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Incidence of HIV, Hepatitis B and C, and their Co-infections among Pregnant Women Attending Selected General Hospitals in Ondo State

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Abstract

Hepatitis B virus (HBV) and Hepatitis C virus (HCV) infections cause chronic hepatitis in humans. The co-infections of these viruses with human immunodeficiency virus (HIV) have increased the burden, especially in the resource-poor nations of the world. In this study we determine the burden of HBV and/or HCV with HIV among pregnant women attending selected General Hospitals in Ondo State, Nigeria. The sera of consented subjects were collected and screened for the presence of HBV using enzyme-linked Immunosorbent Assay (ELISA) kits while HIV was detected using WHO approved rapid kit and its confirmation was done with Western blot assay. Out of two thousand, nine hundred ninety-eight (2.998) pregnant women screened, the numbers positive for HBV (HBsAg), HCV (antibody) and HIV (antibody) were 60, 54 and 28, respectively. The highest HIV seroprevalence was detected among women in the age group of 35-39 years. The seroprevalence of co-infections HBV and HCV was 0.07 % while those of HIV and HBV, and HIV and HCV were 0.03 % each. None of the subjects had the three viruses. The difference in demographic characteristics of the study population in the study areas might explain the varying results observed in this study. Pregnant women should not only be screened for HIV but also for both Hepatitis B and C infections during their first ante-natal visit.

Keywords: Hepatitis B, hepatitis C, co-infections, pregnant women, HIV, seroprevalence

Резюме

Инфекциите с вируса на хепатит В (HBV) и вируса на хепатит С (HCV) причиняват хроничен хепатит при хората. Съвместните инфекции на тези вируси с вируса на човешкия имунодефицит (ХИВ) увеличават тежестта, особено в бедните страни по света. В това проучване ние определихме тежестта на HBV и / или HCV с ХИВ сред бременни жени, които посещават избрани Общи болници в Ondo State, Нигерия. Серумите на доброволци се събират и изследват за наличие на HBV, използвайки ензимно-свързан имуносорбентен анализ (ELISA), ХИВ се открива с помощта на бърз кит, одобрен от СЗО, като потвърждаването му е извършено с Western blot анализ. От скринираните 2 998 бременни жени, положителни числени стойности за HBV (HBsAg), HCV (антитела) и HIV (антитела) са установени съответно при 60, 54 и 28 души. Най-висока серопревалентност на ХИВ е установена сред жените във възрастовата група от 35-39 години. Серопревалентността на ко-инфекции HBV и HCV е 0,07%, докато тези на HIV и HBV, и HIV и HCV са 0,03% всеки. Никой от субектите не е имал трите вируса едновременно. Разликата в демографските характеристики на изследваната популация в проучените райони може да обясни различните резултати, наблюдавани в това проучване. Бременните жени трябва да бъдат подложени на преглед не само на ХИВ, но и на хепатит В и С инфекции по време на първото им предродилно посещение

Introduction

Infection with Hepatitis B virus (HBV) and Hepatitis C virus (HCV) is a widespread problem globally. Epidemiological survey showed that about 5% of the world populations are asymptomatic hepatitis B carriers (Omer, 1995). Chronic hepatitis B

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virus infection is a major cause of mortality and 50 % of chronic carriers are expected to die from the disease due to liver cirrhosis or hepatocellular carcinoma (Omer, 1995). Approximately, 350 million people are infected with HBV worldwide (Liu and Hou, 2006).

Human immunodeficiency virus is the causative agent of acquired immune deficiency syndrome (AIDS). The acquired immune deficiency syndrome was first described in 1981, and HIV-1 was isolated by the end of 1983 (Green *et al*., 2007). Months to years after HIV infection, the virus destroys all the T-cell lymphocytes. This incapacitates the immune system from defending the body against diseases and tumors. Various opportunistic infections will be able to develop by taking advantage of the body's weakened immune system. These infections, which normally do not cause severe or fatal health problems, will eventually cause the death of the HIV patient (FMOH, 2010).

Chronic HBV infection occurs in 5-10 % of HIV-infected individuals who are exposed to HBV, a rate 10 times higher than that for the general population (Luetkemeyer, 2010). Co-infection of HIV and HBV is a state in which an individual is infected with both HIV and HBV viruses (Omonkhelin *et al*., 2010). The risk of co-infection is not uncommon, especially in areas of high prevalence and people at high risk for parenteral infection (Liu and Hou, 2006). Co-infections with HIV and HBV are common, with 70-90% of HIV-infected individuals in the United States having evidence of past or active infection with HBV (Luetkemeyer, 2010). Many of the countries that are affected by hepatitis B are also affected by a high HIV burden, leading to frequent HIV and HBV co-infections (Hoffmann and Thio, 2007).

In the United States, HIV and HBV co-infection rates are the highest among men who have sex with men (MSM), and injection drug users (Luetkemeyer, 2010). In contrast, in Asia and sub-Saharan Africa, where vertical and early childhood exposure are the most common modes of transmission, respectively, there is an overall high prevalence of HBV (Luetkemeyer, 2010). The prevalence of HBV among HIV-infected individuals also is higher, at an estimated 20-30% (Luetkemeyer, 2010). The prevalence of HIV and HBV co-infection in ante-natal populations in Nigeria is as high as 8.9% (Adesina *et al*., 2010).

Human immunodeficiency virus and HBV have overlapping transmission routes; hence many people are infected with both viruses (Uneke *et al*., 2005). Rates of new cases of hepatitis B in the population as a whole have fallen dramatically since the advent of routine childhood HBV vaccination, but trends among people with HIV have not been well studied (Highleyman, 2009; Chun *et al*., 2010).

Hepatitis B virus and HIV are endemic in the same world regions, although HBV is more infectious than HIV (Hoffmann and Thio, 2007). Hepatitis B virus infection in Nigeria has remained a public health issue. It is a major cause of mortality, especially in developing countries (Eke *et al*., 2011). Vertical transmission of HBV infection is thought to be a major route of transmission in low resource areas. In spite of this, routine ante-natal screening for HB infection is not yet practiced in many Nigerian hospitals (Eke *et al*., 2011).

In the study area there has not been any investigation to determine the prevalence of HIV, Hepatitis B and C infections and co-infections among pregnant women attending ante-natal care in some General Hospitals in Ondo State, hence the objective of this study.

Materials and Methods

Study area and sample size determination

This study was conducted in three General Hospitals in Ondo State, Nigeria. Each of the hospitals was drawn from each of the three Senatorial districts of the State. Ethical approval to carry out the study was obtained from the ethical committee of the various hospitals, while consent was obtained from each of the participants enrolled in the study.

The specimen size was determined using the formula described by Mugo (2008).

$$N = \frac{Z^2\,PQ}{D^2}$$

Where:
N=Minimum number of samples to be collected
Z=1.96 (standard normal distribution at 95 % confidence limit)
P= Local prevalence rate of previous study on HIV and HBV co-infection among pregnant women = 8.9% = 0.089 (Adesina *et al.*, 2010)
Q= (1-P) =1-0.089 = 0.911
D=Tolerable error (5%)

$$N = \frac{1.96^2 \times 0.089 \times 0.911}{0.05^2} = \frac{0.31147309}{0.0025} = 124.589$$

N= 125

The least number of specimens to be collected for the study was calculated to be 125. To get the maximum number of specimens, the tolerable error

used was 1%, and for this study a total of 2 998 non-repeat samples were collected.

Specimen Collection and Processing

About 5 mL of blood specimen was collected by a laboratory scientist by venipuncture from each of the 2 998 participants who had consented to participate in the research, using a disposable sterile needle and a 5 mL vacutainer tube. The plasma was carefully aspirated into cryovials after centrifugation for five minutes and then stored at -20°C until analyzed.

Analysis of specimen for HIV, HBV and HBC

All the 2 998 blood specimens collected from the pregnant women were tested for antibodies to HIV 1 and HIV 2 using the Determine test kit and the HIV positive specimens were re-tested using Uni-Gold™ test kit. The presence of HBsAg was detected using First response test kit and the HBsAg positive specimens were confirmed using Kinghawk ELISA. The HBsAg positive specimens were further tested for other HBV markers using One Step HBV multi-5 test.

Results and Discussion

The seroprevalence of HIV and HCV antibodies and HBV surface antigen for the study population is shown in Table 1. A total of 2 998 pregnant women were screened in this study and a total of 28 (0.93%) were positive for HIV antibodies while for HBV surface antigen and HCV antibodies were 60 (2.01%) and 45 (1.51%), respectively.

The highest HIV prevalence was observed in age group 35-39 years with seroprevalence of 8 (1.8%) (Table 2). The findings of this study revealed low seroprevalence of HIV, hepatitis B and C among pregnant women in Ondo State. The prevalence obtained for HIV infection (0.93%) in this study may be considered low prevalence as it is lower than the Nigerian national overall prevalence of 1.4% reported among pregnant women (FMHN, 2019). Similarly, the prevalence rate (0.93%) in this study is lower than the 3.9% prevalence among pregnant women attending ante-natal care within Kaduna Metropolis by Aba and Aminu (2016).

Table 1. The sero-prevalence of HIV, HBV and HCV infection among pregnant women [n(%)]

Age (Years)	Samples screened	HIV	HBV	HCV
15- 19	1133	1 (0.88)	1 (0.88)	0
20- 24	573	4 (0.7)	10 (1.74)	7 (1.22)
25-29	955	8 (0.84)	22 (2.3)	16 (1.68)
30-34	815	6 (0.74)	16 (1.96)	13 (1.64)
35-39	441	8 (1.8)	11 (2.5)	8 (1.8)
40-44	91	1 (1.10)	0	1 (1.1)
45-49	8	0	0	0
50-54	2	0	0	0
Total	2998	28 (0.93)	60 (2.0)	45 (1.5)

Table 2. The seropositivity of HIV, HBV and HCV in relation to age of the pregnant women in Ondo State, Nigeria

Infection	Health Care Facility	Total sample	Age range (years) [n (%)]							
			15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
HIV	GNI	1321	1(0.08)	3 (0.23)	2 (0.15)	2 (0.15)	3 (0.23)	0	0	0
	GHIO	511	0	1 (0.2)	1 (0.2)	0	0	0	0	0
	MCHA	1166	0	0	5 (0.43)	4 (0.34)	5 (0.43)	1 (0.09)	0	0
	Total	2998	1(0.03%)	4 (0.13)	8 (0.27)	6 (0.20)	8 (0.27)	1 (0.03)	0	0
HBV	GNI	1321	1 (0.08)	3 (0.22)	9 (0.68)	2(0.15)	2 (0.15)	0	0	0
	GHIO	511	0	1 (0.2)	0	1(0.2)	0	0	0	0
	MCHA	1166	0	6 (0.5)	13 (1.11)	13 (1.11)	9 (0.77)	0	0	0
	Total	2998	1 (0.03)	10 (0.33)	22 (0.73)	15 (0.5)	11 (0.37)	0	0	0
HCV	GNI	1321	0	1 (0.08)	1 (0.08)	2(0.15%)	0	0	0	0
	GHIO	511	0	0	0	0	0	0	0	0
	MCHA	1156	0	6 (0.5)	15 (1.29)	11 (0.94)	8 (0.69)	1 (0.09)	0	0
	Total	2998	0	7 (0.23)	16 (0.53)	13 (0.43)	8 (0.27)	1 (0.03)	0	0

Out of the three health facilities, MCHA had the highest occurrence of all the tested viral infections as shown in Table 3. The overall seroprevalence of 2.01 % for hepatitis B viral surface antigen (HBsAg) among pregnant women screened in this study is lower than what was reported among pregnant women in Kano, Nigeria and is also lower than that reported in Awka, Makurdi, Benin and Zaria all in Nigeria (Ezegbudo *et al*., 2004). Kolawole *et al*. (2012) equally reported a much higher prevalence of 16.5% in the Osogbo metropolis. The prevalence reported in this study for HBsAg (2.01%) is lower than the prevalence rate of 5.3% in Niger Delta (Buseri *et al*., 2010), 5.7% in Ilorin, 6.78% (Esan *et al*., 2014) in Ekiti and 4.6% (Obi *et al*., 2006) in Enugu all among pregnant women in Nigeria.

Table 3. Distribution of HIV, HBV and HCV in different health care facilities [n (%)]

Infection	Health care facilities			Total
	GNI (n=1321)	GHIO (n=511)	MCHA (n=1156)	
HIV	11 (0.83)	2 (0.39)	15 (1.30)	28 (0.93)
HBV	17 (1.29)	2 (0.39)	41 (3.55)	60 (2.00)
HCV	4 (0.30)	0	41 (3.55)	45 (1.50)

The wide variations in the seroprevalence of HBV in pregnant women from the literature may be due to geographical variation, differences in cultural practices, sexual behaviour and practices, and differences in the test methods employed to detect HBV infection as suggested by Olokoba *et al.* (2011). It is also likely that the infected women had missed the HBV vaccine which became available in 1982 and was introduced into the National Programme on Immunization in 2004 (WHO, 2009). The vaccine has been found to be 95% effective in preventing infection and its chronic consequences (WHO, 2001). The decreasing trend in the HBsAg prevalence might be connected to higher awareness and vaccine coverage of the susceptible persons. The possibility of hepatitis B occult infection due to escape mutations can also be a reason for the relatively low HBsAg seroprevalence reported in this study. Molecular detection of HBV DNA can better clarify this.

Out of the three viral infections HBV had the highest prevalence followed by HIV. The prevalence rate of 1.51% obtained for HCV in this study was higher than the 0.5% HCV prevalence recorded from similar studies among pregnant women in Yenagoa, Bayelsa state Nigeria (Buseri *et al*., 2010; Esan *et al*., 2014). It is also higher than the prevalence (0.9%) found among pregnant women in Bali, Indonesia (Surya *et al*., 2005). It was, however, similar to that found among women of reproductive age in Rome, Italy. MCHA has HBsAg prevalence rate of 13 (1.11%) for the age groups of 25-29 and 30-34, followed by age groups 35-39 and 20-24 with 9 (0.77%) and 6 (0.5 %), respectively. Also, samples collected at GHIO revealed that only 1 (0.2%) from the age between 20-24 and 30-34 was positive to HBV.

The HCV Seroprevalence (1.5%) among pregnant women in Jimma, Southwest Ethiopia reported by Awole and Gebre-Selassie (2005) was similar to the prevalence of HCV in this present study. In this study, the highest prevalence of HBV infection lies within the age group 25-29 years. This suggests that women who are at the peak of their reproductive years are more prone to viral infections as earlier postulated by Olokoba *et al*. (2011). This finding is similar to that of (Mortada *et al*., 2013), in which HBV was detected at a higher rate in pregnant women aged over 25 years than in women aged younger than 25 years. Ugbebor *et al.* (2011) also reported in a research conduted in Benin in Nigeria that the majority of those that tested positive to HBV were in the age range 32-36 years, which was similar to this present study. For HBV infection, pregnant women in age group 35-39 years had the highest seroprevalence of 11 (2.5%) while women between ages 35 and 39 years had the highest seroprevalence of HCV (1.8%).

The seroprevalences of HBV/HCV, HIV/HBV and HIV/HCV co-infections in our study was 0.07%, 0.03% and 0.03%, respectively. This is significantly lower than the 1.5% found by Noubiap *et al*. (2015) in northern Cameroon for HIV/HBV co-infections. Similarly, 1.7% seroprevalence was observed in the study carried out by Abongwa *et al*. (2015) for HIV/HBV co-infections among pregnant women. The study recorded 0.07% co-infection for HBV/HCV, which is higher than 0.03% recorded for HIV/HBV and HIV/HCV each. There was no case of HIV/HBV/HCV co-infection (Table 4).

Table 4. Seroprevalence of HIV, HBV and HCV and co-infections in the study

Variables	Seropositivity	
	n	%
HIV/HBV/HCV	0	0.0
HBV/HCV	2	0.07
HIV/HBV	1	0.03
HIV/HCV	1	0.03

In addition, the prevalence recorded in this study was found to be low compared to the 11.9% obtained among Nigerian cohort of HIV infected patients (Otegbayo *et al*., 2008), 4.47% obtained in the United States (Kim *et al*., 2008), 0.88% co-infection rate obtained by Dao *et al.* (2001) in Burkina-Faso, and 1.13% obtained by Tounkara *et al.* (2009) in Mali. This difference may be due to the difference in the study population.

Pregnant women should be screened for both HIV and Hepatitis B and C infection during their first ante-natal visit in order to inform clinical management and prevent vertical transmission. Awareness should be increased on the mode of transmission of the viral infections as well as risk involved with co-infection with both viruses as co-infection could lead to high risk of maternal mortality and morbidity.

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