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CLINICAL ARTICLE

Bacterial vaginosis among women with tubal factor infertility in Nigeria

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ABSTRACT

Objective: To determine the prevalence of bacterial vaginosis among women with tubal factor infertility. **Methods:** A cross-sectional prospective study of women with tubal factor infertility was conducted at a Nigerian teaching hospital between March and September 2014. An equal number of fertile women attending the family planning clinic were recruited as controls. Interviews were conducted to collect data on sociodemographic characteristics, history and characteristics of vaginal discharge, knowledge, and practices. Bacterial vaginosis was diagnosed using the Amsel criteria. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to determine predisposing factors. **Results:** Overall, 178 women with tubal factor infertility were recruited. Bacterial vaginosis was noted in 50 (28.1%) of these women, compared with 14 (7.9%) of 178 fertile women ($P < 0.001$). Patients with tubal factor infertility had an increased risk of bacterial vaginosis when they were of low socioeconomic class (OR 11.89; 95% CI 5.20–27.69), practiced vaginal douching (OR 19.15; 95% CI 7.26–47.75), used vaginal drying agents (OR 17.04; 95% CI 6.91–43.24), had an early sexual debut (OR 32.08; 95% CI 12.02–88.89), and had a history of sexually transmitted infections (OR 12.42; 95% CI 5.36–29.35). **Conclusion:** The prevalence of bacterial vaginosis was high among patients with tubal factor infertility. Socioeconomic and cultural factors contribute to the risk of the condition.

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1. Introduction

Tubal factors constitute a leading cause of infertility, which is an important reproductive health problem in low-income countries [1,2]. The main etiology of tubal damage is pelvic inflammatory disease, which can arise after induced abortion, intrauterine procedures, or pelvic surgeries. One episode of pelvic inflammatory disease confers a 10% risk of future tubal factor infertility; the risk increases after further infections [1].

The prevalence of infertility in Nigeria has been reported to be as high as 15%–16%, with approximately 60% of infertility being caused by pelvic infections [3,4]. The role of bacterial vaginosis in the etiology of infertility has been demonstrated in various studies worldwide. In a review of infertile patients in Nigeria [5], bacterial vaginosis was observed in 35.3% of cases; a similar review in Egypt [6] noted a prevalence of bacterial vaginosis of 36.6%. By contrast, a prevalence of 8.6% was observed in the Netherlands [7], giving credence to the notion that the occurrence of bacterial vaginosis varies by geographical location.

The organism *Lactobacillus* is the main contributor to vaginal acidity and prevents the growth of pathologic organisms in the vagina. Bacterial vaginosis occurs when the number of lactobacilli is reduced, the pH rises, and the number of pathogenic bacteria increases. These potential

pathogens include *Gardnerella vaginalis*, *Bacteroides* spp., *Escherichia coli*, group B streptococci, and the anaerobes *Peptostreptococcus* and *Mycoplasma hominis*. The anaerobic organisms and *G. vaginalis* are thought to act synergistically to cause vaginal infection. Anukam et al. [8] also observed the polymicrobial nature of bacterial vaginosis among Nigerian women.

Bacterial vaginosis is characterized by a creamy vaginal discharge that is homogenous, is adherent to the vaginal wall, and has a fishy smell, without extensive evidence of inflammation. It is thought to lead to infertility because the natural defense mechanisms of the vagina are disturbed, leading to the spread of infectious agents toward the upper genital tract and resulting in tubal damage, blockage, or tubal motility disorder [9,10].

There is paucity of data in Nigeria concerning the actual contribution of bacterial vaginosis to the tubal component of infertility. The present study therefore sought to determine the prevalence of bacterial vaginosis and the predisposing factors among women with tubal factor infertility in Nigeria.

2. Materials and methods

A cross-sectional prospective study was undertaken at the University of Port Harcourt Teaching Hospital in Port Harcourt, Nigeria, between March 3 and September 30, 2014. All consecutive women with tubal factor infertility who presented for follow-up at the gynecology clinic were recruited. Women with tubal factor infertility had been previously

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diagnosed by hysterosalpingography. Women were excluded if they had received metronidazole or clindamycin for a disease or condition other than bacterial vaginosis within the previous 90 days, irrespective of the route of administration; had experienced vaginal bleeding; had infertility due to causes other than tubal factors; or had undergone bilateral salpingectomy. An equal number of fertile women attending the family planning clinic were also recruited as controls. Ethics clearance for the present study was obtained from the Ethics Review Committee of the teaching hospital. All participants provided informed consent.

Each patient was interviewed using a structured study form that was completed by the interviewers. Information about age, tribe, occupation, level of education, husband's occupation, and parity was obtained. The social class of each participant was determined on the basis of the woman's educational status and her husband's occupation, as proposed by Olusanya et al. [11]. Other collected information included the history of abnormal vaginal discharge, practice of vaginal douching, use of vaginal tightening or drying products, and age of sexual debut. The number of lifetime sexual partners, history of sexually transmitted infections (STIs), and history of smoking were also ascertained.

After the interview, each participant underwent a procedure to obtain a vaginal sample in the presence of a female assistant, who also served as a chaperone. The patient was placed in a dorsal position on an examination table. Guided by an angle point light, a bivalve speculum was introduced into the vagina (without lubrication). A wooden spatula was used to take a sample of the vaginal discharge/secretion from the vaginal walls and the posterior vaginal fornix.

The vaginal discharge or secretion was then assessed on the basis of the Amsel criteria [12]. Initially, three of the criteria were assessed. The discharge/secretion was examined visually to establish whether it was characteristic of bacterial vaginosis (homogenous and creamy). The pH value of the vaginal fluid was then determined with a pH meter, after adding 1 mL of normal saline to the collected vaginal secretion in a sterile test tube and mixing it thoroughly. A vaginal fluid pH of more than 4.5 is indicative of bacterial vaginosis. Thereafter, a drop of the solution was placed on a clean glass slide and one drop of 10% potassium hydroxide in aqueous solution was added to it. The slide was then smelt to determine whether the mixture had a fishy odor ("whiff test"). This odor, when present, is strongly suggestive of bacterial vaginosis. For participants with at least two positive results for these three assessments, a microscopic examination of the prepared slide was then performed to determine whether "clue cells" were present (fourth Amsel criterion). The diagnosis of bacterial vaginosis was confirmed if more than 20% of the epithelial cells had adherent bacteria.

The sample size was determined using a formula proposed by Kish for the estimation of single proportions [13]. The minimum sample size was calculated to be 162. Allowing for an attrition of 10% (i.e. 16 women), 178 women with tubal factor infertility were recruited.

The data were analyzed using SPSS version 20.0 (IBM, Armonk, NY, USA) and Epi Info version 7.0 (Centers for Disease Control and Prevention, Atlanta, GA, USA). Frequency tables were generated and the results were tested for significance using the Student *t* test and the χ^2 test. $P < 0.05$ was considered statistically significant. An assessment of the risk factors for bacterial vaginosis among patients with tubal infertility and among control individuals was estimated by calculating odds ratios (ORs) with 95% confidence intervals (CIs).

3. Results

A total of 178 women with tubal factor infertility were recruited. Bacterial vaginosis was recorded among 50 (28.1%) of these women, compared with 14 (7.9%) of the 178 fertile women recruited as controls ($\chi^2 = 24.69, P < 0.001$). Table 1 shows sociodemographic characteristics of women with and without bacterial vaginosis. The mean age of the women with tubal factor infertility was 28 ± 5 years (range 22–36).

Table 2 shows the analysis of risk factors for bacterial vaginosis. Vaginal douching and use of vaginal tightening and drying products

Table 1
Sociodemographic characteristics, by presence of BV.^a

Variable	Women with tubal infertility		Fertile women (control group)	
	BV (n = 50)	No BV (n = 128)	BV (n = 14)	No BV (n = 164)
Age, y				
<20	0	0	1 (7.1)	5 (3.0)
20–24	6 (12.0)	14 (10.9)	1 (7.1)	19 (11.6)
25–29	22 (44.0)	55 (43.0)	5 (35.7)	61 (37.2)
30–34	19 (38.0)	41 (32.0)	4 (28.6)	56 (34.1)
≥35	3 (6.0)	18 (14.1)	3 (21.5)	23 (14.0)
Educational status				
None	0	0	0	0
Primary	38 (76.0)	17 (13.3)	9 (64.3)	31 (18.9)
Secondary	8 (16.0)	59 (46.1)	3 (21.4)	84 (51.2)
Tertiary	4 (8.0)	52 (40.6)	2 (14.3)	49 (29.9)
Social class ^b				
Low (IV, V) ^c	35 (70.0)	21 (16.4)	8 (57.1)	23 (14.0)
Middle (III)	12 (24.0)	61 (47.7)	4 (28.6)	99 (60.4)
High (I, II)	3 (6.0)	46 (35.9)	2 (14.3)	42 (25.6)

Abbreviation: BV, bacterial vaginosis.

^a Values are given as number (percentage).

^b Age and education level were used to compute the social class of participants and thus it was not necessary to perform a statistical analysis on these variables.

^c BV was significantly more likely among women with tubal infertility who were of low socioeconomic class than among those who were of middle or high socioeconomic class ($\chi^2 = 47.89, P < 0.001$; odds ratio 11.89, 95% confidence interval 5.20–27.69).

were significantly associated with bacterial vaginosis among women with tubal factor infertility ($P < 0.001$ for both). In this population, a young age at sexual debut and a history of STIs were also both significantly associated with bacterial vaginosis ($P < 0.001$ for both). Only having had one sexual partner was a protective factor, reducing the likelihood of bacterial vaginosis among women with tubal factor infertility ($P < 0.001$). Smoking was not found to be associated with bacterial vaginosis in this population. Similar findings were recorded among fertile women (Table 2).

Few women with tubal factor infertility were aware of bacterial vaginosis, irrespective of whether they had the condition (Table 3). Two (8.3%) of the 24 women with tubal factor infertility who were aware of bacterial vaginosis knew that bacterial vaginosis is a risk factor for tubal factor infertility. No woman was aware that bacterial vaginosis is a risk factor for premature rupture of fetal membranes and preterm delivery.

4. Discussion

In the present study, the prevalence of bacterial vaginosis among women with tubal factor infertility was 28.1%. As among fertile women, vaginal douching, the use of vaginal tightening or drying products, early age at sexual debut, a high number of sexual partners, and history of STIs were associated with bacterial vaginosis.

The prevalence of bacterial vaginosis among women with tubal factor infertility in the present study is higher than the prevalence of 12%–12.9% noted among women attending infertility clinics in Rwanda [14] and Mozambique [15]. The high prevalence noted in the present study could be attributed to the fact that the women in the present study constituted a highly selected population compared with more generalized samples of infertile patients in the Rwandan and Mozambican studies. A meta-analysis by van Oostrum et al. [9] showed that the prevalence of bacterial vaginosis was higher among women with tubal factor infertility than among women with infertility due to other causes of infertility, even though most studies reviewed failed to establish causal relationships between bacterial vaginosis and tubal infertility.

Patients of a lower socioeconomic class had an increased risk of bacterial vaginosis in the present survey. In studies from the USA [16] and Bangladesh [17], a lower socioeconomic class has been associated with poor health-seeking behavior and a higher risk of STIs, which in turn

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