Detection of HCV antibody among intending blood donors

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Abstract: This study was carried out to detect hepatitis C virus (HCV) antibody among intending blood donors. In order to estimate the prevalence rate of HCV antibody, blood samples were screened by parallel diagnostic method using One Step Strip Style HCV test kits, by Dia Spot® Diagnostics, USA and Global Diagnostic® Canada. Anti-HCV antibody was repeatedly detected in 2(1.0%) of the blood donors. Intending blood donors aged 40 years and above had the highest prevalence of HCV (2.1%) compared to age groups 18-39 years (0.7%). Anti-HCV antibody was only detected among male blood donors [2(1.2%)]. This study however, further confirmed the presence of HCV among apparently healthy intending blood donors. This highlights the necessity to adopt measures that will ensure safe blood transfusion. General surveillance and public health education to stop the spread of the infection on intending blood donors and the whole society is advocated.

【Okonko IO, Oyediji TO, Anugweje KC, Adeniji FO, Alli JA, Abraham O A. **Detection of HCV antibody among intending blood donors.** Nature and Science 2012;10(1):53-58]. (ISSN: 1545-0740). http://www.sciencepub.net.

Key words: Anti-HCV antibodies, HCV, Sexually active group, Seroprevalence, Nigeria

1. INTRODUCTION

The term hepatitis C virus (HCV) was first adopted in 1989 following the identification of an RNA viral genome in a random-prime DNA library derived from a human plasma sample containing the putative non-A, non-B hepatitis agent (Choo *et al*., 1989). Epidemiological studies established that there were two routes of transmission of non-A, non-B hepatitis. Thus enteric and parenteral or post transfusion forms were recognized. Hepatitis C virus (HCV) is now established as the major parenteral type. However, more recently other related agents including hepatitis G virus have been identified (Mc Lean *et al*., 1997).

Transmission of HCV predominantly occurs parenterally as a result of blood transfusion and exposure to blood derivatives, and the disease was first recognized in recipients of blood and blood products such as factor VIII and immunoglobulins. Transplanted organs and needles stick injuries have also been implicated in transmission. Mc Lean *et al* (1997) reported transmission in drug misusers and patients in dialysis and surgical units. Sexual contact has also been incriminated in the transmission of HCV (Alter *et al*., 1982). There is also a growing evidence of vertical transmission (mother to baby). However, a non-negligible proportion of HCV infections have an "undefined" route of transmission (Golemba *et al*., 2010).

Hepatitis C virus has been shown to have a worldwide distribution, occurring among persons of all ages, genders, races and regions of the world (WHO, 1996). A report by the World health Organization (WHO) estimated that 170 million persons, or about 3% of the world's population, are infected with HCV and are at risk of developing liver cirrhosis, cancer or both (WHO, 1996). Slightly different prevalence was reported from different regions of the world. Prevalence of 1.7% was reported from America, 1.03% from Europe, 3.9% from the Western Pacific, 4.6% from the Eastern Mediterranean, 2.15% from South Asia and 5.3% from Africa (WHO, 1996).

Detection of antibodies to various hepatitis C viral antigens indicates infection with the virus and in most cases portrays a chronic infection (Mc Lean *et al*., 1997). The course of the chronic hepatitis can be prolonged and insidious and infected persons may not develop symptoms for many years after onset of chronic infection (Mc Lean *et al*., 1997). The detection of anti-HCV antibodies in plasma or serum is based on the use of enzyme immunoassays (EIAs) or Enzyme Linked Immunosorbent assays (ELISA) which are

now commercially available. Post infection development of HCV antibodies is slow and variable, and there is a window phase of three months before the tests register positive (Mc Lean *et al*., 1997). Second generation EIAs detect antibodies directed to structural (Core) and non-structural (NS3 and NS4) proteins. Third generation EIAs detect the same antibodies with better sensitivity, plus antibodies directed to the NS5 protein (Vrielink et al., 1997).

With the introduction of routine screening for hepatitis C in blood donors in the developed countries of the world, cases of post transfusion hepatitis has been greatly reduced. In the United States for instance, cases of transfusion-associated non-A, non-B hepatitis during the 1985-1990 declined by greater than 50% because of screening policies that excluded donors with human immunodeficiency virus (HIV) infection and donors with surrogate markers for non-A, non-B hepatitis (Donahue *et al*., 1992). By 1990, risk for transfusion associated HCV infection was approximately 1.5% recipient or approximately 0.02% per unit transfused (Donahue *et al*., 1992). During May 1990, routine testing of donors for evidence of HCV infection was initiated and during July 1992, more sensitive multiantigen testing was implemented, reducing further the risk for infection to 0.001% per unit transfused (Schreiber *et al*., 1996).

The aim of this study was to detect antibodies to HCV among blood donors in Ibadan, Oyo State, Nigeria and to compare the seroprevalence determined with those reported for blood donors and other subpopulations in developed and other developing countries.

2. MATERIALS AND METHODS

2.1. Study Area

The study area is the Blood Grouping & Serology Unit, University College Hospital (UCH), located at the municipal area of Ibadan, which is made up of five local government areas. Ibadan is the capital city of Oyo State located in the forest zone of southwestern Nigeria. Ibadan city lies on the longitude 3°5' East of Greenwich meridian and latitude 7°23' North of the Equator. Besides being the largest indigenous city in Africa south of Sahara, the city is an important trade and educational centre. It also houses one of the largest and foremost teaching hospitals in Africa. However, the city is characterized by low level of environmental sanitation, poor housing, and lack of potable water and improper management of wastes especially in the indigenous core areas characterized by high density and low income populations.

2.2. Samples collections

Two hundred blood samples were collected from Blood Grouping & Serology Unit, University College Hospital, Ibadan, South Western Nigeria. The plasma was then pipetted into sterile ependorf tubes and stored at -20^{0}C until ready for use. Permission, approval, and consent were obtained before carrying out the study.

2.3. Assay for detection of HCV Antibody

DiaSpot® HCV-Ab Test strips (manufactured by DiaSpot Diagnostics, USA), Global® HCV-Ab Kit (manufactured by Global Diagnostics, USA) and IND® HCV-Ab kits (manufactured by IND^R Diagnostica, USA) were used in a stepwise order for the detection of HBsAg in the blood. These methods which are immunochromatographic and qualitative in nature, detect the presence of HBsAg in human blood and can be read in-vitro having more than 99.9% sensitivity and 98.6% specificity. The interpretation of test results was performed according to the manufacturer's specifications.

2.4. Data Analysis

The data generated in this study were analyzed at 5% level of significance by Chi-square statistical test using SPSS 17.0 for windows. Data was presented using descriptive statistics for HCV.

3. RESULTS ANALYSIS

A total of 200 blood samples were tested for HCV antibody and the result obtained showed that only 2 samples tested positive to anti-HCV antibody, giving HCV prevalence of 1.0%.

3.1. Detection of HCV Antibody in relation to Age Groups

In the age group 40 years and above, a total of 48 samples were tested of which 1 tested positive, thus, giving the highest prevalence of 2.1%. Age groups 18-39 years of age showed a prevalence of 0.7% as shown in Table 1.

Table 1: Detection of HCV Antibodies in relation to Age groups

Age Group (Years)	No. Tested (%)	No. Positive (%)
18-39	152(76.0)	1(0.7)
40 and above	48(24.0)	1(2.1)
Total	**200(100.0)**	**2(1.0)**

3.2. Detection of HCV Antibody in relation to sex
Table 2 shows the prevalence of HCV antibody in relation to sex. HCV antibody was more prevalent among males [2(1.2%)] than their female counterparts [0(0.0%)].

Table 2: Detection of HCV Antibodies in relation to Sex

Sex	No. Tested	No. Positive (%)
Males	169 (84.5)	2(1.2)
Females	31(15.5)	0(0.0)
Total	**200(100.0)**	**2(1.0)**

4. DISCUSSION

Hepatitis C virus is an important cause of morbidity and mortality. In this study, a prevalence of antibody to HCV among intending blood donors was found to be 1.0 % during the period under study. This is comparable to what has been previously reported elsewhere in Nigeria and outside Nigeria. A 0.64% seroprevalence of HCV was reported among blood donors in Kathmandu, Nepal (Shrestha *et al*., 2009). However, Imoru *et al*. (2003) reported HCV antibody prevalence of as low as 0.4% among male blood donors in Kano State while Alli et al. (2010) reported zero prevalence for anti-HCV antibody among blood donors in Ibadan. Elfaki *et al* (2008) found no case of HCV infection in the 260 Sudanese blood donors they studied. This figure (1.0%) is higher than the 0.2% found in the study by Abdalla *et al* (2005) in Nairobi; and the 0.5% in the work of Ejele *et al* (2005) in the Niger-Delta area of Nigeria. However, this is comparable to what was previously reported by Matee *et al* (1999), who reported 1.5% prevalence.

This rate (1.0%) is lower than the 3.0% worldwide seroprevalence reported by the World Health Organization (WHO) in 1999. The 1.0% seroprevalence obtained in this study is also lower than the 5.3% reported for the whole African region by WHO (1999). This rate (1.0%) is also lower than the 12.3-14.0% range reported by Mutimer *et al*. (1994) and Halim and Ajayi (2000) among local commercial blood donors in Nigeria; the 8.0% reported by Udeze et al. (2009) among blood donors in UCH, Ibadan; and more recently, the 3.0, and 1.0% seroprevalences reported for HCV antibodies and co-infection of HBV/HCV respectively (Opaleye *et al*., 2010).

In this study 2(1.0%) of all the blood donors (n = 200) were seropositive for anti-HCV antibodies. This disagrees with the findings of Buseri et al. (2009) in Nigeria who reported a 6.0% rate among 1,410 apparently healthy prospective blood donors and Egah *et al.* (2004) in Jos, Nigeria who also reported a 6.0% rate among the 200 blood donors studied. The seroprevalence rate found in this study is also lower than the 2.8% found among blood donors in Ghana (Wansbrough-Jones et al., 1996); the 2.9% among blood donors in Port Harcourt, Nigeria (Koate et al., 2005); the 12.3% prevalence reported among Nigerian blood donors in Benin City (Halim and Ajayi, 2000) and the 15.8% recorded among Egyptian blood donors (Rehman et al., 1996). More recently, a prevalence of 5.0% HCV was reported in Port Harcourt, in the South south region of Nigeria (Jeremiah et al., 2008).

Analysis of the age-related prevalence of HCV in this study showed that age group 40 years and above had the highest prevalence of 2.1% while age group 18 to 39 years had a lower prevalence (0.7%). This pattern indicates that most HCV transmission occurred in the recent past (i.e. 20-40 years ago), primarily among young adults. This slightly agrees with the pattern observed in the United States where highest prevalence was observed among persons 30-49 years old (Alter *et al*., 1999). Another pattern that emerges is observed in Egypt, where the prevalence of HCV infection increases steadily with age and high rates of infection are observed among persons in all age groups (Mohammed *et al*., 1996). The reason for these observed differences in the prevalence pattern of HCV infection in different parts of the world is not immediately known to this study.

Sex-dependence prevalence revealed that only male blood donors 2(1.1%) had HCV. This agrees favourably with the findings in the study by Egah *et al.* (2004) in which all the anti-HCV-positive blood donors were male. It also agrees with the report of Baba *et al*. (1998) that prevalence of viral hepatitis is higher among the males in Nigeria and findings in the study by Buseri et al. (2009) in which the anti-HCV-positive blood donors were majorly male than females. However, it disagrees with the findings of Ndako *et al.* (2009), who reported higher prevalence in diabetic female patients in Jos, Nigeria. Ejele *et al*. (2006) reported that females had higher prevalence of HCV antibodies than males in Niger Delta, Nigeria and Udeze et al. (2011) who also reported that females had higher HCV prevalence than males in Ilorin, Nigeria.

The presence of antibodies of various hepatitis antigens indicates infection with the virus and in most cases portrays a chronic infection (Mc Lean *et al*., 1997). The donors were apparently free of symptoms and were therefore deemed qualified to donate blood. This portends great risks to the general populace, as the transmission of HCV

predominantly occurs parenterally as a result of blood transfusion and exposure to blood derivatives (Udeze *et al*., 2009). Patients transfused with blood from the seropositive donors are subject to direct transmission of the hepatitis C virus (Udeze *et al*., 2009). The healthcare workers are also not left out of the risks. These include the laboratory scientists who bleed these donors, the doctors who transfuse the blood to the patients, the nurses who care for the patients as well as the surgeons and dentists who may have to operate on the patients (Udeze *et al*., 2009). This partly explains why Olubuyide *et al*. (1997) observed a high prevalence (11.0%) of antibodies to HCV among doctors and dentists working at the University College Hospital (UCH), Ibadan-Nigeria.

The finding of 1.0% prevalence rate of HCV in this study further confirm the presence of hepatitis C infection in Nigeria (Mutimer *et al*., 1994; Mwangi, 1999; Egah *et al*., 2004). This prevalence of 1.0% in blood donors in this study is not similar to the report from southern Nigeria, where 5.8% prevalence was found among normal blood donors (Mutimer *et al*., 1994). It is however comparable to the values ranging between 0 and 1.4% reported from USA and Europe (Stevens et al., 1990; Sharara et al., 1996; Alter et al., 1999; Buseri et al., 2009).

Prevalence rates for HCV reported from some African countries also differ from place to place, a low prevalence of 2.8% was found in blood donors in a Ghanaian study while 15.8% prevalence was reported among Egyptian blood donors (Wansbrough-Jones et al., 1996). The differences in prevalence rates of anti-HCV between developed countries where prevalence rates are low and developing countries where prevalence rates are higher may be explained by certain factors. These include the socio-cultural practices involving the use of sharp instruments contaminated by blood and body fluids for procedures such as scarifications, tribal marks, tattooing, circumcision, and so on which are common practices in many developing countries (Odaibo *et al*., 2003; Egah et al., 2004; Udeze *et al*., 2009). Cultural practices such as tattooing, ear piercing, circumcision, face marking (tribal marks) are widely practiced in underdeveloped countries including Nigeria (Odaibo *et al*., 2003). In most developing countries, Nigeria inclusive, most blood transfusion units only test blood donors for hepatitis B virus antigen (HBsAg) and the human immunodeficiency virus (HIV) antibodies (Egah et al., 2004).

Many other studies showing the varying rates of HCV infections among intending blood donors have been reported by several authors in Nigeria, India and abroad. Kaur and Marshalla (1998) screened 233 serum samples for HCV and found that 0.8% were positive for HCV. Garg et al. (2001) evaluated blood donors for HCV and the incidence of HCV was 0.29%. Nanu et al. (1997) screened blood donors and reported that HCV rates to be 1.49% among donors, and those with multiple infections were uncommon. Patel (2004) screened blood donors in Mumbai over a 6-year period, from 1994 to 1999, and found that 0.78% had antibodies to HCV. Gupta et al. (2004) screened blood units in Ludhiana, during the period 2001—2003 and reported that 1.09% were HCV positive. Ruan et al. (2004) reported 71.0% of intravenous drug users (IDUs) in China had antibodies to HCV. HCV—HIV co-infection among IDUs was 11.3% in a study by Ruan et al. (2004).

5. CONCLUSION

The results revealed that some intending blood donors in Ibadan harbored HCV, which would otherwise remain undiagnosed in the absence of screening. In conclusion, this study further confirms the presence of HCV antibody in 1.0% of blood donors in Ibadan, Southwestern Nigeria. This rate will have serious contribution to the morbidity and mortality from HCV. The finding of a 1.0% prevalence of anti-HCV antibodies among apparently healthy blood donors in our study in Ibadan further confirms the presence of hepatitis C infection in Nigeria and highlights the necessity to adopt measures that will ensure safe blood transfusion. This finding of a 1.0% prevalence of HCV antibodies in blood donors in Ibadan brings to therefore the necessity of adopting measures that will ensure that blood is transfused to its recipients with minimal risk of transmission of HCV. Constant screening of blood donors for HCV antibody is strongly recommended. Assay of HCV antibodies in other identifiable subpopulations like drug users, commercial sex workers should also be undertaken in order to ascertain the prevalence for these groups. Further research at the molecular level will reveal the predominant genotype in circulation which might aid in the development of appropriate vaccine.

Acknowledgements

We acknowledge the permission and assistance of the Management and staff of Blood Grouping & Serology Unit, Department of Haematology, Universal College Hospital, Ibadan, Nigeria. We also appreciate the participation of the students who assisted in collection of these samples.

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11/26/2011