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Original Research Article

Prevalence of Co-infection of Hepatitis B and C with HIV in HIV-Positive Adolescents in Anambra State, South-East Nigeria

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Abstract

Purpose: HIV accelerates the progression of HBV-related liver disease which may be as a result of the effect of HAART on the liver. This study evaluated the frequency of hepatitis B and C co-infection, and the viral load suppression rate among children and adolescents receiving ART in six HIV program centers in Anambra State, Nigeria.

Methods: A multi-facility cross-sectional study was conducted among HIV-infected children and adolescents currently receiving antiretroviral treatment (ART) in six selected HIV/AIDS program healthcare facilities in Anambra State between March 2018 and February 2020. The HBsAg and HCV antibody screening were done using LabACON (HangzhouBiotest Biotech C0, China). The HIV viral load of the patients was determined according to the national HIV program algorithm using the RocheCOBASAmpliPrep COBAS TaqMan (CAP/CTM) HIV-1 test, version 2.0. All the patients Data were analyzed using SPSS version 23 and test of significance set at p-value of 0.05.

Results: Of the 308 children and adolescent HIV positive cohorts tested for hepatitis B and C, 156/308 (50.6%) were males. Fourteen of the 308 (4.5%) tested positive for HBV while 34/308 (11.0%) tested positive for HCV. The male participants were frequently infected with HBV 10/156 (6.4) than their female counterparts 4/152(2. 6%). Among the children and adolescents, 3/94 (3.2%) and 11/214 (5.1%) were positive for HBV respectively, while the HCV antibody was present in 9/94 (9.6%) of children and 25/214 (11.7%) of adolescents ($p = 0.24$ and $p = 0.72$).

Conclusions: The estimated prevalence of HIV/HBV and HIV/HCV dual infections in this cohort of Anambra HIV-infected children and adolescents on ART was 15.5%.

Keywords: Seroprevalence, HBV, HCV, HIV, Children, Adolescents, ART, Anambra State

Introduction

Globally, human immunodeficiency virus (HIV), Hepatitis B (HBV) and Hepatitis C (HCV) are the three most common chronic viral infections of public health importance [1]. Hepatitis B and C are among the leading causes of death and disability globally [2,3]. They are common with HIV infection because of the shared channels of viral transmission and challenging co-infection [4-6]. Non-AIDS complications like HBV- and HCV-related liver diseases are fast-becoming a major cause of morbidity and mortality [2]. HCV/HIV co-infection delay treatment success in HIV therapy [7-9]. We investigated the co-infection of HCV/HBV-HIV among children and adolescents to provide information for prevention and control).

Methods

A multi-facility cross-sectional study was conducted among HIV-infected children and adolescents currently receiving antiretroviral therapy (ART) in six selected healthcare facilities in Anambra State between March 2019 and February 2021. Eligible participants were children (< 10) years and adolescents aged (10 – 19) years assessing HIV care in the study healthcare facilities Plasma samples were collected from the 308 children and adolescents and sent to the PCR unit of Nnamdi Azikiwe University Teaching Hospital, Nnewi Nigeria, for viral load assessment and screening for HbsAg and HCV infections. The HIV viral load of the patients was determined according to the national HIV program algorithm using the Roche COBAS AmpliPrep COBAS TaqMan (CAP/CTM) HIV-1 test, version 2.0. The HBsAg and HCV antibody screening were done using LabACON (HangzhouBiotest Biotech C0, China).

Individuals with viral loads < 1000 cp/mL were classified as suppressed while > 1000 cp/mL was classified as unsuppressed. Data were analyzed using SPSS version 23. P < 0.05 was interpreted as significant. The Chi-square test was used to determine if age, gender and viral load suppression were associated with the incidence of HBV and HCV infection amongst the study participants. This study evaluated the frequency of hepatitis B and C co-infection, and the viral load suppression rate among children and adolescents receiving ART in six HIV program centers in Anambra State, Nigeriad significant.

Results and Discussion

This study included 308 participants: 94 children (aged <10 years), 172 younger adolescents (aged 10-15 years); and 42 older adolescents (aged 16-19 years). Of the total, 156/308 (50.6%) were males while 152/308 (49.4%) were females. Fourteen of the 308, (4.5%) tested positive for HBV while 34/308 (11.0%) tested positive for HCV (Figures 1 and 2), to give a total dual prevalence of 15.5%.

Seventeen out of 156 (10.9%) among the male participants tested positive to HCV antibody and 17/152 (11.2%) of the females tested positive to the HCV antibody (Table 1). The male participants were frequently infected with HBV 10/156 (6.4) than their female counterparts 4/152 (2.6%), although there was no significant association between gender and HIV/HBV co-infection (Table 1). As shown in Table 2, about 3/94 (3.2%) and 11/214 (5.1%) were positive for HBV among the children and adolescents respectively while 9/94 (9.6%) and 25/214 (11.7%) among children and adolescents tested positive to the HCV antibody respectively (p = 0.24 and p = 0.72). Table 3, shows that among HIV/HBV dual infected children and adolescents, 35.7% were virally suppressed while 64.3% were unsuppressed. Among children and adolescents who were HIV/HCV dually infected, 76.5% were virally suppressed while 23.5% were unsuppressed (p = 0.01), the prevalence of triple infection was 0% among our study participants. There was a significant association between viral load suppression and incidence of HIV/HBV infections with individuals who had unsuppressed viral load being more likely to have HBV infection. However, there was no significant association between viral load suppression and incidence of HCV infections. Also, there was no significant association between viral load suppression and combined incidence of HCV and HBV infections (Table 3).

Table 1: Association between gender and incidence of HBV and HCV infection

Variable		Gender (%)		x^2	p
		Male	Female		
HBV	Infected	10(6.4)	4(2.6)	2.53	0.11
	Not Infected	146(93.6)	148(97.4)		
HCV	Infected	17(10.9)	17(11.2)	0.01	0.94
	Not Infected	139(89.1)	135(88.8)		
Either HBV or HCV	Yes	27(17.3)	21(13.8)	0.71	0.40
	No	129(82.7)	131(86.2)		

Table 2: Association between age group and incidence of HBV and HCV infection

Variable		Age group (%)			x^2	p
		Children	Young Adolescents	Old adolescents		
HBV	Infected	3(3.2)	7(4.1)	4(9.5)	2.89	0.24
	Not Infected	91(96.8)	165(95.9)	38(90.5)		
	Total infected	3/94 (3.4)	11/214 (5.2)			
HCV	Infected	9(9.6)	19(11.0)	6(14.3)	0.66	0.72
	Not Infected	85(90.4)	153(89.0)	36(85.7)		
	Total infected	9/94 (9.6)	25/214 (11.7)			
Either HBV or HCV	Yes	12(12.8)	26(15.1)	10(23.8)	2.76	0.25
	No	82(87.2)	146(84.9)	32(76.2)		

Young adolescents aged 10-15 years, Old adolescents aged 16-19 years

Table 3: Association between viral load suppression and incidence of HBV and HCV infection

Variable		Viral load (f (%))		x^2	p
		Suppressed	Unsuppressed		
HBV	Infected	5(35.7%)	9(64.3%)	7.98	**0.01***
HCV	Infected	26(76.5%)	8(23.5 %.)	0.28	0.60
Either HBV or HCV	Yes	31(13.9)	16(19.0)	1.25	0.26
	No	192(86.1)	68(81.0)		

Discussion

Although remarkable success has been achieved with antiretroviral therapy in many resource-limited settings, hepatitis infection remains the leading cause of morbidity and mortality among people living with HIV [2]. This study included 308 children and adolescents obtaining antiretroviral care in six HIV Program healthcare facilities in Anambra State and frequently sent samples to the PCR Unit for Viral load assessment.

Overall, the prevalence of HIV/HBV and HIV/HCV co-infection was 4.5% and 11% respectively, with a combined prevalence of 15.5%. There wasn't a single case where HIV, HCV and HBV were concomitantly present. Age and sex were not significantly association with co-infections. Viral load suppression was associated with lower HIV/HBV co-infections, but the opposite was the case for HIV/HCV.

The higher prevalence of HIV/HCV (11%) obtained corroborates that of previously published evidence by Supram *et al*. and even more than the global prevalence of 6.2% and sub-Saharan Africa levels of between 5.6% and 7% [7,11,12]. Possible reasons for this may be the non-existence of a guideline in Nigeria for HCV screening among pregnant women accessing antenatal care [13]. As such, they remain infected with possible perinatal transmission. In Nigeria, other studies investigating HIV/HCV co-infection levels alone have been done in Oshogbo [14] and Lagos [15] and were found to be higher than the rates in our study at 23.3%, 14.7%, respectively. A possible reason for this trend is the unavailability of vaccines at the time for HCV [8,16]. The systematic review by Supram *et al*. also revealed that HCV/HIV co-infection are highest in people who inject drugs (82.4%; CI: 55.2-88.5), men who have sex with men (6.45%; CI: 3.2-10.0), pregnant or heterosexual populations (4.0%; CI: 1.2-8.4), and lowest in the general population (2.4%; CI: 0.8-5.8). However, we gathered no such estimates for these population groups as it was beyond the scope of our study.

To achieve lower HIV/HCV co-infection rates such as the 4.4% reported in Port-Harcourt by Baeka *et al*. [17] and 2.3% reported in Abuja [18]. It is important to follow international guidelines which suggest screening, and treatment of HCV for infected persons as well as increased awareness on infection control practices in healthcare settings.

The HCV screening allows for identification of chronically-infected persons and the subsequent provision of antiviral therapy, care and follow-up. In a country like Nigeria with high HIV burden and the consequent high co-infection rates, implementation of this guideline, along with HCV surveillance is therefore paramount. On the other hand, a study in Malawi by Nyirenda *et al*. showed a higher HIV/HBV prevalence (11%), than that obtained in our study (4.5%). Studies in Nigeria have also

shown varying results. Hamza *et al*. [19] found that HIV/HBV prevalence in a hospital in Kano, North-western Nigeria was 12.5% while Otegbayo *et al*. revealed a rate of 11.9% in Ibadan in the south-west. Investigation into the HBV vaccination coverage in Nigeria, especially in South-east Nigeria where our study was conducted, might shine some light on these regional disparities [20]. A systematic review and meta-analysis by Ajuwon *et al*. showed that vaccination coverage at birth in our study region was 64.9%, although still below the 90% targeted by WHO [21]. Triple infections were not seen in any of the participants and a similar trend has been reported by Bagheri Amiri *et al*. [22]. However, Daw *et al*. [23] and Forbi *et al*. [24] reported a triple prevalence of 0.02% and 7.2% respectively. The increased awareness of infection prevention and control, as well as greater vaccination efforts may have contributed to the lack of triple infections in our study.

Although the Chi-square test did not reveal any association between age and incidence of HBV- or HCV-HIV co-infection in our study, Daw *et al*. [23] found that the HBV infections occurred mainly amongst individuals aged 18-29, and those aged 50 and above. A study by Joanah *et al*. [25] also agrees. Earlier opinions that vertical transmission does not play a significant role in HBV transmission [26,27] may therefore hold true. HBV vaccine was included in the portfolio of vaccines for Nigeria's National Programme on Immunization in 2004 [25]. Hence, adolescents delivered in the pre-vaccination period may not possess the viral antibodies [25]. On gender stratification, the male gender was associated with higher HIV/HBV prevalence (64%), than their female counterparts (2.6%). Although not statistically significant, this was consistent with the findings from Hamza *et al*. [19], where the males had higher prevalence than females (19.2% versus 9.2% respectively). A possible explanation points to the fact that boys tend to engage in risky behaviours that may result in injuries, bleeding and likely infection transmission [19]. This observation could also be attributed to the higher prevalence of multiple sexual partners in adult males than females. A similar explanation is not applicable to the pediatric population as the most likely channels of infection in the population studied are perinatal and horizontal; however, information on maternal HBV status and longitudinal HBV testing was not available to confirm the relationship between the suspected sources of infection in this study.

The HBV and HCV infections can be prevented in children by maternal HBV and HCV screening, HBV immunization in infants. It is essential to implement these measures to reduce the frequency of transmission and early detection especially in high risk population. Majority of the participants in this study were unaware of their HBV and HCV status. This highlights the need for increased awareness amongst the general population, HIV positive patients and their caregivers on HBV and HCV infection, methods for prevention, screening and the dangers of chronic HBV and HCV infection in HIV positive patients. Studies have shown that hepatitis B or C co-infection with HIV is a risk factor for accelerated liver damage and progression to severe liver fibrosis and increased risk of ART associated hepatotoxicity [8,15]. Early detection of co-infections will therefore promote early treatment of HBV and HCV infections in HIV patients who have also been found to be at higher risk of severe liver damage when compared to the rest of the general population

Conclusion

The results of this study showed an estimated 15.5% prevalence of Hepatitis B and C co-infections among HIV-positive children and adolescents in Anambra, Nigeria. Factors found to be associated with higher prevalence were viral load and endemicity of hepatitis infections in sub-Saharan Africa. Due to the high prevalence of hepatitis infections in this region, there is a need for increased awareness of HBV and HCV screening among HIV infected children and adolescents in Nigeria. Increasing the availability, appropriate and timely administration of hepatitis B vaccines for HIV infected and uninfected infants, routine screening for hepatitis B and C in HIV infected patients before the commencement of antiretroviral therapy to reduce the hepatotoxic effects of some antiretroviral drugs, and ensuring that children born to HIV infected mothers with hepatitis B and C co-infections should be of an important priority for managing physicians, and identification of HIV/HBV/HCV co-infected women attending antenatal clinics.

Abbreviations

ART -Antiretroviral therapy, HHAART -Highly active antiretroviral drugs, HIV - human immunodeficiency virus, HBV – Hepatitis B virus, HCV – Hepatitis C virus, NAUTH Nnamdi Azikiwe University Teaching Hospital, PCR -Polymerase Chain Reaction.

Declarations

Ethical approval and Consent to participate: Ethical approval was obtained from the ethical review board of Nnamdi Azikiwe University Teaching Hospital Nnewi; Anambra State. Written informed consent was obtained from the parents/guardian of the children and the adolescents below the age of 18 years. The adolescents above 18 years gave their informed consent.

Conflict of Interest

No conflict of interest is associated with this work.

Contribution of Authors

AMU, and SOK designed and wrote the manuscript; GU, UNS, OCU and EUP performed experiments and collected data. AMU, SIM and OBO analyzed the data. SOK and UNS performed serological experiments, AMU, SIM and OBO revised the manuscript.

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