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Prevalence of hepatitis B virus coinfection among human immunodeficiency virus positive patients in Yola, Adamawa state, Nigeria

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ABSTRACT

Background: Hepatitis B virus (HBV) and human immunodeficiency virus (HIV) coinfection has been reported to impair negatively on the health of the patients because it impacts directly on the outcome of HBV infection, considerably complicating its natural history, diagnosis and management. This study was aimed at determining the incidence and distribution of HBV/HIV coinfection in the study area. **Methods:** The sera people living with HIV/AIDS were screened for hepatitis B surface antigen (HB_sAg) and cluster of differentiation 4 (CD4) cell counts using the Becton Dickinson Fluorescence Activated Cell Sorter procedure. **Results:** The prevalence of HBV co-infection among people living with HIV/AIDS in this study was 11% with the coinfection being higher in males (14.3%) compared to the 9.7% among females. The coinfection was highest among people ages 25-39 yr. (12.9%) while least occurrence of coinfection was observed in ages above 53 yr. (8.3%). The CD4 counts of HBV and HIV coinfecting persons showed that 18.2% of coinfecting persons had CD4 counts above 700-1000 cells/mm³ while 12.1% had CD4 counts between 501-700 cells/mm³. **Conclusion:** The relatively high prevalence of HBV infection in HIV patients confirms the need for baseline screening for these markers in HIV-infected patients, as this could affect the choice of highly active antiretroviral therapy (HAART) regimen for the patients.

Introduction

Human immunodeficiency virus (HIV) and hepatitis B virus (HBV) infections are both major health concerns in developing countries because they cause high morbidity and mortality. Both have overlapping transmission; unprotected sexual intercourse with an infected partner, unscreened blood transfusion and use of sharp objects contaminated with the infectious agent, thereby making it possible to have a coinfection [1]. The risk of infection is reported as common especially in areas of high endemicity like Nigeria [2]. It has been

reported that hepatitis B virus co-infection in HIV infected individuals impact directly on the outcome of HBV infection, considerably complicating its natural history, diagnosis and management [3]. The coinfection has been reported to facilitate higher levels of HBV replication, decreased rates of spontaneous resolution of HBV infections and higher risk of reactivation of previous infection [3].

Hepatitis B virus is said to be one of the most common infectious diseases that has been reported to reach hyper-endemic proportion in sub-Saharan Africa and Asia. It has been estimated that

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400 million people are chronically infected with the HBV worldwide with an annual mortality of 2 million deaths making it the 10th leading cause of death worldwide [4]. Chronic HBV infection is reported to be the major cause of mortality although 5% of the world's population infected by HBV are asymptomatic at the acute stage. Reports also suggests that about 50% of chronic HBV carriers develop liver cirrhosis or hepatocellular carcinoma [5]. Furthermore, it has also been reported that chronic HBV infection occurs in 75-80% of the people infected from childhood while spontaneous clearance of HBV acquired in adulthood occurs in over 90% of immunocompetent individuals [6]. Previous studies have also shown that HIV-infected persons are half as likely as HIV-uninfected persons to spontaneously clear HBV. For this reason, 5-10% of HIV-infected individuals who are exposed to HBV develop chronic infection; a rate 10 times higher than that for the general population [7].

The global prevalence of HBV/HIV co-infection is reported to vary from 1.13% to 59% [8]. The prevalence of the coinfection in children in the USA is 2.6% while in China it is reported as 4.9% [9,10]. In Africa on the other hand, reports have shown that the prevalence of HBV/HIV co-infection in many of the countries in sub Saharan Africa is between 10%-20% because of the endemicity of both agents in the region. Agyeman and Ofori-Asenso [7] have reported that 10% of all HIV infected patients worldwide have chronic HBV coinfection. Adesina et al. [11] reported that the prevalence of HIV-HBV co-infection in antenatal population in Nigeria is 8.9%. Factors affecting the prevalence of chronic HBV include age at time of infection and mode of acquisition, which vary geographically [12]. This implies that there is increased morbidity and mortality from chronic liver disease, among HIV infected individuals.

This study was conducted to provide information on the prevalence of HIV/HBV coinfection in the study area that will help in evidence-based treatment and management of the infection and provide policy makers with data that will bring about scaling up of screening and immunization programmes against HBV.

Materials and Methods

Study population

This cross-sectional hospital-based study was conducted among HIV positive patients receiving anti-retroviral therapy (ART) at the Specialist

Hospital, Yola, Nigeria. The hospital runs a regular HIV/AIDS clinic and it is one of the most utilized health facility in the study area. Ethical approval for the study was obtained from the hospital management in accordance with the code of conduct for biomedical research involving human subjects. A total of 200 HIV patients receiving ART at the Specialist Hospital, Yola were enrolled in this study.

Inclusion criteria

The inclusion criteria were that the subject tested positive for HIV, receiving ART at the Specialist Hospital Yola and then consented to participate in the study as a subject.

Sampling technique

Sterile syringe and needle were used to collect 2 ml of venous blood sample aseptically from each of the 200 HIV positive patients enrolled in the study. The relevant information concerning patients' demographic profile were also obtained. About 1.5 ml of the blood sample was dispensed into a well labelled non-anticoagulant tube. This was allowed to stand on the bench for clotting to occur after which the tubes were centrifuge at 3000 rpm for 10 seconds to separate sera from the clot.

Detection of hepatitis B surface antigen (HBsAg)

This was done using the qualitative immunochromatographic in-vitro diagnostic kit manufactured by Grand Medical Diagnostic Limited, USA. The test strip which is coated with the mouse monoclonal anti-HBs capture antibody has 99.9% sensitivity and 98.6% specificity when read in-vitro. Serum sample and the test strip was allowed to equilibrate to room temperature prior to testing. The test strip was removed from their foil pouches and the test sample portion immersed into serum samples with arrows pointing into the serum sample for 10 secs. the strip was then placed on a non-absorbent flat surface for 15 minutes, after which the result was read. The test and interpretation of the results were done in accordance with the guidelines of the kit's manufacturers

CD4 cell determination/count

Cluster of differentiation 4 (CD4) cell count determination using Becton Dickinson Fluorescence Activated Cell Sorter (BD FACS) was adopted. Briefly, the BD FACS CD4 reagent tube was vortexed and opened using a coring station. Fifty microliters (50 µl) of the patient's whole blood was pipetted into to a tube containing the BD FACS CD4 reagent and the tube was vortexed for 5 seconds. It was then incubated for 1 hour in the BD FACS workstation after which 50 µl of the BD FACS

fixing reagent was pipetted into the tube containing the patients' blood and BD FACS CD4 reagent and then vortexed for another 5 seconds. The tube was then inserted into the specimen holder of the BD FACS CD4 count machine and allowed to run and display the CD4 count results [13].

Statistical analysis

Chi square analysis was done to determine the association between people with co-infection and patients' demographic details.

Results

Out of 200 serum samples of people living with HIV/AIDS screened for HBV, 22 were co-infected with HBV giving a prevalence rate of 11% (**Table 1**). The study also revealed that the rate of co-infection is higher in males 14.3% than females 9.7%. However chi-square test revealed that the difference is not statistically significant at $p=0.05$.

The distribution of HBV co-infection in people living with HIV/AIDS according to age groups is presented in **table (2)**. The data showed that HBV/HIV coinfection rates was highest among age group 26-39 years (12.9%) followed by age

group 12-25 years with a prevalence of 10.7%. The least occurrence of coinfection was observed in those above 53 years (8.3%). Chi square analysis showed that there was no significant association between HBV/HIV coinfection and age at $p=0.05$.

Table 3 shows the distribution of HIV/HBV coinfection in relation to marital status. The results showed that the coinfection rate was similar between singles and divorced subject (11.5%) and slightly higher than the 10.9% observed among married individuals. The widowed subjects had the least prevalence of coinfection (8.3%).

Comparing the CD4 counts between the HBV/HIV coinfecting individuals and those positive for only HIV revealed that none of the coinfecting persons has a CD4 count below 200 although 23 persons with HIV infection had CD4 count below 200 cells/mm³. The results also showed that 18.2% of coinfecting persons had CD4 counts in the range of 700 -1000 cells/mm³ while 12.1% had CD4 counts between 501-700 cells/mm³ (**Table 4**).

Table 1. Distribution of HBV co-infection in relation to gender.

Gender	HBV/HIV positive (%)	HIV positive only (%)	Total (%)	<i>p-value</i>
Male	8 (14.3)	48 (85.7)	56 (28)	0.354
Female	14 (9.7)	130 (90.3)	144 (72)	
Total	22 (11)	178 (89)	200 (100)	

Table 2. Distribution of HBV co-infection in relation to age.

Age groups	HBV/HIV positive (%)	HIV positive only (%)	Total	<i>p-value</i>
12-25	03 (10.7)	25 (89.3)	28	0.89
26-39	11 (12.94)	74 (87.06)	85	
40-53	07 (9.3)	68 (90.7)	75	
> 54	01 (8.3)	11 (91.7)	12	
Total	22 (11)	178 (89)	200	

Table 3. Distribution of HBV/HIV coinfection in relation to marital status.

Marital status	No tested	No. positive for coinfection	No. negative for coinfection	<i>P value</i>
Single	52	6 (11.5%)	46 (88.5)	<i>0.991</i>
Married	110	12 (10.9%)	98 (89.1)	
Divorced	26	3 (11.5)	23 (88.5)	
Widowed	12	1 (8.3)	11 (91.7)	
	178 (89%)	22 (11%)	178 (89)	

Table 4. Distribution of CD4 count in relation to HIV/HBV status .

CD 4 Counts cells /mm ³	HBV/HIV coinfectd persons	HIV infected persons	Total no. sampled
< 200	0 (0)	23 (100)	23
200 500	4 (8.7)	42 (91.3)	46
501 – 700	9 (12.1)	65 (87.9)	74
701 – 1000	8 (18.2)	36 (81.8)	44
>1000	1 (7.7)	12 (92.3)	13
	22 (11%)	178 (89%)	200

Discussion

The prevalence of HBV co-infection among people living with HIV/AIDS in this study was 11%. This confirms earlier reports stating that HBV co-infection exists among people living with HIV/AIDS. The prevalence of HBV/HIV coinfection from this study is slightly higher than the 10% reported for all HIV infected patients [14] but lower than the 12.5% reported in Kano, North Central Nigeria [15] 11.9% in Ibadan [16], 11.5% in Abuja [17] and 11.8% in Jos [18]. This prevalence buttresses the fact that HBV/HIV coinfection is a growing concern because of increasing toxicity to antiretroviral medications in HBV coinfectd individuals as well as higher levels of HBV replication, lower rates of spontaneous resolution of the HBV infection, and higher risk of reactivation of previous infections. This implies that there is an increased risk of developing cirrhosis of the liver among HBV/HIV coinfectd persons [19,20].

Findings from this study also showed that more coinfection was observed in men (14.3%) than women although the difference was not statistically significant at $p=0.05$. The findings are at variance with those reported by **Okechukwu et al.** [21] who reported higher prevalence in females 65.6% compared to 34.4% in males. Another study by **Adewole et al.** [17] in Abuja Nigeria showed higher female preponderance of HIV/HBV co-infection.

The difference between males and female coinfection could mean that men in the study area are more engaged in risk behaviours that favours transmission compared to the women.

The data from this study showed that HBV/HIV coinfection rates was highest among HIV infected individuals who are between the ages of 25 to 39 years followed by those between ages 12 to 25. Other researchers have published similar reports showing that those between ages 26 to 40 years have higher frequencies of HBV /HIV coinfection infection [18,21,22]. The reason for higher prevalence of coinfection in younger people could be attributed to the many routes of transmission which operate among the younger persons compared to the older ones. This is because HBV is more infectious than HIV and can transmitted via dried blood, open cuts, and shared toothbrushes, razors, clippers and having unprotected sex with one or multiple partners who could be infected. The younger people are more vulnerable to these risk behaviours and factors than the adults.

Although 11% of the people tested had coinfection, the likelihood that the HBV infection will become chronic depends on the age at which the infection is acquired [23]. The report showed that children less than 6 years of age who become infected with the hepatitis B virus are the most likely (30–50%) to develop chronic infections compared to

only 5% for healthy adults [24]. Previous studies have shown that most (90%) HBV infections are spontaneously resolved in immunocompetent adults, unfortunately, this spontaneous resolution ability of HBV is lost among HIV patients coinfecting with HBV thereby putting them at greater risk of developing chronic liver disease [6,7, 25]

The results showed that the coinfection rate was similar between singles and divorced subject (11.5%) and slightly higher than the 10.9% observed among married individuals. This shows that the exposure to risk factors among the different groups of persons is fairly the same although it appears higher among the singles and divorced. The higher occurrence among singles and widows has been attributed to absence of family cover which could shield and /or prevent these categories of persons from having multiple sexual partners [26]

The results also showed that 18.2% of coinfecting persons had CD4 counts above 700-1000 cells/mm³ while 12.1% had CD4 counts between 501-700 cells/mm³ (**Table 4**). **Oladepo et al.** [24] have established in healthy Nigerian adults a reference value for CD 4 count of 365 to 1,571 cells/ μ L. with a mean CD4 count of 847 cells/ μ L similar to the mean value of 828 cells/ μ L reported by **Akinsegun et al.** [27] in an earlier study in Nigeria. This implies that most of the coinfecting patients studied have CD4 counts within the safe zone of developing immunodeficiency and hepatotoxicity because their CD4 count is above the <200 cells /mm³ which portends risk of developing immunodeficiency. Although the CD 4 count is within the safe zone, hepatotoxicity is reported to be a common feature of HIV infected patients receiving highly active antiretroviral therapy and coinfecting with HBV. It has been reported that HBV coinfecting HIV patients were found to be 4 times more likely to develop hepatotoxicity [28]. This implies that those HBV/HIV coinfecting individuals must be treated with great caution so that in a bid to control HIV, they do not suffer liver damage because of the presence and activity of HBV.

Conclusion

The relatively high prevalence (11%) of HBV/HIV coinfection from this study confirms the endemicity of the disease and therefore an important marker that must be taken into consideration before the commencement of antiretroviral therapy on those that are HIV positive. This is because it could affect the choice of HAART regimen for the patients.

Recommendation

In view of the seroprevalence of HBV among HIV patients and the public in general, there is a need to up public health enlightenment to address the risk behaviours and promote health through massive testing and immunizations.

Conflict of interest: No conflict of interest exists.

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References

- 1-**FMOH.** Reports on the 2008 National HIV seroprevalence sentinel survey among pregnant women attending antenatal clinics in Nigeria 2009: 1-46
- 2-**Liu Z, Hou J.** Hepatitis B virus and hepatitis C virus dual infection International Journal of Medical Sciences 2006; 3: 57-62
- 3-**Aghasadghi MR, Bahramali G, Sadat SM Farahani A, Mohraz M, Davar, et al.** Variants in HBV monoinfected and HBV/HIV coinfecting Iranian patients under lamivudine treatment Current Human Immunodeficiency Virus Research 2011; 9: 263-269
- 4-**Awoleki JO.** Hepatitis B surface antigenaemia among pregnant women in tertiary health institute in Ekiti state, Nigeria. Tropical Journal of Obstetrics and Gynaecology 2012; 29: 57-59
- 5-**Lawal MA, Adeniyi OF, Akintan PE, Salako AO, Omotosho OS, Temiye EO.** Prevalence of and risk factors for hepatitis B and C viral coinfections in HIV infected children in Lagos, Nigeria. PLoS ONE 2020; 15(12): e0243656
- 6-**Šegalo S, Kiseljaković E, Berhamović L, Pašalić A, Mahmutović Vranić S, Berhamović E, et al.** Hepatitis B vaccination coverage rate and immune response among primary health care workers in Sarajevo Canton, Bosnia and Herzegovina. Microbes and Infectious Disease 2021; 2(1): 60-67.
- 7-**Agyeman AA, Ofori-Asenso R.** Prevalence of HIV and hepatitis B coinfection in Ghana: a

- systematic review and meta-analysis. *AIDS Research Therapy* 2016; 13:23.
- 8-Askari A, Hakimi H, Ahmadabadi BN, Hassanshahi G, Arababadi MK. Prevalence of Hepatitis B Co- Infection among HIV Positive Patients: Narrative Review Article. *Iran Journal of Public Health* 2014; 43(6):705– 712.
- 9-Toussi SS, Abadi J, Rosenberg M, Levanon D. Prevalence of Hepatitis B and C Virus Infections in Children Infected with HIV. *Clinical Infectious Disease* 2007; 45(6):795–798.
- 10-Zhou S, Zhao Y, He Y, Li H, Bultery M, Sun X. Hepatitis B and hepatitis C seroprevalence in children receiving antiretroviral therapy for human immunodeficiency virus-1 infection in China, 2005– 2009. *Journal of Acquired Immune Deficiency Syndrome*. 2010; 54(2):191–6.
- 11-Adesina O, Oladokun A, Akinyemi O, Adedokun B, Awolude O, Odaibe GN, Olaleye D, Adewole I. HIV and HBV coinfection in pregnancy at the university college hospital Ibadan, *African Journal of Medical Sciences* 2010; 39:305-310
- 12-Hoffmann CJ, Thio CI. Clinical implications and hepatitis B coinfection in Asia and Africa. *Lancet Infectious Diseases* 2006; 7:402-209
- 13-Becton, Dickinson, Company. BD FACSCount™ CD4 for enumerating absolute counts and determining percentages of CD4 T lymphocytes in unlysed whole blood Manual 2015: 1-19
- 14-Ranjbar R, Davari A, Izadi M, Jonaidi N, Alavian SM. HIV/HBV coinfections: epidemiology, natural history, and treatment: a review article. *Iran Red Crescent Medical Journal* 2011;13(12):855–62.
- 15-Hamza MA, Samaila A., Yakassai A, Babashani M, Borodo MM, Habib AG. Prevalence of Hepatitis B and C virus infection among HIV infected individuals in tertiary hospital in Northe western Nigeria, *Nigeria Journal of Basic Clinical Sciences* 2013: 10:76-81
- 16-Otegbayo JA, Taiwo BO, Akingbola TS, Odaibo GN, Adedapo, KS. Prevalence of hepatitis B and C seropositivity in a Nigerian cohort of HIV infected patients. *Annals of Hepatology* 2008: 7:152-156
- 17-Adewole OO, Anteyi E, Ajuwon Z, Wada I, Elegba F, Ahmad P, et al. Hepatitis B and C virus coinfection in Nigerian patients with HIV infection. *Journal of Infectious diseases in developing countries* 2009; 3(05):369-75.
- 18-Lar PM, Pam VK, Christopher PB, Gwamzhi I, Mawak. Prevalence and immune status of HIV/AIDS coinfecting pregnant women. *African Journal of Experimental Microbiology* 2013: 14: 120-126
- 19-Feld JJ, Ocama P, Ronald A. The liver in HIV in Africa. *Antivir Ther* 2005;10: 953-965.
- 20-Gilson RJ, Hawkins AE, Beecham MR, Ross E, Waite J. Interactions between HIV and hepatitis B virus in homosexual men: effects on the natural history of infection. *AIDS* 1997; 11: 597-606.
- 21-Okechukwu N, Godwin, M, Desmond FE, Patrick O. Seroprevalence of hepatitis viral infections in HIV tested positive individuals in Owerri, Imo state, Nigeria. *Journal of AIDS and Clinical Research* 2014: 5: 272-27.
- 22-Sarkar JB, Badyopadhyay R, Chakrabty N, Bhattacharya N, Adhikarim S. HIV-HBV coinfection among individuals attending the ICTC of tertiary care hospital in west Bengal India. *ISRN Virology* 2013:12
- 23-WHO. Hepatitis B Virus Factsheet 2020
- 24-Oladepo DK, Idigbe EO, Audu RA, Inyang US, Imade GE, Philip AO, et al. Establishment of reference values of CD4 and CD8 lymphocyte subsets in healthy Nigerian adults. *Clinical and Vaccine Immunology* 2009;16(9):1374-7.

- 25-**Anigilaje EA, Olutola A.** Prevalence and Clinical and Immunovirological Profile of Human Immunodeficiency Virus-Hepatitis B Coinfection among Children in an Antiretroviral Therapy Programme in Benue State, Nigeria. *ISRN Pediatrics* 2013; 1-7:932697
- 26-**Sule WF, Okonko IO, Yumusa IP, Odu NN, Frank-Peterside N.** Hepatitis B surface antigen (HBsAg) and risk factors of transmission among patients attending hospital in Ankpa, Kogi State, Nigeria. *Nature and Science* 2011; 9:37- 41.
- 27-**Akinbami A, Dosunmu A, Adediran A, Ajibola S, Oshinaike O, Wright K, et al.** . CD4 Count Pattern and Demographic Distribution of Treatment-Naïve HIV Patients in Lagos, Nigeria *AIDS Research and Treatment* 2012;2012: 352753.
- 28-**Olawumi HO, Olanrewaju DO, Shittu AO, Durotoye IA Akande AA, Nyamngee, A.** sEffect Of Hepatitis-B Virus Co-Infection on CD4 Cell Count And Liver Function Of HIV Infected Patients *Ghana Medical Journal* 48(2):96-100.

Sale MP, Bagarmi A, Yunana S. Prevalence of hepatitis B virus coinfection among human immunodeficiency virus positive patients in Yola, Adamawa state, Nigeria. *Microbes Infect Dis* 2022; 3(1): 48-54.