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Full Length Research Paper

Maternal and neonatal seroprevalence of hepatitis B surface antigen in a hospital based population in South-South, Nigeria

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Despite the existence of a safe and effective vaccine, Nigeria has remained a hyper-endemic area for hepatitis B virus infection, with estimated 12% of the total population being chronic carriers. Vertical transmission is an important route of transmission for hepatitis B virus infection. Neonates who contact hepatitis B virus infection will have an almost 90% risk of developing chronic hepatitis B surface antigen (HBsAg) carrier state and chronic liver disease. The objectives of this study was to determine the sero-prevalence of hepatitis B Virus among pregnant women, rate of vertical transmission and identifying potential risk factors associated with the infection. This study was an observational cross-sectional study of 250 pregnant women who presented to the labour ward of the University of Port-Harcourt Teaching Hospital (UPTH). Blood samples from all consenting pregnant women and corresponding umbilical cord blood were collected at delivery. A structured proforma designed for this purpose was used to obtain socio-demographic information and the presence of risk factors. Data collated was analysed using Statistical Package for Social Sciences (SPSS) 17.0 for windows® statistical software with P<0.05 at 95% confidence interval. The mean age of the pregnant women studied was 33.5±0.8 years, while the mean parity was 1.58 ± 0.5. HBsAg was detected in 15 women, giving a seroprevalence rate of 6% and a neonatal seroprevalence rate of 3.2%. All HBsAg-positive babies were born to HBsAg-positive mothers with a vertical transmission rate of 53.3%. Hepatitis B virus infection amongst parturients was more in patients with history of termination of pregnancy and multiple sexual partners (P<0.05). An intermediate prevalence of hepatitis B virus infection was identified which justifies the need for routine screening in pregnancy in order to identify and treat the infection, thus reducing the risk of vertical transmission of the virus. Contraceptive options aimed at prevention of pregnancy and sexually transmitted infection (STI) should be encouraged.

Key words: Hepatitis B surface antigen (HBsAg), seroprevalence, University of Port-Harcourt Teaching Hospital (UPTH), Nigeria.

INTRODUCTION

Hepatitis B virus (HBV) infection is a serious global public health problem and is endemic in Africa, including Nigeria with the viral antigen initially called Australian antigen (Weinbaun et al., 2008; Andre, 2004; Dane et al., 1970). HBV is the prototype member of the Hepadnaviridae (hepatotropic DNA virus) family with virions which are double-stranded particles, measuring 40 to 42 nm in diameter with an outer lipoprotein envelope that contains three related envelope glycoproteins (or surface antigens) (Uyar et al., 2009; Hinnachi et al., 2009). The infection

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can be acute or chronic, while adults that acquire acute infection usually recover or can be managed by supportive therapy, the chronic type is ultimately fatal (Shepard et al., 2006). Diagnosis of HBV infection is usually through serological and virological markers. Hepatitis B surface antigen (HBsAg) is the hallmark of HBV infection and is the first serological marker to appear in acute HBV infection, and persistence of HBsAg for more than 6 months suggests chronic HBV infection (Kao, 2008). Globally, over 2 billion people are infected with the virus and over 350 million have chronic infection (Eke et al,.2011). Infection with this virus does not only leads to acute illnesses, but chronic illnesses like liver cirrhosis and hepatocellular carcinoma which accounts for more than 1 million deaths globally (Eke et al.,2011; El-Magrahe et al., 2010). The prevalence of hepatitis B virus infection is relatively high in Africa, having the second highest number of chronically HBV-infected individuals (Mbaawuaga et al., 2008).

Acute HBV infection occurs in 1 to 2 of every 1000 pregnancies with 1 to 5% of pregnant women being chronic carriers of HBV (Ugwuja, 2010). If the acute maternal infection occurs in the first trimester and resolves, the risk of neonatal infection is minimal. However, an infection during the second and third trimester poses a threat of 10 and 90%, respectively for vertical transmission (Obi et al.,1993).

The risk of transmission depends on the degree of maternal infectivity and the genomic type of the virus (Ezegbudo et al., 2004). These babies are at serious risk of developing chronic liver disease, cirrhosis of the liver and hepatocellular carcinoma in later life and up to 25% of them will die as adults due to liver disease. (Baba et al.,1999). There are three mechanisms of HBV transmission from HBsAg-positive mothers: (i) trans-placental intra-uterine transmission; (ii) transmission during delivery by contact with maternal infected fluids in the birth canal; and (iii) post natal transmission from mothers to infants during child care or through breastfeeding (Chen and Chang, 2010). Vertical transmission has been reported in 90% of infants born to HBsAg positive mothers (Pennap et al.,2011; Akani et al., 2005).

Nigeria is classified among the group of countries endemic for HBV infection with a current infected population of 18 million (Ojo and Anibijuwon, 2009).. Despite the existence of a safe and effective vaccine, Nigeria has remained a hyper-endemic area for HBV infection, with an estimated 12% of the population being chronic carriers (Jatua and Yabaya, 2009).. Sero-prevalence studies on HBsAg in Nigeria have shown that the prevalence of the infection in pregnant women range from 2 to 15.8% (Ojo and Anibijuwon 2009; Ndams et al.,2008; Ducan et al 1995; Candotti et al,. 2007). Even though studies have been carried out on HBV infection in different parts of Nigeria, and in different sub-groups of individuals, the prevalence among pregnant women and information regarding the vertical transmission rate is scanty from the South-South region of the country. Since most transmission occur intra-partum, this study is aimed at determining the sero-prevalence of HBsAg at delivery and the rate of vertical transmission. It will also show the risk factors associated with maternal infection.

Objectives

The aim of this study is to determine the maternal and neonatal seroprevalence of HBsAg amongst parturients. The specific objectives are: (1) to find out the prevalence of HBV in pregnant women presented in labour to the University of Port Harcourt Teaching Hospital; (2) to identify known risk factors for Hepatitis B viral infection in parturients; (3) to determine the sero-prevalence of HBV in babies delivered at UPTH.

METHODOLOGY

Study area

This study was carried out at the labour ward of the University of Port Harcourt Teaching Hospital in River State of Nigeria from 5th September to 5th December 2011.

Study design

This was an observational cross-sectional study involving all pregnant women presented in labour to the University of Port-Harcourt Teaching Hospital. The purpose of the study was duly explained to the participants prior to the study at the antenatal clinic and an informed consent was obtained, this was indicated on their antenatal cards. When they presented in labour, their socio-demographic characteristics and risk factors for HBV infection were documented in a structured profoma for each participant.

Inclusion criterion

The inclusion criteria for the study was any pregnant woman who gave consent to participate in the study.

Exclusion criteria

Those excluded from the study are: patients who withheld their consent for inclusion in the study; those immunized against hepatitis B infection (information obtained by verbal confirmation of previous immunization); and patients with HIV comorbidities were excluded.

Sample size

Sample size calculation was done using the Fish formula with the prevalence of hepatitis B at 15.8% (Baba et al .,1999). with an error margin (d) of 0.05.

$$N = Z^2 P (1-P)/ d^2$$

The minimum sample size was thus calculated to be 206 with a allowance of an attrition rate of 20%. However, a total of 250 consecutive women who presented in labour were used for the study. In a

Table 1. Socio-demographic characteristics of the women.

Characteristic	n	%
Age (years)		
20-24	24	9.6
25-29	112	44.8
30-34	81	32.4
35-39	31	12.4
>40	2	0.8
Parity		
Para 0	107	42.8
Para 1-4	141	56.4
Para>5	2	0.8
Occupation		
Civil servant	22	8.8
Public servant	59	23.6
Business woman	68	27.2
Housewife	73	29.2
Student	28	11.2
Educational status		
Primary	6	2.4
Secondary	60	24.4
Tertiary	184	73.6

pilot study conducted, an average of 10 women were admitted in the labour ward on a daily basis. Patients presenting to the labour ward who had given consent for the study were recruited as they presented.

Five milliliters of blood form the pregnant woman (coded M) and same volume of corresponding umbilical cord blood (coded C) were collected at delivery into plain specimen containers (without anti-coagulants). The blood samples were then left to stand for about 5 min to obtain serum. The ACON HBsAg *in-vitro* diagnostic test strips were used for the test (ACON Laboratories, USA). With the arrows pointing downwards, the ACON strip was immersed into the serum for 10 to 15 s. The maximum line (MAX) on the strip was observed and the strip was then placed on a non-absorbent surface, the timer was set for 15 min, awaiting the red lines to appear. Two distinct red lines appeared, one on the control region (C) and the other red line on the test (T) region. The intensity of the red line varied depending on the concentration of the HbsAg in the specimen. Therefore, any shade of red line in the test (T) region was considered positive, one red line on the control (C) region and no shade of red colour on the test (T) region was considered as negative. The test was invalid if the control line failed to appear and was discarded.

Data management and analysis

All participants' proforma was collected at the end of every day from the labour ward and data entry errors were checked at the labour ward before collation. The forms were checked for completeness at the end of each day.

Data entry and statistical analysis were done using statistical software (SPSS for windows® version 17.0, SPSS Inc.; Chicago, USA). Chi square test was used for categorical variables. Results were presented as frequency tables and $P<0.05$ at 95% confidence interval.

Ethical consideration

Ethical approval for this study was obtained from the ethical review board of the hospital. A written informed consent was also obtained from every participating woman.

RESULTS

Two hundred and fifty women were enrolled into the study during the three month period from September 5 to 5th December, 2011. Of these, 15 tested positive to HBsAg, giving a sero-prevalence rate of 6% in the study population.

The age range of the women studied was 20 to 45 years. The mean age of the pregnant women was 33.5±0.8 years, with majority of the women in the 25 to 29 years age group constituting 44.8% of the total population. 184 (73.6%) of the women had tertiary level of education while 60 (24.4%) and 6 (2.4%) had secondary and primary level of education, respectively. About one-third, 73 (29.2%) of the women in the study population were housewives (Table 1).

Figure 1 shows the sero-prevalence rate for HBsAg against age in the study population, the prevalence was the highest among the 20 to 24 years age group, where 3 out of the 24 (12.5%) women tested positive to HBsAg and the least prevalence was seen in the 30 to 34 years age group where only 2 (2.5%) out of the 81 women tested positive to HBsAg. Figure 2 shows the relationship between parity and HBV infection in the study population. 141 (56.4%) were multiparous, 107 (42.8%) were nulliparous, while 2 (0.8%) were grand multiparous. Eleven of the 15 women that were sero-positive to HBsAg were nulliparous (73.3%) while the remaining 4 were multiparous (26.7%). The mean parity was 1.58±0.5. There was an inverse relationship between parity and HBV infectivity, which was statistically significant (P=0.04).

The women's occupation as a risk factor to the acquisition of HBV showed that the highest prevalence was seen in civil servants where 2 (8%) of the 25 women in this group were sero-positive for HBsAg (6.8%) and the least prevalence was seen in public servants (3.4%).

All the participants in the study were married with 243 (97.2%) in monogamous and 7 (2.8%) in polygamous marriages. All 15 women that were positive to HBsAg were in monogamous marriages. 117 (46.8%) of the women gave a history of termination of pregnancy in the past, while 133 (53.2%) had no termination of pregnancy. Among those who had a history of termination of pregnancy, 11 (9.4%) tested positive to HBsAg; this was statistically significant (P=0.04).

Table 2 highlights the relationship between the risk factors and HBsAg positivity. Eight out of the 15 women that were positive to HBsAg had 3 to 4 sexual partners in the past (P=0.01), while the remaining 7 had 1 to 2 sexual

Table 2. Prevalence of HbsAg associated with risk factors.

Variable	Number	HBsAg (+)	HBsAg (-)	P value	Relative risk
Risk factor					
Induced abortion	117	11	106	0.04	3.13
Dental procedure	62	3	59	0.66	0.76
Previous c/s	62	2	60	0.31	0.47
Tatoo/tribal marks	56	4	52	0.68	1.26
Previous surgeries	53	5	48	0.24	1.86
IV drug use	44	1	43	0.28	0.33
Blood transfusion	21	2	19	0.48	1.86
Monogamous marriage	243	15	228	0.99	1.02
Polygamous marriage	7	0	7	0.99	0.98
No. of sexual partners					
1-2	191	7	184	0.01	0.27
3-4	55	8	47	0.01	4.01
>4	4	0	4	0.73	1.59

*Statistically significant; P < 0.05.

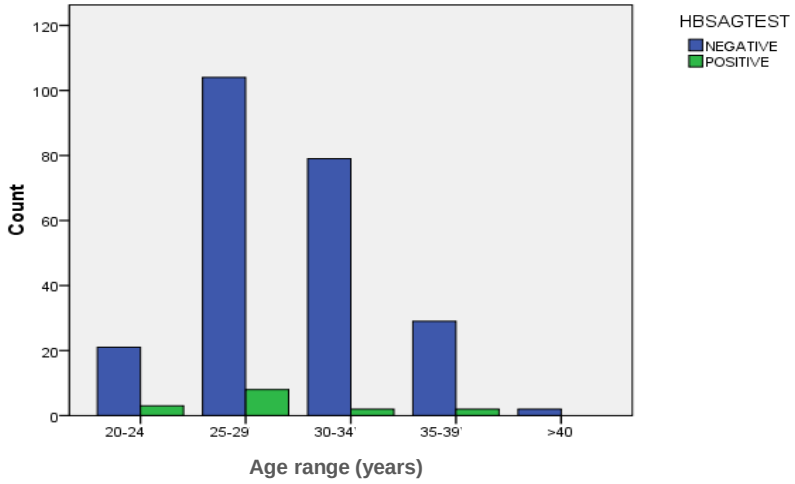

Figure 1. Seroprevalence of HBsAg status according to age group.

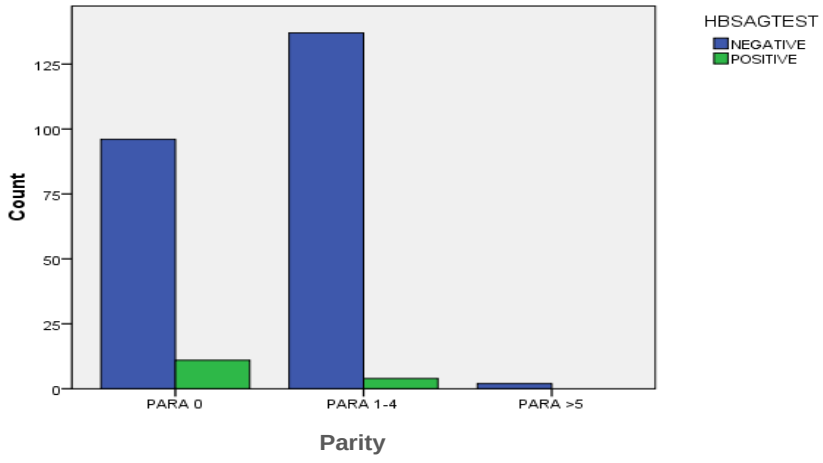

Figure 2. Seroprevalence of HBsAg status according to parity.

sexual partners (P= 0.01). Of the 21 women with a previous history of blood transfusion, 2 tested positive to HBsAg, this was not statistically significant (P=0.48). Forty-four women gave a history of intravenous drug use, of these, one was positive to HBsAg. This was not statistically significant (P=0.28). Sixty two of the women gave a history of previous dental procedure; of these 3 were sero-positive to HbsAg (P=0.66), while 5 of the 53 women with previous surgical procedures were sero-positve to HBsAg (P=0.24). It was noted from this study that previous caesarean section, type of marriage and scarification marks or tattoos were not significantly associated with HBV infection (P=0.31 and 0.68, respectively).

Eight out of the 15 babies born to HBsAg-positive mothers were positive to HBsAg, giving a neonatal seroprevalence rate of 3.2% (8/250) and a vertical transmission rate of 53.3% (8/15).

DISCUSSION

The study showed that pregnant women in labour have an intermediate endemicity of 6% for HBV infection according to the world Health organization (WHO) classification for HBV infection (Chen and Chang 2010). This is similar to results obtained in Keffi, Nigeria (Ndam et al.,2008), but higher than some previous studies in Nigeria (Pennap et al., 2011; Akani et al., 2005 Ojo and Anibijuwon 2009). The highest prevalence of HBV infection was found among pregnant women of 20 to 24 years of age and the lowest among those of 30 to 34years of age. These could be explained by the relationship between hepatitis infection and high risk sexual practices which is noted to be higher amongst the younger age group. Similar results were obtained in Zaria and Ethiopia (Jatau and Yabaya ,2009; Awole and Gebre-Selassie 2005).

Inverse relationship between educational status and HbsAg positivity with less educated women showing the highest positivity had been noted (Eke et al., 2011; Pennap et al., 2011 ; Ndams et al., 2008). However, in this study, it was noted that educational attainment did not reduce the risk factors for transmission of the infection. This brings to light the need for focused education on prevention of high risk behaviors amongst the educated. One would have expected HBsAg prevalence to be higher in multiparous women, because of repeated risk of exposure to contaminated surfaces and instru-ments during delivery (Pennap et al., 2011). However, the reverse was the case as the prevalence was significantly higher in nulliparous women. The reason for this may be because most of the nulliparous women (65.4%) had had a termination of pregnancy and had more number of sexual partners in the past which could have exposed them to the virus as compared to the multiparous women in monogamous relationships.

This study showed an intermediate prevalence of HBsAg among the pregnant women, yet, only few of the known predisposing factors to HBV infection showed statistically significant association. Some of the predisposing factors in previous studies in this environment are no longer applicable because tribal marks, tatoos, reusable needles and surgical blades are no more common practice, particularly in highly educated population in the urban centre like in this study. Abortion is related unprotected to sexual intercourse which results in unplanned pregnancies and also increases the risk of HBV infection if such partners are infected (Duncan et al., 1995). Also, instrumentation during abortion and related activities may serve as sources of exposure since most terminations are done by unskilled persons using contaminated instruments and surfaces (Awole and Gebre-Selassie 2005). This study found that HBsAg positivity was significantly higher in patients who had previous termination of pregnancy (RR=3.13; P<0.05). This finding is similar to the report from Ethiopia (Awole and Gebre-Selassie 2005).

Policies aimed at reducing the incidence of unsafe abortions and promotion of barrier contraception in the environment may assist in reducing the incidence of this condtion. An obvious observation of the four fold risk of acquiring hepatitis B infection amongst women having 3 to 4 sexual partners was noted in this study (RR=4.05; P<0.05). This brings to light the need to advice strongly against such high risk behavoiurs amongst parturients. Several studies have shown that vertical transmission of HBV can occur. (Candotti et al., 2007;Chakravati et al., 2005;Wiseman et al., 2009).

In this study, all the babies that tested positive to HBsAg were born to HBsAg positive mothers. The reported variable vertical transmission rates from HBsAg-mothers to their infants depend on several factors, namely viral load, HBV variants, HBV DNA levels, HBsAg-positivity, HBV genotype, sensitivity and accuracy of diagnostic tests (Rumi et al., 1998; Wiseman et al., 2009). These factors correlate with the level of infectivity of the mother in transmitting the virus to the fetus which may explain why some of the babies born to the HBsAg-positive mothers tested negative.

This study has some limitations and issues attracting criticisms. The tool of laboratory analysis, serology by rapid test kit, is less sensitive than amplification assays (liquid phase hybridization, antibody capture approach, branched DNA) and DNA amplification tests based on the polymerase chain reaction which are now considered the gold standard in the diagnosis of HBV infection. These tests are expensive and are not available in most centers. Nevertheless, rapid tests can be used as a screening tool in order to identify those women that would require confirmation of their status and further management.

Conclusion

In order to determine the extent of perinatal transmission

of HBV, the prevalence of HBsAg which is a serum marker for active viral replication among the HBsAg carrier mothers should be determined in a further study. Preventive measures should be taken against unwanted pregnancies, sexually transmitted infections and multiple sexual partners as these are all routes of transmission of the virus. Sensitization on risk factors and routine screening for HBV in pregnancy is strongly advocated to reduce morbidity and treatment of HBV infection in pregnancy to reduce mother-to-child transmission.

Availability and accessibility of hepatitis B immunoglobulin to babies born to HBsAg-positive mothers by Government and Non-governmental organizations is also suggested.

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