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Association of Bacterial vaginosis and other Sexually Transmitted Infections with HIV among pregnant women in Nigeria

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Abstract

Objectives—To determine the association of Bacterial vaginosis (BV) and other sexually transmissible infections (STIs) with HIV prevalence among pregnant women in Jos, Nigeria.

Methods—This was a cross- sectional study of pregnant women who participated in the Prevention of Mother-to-Child Transmission of HIV program of the AIDS Prevention Initiative in Nigeria, between April 2002 and July 2004, at the Jos University Teaching Hospital in Jos, Nigeria. Blood, high vaginal and endocervical samples were obtained for diagnosis of HIV, BV and other STIs. Data were analyzed for prevalence of HIV, BV and other STIs. Univariate and multivariate logistic regression models generated unadjusted and adjusted odds ratios (OR) as well as 95% confidence intervals (CI) of the association of BV and other STIs with HIV prevalence. P value <0.05 was considered statistically significant.

Results—A total of 4,046 pregnant women were studied and 97.6% (3,950/4,046) had complete laboratory records for analysis. The prevalence of HIV was 8.2% (CI: 7.4–9.1); BV 11.9% (CI: 10.9–12.9); Candida 10.7% (CI: 9.7–11.7); mixed infection of BV and Candida 2.8% (CI: 2.3–3.4); Trichomonads 0.6% (CI: 0.3–0.8) and syphilis 0.35% (0.16–0.54). BV, Candida, mixed BV and Candida; and Trichomonads were independently associated with HIV infection [adjusted OR (95% CI), 2.9 (CI: 2.2–3.9); 2.0 (CI: 1.5–2.9); 3.4 (CI: 2.0–5.6), and 3.3 (CI: 1.1–9.7) respectively].

Conclusion—HIV prevalence is higher among pregnant women who have BV, Candida and Trichomonads vaginal infections compared with women who have no evidence of infection. The

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practice of routine screening for BV and other STIs among pregnant women as a strategy for identifying women at risk for prevalent HIV infection should be sustained/ encouraged and the syndromic management of STIs should be integrated into all antenatal care management protocols in antenatal clinics in order to curb the epidemic of heterosexual HIV transmission.

Keywords

HIV; Bacterial Vaginosis; STIs; Pregnancy; Nigeria

Introduction

Bacterial vaginosis (BV) is a non-inflammatory polymicrobial syndrome characterized by a depletion of Lactobacillus spp and an overgrowth of diverse aerobic, anaerobic and micro-aerophilic species [1]. An estimated 25–30% of women have bacterial vaginosis at any given time, mostly without signs such as fishy odour or discharge [2]. The prevalence of BV is 85% among female sex workers' (FSWs) populations [3], and is 17.5% and 29% among antenatal populations in Nigeria and Malawi respectively [4, 5].

BV has been strongly associated with adverse obstetric sequalae such as late miscarriage, spontaneous preterm rupture of membranes, chorioamnionitis, preterm labor, prematurity and related neonatal complications [6, 7]. The acidic environment of the normal vaginal flora inhibits colonization by potentially pathogenic organisms where as an alkaline environment in the presence of BV facilitates the growth of sexually transmissible agents. The association of BV and HIV as well as the possible mechanisms for the increase transmission and acquisition of HIV in the presence of BV have been documented [5, 8, 9, 10,11].

The socio-demographic risk factors for HIV infection among pregnant women in Nigeria have been reported [4] as part of the behavioral surveillance study of pregnant women participating in the Prevention of Mother-to-Child Transmission (PMTCT) of HIV project, Jos University Teaching Hospital (JUTH), Jos, Nigeria. This study examines the association between BV and related sexually transmitted infections (STIs) with HIV infection among pregnant women in Jos, Nigeria. The findings from this study will further strengthen the evidence for screening and treatment of STIs as a HIV prevention intervention in Nigeria.

Methods

This was a cross-sectional study of pregnant women who participated in the PMTCT program at the AIDS Prevention Initiative Nigeria (APIN), JUTH, Jos between April 2002 and July 2004. Details of the setting, study population and laboratory methods have been described [4]. In brief, the study procedure was as follows:

Those who consented to participate were recruited by a trained nurse counsellor who administered pre-test counselling one on one with each participant and obtained relevant socio-demographic variables using the Behavioral Surveillance Study questionnaire [4]. Afterwards, the participants were seen by a laboratory scientist for blood sample collection for HIV and VDRL tests. High Vaginal Swabs (HVS) and Endocervical Swabs (ECS)

Samples were collected for the diagnosis of trichomoniasis, candidiasis, bacterial vaginosis, and gonorrhoea.

The venous blood sample was tested for HIV and syphilis. The serum was screened for HIV-1 and HIV-2 using the Abbott Determine test kits (Abbott laboratories, Abbott park, IL USA). Western blot test was done in all cases of a positive rapid HIV test to confirm HIV infection based on the APIN approved protocol for diagnosis of HIV infection. Syphilis was diagnosed if the patient's serum was reactive with both the Rapid Plasma Reagin Syfacard-R (Murex Biotech, Kent, UK) and the Determine Syphilis Treponema Pallidum Antibody Assay (Abbott, Wiesbaden, Germany).

For the diagnosis of other STIs, a wet mount of the vaginal swab was prepared in saline immediately after collection and examined microscopically for the presence of clue cells and motile trichomonas vaginalis. Direct microscopy of Gram-stained genital swabs was carried out for the detection of leukocytes and Gram-negative diplococci. Isolation of Neisseria gonorrhoea was done by inoculation of the endocervical swab on modified Thayer Martin media followed by incubation in a candle-extinctive jar at 36°C for 24–48 hours. Isolates were identified on the bases of colony morphology, visualization of Gram-negative diplococci, positive oxidase reaction and sugar fermentation tests. Antibiotic sensitivity was assessed on all N. gonorrhoea isolates to determine the appropriate drug of choice for treatment. Bacterial vaginosis was diagnosed according to the Amsel criteria [12].

Post-test counselling was offered by the nurse counselor, treatment of various STIs were offered by the gynaecologist in the PMTCT team and those HIV infected were evaluated and given appropriate antiretroviral treatment within the APIN treatment facility in JUTH.

Data management

Relevant Data were collected on a study questionnaire (Behavioral Surveillance Study questionnaire). Participants identification number, age and various laboratory findings and diagnosis were entered into File Maker Pro version 8 and exported into an excel file (Microsoft 2003) for subsequent analysis. Those with incomplete records on the laboratory diagnosis of HIV, BV or other STIs as well as those with Western Blot 'Indeterminate' HIV status were excluded from the final analysis.

Statistical analysis

All Statistical analyses were done using STATA version 11, StataCorp, College Station, Texas 77845, USA. We computed summary statistics for relevant variables, including age of the participants. The prevalence of BV, various STIs and HIV in the study population was also computed as proportion of participants detected with each of these conditions. We then conducted univariate analysis to assess the associations between HIV prevalence with a number of potential predictors, including BV and other STIs and results summarized using unadjusted odds ratios and 95% confidence interval. Multivariate logistic regression analysis was then performed to determine independent predictors of HIV prevalence. We included BV and STIs in the list of potential predictors in this analysis. All variables which remained significant in the models (with P value <0.05) were retained in the final model. We assessed confounding of variables not significant in the model by entering them one at a time into the

final model and retained only those which changed the estimate of any of the predictors in the model by more than 10%, indicating that they were confounders. Model fit was assessed with Hosmer-Lemeshow goodness-of-fit test.

Participants' protection

The ethical committee of JUTH reviewed and approved this study.

Results

During the study period, a total of 97.6% (3,950/4,046) pregnant women had complete laboratory records suitable for analysis. The mean age of women was 28.18 years ± 6.44 (95% CI 27.98–28.38).

The HIV prevalence was 8.2% (325/3950) with 95% confidence interval (CI) was 7.4%–9.1%. The prevalence of BV and various STIs were 11.9%, 10.7%, 0.58%, 2.8%, 0.17% and 0.35% respectively for BV, Candida, Trichomonads, combined BV and Candida; combined Candida and Trichomonads and syphilis.

The HIV prevalence among women with no evidence of STIs was 6.0% (175/2893), 95% CI 5.2%–6.9% compare to a combine prevalence of 14.2% (150/1057), 95% CI 12.1% –16.3% among women who had one or more STIs. This difference was statistically significant with P-value <0.001.

In univariate models, the odds ratio (OR) and 95% CI for the association of BV and other STIs with HIV prevalence were: 2.4 (CI 1.8–3.2) for BV, 1.54 (CI 1.1–2.1) for Candida, 2.4 (CI 0.80–7.0) for Trichomonads, 2.5 (CI 1.5–4.1) for combined BV and Candida infection, 1.7 (CI 0.2–15.5) for combined Candida and Trichomonads infection and 1.9 (CI 0.4–8.4) for syphilis infection.

The multivariate model showed a significant association of increased HIV prevalence with BV and other STIs. The global LR X^2 was 67.7, p value <0.0001, Pseudo R^2=0.030. The adjusted OR of the association of HIV prevalence and various STIs were as shown in Table 2 (No evidence of infection as referent category).

Discussion

The HIV prevalence of 8.2% found in this study is similar to the earlier report by Sagay et al [4] on pregnant women in the same population. The present report focuses mainly on the association of BV and related STIs with HIV prevalence in the same population. The findings of this study suggest that BV and related STIs are associated with a higher prevalence of HIV infection among pregnant women in Jos, Nigeria.

Our data showed that the prevalence of BV and other STIs was 11.9% (BV), 10.7% (Candida), 0.6% (Trichomonads) and 0.35% (Syphilis); some had mixed pathogens. The univariate models showed a significant association of BV, Candida and mixed infection of BV and Candida with increased prevalence of HIV. This association was significant in the multivariate model in addition to a significant association observed for Trichomonads in the

presence of other STIs in the model. Screening for these potential STIs as well as syndromic management of STIs could possibly have a significant impact in HIV prevention in our antenatal settings. Indeed, a prospective cohort study in Africa [13] has demonstrated a higher hazard of female-to-male transmission of HIV-1 in women who have evidence of BV infection compare to those without BV in HIV-serodiscordant HIV relationships after controlling for other confounding factors such as male circumcision, pregnancy, plasma HIV-1 RNA levels and sexual behavior. Our findings thus support the need to actively screen to detect and treat women with BV as a strategy for preventing HIV transmission in setting where BV prevalence is relatively high.

In view of the cross-sectional methodology in this study, we cannot establish a causal relationship of BV and other STIs with HIV acquisition; however, a prospective study [5] has documented a temporal association and therefore strengthens the causal hypothesis. There are several mechanisms by which BV and STIs could increase risk of HIV acquisition and transmission. First, the presence of hydrogen peroxide-producing Lactobacilli in the vagina results in a more acidic environment, which is not only toxic to BV-associated flora but also to HIV [14,15]. Lower vaginal pH may block the production of CD4 lymphocytes whereas a higher, more alkaline pH associated with BV, may enhance HIV survival.

Second, the BV microorganisms, especially M. hominis, are able to increase the activity of a soluble HIV-inducing factor and, therefore, increase HIV-1 expression [16]. Genital tract infection with G. vaginalis, which is commonly isolated in BV, has been shown to stimulate HIV-1 production and increase the likelihood of sexual transmission [17]. Furthermore, studies have shown that HIV load in the genital tract correlates positively with BV and inversely with absence of BV [10]. The evidence available supports a causal relationship between BV and HIV and BV may be an independent risk factor or a cofactor for transmission of HIV infection.

Although previous studies have documented that syphilis and other ulcerative STIs are strongly associated with increased risk of HIV acquisition and transmission [5], our data showed a non-significant association (adj. OR=2.6, CI: 0.6–11.7). This may be explained by the relatively few cases of syphilis (0.35%) in the population of women studied thereby lacking sufficient statistical power to detect a significant association.

The relatively large sample size in this study may have added strength and validity to our findings. However, we acknowledge the following limitations of the study. First, a few of the records were either missing or incomplete and were excluded from the final analysis. Second, women with ‘indeterminate’ HIV status by Western Blot were excluded. This might have resulted in some differential misclassification thereby affecting our point estimates.

Within our study limits, our data supports the practice of routine screening for BV and other STIs among pregnant women in Jos, Nigeria as a strategy for identifying women at risk for prevalent HIV infection in this population. Additionally, syndromic management of STIs should be integrated into all antenatal care management protocols in our antenatal clinics in order to curb the epidemic of heterosexual HIV transmission in Nigeria.

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Table 1

Baseline prevalence of HIV and STIs among Pregnant Women in Jos, Nigeria N=3,950

Outcome	N	Proportion (%)	[95% confidence Interval]
HIV			
Negative	3,625	91.8	90.9–92.6
Positive	325	8.2	7.4–9.1
STIs			
No evidence of infection	2,893	73.2	71.9–74.6
BV	470	11.9	10.9–12.9
Candida	423	10.7	9.7–11.7
Trichomonads	23	0.6	0.3–0.8
BV and Candida	112	2.8	2.3–3.4
BV and Trichomonads	7	0.2	0.04–0.30
BV, Cand and Tricho	1	0.0	0.00–0.00
Candida and Tricho	7	0.2	0.04–0.30
Syphilis	14	0.35	0.16–0.54

Cand= Candida, Tricho=Trichomonads, BV=Bacterial vaginosis

Table 2

Multivariate logistic regression model of HIV prevalence with BV and other STIs among Pregnant Women in Jos, Nigeria.

HIV predictors	adj. odds ratio	[95% conf. Interval]	P-value
BV	2.9	2.2–3.9	0.001
Candida	2.0	1.5–2.9	0.001
Trichomonads	3.3	1.1–9.7	0.033
BV and Candida	3.4	2.0–5.6	0.001
Candida and Tricho	2.6	0.3–21.7	0.378
Syphilis	2.6	0.6–11.7	0.214

Cand= Candida, Tricho=Trichomonads, BV=Bacterial vaginosis

*No evidence of infection as referent category