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Serological Evidence of HIV/HBV Co-infection among HIV-infected patients in Onitsha, Anambra State, Nigeria

Chineze Helen Ugwu [1], Edith Nnenna Oketah [2], Phillip Oritsegbubemi Okerentugba [2], Nnenna Frank-Peterside [2] and Iheanyi Omezuruike Okonko [2,*]

[1] *Virology Research Unit, Department of Applied Microbiology, Nnamdi Azikiwe University, Awka, Nigeria.*
[2] *Virus & Genomics Research Unit, Department of Microbiology, University of Port Harcourt, Choba, Port Harcourt, Rivers State, 500102 Nigeria.*

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Abstract

Research suggests that HIV-infected individuals who have also been co-infected with HBV face a greater risk of HIV progression. Hepatitis B and HIV infections pose serious public health challenges in sub-Saharan Africa. This study examined the possible HBV co-infection with the socio-demographic traits of HIV-infected individuals attending the HIV clinic at a referral specialist mission hospital in Onitsha, Anambra State, Nigeria. Two hundred and twenty (220) HIV-infected individuals gave consent to participate in the study. Between March 2022 and October 2022, blood samples (about 5ml) were aseptically collected during routine investigations into sterile EDTA bottles, and plasma samples were obtained by centrifugation. These samples were tested for HBsAg using a Monolisa HBsAg ULTRA kit (Bio-Rad, USA). CD4 counts were measured using the Partec CyFlow. Plasma viral loads (PVL) were also determined using the Abbott Real-Time HIV-1 Assay US protocol. HIV/HBV co-infection was 40.9%. The results showed that most (39.7%) study participants co-infected with HBV had a CD4 cell count of 350 cells/µl. The virological assay revealed that the highest HBsAg seroprevalence was detected in the study participants whose viral loads were between 40 and 1000µl (61.9%). The majority of the study participants were female HIV patients (74.5%), while those co-infected with HBV were mainly male patients (48.2%). HIV-positive individuals aged 18-30 (53.3%) were mostly affected. None of the socio-demographic variables tested was significantly associated with HBV in HIV-infected patients in Onitsha, Anambra State, Nigeria. This study showed a high HIV/HBV co-infection in Onitsha, Anambra State, Nigeria.

Keywords: HBV; HIV; Co-infection; Nigeria

1. Introduction

HIV (Human Immunodeficiency Virus), the causative agent for AIDS) has infected an estimated 35.3 million persons across the globe. Out of this population, about 4 million individuals are already co-infected with HBV (Weldemhret, 2021). In 2019, more than 820,000 people died from HBV-related diseases, and an estimated 296 million had chronic HBV infection (WHO, 2021a, b; Im et al., 2022).

HIV/HBV co-infection is a growing concern because of its potential to lead to an increased risk of developing liver cirrhosis resulting from co-infected patients having higher levels of HBV replication and lower rates of spontaneous resolution of the HBV infection and higher risk of reactivation of previous infections. It can also increase the toxicity of antiretroviral medications (Owolabi et al., 2014).

* Corresponding author: Iheanyi O. Okonko

The prevalence of HBV/HIV co-infection varies in different geographic regions, ranging from 10 to 28%. Studies in highly endemic regions like sub-Saharan Africa and East Asia have reported that 10% of HIV-infected individuals also have HBV infection (Cheng et al., 2021). Sub-Saharan Africa has a high prevalence of hepatitis B (HBV), with more than 60% of the population contracting the disease and 8 – 20% becoming chronic carriers who are in danger of developing a fatal hepatic condition. HBV and HIV are significant causes of morbidity and mortality in Africa and have several modes of transmission in common (Patassi et al., 2016).

The prevalence of HBV infection in Nigeria is between 12.2%-14% (Oluwaseyitan et al., 2020). The prevalence of HIV/HBV co-infection in Nigeria ranges between 10% and 70% (Owolabi et al., 2014). The epidemiological data on the two viruses in Nigeria will be further enhanced by studies on HIV/HBV co-infection, which will provide insights into the variation in the prevalence of the two viruses.

It is worthy of note that data relating to the prevalence of the hepatitis B virus among HIV patients in Nigeria are essential and of topmost priority, as they will enable the health agencies responsible for developing and implementing policies to adequately address and eliminate possible hazards posed to the health of the Nigerian populace. Also, these data will be beneficial for designing campaigns to raise public awareness and health literacy regarding the infectious causes and modes of transmission of the disease across Nigeria.

Hence, this study aimed to investigate HIV/HBV co-infection in HIV-infected individuals attending an HIV clinic in a referral specialist hospital in Anambra state, Southeast Nigeria.

2. Materials and methods

2.1. Study Area

Sampling was done in a reference hospital that provides health care services to HIV-1 patients in Ànambra State, Nigeria; Saint Charles Borromeo Specialist Hospital, Onitsha, Anambra State, Nigeria.

2.2. Ethical standards

The study only proceeded after ethical approval was obtained from the Board of Research Ethics Committee for Saint Charles Borromeo Specialist Hospital, Onitsha, Anambra State, Nigeria. All consenting HIV-infected individuals attending the HIV clinics at these hospitals were considered eligible for recruitment in this study.

2.3. Study population

The study subjects were HIV-positive individuals attending the HIV clinic at Saint Charles Borromeo Specialist Hospital, Onitsha, Anambra State, Nigeria. Exclusion criteria were based on "no consent to participate' in the study. Those whose HIV status was unconfirmed and were seronegative were also excluded. Plasma samples (n=220) collected from March 2022 to April 2022 were analysed in our study. Questionnaires with information including socio-demographics (age, sex, occupation, education levels, and marital status) were administered to the study participants, and trained interviewers collected the demographic data relevant to the study.

2.4. Sample collection/preparation

The venous blood samples were collected from the study subjects in the EDTA vacuum tube, and $CD4^+$ T-cell counts were measured within 24 h after sampling. Meanwhile, plasma samples were obtained by centrifugation and stored at −80 °C until further analysis.

2.5. Serological analysis

Serum samples were tested for detection of hepatitis B surface antigen (HBsAg) with an ELISA kit (DIA.PRO Diagnostic Bioprobes, Italy). The tests were carried out in line with the manufacturer's instructions. The test results were computed using a cut-off value based on the mean OD450nm value of the negative control (NC), using the formula NC + 0.050 = Cut-Off (Co). Calculated as the ratio of the sample OD450nm (S) and the Cut-Off value (Co), test results were interpreted as follows: 0.9 = negative, 0.9 - 1.1 = equivocal, and > 1.1 = positive. A negative result indicated that HBV did not infect the patient.

2.6. Data Analysis

Data were analysed using the Statistical Package for Social Science (SPSS) version 22.0. The data were recorded and analysed using a Microsoft Excel spreadsheet (Microsoft Corporation). Chi-square or Fisher's exact was used where appropriate to test association. A p-value of <0.05 was considered significant.

3. Results

3.1. Patients Characteristics

A total of two hundred and twenty (220) HIV-positive patients consented to participate in the study, where 56 (25.5%) and 164 (74.5%) HIV patients were males and females, respectively. The HIV/HBV co-infection rates with their demographic characteristics are shown in Table 1.

3.2. HIV/HBV Co-infections with socio-demographical characteristics

The HIV/HBV co-infections were detected in 40.9% of HIV-positive patients. Most of the patients infected were male patients (48.2%) than females (38.4%). Those HIV-positive individuals aged 18 to 30 (53.3%) were the most affected. Patients with secondary (44.3%) and primary (39.3%) education showed more excellent rates of HIV/HBV than those with tertiary (34.1%) and no formal education qualification (0.0%) concerning their educational background.

Marital status-related seroprevalence revealed a higher HBV prevalence among HIV patients who were single (51.4%) and married (43%) compared to those who were separated/divorced (42.9%) or widowed (29.1%).

Regarding their occupational status, Hepatitis B surface Antigen (HBsAg) was detected highest in the student patients (100.0%), followed by the unemployed patients with a record of 45.5%. In comparison, the self-employed and employed patients had 44.3% and 19.4% HIV/HBV co-infection rates, respectively.

3.3. HIV/HBV Co-infections concerning the Virological and Immunological markers of the HIV-infected individuals in Borromeo Hospital, Onitsha, Anambra State, Nigeria.

Table 1 also shows the HIV/HBV co-infection concerning the virological and immunological markers. In terms of their virological marker, participants whose target viral RNA fell within 40-1000 copies/ml had the highest HIV/HBV co-infection rate (61.9%, n = 13), followed by 60% (n = 9) in those with viral loads less than 40 copies/ml, and the lowest seroprevalence (36.6%, n = 59) in those whose viral loads were at a non-detectable level. The viral load groups and HIV/HBV co-infection were not significantly different from one another (χ^2 = 5.529, p=0.24).

In terms of their immunological markers, HIV-infected individuals with CD4 T cell counts between 200 and 350 cells/µl had a higher rate of HIV/HBV co-infection (50.0%) compared to those with counts under 200 cells/µl (41.2%) and over 350 cells/µl (39.7%). The CD4 groups and HIV/HBV co-infection were not significantly different from one another (χ^2 = 1.115, p= 0.774).

Table 1 Prevalence of Hepatitis B Surface Antigen (HBsAg) among HIV-positive individuals with their demographic characteristics

Variables	Number Tested	HBV +ve	%	Chi-Square test
Age groups (Years)				
Below 18	13	5	38.7	χ^2 = 10.470, p= 0.489
18-30	15	8	53.3	
31-40	70	32	45.7	
41-50	71	27	38.0	
Above 50	51	18	35.3	
Sex				
Males	56	27	48.2	χ^2 =1.658, p= 0.129

Females	164	63	38.4	
Marital Status				
Married	121	52	43.0	χ^2 = 5.071, p= 0.167
Single	37	19	51.4	
Separated/Divorced	7	3	42.9	
Widowed	55	16	29.1	
Educational Status				
Primary	57	22	38.6	χ^2 = 2.097, p= 0.553
Secondary	122	54	44.3	
University/Polytechnics	41	14	34.1	
Occupation				
Student	2	2	100.0	
Self-employed	149	66	44.3	
Employed	36	7	19.4	
Unemployed	33	15	45.5	
CD4 (Cells/µl)				
<200	17	7	41.2	χ^2 = 1.115, p= 0.774
200-350	24	12	50.0	
>350	179	71	39.7	
Viral Load (Copies/ml)				
<40	15	9	60.0	χ^2 = 5.529, p= 0.237
40-1000	21	13	61.9	
>1000	23	9	39.1	
ND	161	59	36.6	
TOTAL	**220**	**90**	**40.9**	

4. Discussion

The mortality rate of HIV patients undergoing HAART has increased due to the incidence of HBV in HIV patients (Cookey et al., 2021). In a recent meta-analysis study on HBV and HIV co-infection, the rate was observed to vary from 0.0% to 28.0% across sub-Saharan Africa, with higher rates recorded in West African nations (11.5%) and the lowest rates in East African countries (4.1%). A significant burden of HIV/HBV co-infection is evident across several parts of Nigeria, where both HIV and HBV have been reported to be prevalent over the years. (Boateng et al., 2019; Okonko & Shaibu, 2023).

The overall prevalence rate of HBV/HIV co-infection registered in this study was 40.9%. This tallies with the global prevalence of HBV/HIV co-infection, which varies from 1.13% to 59% (Lawal et al., 2020). However, this prevalence rate is significantly higher than records obtained from similar research in Nigeria. In northern Nigeria, precisely north central, a 9.2% HBsAg seroprevalence rate was recorded (Akindigh et al., 2019). Omatola et al. (2019) also reported a 3.5% HBV/HIV co-infection at Anyigba, Kogi State, located in North central Nigeria. Additionally, in southeast Nigeria, Nnakenyi et al. (2020) recorded a 7.8% HBsAg seroprevalence rate among HIV-infected individuals. Also, in the south-south region of Nigeria, HIV/HBV co-infection rates of 6.3% and 3.1 % were reported in Rivers State and Uyo, Akwa Ibom State, respectively (Cookey et al., 2021; Innocent-Adiele et al., 2021). Tassachew et al. (2022) recorded a slightly higher frequency HIV/HBV rate of 46.7% of patients with liver disease in Ethiopia.

Data from this study revealed a higher HBsAg seroprevalence rate (48.2%) in HIV-infected male patients than in their female counterparts (38.4%). This result agrees with a previous report which stated that male patients are more prone to acquiring such co-infection, and the possibility for such is mainly attributable to their higher rate of sexual promiscuity and their predominance as HBV carriers (Boateng et al., 2019). Seyoum et al. (2022) also reported that HIV/HBV co-infection was twice as high in men as in women in the same age group. However, the finding from this study (48.2% HBsAg seroprevalence rate in males) is much higher when compared to studies conducted in some other African countries such as Tanzania (6.1%), Addis Ababa (8.8%), Ethiopia, and Sodo town, Southern Ethiopia (8.6%) (Goa et al., 2019; Nyalika, 2021; Seyoum et al., 2022).

More women (74.5%) than males (25.5%) were also observed to have participated in this study, indicating that more women than men accessed the ART clinic during the study's timeframe. This observation aligns with findings from previous research that registered more female HIV patients attending ART clinics than their male counterparts (Omatola et al., (2019).

Our investigation reveals that the prevalence of HIV/Hepatitis co-infection is more in middle-aged people than in any other age group, particularly in those between the ages of 31 and 50. The highest co-infection rate of HIV/HBV occurred among HIV-positive individuals aged 18 – 30 years (53.3%), followed by those within the age range of 31-40 years (45.7%). HIV patients below 18 years and those within the age range of 41-50 years had nearly the same HBsAg seroprevalence rate of 38.7% and 38%, respectively. However, the highest co-infection rate was recorded in ages 18-30 years. This result agrees with a similar finding by Oluwaseyitan et al. (2020), who reported that the burden of HIV/Hepatitis co-infection is higher in middle-aged individuals than in any other age bracket, especially in those aged 31-40 years. Reports from other research have some contrasting as well as similar results shown in comparison to our findings. Okonko and Shaibu (2023) recorded their highest seroprevalence (2.2%) among those within 41 years and above and those within 21 – 40 years (2.0%) in Yenagoa, Bayelsa State, Nigeria. In Makuenyi, Kenya, most (32.8%) of the HIV/HBV cohort were aged 26-30 (Mutisya et al., 2021). Katamba et al. (2020) showed that one of the correlates of HIV and hepatitis B co-infections was age (between 20 and 39 years).

In terms of the study participants' educational levels, those with secondary and primary levels of education had higher HBV seroprevalence rates, at 44.3% and 39.4%, respectively, compared to those with tertiary education (34.1%). A 0.0% HBV/HIV co-infection rate occurred for those without formal education. Our finding varies with the reports obtained from other research conducted in Nigeria. In Yenagoa, Bayelsa State, Okonko et al. (2023) observed a higher HIV/HBV co-infection among those with tertiary educational backgrounds (5.0%) than those with primary or secondary education (0.0%). In Uyo, Akwa-Ibom, Innocent-Adiele et al. (2021) reported a higher HBV seroprevalence rate among those with primary educational status (8.3%) compared to other educational status (tertiary 6.9% and secondary 4.9%). In Anyigba, Kogi State, Nigeria, Omatola et al. (2020) attested a fact of higher prevalence among individuals with less formal education among the study participants.

Data obtained from the marital status of the study participants showed a higher HBsAg seroprevalence rate among the single (51.4%) and married (43.0%) when compared to the separated/divorced (42.9%) and widowed (29.1%). This result disagrees with the findings by Omatola et al. (2019), who revealed that their widowed patients significantly had a higher HBV/HIV co-infection rate. The researchers attributed this to the absence of family cover, which could shield or restrain them from having multiple sexual partners. Our result agrees partly with the findings by Oluwaseyitan et al. (2020), who reported that a large majority of their respondents with co-infection were married, associating it with the cultural practice of the people that permits polygamy, the study being carried out in a rural community of the northern region of Nigeria. Also, Innocent-Adiele et al. (2021) had a slightly similar report to our finding, where the HBV seropositivity was higher among HIV-infected individuals who were singles (10.5%) as compared to the married (4.7%).

With their occupational status, the students amongst them, though few (n=2), had the highest HBV/HIV co-infection (100.0%) recorded, followed by the unemployed (45.5%). Ugwu et al. (2023) had a similar record of 20.0% prevalence among unmarried patients. This study also partly tallies with the findings of Ikeako et al. (2014), who reported a higher prevalence of unemployed subjects and artisans. Ogundeji (2018) also reported a higher prevalence of HBV in unemployed subjects and artisans.

Higher HIV/HBV co-infection occurred in patients with CD_4^+ T cell count 200-350 cells/µl (50.0%) than other CD4 groups. This result deviated from that of Ojide et al. (2015). This finding was not comparable to other studies (Okonko et al., 2020; Innocent-Adiele et al., 2021), which observed higher HIV/HBV co-infection for participants with CD4 counts <200 than other categories. However, the higher HBV/HIV co-infection rates observed in these groups are not

statistically significant. This observation is similar to findings from other studies (Sulkowski, 2008; Anigilaje & Olutola, 2013; Okonko et al., 2023).

The highest HBsAg seroprevalence rate was detected in the study participants whose viral loads were between 40 and 1000 ml (61.9%), followed by those with viral loads less than 1000 copies/ml (60.0%). The high HBV/HIV co-infection rate could be attributed to the fact that the presence of these viruses already compromises the immunity of the infected individuals. A study by Okonko and Shaibu (2023) showed that a higher HIV/HBV (2.4%) was recorded for participants that had 20-999 copies/ml in Yenagoa, Bayelsa State. Also, Geoffrey et al. (2021) reported a reduction in the viral load of patients in Kenya at six months of ARV treatment and a significant improvement noticed in HIV/HBV co-infected patients.

In this study, no significant difference existed between the characteristics of the study participants and HBV infection. This observation agrees with the results from other studies (Okonko et al., 2020; Innocent-Adiele et al., 2021). This finding correlates with similar research in a teaching hospital in Awka, Anambra State, Nigeria (Ugwu et al., 2023).

5. Conclusion

Results from this study revealed a comparatively high HIV/HBV co-infection rate for people living with HIV attending the HIV clinic in a referral hospital, Onitsha, Anambra State, Nigeria. The high HBV seroprevalence recorded within this study indicates the need to design campaigns to create public awareness and health literacy regarding the infectious causes and modes of transmission of the disease across Nigeria. Also, as a matter of urgency, the government of the State needs to collaborate with health agencies in providing adequate treatment and vaccination against the Hepatitis B virus and other possible infectious agents, especially among HIV patients that have their immune systems already compromised.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have declared that no competing interests exist.

Statement of ethical approval

All authors declare that all experiments have been examined and approved by the Saint Charles Borromeo Specialist Hospital Research Ethics committees. Therefore, the study is performed following the ethical standards laid down in the 1964 Declaration of Helsinki.

Statement of informed consent

All authors declare that informed consent was obtained from all individual participants included in the study.

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