%)</td>
<td></td>
</tr>
<tr>
<td>29-38</td>
<td>39 (26)</td>
<td>1 (2.6%)</td>
<td>0.01</td>
</tr>
<tr>
<td>39-48</td>
<td>7 (4.67)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>49-58</td>
<td>2 (1.33)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>59-68</td>
<td>0 (0%)</td>
<td>0 (0)</td>
<td></td>
</tr>
</tbody>
</table>

Marital Status

| Single            | 57(38%)                   | 6(10.5%)                    | 0.01    |
| Married           | 93(62%)                   | 1(1.1%)                     |         |

Table 3. Distribution of HIV 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 HIV</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>48 (32)</td>
<td>3(6.25%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Trader</td>
<td>24 (16)</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Civil servants</td>
<td>35 (23.3)</td>
<td>2(5.71%)</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>43 (28.7)</td>
<td>2(4.7%)</td>
<td></td>
</tr>
</tbody>
</table>

Type of Donors

| Voluntary Non-renumerated | 27 (18) | 0(0) | 0.35 |
| Family Replacement       | 123 (82) | 7(5.7%) |     |

The prevalence of HIV was compared based on the occupational groups and type of blood donors. HIV prevalence was higher among Farmers 3(6.25%) followed...
by Civil servants 2(5.71%) and Students 2(4.7%) respectively (p=0.01). HIV was higher among family replacement donors 7(5.7%). No case of HIV infection was observed among voluntary non-remunerated blood donors (p=0.35). Table 3 show the distribution of HIV based on occupational groups and type of blood donors.

4. Discussion

Infection due to HIV is a significant health problem worldwide and particularly in sub-Saharan Africa. In this present study in Sokoto, North Western Nigeria, we observed HIV prevalence of 4.67% among our cohort of 150 consecutively-recruited blood donors. The prevalence of HIV observed in this study is consistent with a 3.5% prevalence rate reported by Chukwuorah and Neili 18 in Enugu, 2.8% reported by Hassan and colleagues 19 in Kaduna, 1% was reported by Ejele and colleagues 20 in Port-Harcourt, South South, Nigeria, 0.5% prevalence rate of HIV reported by Offor and colleagues 21 in Benin City, 8% reported by Irena and colleagues (2002) in Lagos- island, 10.6% reported by Amadi and colleagues 10 in Abia State, 5.5% previously reported by Baba and colleagues 11 in Maiduguri and 3.1% reported in Osogbo by Musa and colleagues 12.

Our observed prevalence of 4.67% is also consistent with prevalence reported in other countries, 4.55% in Cameroon by Musi and colleagues 13, 5.9% in Ethiopia by Sentjens and colleagues 22, 3.1% in Ghana by Ampofo and colleagues 14, 2.92% reported by Glynn and colleagues 15 in the United States. Similarly, a total of 29,501 units of blood were screened for HIV in Eritrea. The overall prevalence of HIV was 0.18% 23. Also, a previous report indicated that 2-20% of Kenyan donors are HIV positive 16. In Egypt EL-Gilany and EL-Fedawy observed HIV prevalence of 6.9% among their cohort of 1,257 voluntary donors 19. In Saudi Arabia, El-Hazmi observed a zero percent HIV prevalence among their cohort of 24,173 24. A study of 213,666 blood donors in Brazil yielded an overall HIV prevalence of 0.149% 25. Blood transfusion faces several daunting challenges particularly in a high prevalence of human immunodeficiency virus (HIV) in the general populations, predominance of family replacement donors rather than voluntary non-remunerated blood donors who donate blood due to altruism, inadequate and sub-optimal screening facilities and lack of infrastructure. These factors play a role in the high incidence of HIV among blood donors in Nigeria.

The highest prevalence of HIV was found in the 18-28 years age group 6(85.7%) followed by the 29-38 years age group 1(14.3%). Our finding is in agreement with previous results reported by Baba and colleagues 11, Ejele and colleagues 8, Erhabor and colleagues 22 and Buseri and colleagues 21 in which a higher prevalence of HIV was observed among youths. The high prevalence of HIV observed among the youth in this present study could be as a result of lack of adequate educational enlightenment about transmission and prevention of HIV. It may also be due to prevalence of high risk behavior among youths such as maintenance of multiple sex partners, having unprotected sex intercourse, intravenous drug abuse, tattooing and other high risk socio-cultural life styles. This observation is worrisome since the most productive and economically viable age group of the population is most affected. There is the urgent need for renewed intensification of prevention programmes aimed at changing high-risk behaviors among youths.

The male donors showed a higher HIV prevalence compared to females donors. Our finding is consistent with previous report involving Brazilian blood donor which found a higher prevalence of HIV among men compared to women 25. The reason for this male gender-related predisposition to HIV is not known. Cultural and religious beliefs may play a role in the male gender predisposition to HIV observed in this study. Men in most African settings are culturally allowed to have multiple sex partners and multiple wives. In most African settings, it is a taboo for a married woman to have extramarital affairs. Also the increasing number of Men who have Sex with Men (MSM) in Nigeria with associated increased trauma associated with anal sex may also be a factor. HIV can be transmitted through sexual activity. 25 There is an association between high-risk sexual activity and HIV infection. The majority of evidence supports the fact that there is less risk for monogamous heterosexual couples 25. Sexual practices that involve higher levels of trauma to the anal and genital mucosa, such as anal penetrative sex, or that occur when there is a concurrent sexually transmitted infection, including HIV or genital ulceration, do present a risk 25. Similarly, under Islamic marital jurisprudence, men are allowed to practice polygyny or polygamy, that is, they can have more than one wife at the same time, up to a total of four. Polyandry, the practice of a woman having more than one husband, by contrast, is not permitted. The verse most commonly referred to with the topic of polygyny is Verse 3 of Surah 4 (An-Nisa [Women]). A translation by Yusuf Ali is shown below: If ye fear that ye shall not be able to deal justly with the orphans, Marry women of your choice, Two or three or four; but if ye fear that ye shall not be able to deal justly (with them), then only one, or (a captive) that your right hands possess, that will be more suitable, to prevent you from doing injustice 26. The North West of Nigeria is predominantly Muslim. Previous report by Sambo and colleagues 27 indicated that about 51% of Islamic Clerics do not have the knowledge about HIV/AIDS and are not in support of pre-marital HIV test. There is need to build capacity among Islamic Clerics in the area to facilitate their awareness about mode of transmission of HIV and ways to prevent HIV infection. This is to enable them provide evidenced-based information to their followers to enable them make informed decision about HIV transmission and prevention. Given proper information and training, religious leaders can become strong allies in HIV/AIDS prevention and control in view of their influence and acceptance among the people they lead. Also religious organizations can also serve as useful channels for disseminating messages about
HIV since congregations do have reverence for places of worship and for religious leaders.

Single blood donor had a higher prevalence of HIV compared to married donors. Singles are more sexually active and more like to engage in high risk behaviors (maintenance of multiple sex partners, having unprotected sex intercourse, intravenous drug abuse, tattooing and other high risk socio-cultural life styles) that put them potentially at risk for HIV.

The majority of donors tested in this study were family replacement donors rather than voluntary non-remunerated blood donors. All the cases of HIV infection was concentrated among family replacement donors. Our finding is consistent with findings in the Niger Delta of Nigeria which observed a higher prevalence of HIV among commercial and family replacement donors. In sub-Saharan Africa, two major factors account for the difficulties encountered in assessing safe and adequate blood supply; high frequency of transfusion-transmissible infections in the general population and an insufficient proportion of voluntary donors which constitute the safest group of blood donors. The amount of voluntarily donated blood has continued to fall over the years in Nigeria due to logistics and organizational problems associated with the Nigerian National Blood Transfusion Service. The net result is that family replacement blood donation is the order of the day.

Our finding is consistent with the suggestion by the World Health Organization (WHO) that commercially remunerated blood donors are more at risk for transmitting transfusion-transmissible infection. It is difficult for a country's blood transfusion services depending solely on family replacement donors to provide adequate and safe blood transfusion services. No country can guarantee adequate and safe blood transfusion services depending solely on family replacement donors. A family replacement donor is one who gives blood when it is required by a member of the family or community. The disadvantages of this method of blood donation include; patients or their relatives are under intense strain when their relatives are on admission in hospital. Being expected to provide replacement donors puts additional responsibility and stress on them, there is undue pressure on members of the family to give blood, even when they know that donating blood may affect their own health or potentially put the recipient at risk of a transfusion-transmissible infection. It is difficult for a country's transfusion needs to be met solely relying on family replacement donations. The World Health Assembly recommended that reliance on replacement donations should be phased out due to their association with an increased risk of transfusion-transmitted infections. There is also the challenge of transfusion need of recipient not being met because blood given may not necessarily be replaced in type or quantity. Also, blood donated by certain relatives particularly spouses of women of child bearing age can put their wives/partners potentially at risk of producing alloantibodies to clinically significant red cell antigens that the husband and the developing foetus may have but which the wife lacks. This can potentially predispose subsequent babies to Haemolytic Disease of the Foetus and Newborn (HDFN) and the mother to Haemolytic Transfusion Reaction (HTR) in subsequent antigen positive transfusions.

The prevalence of HIV was higher among blood group A donors followed by blood group B donors. The reason for this association is unknown. Our finding is in variance with the work of Kumar and colleagues who reported that the highest prevalence of transfusion transmissible viral infections was higher in individuals who are blood group O.

In an analysis of sero-prevalence of HIV, HBV and syphilis among healthy Nepalese male donors, Joshi and Ghimire indicated that the prevalence of HIV was higher in blood group O positive donors.

In the present study, we observed that the prevalence of HIV was significantly higher among farmers followed by civil servants and students. The reason for this occupation-related predisposition to HIV among farmers is unknown.

5. Conclusion and Recommendations

This study demonstrates a substantial risk of transfusion-transmissible HIV infections in Sokoto, North Western, Nigeria. We recommend that effort be made to recruit and retain low risk voluntary non-remunerated donors. There is also the need to routinely screen all blood donors in the area for HIV. We recommend that evidenced-based practice of inclusion of nucleic acid testing in the donor screening menu be implemented to reduce the risk of transfusing HIV infected donor blood during the window phase of infection and by extension improve the access to safe blood in the area. There is need to intensify of public awareness and prevention programmes for HIV aimed at changing high-risk behavior among youths.

6. Limitations of Study

This study had some limitations. A single positive HIV antibody test was considered positive for the purpose of this study. There was no confirmatory Western Blot performed. Study investigated 150 consecutively recruited blood donors visiting the blood donation centre in Sokoto. A larger sample size may have demonstrated the difference that exists, between the various groups better.

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