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A case control study of anovaginal distance and bacterial vaginosis

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Abstract

Objective—To test the hypothesis that a short anovaginal distance may increase the risk of bacterial vaginosis (BV) due to fecal contamination and disruption of the vaginal microbiota.

Methods—Women attending two STD clinics in Baltimore, Maryland who complained of a vaginal discharge were asked to participate in a study to measure mucosal immune responses. In this pilot study of all enrolled women, a small plastic ruler was used to measure the anatomic distance from the posterior fourchette to the anus with the participant in the lithotomy position. Cases of BV, defined by Amsel's clinical criteria (n=62), were compared to controls (n=31) without BV. We used linear and logistic regression models to adjust for potential confounders.

Results—A total of 93 women were recruited (median age 28.6 years, 93% Black, 4.4% gonorrhea infection, 7.4% Chlamydia infection, 8.6% trichomonas infection, 62% BV diagnosed). Mean anovaginal distance was 3.22 cm (SD:0.74, range 1.8–5.2) for controls and 3.37 cm (SD: 0.76, range: 1.8–5.7) for cases (p=0.38). There was no difference between cases and controls when comparing median values, quartiles, and after adjusting for potential confounders.

Conclusions—Among high-risk women with multiple co-infections, there was no association between anovaginal distance and clinical diagnosis of BV.

Keywords

Vaginosis; Bacterial; Perineum

Introduction

In 1999, Hooton *et al* evaluated the relationship between perineal anatomy and recurrent urinary tract infections.¹ They observed that the distance from the urethra to the anus among 213 women was significantly shorter in cases than in controls. Although the mean difference was only 2 mm (4.8 cm versus 5.0 cm, p-value=0.03), a case subject was 2.4-fold more likely to have a distance from urethra to anus of less than 4.5 cm (OR: 2.4, 95% CI: 1.2–4.8).

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Bacterial vaginosis (BV) is an episodic, recurrent, polymicrobial disturbance of the vaginal microbiota and is associated with adverse gynecologic and obstetric sequelae.² BV is traditionally defined as a shift in the composition of vaginal microbial communities that results in decreased numbers of *Lactobacillus* sp. and elevated vaginal pH. A number of risk factors for BV have been identified, but despite a century of work, the natural history is not fully understood.

Transfer of microorganisms from the rectum to the vagina may disrupt the vaginal microbiota's equilibrium or induce local inflammatory responses predisposing women to BV. Despite the frequent report of anal sex by women³, there are few and conflicting data on the association between anal sex (or rectal bacteria) and BV.⁴⁻⁷ Microbiologic studies of Chinese rhesus macaques found that *Lactobacillus* species from the vagina and rectum were not identical,⁸ however, a study in 132 pregnant women found similarity between vaginal and rectal isolates.⁹ Antonio *et al* also reported from a large study of reproductive-age women that *Lactobacillus* sp. in the rectum contributed to a reduced risk for BV diagnosis.¹⁰ In this brief report, we describe a pilot study to collect preliminary data on the association of short anovaginal distance and diagnosis of BV.

Methods

Women attending a sexually transmitted diseases clinic in Baltimore, Maryland who complained of a vaginal discharge were asked to participate in a study whose primary outcome was to measure mucosal immune responses. Women were eligible for the parent study if they were over age 18 and not menstruating or pregnant. All women enrolled in the parent study were eligible for the sub-study, a pilot study of anovaginal distance and BV diagnosis. There were missing anovaginal distance measurements on seven women. In the sub-study, a small plastic ruler was used to measure the anatomic distance from the posterior fourchette to the anus with the participant in the lithotomy position. Laboratory specimens included culture for *Neisseria gonorrhoeae* (GC) and polymerase chain reaction for *Chlamydia trachomatis* (CT) (Amplicor; Roche Diagnostic Systems, Branchburg, NJ). Vaginal wet mount was performed and data on pH, KOH prep, and microscopic evaluation for *Trichomonas vaginalis* (TV), clue cells, and yeast were recorded. BV diagnosis was based on 3 of 4 Amsel's clinical criteria.¹¹ In this cross-sectional analysis, cases with BV (n=62) were compared to controls without BV (n=31). We used linear and logistic regression models to adjust for potential confounders.

Two trained clinicians performed all measurements; however one of the clinicians collected only eight samples. These eight samples were excluded in a sensitivity analysis to evaluate the effect the bias may have on the study findings. We do not have data on intra and inter observer variability. The protocol was approved by the Institutional Review Board of the Johns Hopkins University School of Medicine. All participants provided written informed consent.

Results

The median age of sub-study participants was 28.6 years and self-reported race was 93% African American. There was a prevalence of 4.4% GC infection, 7.4% CT infection, and 8.6% TV infection. Sixty two women (67%) were diagnosed with BV by Amsel's clinical criteria.

The mean anovaginal distance was 3.22 cm (SD: 0.74, range 1.8–5.2) for controls and 3.37 cm (SD: 0.76, range: 1.8–5.7) for cases (p=0.38). There was no difference between cases and controls when comparing quartiles (p=0.57), median values (p=0.66), and after

adjusting for potential confounders, including sexual intercourse and condom use (Table 1). There was no association in cross-tabulations with pH (p-value= 0.13) or amount of vaginal discharge (mild, moderate and severe, p-value=0.74). In sensitivity analyses in which eight observations were excluded because the clinician collected only eight samples (5 were BV cases and 3 were non-BV) our findings were unchanged.

Discussion

The relationship between the vaginal and rectal microbiomes has recently become a topic of increased attention in BV research.^{4-7;9;10;12;13} This small pilot study sought to examine anovaginal distance, an aspect of the relationship between rectal and vaginal microbiomes that has not been assessed previously. We found in this group of high-risk women with multiple co-infections, there was no apparent association between anovaginal distance and a clinical diagnosis of BV.

Strengths of this paper include fairly large sample size of 93 women and two trained STD clinic clinicians who carefully recorded measurements of the anovaginal distance using disposable rulers. The prevalence of BV in this study was 67% which is relatively high, but similar to the BV prevalence noted in the U.S. national surveys among women of the same age and ethnic demographics.¹⁴

There are several limitations worth noting. A small association between anovaginal distance and BV may have been missed because our study was conducted among high-risk women, with multiple risk factors for BV. Anovaginal distance may have an effect on the vaginal microbiota which was not captured using Amsel's clinical criteria. In addition, Amsel's criteria are subjective as it is dependent on a clinician's findings. The sample size may have limited our ability to detect the influence of small differences in anovaginal distance. Our study recruited predominantly African American women, and as such, our findings may not be generalizable to other populations. Lastly, we do not have data available on body mass index or weight which may affect anovaginal distance measurements and relation to BV diagnosis. We also lacked data on other possible confounders including toilet practices and hygiene, tampon or sanitary napkin use, other forms of anal-sexual contact (anal-oral sex, sex toy use, ano-digital sex), numbers of sexual partners, and gender of sexual partners. We included last sexual contact information only.

The role of rectal bacteria and anal sex in the pathogenesis of BV is unclear as studies have presented seemingly conflicting results.^{4-7;10} Future work using molecular tools may help to clarify some of these issues.

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Table 1

Association of anovaginal distance and confounding factors with diagnosis of bacterial vaginosis

	Non-BV controls		BV cases		p-value	OR	p-value	95% CI	aOR*	p-value	95% CI
Anovaginal distance by quartile (centimeters):	N	%	N	%	0.57						
<25th (<2.8cm)	15	24.19	9	29.03		REF	-	-	REF	-	-
25th–50th (2.9cm–3.3cm)	14	22.58	10	32.26		0.84	0.77	0.26	0.67	0.56	0.17
50th–75th (3.4cm–3.8cm)	19	30.65	6	19.35		1.90	0.31	0.55	1.37	0.66	0.34
>75th (>3.9 cm)	14	22.58	6	19.35		1.40	0.60	0.40	0.87	0.85	0.21
Days since last menstrual cycle:											
<10	5	16.13	7	11.29	0.59	REF	-	-	-	-	-
11–20	11	35.48	28	45.16		1.82	0.38	0.47	6.96	-	-
21–30	6	19.35	15	24.19		1.79	0.45	0.40	7.91	-	-
31+	9	29.03	12	19.35		0.95	0.95	0.23	4.01	-	-
History of vaginal douching	7	22.58	19	30.65	0.41	1.51	0.42	0.56	4.12	-	-
Prevalent STI infection:											
Trichomonas vaginalis	1	3.33	7	11.29	0.27	3.69	0.23	0.43	31.47	-	-
Neisseria gonorrhoeae	2	6.9	2	3.23	0.59	0.45	0.44	0.06	3.36	-	-
Chlamydia trachomatis	2	6.45	4	6.45	0.61	0.82	0.57	0.43	1.59	-	-
Hormonal contraception use	4	12.9	8	12.9	1.00	1.00	1.00	0.28	3.62	-	-
Sexual behavior at last intercourse:											
Condom use	15	48.39	39	62.9	0.18	1.81	0.18	0.76	4.33	0.13	0.79
Anal sex	4.00	12.90	2	3.23	0.09	0.23	0.10	0.04	1.30	0.13	0.04
Days since last sexual intercourse:											
<3	5	16.67	19	32.20	0.06	REF	-	-	REF	-	-
4–11	6	20.00	19	32.20		0.83	0.79	0.22	3.20	0.83	0.27
12–20	8	26.67	12	20.34		0.39	0.17	0.10	1.49	0.48	0.11
21+	11	36.67	9	15.25		0.22	0.02	0.06	0.81	0.22	0.03

† Bacterial vaginosis defined by 3 of 4 Amsel's clinical criteria

* aOR, adjusted odds ratio. All variables listed were adjusted for in the aOR model.