

Co-infection of Hepatitis C among HIV-infected patients: A cross-sectional study from A University Teaching hospital in Anambra State, Nigeria

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Abstract

Hepatitis C virus co-infection (HCV) with HIV is regarded as a significant public health risk despite being less frequent than hepatitis B co-infection with HIV. This observation results from HIV's impact on the HCV life cycle and, ultimately, the hepatic system. In this study, potential HCV co-infection was examined in connection to the socio-demographic characteristics of HIV-positive patients attending an HIV clinic at a University Teaching Hospital in Awka, Anambra State, Nigeria. Between September 2021 and June 2022, 255 HIV patients who consented to participate in the study had their HCV levels checked using the anti-HCV antibody ELISA kit (DIA.PRO, Italy). Using the Partec CyFlow, CD4 counts were calculated. During routine investigations, blood samples (approximately 5ml) were aseptically collected into sterile EDTA vials, and plasma samples were obtained by centrifugation. With the aid of Abbott Real-Time HIV-1 Assay US methodology, plasma viral loads (PVL) were also calculated. A total of 11 (4.3%) HIV-positive people were also confirmed to have HCV infection, with women making up the majority (4.8%). Most of those affected were between the ages of 31 and 40 (6.8%). With marital status, HCV co-infection was found more amongst married patients, with a rate of 4.8%. The prevalence of HIV/HCV co-infection was higher (4.8%) in those with CD4 cell counts under >350 cells per ml than others. Most patients (3.1%) did not have their viral RNA detected (TND). Self-employed infected persons and those with secondary school educational backgrounds had the highest HIV/HCV prevalence rate of 6.6% and 7.6%, respectively. The study's findings show no statistically significant relationships between the patients' socio-demographic traits and HCV. Also, HCV co-infection prevalence was significantly low in the study participants.

Keywords: Antibodies; Cross-sectional study; HCV; HIV-infected; Nigeria

1. Introduction

Hepatitis C is a liver infection caused by a blood-borne virus called hepatitis C virus (HCV) acquired through close contact with an infected person's blood. According to published reports from the World Health Organization, it is estimated that more than 3% of the world's population is infected with HCV (Salari et al., 2022).

Human immunodeficiency virus (HIV), the causative agent for AIDS, and HCV are RNA viruses that share the same transmission mode and consequentially pose a severe threat to public health globally. Hepatitis C virus co-infection with HIV (HCV/HIV co-infection) is regarded as a significant public health risk despite being less frequent than hepatitis B co-infection with HIV. According to reports by Akhtar et al. (2021), several studies have shown higher levels of HCV in the blood of HIV-infected patients coinfecting with HCV following a rapid progression to liver diseases related to HCV

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and a higher risk of liver cirrhosis. Investigations have shown the widely varying prevalence of HIV/HCV co-infection even within the same geographical area, indicating that an environmental factor—likely hygiene—is at play. However, this remains to be proven (Mabayoje, 2018).

Hepatitis is a significant public health issue in Nigeria. It is a highly contagious disease as those with it are usually unaware of their status and unable to take the necessary precautions to prevent the infection from spreading. There is a global campaign for the eradication of HIV and HCV by the year 2030 (WHO, 2017). In Nigeria, there have been many studies on the epidemiology of HIV, HBV, and HCV (Omatola et al., 2019). However, there is a paucity of data on this subject, especially in the southeastern part of Nigeria. Therefore, this study was undertaken to ascertain the possible co-infection of HCV among HIV patients attending an HIV clinic in a teaching hospital in Awka, Anambra State, Southeast Nigeria.

2. Material and methods

2.1. Study area

Sampling was conducted at Chukwuemeka Odumegwu Teaching Hospital (COOUTH) Awka, a reference facility that offers health care services to HIV-1 patients at their retroviral clinic section in Anambra State, Nigeria.

2.2. Ethical considerations

The Board of Research Ethics Committee for Chukwuemeka Odumegwu Teaching Hospital (COOUTH) in Awka issued its ethical approval before the study. All consenting HIV-infected individuals accessing the hospital's HIV clinics were considered eligible for enrollment in the research.

2.3. Study population

The study's participants were HIV-positive individuals attending an HIV clinic at Chukwuemeka Odumegwu Teaching Hospital (COOUTH) Awka in Anambra State, Nigeria. The study's exclusion criteria were based on "no consent to participate". Individuals with an unconfirmed HIV status and those who are seronegative were also excluded. Our investigation examined plasma samples (n=255) collected between September 2021 and June 2022. The study participants were given questionnaires with socio-demographic data (age, sex, occupation, and education levels, among others). At the same time, qualified interviewers obtained the demographic data necessary for the study from them.

2.4. Sample collection/preparation

Blood samples were aseptically collected by venipuncture from the study subjects. A 5-ml blood sample was obtained using a disposable sterile needle and syringe in an EDTA vacuum tube. CD4⁺ T-cell counts were measured within 24 h after sampling. The blood samples were then transferred into a labelled blood sample tube containing no anticoagulant. Plasma samples were obtained by centrifugation and stored at -80 °C until further analysis for serological aspect.

2.5. Serological analysis

Serum antibodies against HCV were evaluated in vitro using an Enzyme-linked Immunosorbent Assay kit (DIA.PRO Diagnostic Bioprobes, Milano, Italy). The manufacturer's protocols regarding testing and result interpretation were followed. An ELISA plate reader was employed to read the optical signals produced in the microwells at 450 nm. The formula for calculating the cut-off OD_{450nm} (OD of negative control plus 0.350) used as the threshold for differentiating between reactive and non-reactive serum samples was provided by the manufacturer of the ELISA kit.

3. Results

A total number of two hundred and fifty-five (255) respondents enrolled in the study. 34.9% (n=89) of the HIV-infected individuals were males, while 65.1% (n=166) were females. Table 1 represents the HCV co-infection with the socio-demographics of the respondents.

Of the 255 HIV-positive individuals who tested positive for the HCV antibodies, 11 (4.3%) were positive for HCV antibodies, whereas 244 (95.7%) tested negative. Of these individuals, 3(3.4%) were males, and 8 (4.8%) were females (Table 1).

Based on their age bracket, the age category spanning 31 – 40 years featured the highest prevalence of HCV antibodies (6.8%, n=5), followed by 18 - 30 years (5.0%, n=2), while 41– 50 and ≥ 50 years had the lowest number 4.2% (n=3) and 2.0% (n=1), respectively. Study participants under 18 had no record of HIV/HCV co-infection (Table 1).

In terms of their level of education, 8.6 % (n=3) of the study participants who had attained a tertiary level of education had the highest rate of HIV/HCV co-infection, followed by 7.6% (n=5) with a secondary education level. Study participants with no formal education and those with a primary education background recorded 7.3% and 0.0%, respectively (Table 1).

Regarding their marital status, the married (4.8%, n=8) patients had a higher HIV/HCV co-infection rate than the widowed (4.5%, n=1), separated/divorced (4.3%, n=1) and singles (2.2%, n=1) patients (Table 1).

Self-employed respondents had the highest HIV/HCV co-infection rate of 6.6%. The unemployed and employed recorded a 4.0% and 1.5% HIV/HCV prevalence rate, respectively, while the students had a 0.0% record (Table 1).

Table 1 Socio-demographic features of the study participants with HIV/HCV Co-infection rates

Variables	Number Tested	HCV +ve	%	Chi-Square test
Age groups (Years)				
Below 18	18	0	0.0	$\chi^2 = 2.615, p = 0.624$
18-30	40	2	5.0	
31-40	74	5	6.8	
41-50	72	3	4.2	
Above 50	51	1	2.0	
Sex				
Males	89	3	3.4	$\chi^2 = 0.295, p = 0.426$
Females	166	8	4.8	
Educational Status				
None	41	3	7.3	$\chi^2 = 9.229, p = 0.026$
Primary	113	0	0.0	
Secondary	66	5	7.6	
Tertiary	35	3	8.6	
Marital Status				
Married	165	8	4.8	$\chi^2 = 0.594, p = 0.898$
Single	45	1	2.2	
Separated/Divorced	23	1	4.3	
Widowed	22	1	4.5	
Occupational Status				
Student	26	0	0.0	$\chi^2 = 4.159, p = 0.245$
Self-employed	137	9	6.6	
Employed	67	1	1.5	
Unemployed	25	1	4.0	
TOTAL	255	11	4.3	

Figure 1 depicts a graph representing the virological markers of the study participants with the HIV/HCV co-infection. Those patients whose viral loads fell within the range of 40-1000 copies/ μ l recorded the highest prevalence rate of 13.3%. Those with less than 40 copies/ μ l and more significant than 1000 copies/ μ l had a prevalence rate of 3.6% and 2.9%, respectively, while those with undetectable viral load (TND) had a 3.1% HIV/HCV co-infection rate.

Figure 2 shows the immunological markers of the patients with HIV/HCV co-infection. Individuals whose CD4 counts were more significant than 350 had the highest prevalence rate of 4.8%, followed by 4.2% of those with CD4 counts less than 200. Those whose CD4 level fell within the range of 200-350 registered a 2.2% HIV/HCV prevalence rate.

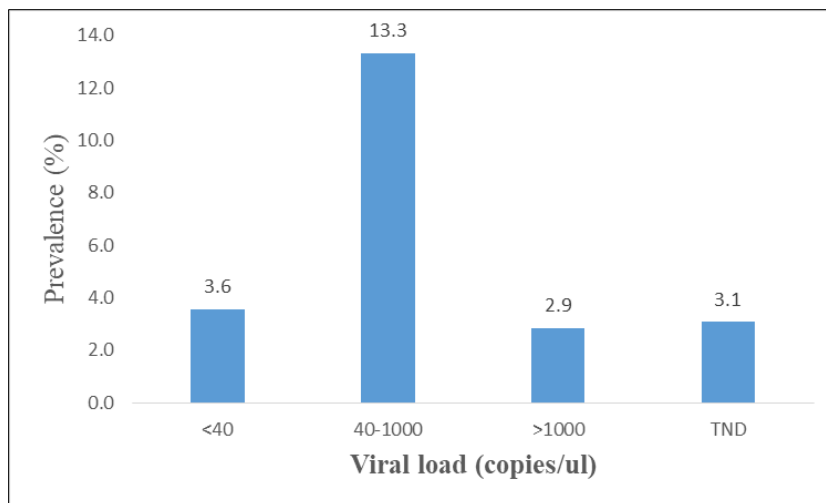


Figure 1 Prevalence of HIV/HCV co-infection with the viral loads of the study participants

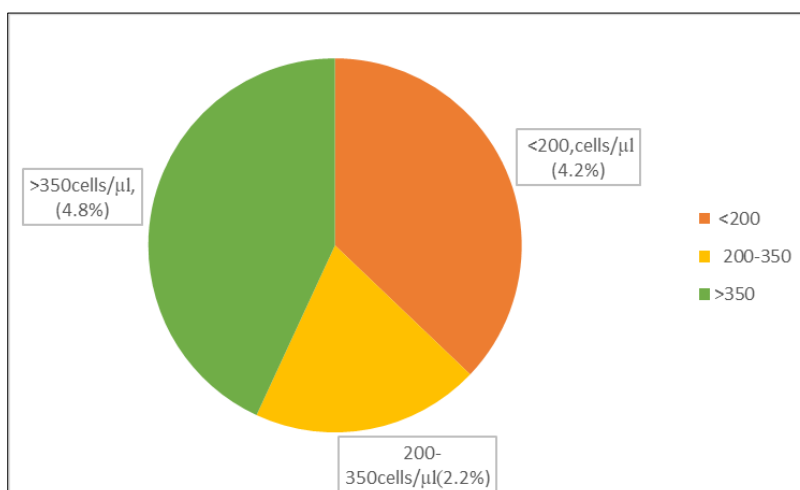


Figure 2 HIV/HCV co-infection with the study participants' immunological markers (CD4 Counts [cells/ μ l])

4. Discussion

Hepatitis C virus is mainly transmitted via blood contact or transfusion, aesthetic body piercing, drug injection, and nosocomial transmission and increases the risk of chronic liver disorders such as fibrosis, steatosis, liver cirrhosis, and hepatocellular carcinoma, especially in immunocompromised individuals (Baeka et al., 2021). It may have infected up to 2%–3% of the world's population, making it a severe threat to health on a global scale (Okonko & Shaibu, 2023).

This study was undertaken to determine the prevalence rate of hepatitis C virus (HCV) among people living with HIV (PLWHIV). The number of study participants enrolled was 255 HIV patients. The overall HIV/HCV prevalence rate

recorded was 4.3%. This result is similar to reports obtained from previous similar research. It has similar findings with a 4.0% HIV/HCV co-infection rate obtained in Yenagoa, Bayelsa State (Okonko & Shaibu, 2023), 4.4% in Port Harcourt, Rivers State (Baeka et al., 2021), and 4.7% from a southeastern state (Nnakenyi et al., 2020), all in Nigeria. Moreover, Cookey et al. (2021) recorded a zero per cent HIV/HCV co-infection prevalence among highly infected HIV patients in Rivers State. However, our result contrasts with 14.6% recorded in a rural community in northern Nigeria (Adesegun et al., 2020).

There are also various records documented from other African nations on similar research. Gedefie et al. (2021) reported a 5.2% HIV/HCV co-infection in northeastern Ethiopia, and also a 13.33% rate was reported in Cameroon (Marceline et al. (2018). However, a reviewed article stated that the overall prevalence of HCV among PLWHIV in Africa was 5.4% and was higher in the Northern Africa UNSD (United Nations Statistics Division) region and IDU (Injecting Drug Users) (Kenfack-Momo et al., 2022)

Most of the patients infected with the two viruses (HIV/HCV co-infection) were women, with a 4.8% HIV/HCV prevalence rate, whereas a 3.4% rate was observed in their male counterparts. This observation agrees with a higher HIV/HCV co-infection rate reported amongst female HIV patients compared to male patients in Port Harcourt, Rivers State (Okonko et al., 2022). Additionally, another recent similar research conducted in Rwanda showed that among HIV/HCV-coinfected participants, female individuals were more affected than male patients, with 7.7% and 4.8%, respectively (Munyemana et al., 2021). On the contrary, research conducted in the northwest of Ethiopia had HCV being more prevalent in males (85.7%) than in female HIV-infected participants (14.3%) (Ayelign et al., 2021). This disparity and contradictory findings could be attributed to geographical distribution, sample size, and recruited participants, according to Munyemana et al. (2021).

Erasmus et al. (2021) record showed the highest prevalence of HIV/HCV infection in the age range of 30-39 years at 5.6% in Rivers State, Nigeria explaining further that the results obtained from their study were consistent with those from other regions of the nation where HBV and HCV were more prevalent in the same age groups, suggesting that this age group engages in more sexual activity (Lawal et al., 2020; Malu et al., 2020). The HIV patients mainly infected with HCV were within the age bracket of 31- 40 years (6.8%). This result corresponds to the data reported in Gombe State, Nigeria, where HIV/HCV infections were also higher in the age group 31-40 years (Precious et al., 2022).

In this study, 8.6 % of the participants who had attained a tertiary level of education had the highest rate of HIV/HCV co-infection, followed by 7.6% of the respondents with a secondary education level. Study participants with no formal education and those with a primary education background recorded 7.3% and 0.0%, respectively. Some similar/contrasting records have also been documented. Oluremi et al. (2020) recorded a prevalence rate (of 0.8%) of HCV/HIV co-infection among those with bachelor's degrees in Osun State, Nigeria. Adesegun et al. (2020) had a contrasting view, with a higher prevalence of data among the uneducated. However, according to the report, the attributing factor is related to the rural community, where most respondents need to be educated. However, a significant difference of p-value = 0.026 was observed between HIV/HCV prevalence rate and their educational status.

According to data obtained about the study participants' marital status, the married (4.8%) and the widowed (4.5%) had higher rates of HCV prevalence compared to those who were separated/divorced (4.3%) and single (2.2%). This finding tallies with the report by Anyanwu et al. (2020), who recorded the highest occurrence among married patients (10.3%) but 0.4% among divorced patients. Oluremi et al. (2020) showed a 0.8% rate in married individuals only and 0% in others in this category.

The highest HCV/HIV co-infection prevalence was observed among the self-employed (6.6%) and the unemployed (4.0%) regarding their employment status. The employed and students recorded a prevalence rate of 1.5% and 0%, respectively. This observation correlates with the 6.7% rate seen among self-employed patients reported in some parts of Nassarawa State and Abuja, the capital city of Nigeria (Anyanwu et al., 2020). This observation, however, disagrees with the 5.3% rate seen among the employed (categorized as civil servants) in Cameroon (Marceline et al., 2018).

The study participants with viral loads between 40 and 1000 copies/ml had the highest prevalence of HIV/HCV (13.3%), followed by those with less than 40 copies/ml (3.6%). The existence of these viruses has already impaired the immunity of the infected, which could be the possible factor behind the elevated HCV seroprevalence rate.

In terms of the immunological marker data, the highest HIV/HCV prevalence rate was 4.8% among individuals who had CD4 counts above 350. This observation is consistent with previous findings where the study participants with HIV/HCV co-infection had higher CD4 count (350-499 cells/ μ l) (Okonko & Shaibu, 2023). Ngwogu et al. (2018) had a similar

report of a higher prevalence of HCV among the respondents with a CD4 count greater than 350 (CD4 > 350). Our report differed from theirs only in their HIV patients not undergoing antiretroviral therapy.

5. Conclusion

One critical global health sector strategy to eliminate hepatitis is information for focused action. In this study, we evaluated the rate of HIV/HCV co-infection among HIV patients attending the ART clinic in a teaching hospital at Awka, Anambra State. The study's findings revealed a low prevalence rate of HCV co-infection among the HIV-positive patients visiting the HIV clinic in this tertiary hospital. Therefore, an effective Nigerian response to the hepatitis C (HCV) pandemic requires data on the current burden and epidemiology of viral hepatitis, which our research was able to supply current data in Anambra State.

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 Nnamdi Azikiwe University Teaching Hospital Research Ethics Committee. 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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