



Research Article

Retrospective Study of Hepatitis and Human Immunodeficiency Virus Co-Infections among Blood Donors in Umuahia, South East, Nigeria

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ABSTRACT

Transmission of blood-borne transfusion infections in developing countries remains a significant risk because of limited access to personal protective equipment and vaccination. This retrospective study estimated the seroprevalence and epidemiological features of HbV, HcV, and HIV infections among asymptomatic blood donors attending the Abia State Specialist Hospital and Diagnostic Centre (ASSHDC), Umuahia, Nigeria. A total of 300 individuals participated in this study. Ethical clearance was obtained from the Ethics Committee of the ASSHDC. All experiments in this study were performed in accordance with standard assay procedures. This study identified blood donors between 20 and 59 years old, with an average age of 39.5 years. Overall co-infection seropositivity shows that 10.3% (31/300) of the donors tested positive for anti-HIV antibodies. The seroprevalence of HBsAg and HcV antibodies among donors was 23.6% and 7.3%, respectively. HcV seroprevalence was lower among HIV- infected females (1.6%) than among male (8.0%) donors, while HbV seroprevalence was higher among male (11%) than female (1.3%) donors. Co-infections varied by age and gender. The prevalence of HBsAg and HcV antibodies was moderate (21.3% HBsAg, 6.6% HcV) in gender stratification. The co-infection of HIV and HbV was uniformly low (3.3%) in this study. Co-infection of HIV/HbV and HcV in blood donors was unstable, varying largely among age groups of cohorts. Amongst the samples assayed, 6.3% (21/300) were dually seropositive for HBsAg and HcV. Co-infections of seropositive HBsAg donors with HIV were more common than co-infections with HIV/HcV. This study showed that transfusion-transmitted infections are still significant in Abia State.

Keywords: Blood; Infection; Pathogens; Transfusion; Transmission

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INTRODUCTION

The transmission of blood-borne transfusion infections like Hepatitis B virus (HbV), Hepatitis C virus (HcV) and human immunodeficiency virus (HIV) in some developing countries in sub-Saharan Africa remains a significant risk despite several awareness programmes. Clinical emergencies and life-threatening conditions often require blood transfusion which abounds with risks of blood infections (Shariff and Saldanha, 2014; Suresh *et al.*, 2016). Numerous infections and pathogens can be

transfused through blood; Cases of transfusion of HbV, HcV and HIV are increasing worldwide due to globalization and increased demand for blood transfusion (Bartonjo, 2013, Mandal and Mondal, 2016). The human immunodeficiency virus causes AIDS, a condition in humans characterized by progressive failure of the immune system which allows for threatening opportunistic infections (WHO, 2017). About 38 million individuals in 2019 were living with HIV, and 690,000 died due to HIV-related illness (UNAIDS, 2021). Report from the Global Burden of

Disease (GBD) database have shown trend of high mortality in sub-Saharan Africa due to HIV/AIDS with nearly 70% of all global cases (Milazzo and Antinori, 2014; Ndifontaiyong *et al.*, 2021).

One of the main factors in non-AIDS associated mortality in HIV-positive individual were liver malignancy with which HcV was frequently found (Malewezi *et al.*, 2016; Nieuwenburg *et al.*, 2021).

Hepatitis B virus (HbV), a double stranded deoxyribonucleic acid (DNA) virus that belongs to the Hepadnaviridae causes hepatitis B infection, which may be acute and chronic. Globally as at 2015, 257 million people were infected with HbV with estimated 887,000 deaths associated with its complications (WHO, 2017; Bangura *et al.*, 2021). Hepatitis B virus (HbV) has high transmissibility especially through small quantities of blood. Portal of entry for HbV may be through cut, abrasions and transfused blood (Gerlich, 2007). Infection with HbV is mostly asymptomatic and deadly among infected carriers as they fail to seek appropriate medical attention (Lemoine *et al.*, 2013; Malewezi *et al.*, 2016). Hepatitis B virus infection can be detected serologically by screening for hepatitis B envelope antigen (HBsAg) (CDC, 2019). Infectivity and pathogenesis of HbV is largely associated with the genetic variability of the host and virus.

Blood contact associated with intravenous drug use, poorly sterilized medical equipment and transfusion can result to HcV infections. An estimated 150-200 million individuals globally are infected with HcV and it is the leading reason for liver transplantation (Chung *et al.*, 2013; Babcock *et al.*, 2014). Transmission of HIV, HbV and HcV by blood transfusion, sexual transmission and mother-to-child transmission are significant health issues in sub-Saharan Africa. Studies have shown that it is common that HIV positive individuals are co-infected with HbV and HcV. It is estimated that approximately 5-20% of HIV-positive individual globally are infected with HbV (WHO, 2017) and 15-30% are simultaneously infected with HcV (Armignacco *et al.*, 2014). Increased death rates and morbidities resulting from the rise in numbers of co-infection cases is a severe health challenge (Armignacco *et al.*, 2014). Due to common portals of transmission, blood donors may not know their infection status for HIV, HbV and HcV. Also, previous studies have shown varying rates of co-infections with HIV, HbV and HcV in commercial and volunteer blood donors (Mukami *et al.*, 2013; Sanjiv *et al.*, 2013; Noubiap *et al.*, 2015).

The epidemiological indication of the impact of HIV, HbV and HcV among blood donors is properly

characterized. However, there are limited reliable estimates on HIV, HbV and HcV co-infections among blood donors. Therefore, the purpose of this study was to estimate the seroprevalence and epidemiological features of HIV, HbV and HcV infections among asymptomatic blood donors attending, Abia State Specialist Hospital and Diagnostic Centre (ASSHDC), Umuahia North Municipal Council, Abia State, South East, Nigeria.

MATERIALS AND METHODS

The Abia State Specialist Hospital and Diagnostic Centre (ASSHDC) is a multipurpose secondary health facility for in-patient diagnosis, management and care. The ASSHDC is a referral centre with a wide coverage as it is accessible to clients from adjoining cities and towns. A retrospective observational study to evaluate the HbV, HIV and HcV seroprevalence of among blood donors and related epidemiological risk factors in Umuahia North Municipal Council was carried out using secondary data of blood donors at ASSHDC from January to June 2020. Compulsory pre-screening for health and social status were done on all prospective blood donors that presented for donation at the blood transfusion service. Data from a total of 300 (74 males, 226 females) were included in this retrospective study. Ethical clearance was granted by the Ethics Committee of the ASSHDC. All data collected were screened. Only records essential to this study were collected. All experiments in this study were performed in accordance with standard operating test and assay procedures. To identify blood types, a small drop of blood was spotted onto glass slides and mixed with anti-A and B monoclonal sera and an anti-O blend (Alpha Laboratories Ltd, Hampshire, United Kingdom). The slides were checked for agglutination within 10 minutes of mixing blood and antisera. The information about ABO blood groups were collected retrospectively and were available for all the donors who were ethnic Igbos. Transfusion reactions were collected from receipts and patients medical records.

Enzyme linked immunosorbent assay (ELISA) kits i.e. Determine™HBsAg (Abbott, Laboratories, Tokyo), SD BIOLINE™HbV kit (SD standard diagnostics, Inc., Korea) and Immune Combo® II HIV 1 and 2 (Bisport Organics, Israel) were used to test for HBsAg (Hepatitis B surface antigen), anti-HcV Hepatitis C antibody) and HIV antibodies respectively.

RESULTS

This retrospective analysis of laboratory records identified 300 blood donors between January to

November 2020 at ASSHDC, Umuahia, Abia State between 20-59 year old, with an average age of 39.5 years. Median age observed was 40 years old and the distribution was mainly concentrated in 30-39 years old (55%). Married donors had a high proportion (60%). More than 10% of the donors had no employment. Table 1 shows the distribution of overall co-infection seropositivity. In all, 10.3% (31/300) donors tested positive for anti-HIV antibodies. The overall seroprevalence of HBsAg and HcV antibodies among donors was 23.6% and 7.3% respectively (Table 2). Seroprevalence of HcV was less among HIV-infected females (1.6%) than among the HIV infected

male (8.0%) donors, while HbV seroprevalence was higher among male (11%) than females (1.3%) donors. Co-infections varied by age and gender. The prevalence of HBsAg and HcV antibodies was moderate (21.3% HBsAg, 6.6% HcV) in gender stratification. The co-infection of HIV and HbV was uniformly low (3.3%) in this study. Co-infection of HIV/HbV and HcV in blood donors was unstable, varying largely among age groups of cohorts. In all, 300 blood samples assayed, 6.3% (21/300) were dually seropositive for HBsAg and HcV. Co-infections of seropositive HBsAg donors with HIV were more common than co-infections with HIV/HCV.

Table 1: Distribution by age and sex, clinical laboratory parameters of HIV infections of blood donors at the Abia Specialist Hospital and Diagnostic Centre Umuahia

Age group	Male (n=74)		Female (n=226)		Total	
	Uninfected	Infected	Uninfected	Infected	Uninfected	Infected
20-29	15 (20.3)	3 (4.1)	51 (22.6)	5 (2.2)	66 (22)	8 (2.7)
30-39	20 (27.0)	6 (8.1)	60 (26.5)	9 (3.9)	80 (26.7)	15 (5.0)
40-49	18 (24.3)	2 (2.7)	58 (25.7)	1 (0.4)	76 (25.3)	3 (1.0)
50-59	7 (9.5)	3 (4.1)	40 (17.7)	2 (0.9)	47 (15.7)	5 (1.7)
Total	60 (81.1)	14 (18.9)	209 (92.4)	17 (7.6)	269 (89.7)	31 (10.3)

Table 2: Positivity of diagnostic tests for detection of Hepatitis B and C virus infections in blood donors at the Abia State specialist Hospital and Diagnostic Centre Umuahia

Assays Parameters	Male (74) No. (%)	Female (226) No. (%)	Total (%)
Anti-Hepatitis B antigen	24 (32.4)	47 (20.8)	71 (23.7)
Anti-Hepatitis C antigen	8 (10.8)	14 (6.2)	22 (7.3)
HIV/Hepatitis B co-infection	8 (10.8)	3 (1.3)	11(3.7)
HIV/Hepatitis C co-infection	6 (8.1)	4(1.8)	10(3.3)
At least one positive test	32 (43.2)	61 (27.0)	93 (31.0)

DISCUSSION

The onset of HbV and HcV present no symptoms and the asymptomatic characteristics in most infected individuals favour its silent spread, further exacerbating efficient spread among vulnerable population during transfusion. This study showed that transfusion-transmitted infections is still significant in Abia State, South East, Nigeria. The overall HIV prevalence of 10.3% (31/300) found among blood donors in this study was lower compared to observations in another study by Zhang *et al.* (2019), who recorded 100% a HIV prevalence of among blood donors in a China. The HcV incidence of 6.6% was higher than prevalence reported in Douala, Cameroon (1.3%), Ethiopia (0.8%), Nigeria (3.6%) and Qatar (0.6%) among blood donors (Moukoko *et al.*, 2014; AbuOdeh *et al.*, 2015; Okoroiwu *et al.*, 2018). The observed HbV prevalence was however lower than estimates reported by Sama *et al.*, (2004) and

Noubiap *et al.* (2013) with prevalence 10.1% and 10.7% respectively. The reported HIV/HbV co-infections prevalence in our study was however, higher than the 1.5%, and 0% each reported by El-Gilany and El-Fedawy (2006), Al-Mughales (2016) and Afsar *et al.* (2008) in Egypt, Saudi Arabia and Turkey respectively among voluntary blood donors. Zhang *et al.* (2019) recorded a prevalence of 28.6% in HIV/HcV co-infections among HIV patients in China which contrast with observation in this study. Hussain *et al.* (2012) reported co-infections of hepatitis B patients, HcV and human immunodeficiency virus (HIV). These viral co-infections could cause minimal adverse effects in infected individual by changing normal host response, altering assay outcomes and interfering with host responses to treatment (McArdle *et al.*, 2018). In HIV-infected populations, HbV co-infections rates could reach 25% in countries where the viruses

are endemic particularly due to the sexual and percutaneous routes of transmission (Thio, 2009). Age group 30-39 years recorded a high HIV prevalence of 5.0% which contrasts with the findings of Dikosso, (2010) and Zhang *et al.* (2019), who recorded higher prevalence among blood donors. The observed HcV prevalence among male donors could be attributed to risk exposure, while the low prevalence of HIV/HbV co-infections in female donors (1.3%) could indicate an improvement in preventive measures and health measures. High proportion of HcV and HbV infection in male donors in this study agrees with the reports of Dikosso (2010). Young age is independent risk factors for transfusion-transmitted infections (TTIs). Age associated immunity also plays an important part in controlling TTIs in areas of high and stable transmission. World Health Organisation (WHO) estimates that about 2.7 million people with HbV are HbV/HIV co-infected (WHO, 2019), which differ with the 3.7% of HbV positive donors co-infected with HIV in this study. Studies have demonstrated incidence of HBsAg co-infections with HIV among immune compromised and high risk sexual behaviour individuals (Burek *et al.*, 2010; Moore *et al.*, 2010). Perazzo *et al.* (2015) have reported HbV/HIV co-infections which is relatively higher than that observed in this study. Hepatitis B seroprevalence was prevalent in male than in female donors. This is in contrast to Nkrumah *et al.* (2011) who reported a higher HBsAg prevalence in female (21.4%) than male donors. More females were presenting for blood donation in this study which differs from other studies (Sharma *et al.*, 2015). The higher prevalence of positive males could also be due to increased male susceptibility to infection. Studies by Kourtis *et al.* (2012) and Thio *et al.* (2013) have reported that HbV co-infections could result in higher liver related mortalities than to HbV mono-infected individuals. The low percentage of male donors in this study contrasts with the observations of Moukoko *et al.* (2014) who reported high male donors. A limitation of this study is its inability to trace repeat donors and it may have been possible that some donors had visited and donated blood more than once but were treated as new donors. Limits of detection of assay kits specificity and sensitivity were not indicated in this study which could have an impact on the results, as well as the non-performance and documentation of baseline tests for CD4⁺ T-cell counts for all donors. Also, HIV viral load results were not computed.

CONCLUSION

Hepatitis B virus was still prevalent in the sample population and is likely to be perinatal or vertical by high levels of HBsAg prevalence in males (32.4%). These findings should be considered when planning public health campaigns and high risk groups need to be targeted for interventions and existing control measures reviewed. In summary, this study showed that HIV, HbV and HcV infection still occurs among blood donors.

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