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RESEARCH ARTICLE

THE RISK OF TRANSFUSION –TRANSMISSIBLE HEPATITIS C INFECTION AMONG BLOOD DONORS IN SOKOTO, NORTH WESTERN NIGERIA

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ABSTRACT

In this present study we investigated the prevalence of hepatitis C infection among 150 consecutively recruited blood donors aged 18 to 65 years and mean age 27.4 ± 6.6 years made up of 133 (86.7%) male and 17 (11.3%) females. Among the donors tested, 3(2%) were positive for hepatitis C. The prevalence of hepatitis C was compared based on the gender and ABO blood group of blood donors. HCV infection was significantly higher among male donors 3 (2%) compared to female donors (p=0.001). The prevalence of hepatitis C was significantly higher among blood group B donors 2(66.7%) followed by group O donors 1(33.3%) (p=0.01). The prevalence of hepatitis C was compared based on the age groups and marital status of blood donors. Hepatitis C infection was significantly higher among donors in the 18-28 years age group 2(66.7%) (p=0.001). Married donors 3(100%) had a higher hepatitis C prevalence compared to single donors. The prevalence of hepatitis C was compared based on the occupational group and type of blood donors. Hepatitis prevalence was significantly higher among farmers 2(66.7%) followed by traders 1 (33.7%) (p=0.001). Hepatitis C infection was significantly higher among family replacement donors 3(100%) compared to voluntary non-remunerated blood donors (p=0.001). This study demonstrates a substantial risk of transfusion-transmissible HCV 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 hepatitis C. 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 HCV infected donor blood during the window phase of infection.

INTRODUCTION

Hepatitis C virus (HCV) infection is an increasing public health problem affecting large numbers of people in both developed and the developing countries of the world [1]. The World Health Organization (WHO) reports that approximately 360 million people are chronically infected with hepatitis B virus (HBV) and 170 million with hepatitis C virus (HCV) worldwide [2-3]. About 3–4 million people are infected per year, and more than 350,000 people die yearly from hepatitis C-related diseases and rates have increased substantially in the 20th century due to a combination of IDU and intravenous medication or poorly sterilized medical equipment [4]. Hepatitis C is a transfusion transmissible infectious disease affecting primarily the liver. The infection is often asymptomatic, but chronic infection can lead to scarring of the liver and ultimately to cirrhosis, which is generally apparent after many years. Symptoms are generally mild and vague, including a decreased appetite, fatigue, nausea, muscle or joint pains, and weight loss [5]. About 80% of those exposed to the virus develop a chronic infection [6]. Despite the fact that HCV infection is an important infectious disease, yet most blood banks in Nigeria do not routinely screen blood donors for anti-HCV serology. The risk of transfusion-transmissible hepatitis C in Sokoto is not known. The aim of this present study was to determine the prevalence of anti-HCV among blood donors and to determine the risk of transmission of hepatitis C to recipients through the transfusion of unscreened blood in Sokoto, North Western Nigeria.

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MATERIALS AND METHODS

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 were screened for the presence of antibody to hepatitis C virus.

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 28.3^0c ($82.9\ ^0$F). Sokoto is, on the whole, a very hot area. However, maximum day time temperatures are for most of the year generally under 40 ^{0}C (104.0 ^{0}F). The warmest months are February to April when daytime temperatures can exceed 45 ^{0}C (113.0 ^{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 million [7]. 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 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 training in medical education and conducting of relevant researches. The state has a landed area of 26.64km and is located between longitude 11.30° to 13.50° east and latitude 4° to 6° north. It is bounded to the north by Niger Republic, Kebbi State to the South-West and to the East by Zamfara state.

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 Sokoto North Western Nigeria for blood donation purpose constituted the subjects for this case study.

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 counselling and non-menstruating (women).

Exclusion criteria

All consecutively recruited blood donors who did not meet the inclusion criteria were excluded from study.

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. The rafter, the samples were centrifuged to give a clear serum. The serum was separated and stored at -20c° prior to testing. The manufacturer's standard operating procedures was followed strictly.

Methods

Qualitative detection of hepatitis C antibodies in the serum was carried out using ELISA test strip (serum/plasma) manufactured and described by *Diaspot Diagnostics (*USA). The manufacturer's standard operating procedures was followed strictly.

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 chi- square. Correlation was compared using linear regression analysis. Differences were considered significant when $p \leq 0.05$.

RESULTS

In this present study we investigated the prevalence of hepatitis C infection among 150 consecutively- recruited blood donors aged 18 to 65 years and mean age 27.4 ± 6.6 years made up of 133 (88.7%) male and 17 (11.3%) females. Among the donors tested, 3(2%) were positive for hepatitis C. Table 1 show the prevalence of Hepatitis C infection among blood donors.

Table 1. Prevalence of Hepatitis C among blood donors

Parameter	Number Tested	Number (%) positive for HCV	Number (%) negative for HCV
Hepatitis C	150	3 (2)	147 (98)

The prevalence of hepatitis C was compared based on the gender and ABO blood group of blood donors. HCV infection was significantly higher among male donors 3 (2%) compared to female donors (p=0.001). The prevalence of hepatitis C was significantly higher among blood group B donors 2(66.7%) followed by group O donors 1(33.3%) (p=0.01). Table 2 show the distribution of hepatitis C virus among blood donors based on gender and ABO blood group.

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

Blood Group	Number (%) of donor tested	Number (%) positive for HCV	p-value
O	92 (6)	1 (33.3)	0.001
A	24(16)	0 (0)	
B	31(20)	2 (66.7)	
AB	3(2)	0 (0)	
	Gender		
Male	133 (88.7)	3 (100)	0.001
Female	17 (11.3)	0 (0)	

The prevalence of hepatitis C was compared based on the age groups and marital status of blood donors. Hepatitis C infection was significantly higher among donors in the 18-28 years age group 2(66.7%) (p=0.001). Married donors 3(100%)

had a higher hepatitis C prevalence compared to single donors. Table 3 show the distribution of Hepatitis C Virus infection among blood donors based on age group and marital status.

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

Age group (Years)	Number (%) of donor tested	Number (%) positive for HCV	p-value
18-28	102 (68)	2 (66.7)	
29-38	39 (26)	0 (0)	
39-48	7 (4.67)	1 (33.3)	0.001
49-58	2 (1.33)	0 (0)	
59-68	0 (0%)	0 (0)	
	Marital Status		
Single	57(38%)	0 (0)	0.001
Married	93(62%)	3(100)	

The prevalence of hepatitis C was compared based on the occupational groups and type of blood donors. Hepatitis C prevalence was significantly higher among farmers 2(66.7%) followed by traders 1 (33.7%) (p=0.001). Hepatitis C infection was significantly higher among family replacement donors 3(100%) compared to voluntary non-remunerated blood donors (p=0.001). Table 4 show the distribution of Hepatitis C virus infection based on occupational groups and type of blood donors.

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

Occupational groups	Number (%) of donor tested	Number (%) positive for HCV	p-value
Farmers	48 (32)	2 (66.7)	
Trader	24 (16)	1 (33.3)	0.01
Civil servants	35 (23.3)	0 (0)	
Students	43 (28.7)	0 (0)	
Type of Donors			
Voluntary Non-remunerated	27 (18)	0 (0)	0.001
Family Replacement	123 (82)	3 (100)	

DISCUSSION

Infection due to hepatitis B and C viruses are significant health problem worldwide. In this present study in Sokoto, North Western Nigeria, we observed a hepatitis C prevalence of 2% among our cohort of 150 consecutively-recruited blood donors. The prevalence of HCV observed in this study is lower than a 6% prevalence recorded by Buseri and colleagues [8] in Osogbo South West Nigeria. The prevalence of HCV reported by Egah and colleagues [9] in Jos Nigeria was 6%. Our observed prevalence of 2% is also lower than a 5.8% prevalence obtained by Mutimer and colleagues [10] among blood donor from Southern Nigeria. In Benin City Edo State, Nigeria, Halim and colleagues [11] investigated their cohort of 260 healthy blood donors for hepatitis C virus infection and obtained anti-HCV prevalence rate of 12.3%. Similarly, seroprevalence of 2.9% was observed in the Niger Delta by Ejele and colleagues [12]. In Port Harcourt in the Niger Delta of Nigeria, Erhabor and colleagues observed among their cohort of One Thousand Five Hundred consecutively-recruited blood donors obtained HCV antibodies prevalence of 0.5% [13]. Among a total of 543 blood donors screened for HCV in Cameroon, the overall seroprevalence of HCV was 4.8% [14]. Similarly, out of 750 consenting blood donors tested in Mozambique, no confirmed HCV infection was found [15]. Prevalence study from other parts of the world obtained a 0.5% - 0.97% prevalence in Iran [16], 0.2% in Kenya [17], 1.5% in Tanzania [18] and 2.7% in Egypt [19]. Elfaki and colleagues [20] found no case of HCV among their cohort of 260 Sudanese blood donors. Similarly, a seroprevalence of 2.8% was observed in Ghana [21]. Out of 16.727 donors who donated whole blood as FRD in Turkey, 0.37% were positive for HCV [22]. Similarly, out of 80.454 donors tested in Turkey made up of 61.950 (77%) voluntary donors and 18.504 (23%) familial/replacement donors, 312 (0.38%) were positive for anti-HCV [23]. Out of 308,762 donors tested in Egypt, the overall prevalence of HCV antibodies was 4.3% [24]. A previous report that investigated the prevalence of hepatitis C virus infection among 1006 individuals in the Seychelles islands observed a seroprevalence of 0.34% [25]. A study performed to determine the prevalence of HCV antibodies among 536 random Lebanese blood donors observed an overall prevalence of HCV antibody in 0.7% of donors tested [26] A previous report obtained among 403 blood donors at the Blood Center of Mongolia indicated that 21 (5.2%), and 27 (6.7%) tested positive for HCV RNA and anti-HCV [27].

A review of identified 5 reports in the literature involving 39,633 voluntary donors in Thailand observed an overall anti-HCV seroprevalence of 1.37% [28] with about 35,000 to 185,000 new cases a year. This variation in the prevalence of HCV among different countries and states in Nigeria could be due to differences in the socio cultural, environment, sexual activities and tribal practices that predisposes people to HCV infection. There is a high prevalence of numerous endemic and epidemic diseases including viral hepatitis in sub-Saharan Africa [29]. The median overall risks of becoming infected with HCV from a blood transfusion in sub-Saharan Africa was 2.5 infections per 1000 units [30]. In general, high prevalence rates of HCV (7-19.3) per 1000 donors were found in the majority of countries in the Caribbean [31]. There are several high risk factors that may be responsible for the high prevalence of HCV in developing countries; transfusion of unscreened blood, intravenous drug use, sexual promiscuity, tattooing, sharing of personal-care items such as razors, and manicuring, risk of mother to child transmission, suboptimal universal precaution against sharps, poor management needle stick injuries among healthcare worker and use of poorly sterilized medical equipment.

The primary route of transmission in the developed world is intravenous drug use (IDU), while in the developing world the main methods are blood transfusions and unsafe medical procedures [32]. IDU is a major risk factor for hepatitis C in many parts of the world [33]. Of 77 countries reviewed in a previous report, 25 were found to have prevalence of hepatitis C in the intravenous drug user population of between 60% and 80% [33]. It is believed that ten million intravenous drug users are infected with hepatitis C; 1.6 million in China, 1.5 million in the United States, and 1.3 million in Russia [34]. Occurrence of hepatitis C among prison inmates in the United States is 10 to 20 times that of the occurrence observed in the general population. This has been attributed to high-risk behavior in prisons such as IDU and tattooing with use of non-sterile equipment [35]. Blood transfusion and organ transplantation without HCV screening carry significant risks of infection. The United States instituted universal screening in 1992 [37] and

Canada instituted universal screening in 1990 [36]. This has decreased the risk from one in 200 units to between one in 10,000 to one in 10,000,000 per unit of blood [38]. This low risk remains because there is a period of about 11–70 days between the potential blood donor acquiring hepatitis C and their blood testing positive depending on the method used for screening [38]. Some developing countries do not screen blood donors routinely for hepatitis C due to the cost [39] .Those who have experienced a needle stick injury involving a source patient who is HCV positive have about a 1.8% chance of subsequently contracting the disease themselves [39] . The risk is greater if the needle in question is hollow and the puncture wound is deep. There is a risk from mucosal exposures to blood; but this risk is low, and there is no risk if blood exposure occurs on intact skin [39]. Hospital equipment use without adequate sterilization in between has also been documented as a method of transmission of hepatitis C including; re-use of needles and syringes, multiple-use medication vials, infusion bags, and improperly sterilized surgical equipment, among others [39].

Tattooing is associated with two to threefold increased risk of hepatitis C. This can be due to either improperly sterilized equipment or contamination of the dyes being used [40]. Tattoos or piercings performed either before the mid-1980s, "underground," or non-professionally are of particular concern, since sterile techniques in such settings may be lacking. The risk also appears to be greater for larger tattoos [40]. Personal-care items such as razors, toothbrushes, and manicuring or pedicuring equipment can be contaminated with blood. Sharing such items can potentially lead to exposure to HCV [41]. HCV is not spread through casual contact, such as hugging, kissing, or sharing eating or cooking utensils neither is it transmitted through food or water [42]. Vertical transmission of hepatitis C from an infected mother to her child occurs in less than 10% of pregnancies [43]. There are no measures that alter this risk. It is not clear when during pregnancy transmission occurs, but it may occur both during gestation and at delivery. A prolong labor is associated with a greater risk of transmission [39]. There is no evidence that breast-feeding spreads HCV; however, to be cautious, an infected mother is advised to avoid breastfeeding if her nipples are cracked and bleeding or her viral loads are high [38].

In sub-Saharan Africa, two major factors account for the difficulties encountered in assessing safe 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 [44]. Out of 1079 blood donors screened in the Central Blood Bank of Bukavu in Democratic Republic of Congo, the prevalence of hepatitis C was 3.8% [45]. One of several strategies for prevention of HCV transmission is screening for anti HCV serology among of blood donors. However, screening for HCV infection varies considerably throughout the world; differences between resource-poor and resource-rich countries are particularly pronounced. While the resource-rich countries can afford more sophisticated screening methods using nucleic acid testing that significantly reduces the risk of transfusing blood in the window phase of HCV infection. However, nucleic acid testing (NAT) are technically, logistically and financially still far beyond the reach of many blood banks in many resource-limited countries particularly in sub Saharan Africa [46]. Previous report suggest that the implementation of nucleic acid amplification technology, proper recruitment of blood donors are potential ways to reduce the risk of transfusion transmissible HCV infection [47-48]. Rates of HCV infection have decreased in the Western World since the 1990s due to improved screening of blood before transfusion [49]. In this study, the highest sero prevalence rate of HCV was observed among youths in the age group 18-28 years. This finding is in agreement with previous results reported by Baba and colleagues [50], Ejele and colleagues [12] and Erhabor and colleagues [13] in which a higher prevalence were observed among the youths. Our finding is also consistent with a previous report by Buseri and colleagues [51] in Osogbo Nigeria in which a higher prevalence was observed among youths. The high prevalence of HCV observed among the youth could be as a result of the high risk behaviour among youths such as maintenance of multiple sex partners, having unprotected sex intercourse, intravenous drug abuse, tattooing and other unhygienic activities seen commonly among youths.

The majority of donors tested in this study were family replacement donors rather than voluntary non-remunerated blood donors. All the cases of HCV infection was concentrated among family replacement donors. Our finding is in agreement with previous report which observed a higher prevalence of HCV among family donors compared to voluntary donors [52]. Our finding is also in agreement with report by Durro and Qyra1 [53] in Albania, which indicated that the prevalence of HBV was significantly higher in family replacement donors than in voluntary donors. In addition, in a report from Pakistan by Asif and colleagues [54], a significantly higher prevalence of HCV was observed among family replacement donors than in voluntary donors. Difference in infection rates between voluntary and replacement donors have been observed in many previous studies [55-57]. Our finding is also in agreement with recommendation by the WHO that voluntary non-remunerated blood donors who give blood out of altruism are the safest source of blood. Family replacement donors are often under pressure to donate blood when their relations are admitted in hospital and in need of blood transfusion even when they know that they are potentially at risk for HCV from high risk behaviours. They are more likely to conceal medical history and be involved in high risk behaviour that can potentially predispose them to infection with HCV and thus pose a great threat to the safety of blood supply. The number of voluntarily donated blood has continue to fall over years in Nigeria due to logistic and organizational problem associated with the Nigerian National Blood Transfusion Service [13]. The net result of this failure in the stewardship of blood and blood products is that the commercial and family replacement donors continues to predominate.

The prevalence of hepatitis C was higher among blood group B donors followed by blood group O donors. The reason for this association is unknown. Previous report by Omar and co-workers reported that the seroprevalence of HCV antibodies were higher in donors who are blood group O and lowest in blood group AB donors [58]. Our finding is also consistent with a previous study, which indicated that blood group B negative individuals were more affected by HCV [59]. Similarly, Kumar and colleagues [60] reported that the highest prevalence of transfusion transmissible viral infections was higher in individuals who are blood group O and Rh positive. In an

analysis of sero-prevalence of HIV, HBV and syphilis among healthy Nepalese male donors, Joshi and Ghimire [61] indicated that the prevalence was higher in blood group O positive donors. However. A previous report indicated that non-O blood group is a genetic risk factor for progression of liver fibrosis in patients with HCV infection [62].

We observed a higher prevalence of hepatitis C among male donors compared to female and among married blood donors compared to those who were single. Our finding is consistent with a previous reports in a large population-based study in the USA [63]. Our finding is also consistent with findings from previous report by Egah and collegues [9] which indicated that all the anti- HCV positive donors were males. Our finding is at variance with a multi-center seroprevalence survey conducted among 3,598 first-time blood donors in Sao Paulo, Salvador and Manaus in Brazil which indicated that the seroprevalence of anti-HCV was higher in women compared to men [64]. However, previous report in Uganda [65] and Brazil [66] observed no gender differences in the prevalence of hepatitis C infection among their cohort of blood donors. The reason for the higher prevalence of HCV among men may be culturally related. 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) with associated increased trauma associated with anal sex may also be a factor. Hepatitis C can be transmitted through sexual activity [67]. There is an association between high-risk sexual activity and hepatitis C. The majority of evidence supports the fact that there is less risk for monogamous heterosexual couples [67]. 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 [67].

In this present study, we observed that the prevalence of hepatitis C was significantly higher among farmers followed by traders. The reason for this occupation-related predisposition to HCV among farmer is unknown.

Conclusion and recommendations

This study demonstrates a substantial risk of transfusion-transmissible HCV 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 hepatitis C. We recommend that evidenced- based best practice of inclusion of nucleic acid in the donor screening menu be implemented to reduce the risk of transfusing HCV infected donor blood during the window phase of infection and by extension improve the access to safe blood in the area.

Conflict of Interest

We declare that we have no conflict of interest

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