Prevalence of *Gardnerella vaginalis* in Prepubertal Males

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**Objectives**: To determine the rate of occurrence of *Gardnerella vaginalis* in the genital tract and rectum of the asymptomatic prepubertal boy and to examine the effect of circumcision on the rate of recovery.

**Design**: A prospective survey design was used. Cultures for *G vaginalis* were obtained from the urethral meatus, surrounding glans, and rectum of prepubertal boys. Boys who had a history of sexual abuse, current urogenital symptoms, or who had taken antibiotics in the preceding 2 weeks were excluded from this study.

**Setting**: The study was conducted in ambulatory clinical settings at a children’s hospital within a major medical center that serves as a statewide referral center.

**Participants**: A group of 99 circumcised and uncircumcised prepubertal boys participated in the study. The participants ranged in age from 1 month to 7 years 4 months.

**Main Outcome Measures**: Results of cultures for *G vaginalis*.

**Results**: No cultures were positive for *G vaginalis* from the urethra, glans, or rectum in any of the participants in this study.

**Conclusions**: The findings of this study provide preliminary evidence that *G vaginalis* is not an organism that commonly colonizes the urogenital or gastrointestinal tract in asymptomatic prepubertal boys. Based on these findings, it does not seem prudent to apply the concept of asymptomatic colonization to prepubertal boys unless further studies refute these findings.


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Editor’s Note: This is a nicely done first study to determine the prevalence of *Gardnerella vaginalis* in asymptomatic prepubertal boys. The authors outline the next step in the last sentence of their article. I hope support is forthcoming for them (or others) to perform the next study.

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In 1990, a 30-month-old black boy presented with penile swelling for 1 day and was admitted to the pediatric emergency department of the medical center where this study was conducted. On physical examination, the child was found to have edema and erythema of the foreskin that was partially retractable. When retracted, thick subpreputial purulent exudate was found, which we cultured. A diagnosis of balanitis was made and antibiotics and sitz baths were prescribed. The parents were asked to return with the child for follow-up. After 72 hours, the condition had improved clinically, but the culture results of the exudate yielded a light growth of *Gardnerella vaginalis*.

The parents were informed of the culture results and, when questioned, denied that the child had a history of sexual abuse. The question of whether *G vaginalis* could be transmitted by nonsexual means was controversial at the time. Finding of a sexually transmissible organism in a prepubertal child aroused suspicion of sexual abuse; thus, the case was reported to the Department of Human Services for investigation and the parents were informed of the legal requirement to report suspicion of sexual abuse. Investigation by the caseworker failed to reveal any evidence of sexual abuse within the nuclear family, yet the review team from the Department of Human Services “insisted” to the caseworker that because the culture showed *G vaginalis*, the child had been sexually abused.

Because the physician who initially examined the child disagreed with the review team’s conclusion based on culture results alone, the English-language litera-
SUBJECTS AND METHODS

This study was conducted at the children's hospital of a major medical center in the southeast and data were collected from May 1, 1993, through July 31, 1996. Prepubertal boys were recruited from the general pediatric clinic, pediatric urology clinic, and pediatric emergency department. Once the purpose of the study was explained, a short interview was conducted with the parent/guardian to determine the child's eligibility for inclusion in the study. Children with a serious illness, infection requiring antibiotics in the preceding 2 weeks, genitourinary symptoms, or any history or suspicion of sexual abuse were excluded from the study. Demographic information included the child's age, race, toilet habits, and circumcision status. Relationship of the child to the person who provided written informed consent for participation in the study was also documented.

Culture specimens were obtained from the child using the following technique: A sterile rayon-tipped swab was used to obtain a culture from the meatus and the surrounding glans. Another swab was introduced into the rectum; care was taken to swab the side wall rather than fecal material. Both swabs were stored for transportation in a PDC-100 Amies-modified medium and transported to the laboratory within 60 minutes. The cultures were streaked onto a plate of human blood–bilayer-polysorbate (Tween, ICI Americas Inc, Wilmington, Del) and incubated for 48 hours at 37°C in a carbon dioxide incubator. Previously, this method has yielded 97% specificity and has been designated the most satisfactory differential selective medium for isolation of *G vaginalis*. Incubation of cultures for 72 hours results in only a slight increase in isolation of *G vaginalis*, which can be identified at 48 hours.

Since 1955, when Gardner and Dukes identified *G vaginalis* as the cause of nonspecific vaginitis, there has been controversy regarding its pathogenicity and transmission. Researchers have attempted to clarify the colonizer vs pathogen question in studies of bacterial vaginosis in women and in urogenital problems in men. Questions regarding sexual transmission have been addressed in studies of adults and children.

RELATED LITERATURE

Our knowledge of bacterial vaginosis has changed over time, but currently the clinical definition is based on several diagnostic criteria, including replacement of *Lactobacillus* with *G vaginalis*, *Mycoplasma hominis*, and various anaerobes. *Gardnerella vaginalis* is believed to be of polymicrobial origin, and isolation of *G vaginalis* is no longer considered diagnostic of the clinical entity because the organism has been isolated in asymptomatic women. Several postulates have been proposed to explain symptoms that arise with a decrease in lactobacilli and an increase in *G vaginalis* and other anaerobes made possible by endogenous, bacterial, and exogenous factors not yet clearly understood.

The role of *G vaginalis* as a pathogen responsible for symptoms in the urogenital tract of the male is unclear. The organism has been isolated from the urethra of both symptomatic and asymptomatic men. Prevalence rates from urethral cultures of sexually active men have been reported in various studies (1.5%-11.4%), but no significant association was found between a positive culture and symptoms. This contradicts reports in which *G vaginalis* has been deemed a pathogen in nongonococcal urethritis, cystitis, bacteriospermia, and balanoposthitis. *Gardnerella vaginalis* was not found in some men with balanitis, but culture methods may have influenced findings in one study.

Because *G vaginalis* has been implicated as a pathogen in both the male and female genital tracts, a question arises as to whether this represents a sexually transmitted disease. Evidence has been cited supporting the theory that *G vaginalis* is a sexually transmitted disease. There is, however, contrary evidence that the organism is not an exclusively sexually transmitted pathogen, since asymptomatic colonization is common in men and women. Another piece of evidence against exclusive sexual transmission is found in a study reported from Sweden in 1990 that shows that the rectum may be a reservoir for organisms associated with bacterial vaginosis including *G vaginalis*.

The determination of the occurrence rate of *G vaginalis* and its role as a pathogen in children, because they are not well understood, are problematic in the evaluation of suspected cases of child abuse, especially when research done on adults is extrapolated to children. Hammerschlag et al found *G vaginalis* in 13.5% of the girls in their study, 2 months to 15 years old, but failed to control for child sexual assault or sexual activity of adolescents and included children with other sexually transmitted diseases in the sample. Additionally, inclusion of estrogen-producing (neonatal and peripubertal) and nonestrogen-producing (prepubertal) subjects in that study has received criticism.

*Gardnerella vaginalis* is common in sexually abused girls, but findings in regard to differences between...
abused and nonabused girls have differed. Significantly higher rates of *G. vaginalis* have been found in sexually abused girls in some studies, while other studies found no significant differences based on history or physical evidence of sexual abuse. Because the organism has been isolated in prepubertal controls and in virginal adolescents, it has been argued that *G. vaginalis* may be a part of the normal vaginal flora. However, validity of the control groups and the difficulty inherent in determining that a child has never had genital contact have been recognized as potential methodological problems.

While there are several studies of prepubertal girls in this field, there are no similar data available for prepubertal boys. *Gardnerella vaginalis* has not been reported in the literature as a possible pathogen in urogenital infection (specifically balanitis) in the prepubertal boy. In one study of boys with balanitis, *G. vaginalis* was not found in any of 32 cultures. However, the culture methods, which were not clearly described, may have influenced the recovery rate. The only study that reports *G. vaginalis* in asymptomatic boys is a Swedish study of 10 male subjects, aged 2 to 11 years, but this small sample is not adequate for determining occurrence rates in male children.

In summary, the prevalence of *G. vaginalis* in the urethra and rectum of the prepubertal boy is unknown. As the rectum may serve as a reservoir for the organism, colonization may be frequent and may mimic the adult rate, assuming sexual activity is not a factor in colonization. The role of circumcision in the rate of colonization can only be speculated and may be a factor in the incidence of positive cultures as it is in balanoposthitis in adults.

Is *G. vaginalis* a normal part of the flora of the genital or rectal tract of the asymptomatic prepubertal boy, and does circumcision influence the rate of recovery on culture? This study was designed to provide preliminary data to answer these questions, while controlling for previous sexual contact and antibiotic administration. Once the occurrence rate of *G. vaginalis* is estimated, studies of its role as a pathogen in urogenital tract disease and child sexual abuse in prepubescent boys can be conducted.

### RESULTS

#### SAMPLE

A total of 99 boys were enrolled in the study. Ages ranged from 1 month to 7 years 4 months (n = 93; mean age = 2 years 7 months ± 1 year 11 months). Age distribution is shown in the Figure. Eighty-two subjects were African American, 16 were white, and 1 was American Indian. In regard to toilet habits, 42.9% were potty trained, 8.2% partially potty trained, and 49% were in diapers. There were similar percentages of circumcised (54%) and uncircumcised (46%) boys. There were no significant differences in age by circumcision (Student t test = 0.23, P = .82) or race (F = 0.23, P = .78), nor were there any differences in circumcision status by race or toilet habits (Table).

Most children (89.8%) were accompanied by their mother. Others were accompanied by the father, grandmother, both parents, or another legal guardian. Thirteen of the children had a recent or current infection, as reported by the accompanying adult. Time since recent infection ranged from 3 weeks to 2 months, and infection sites were identified as the ear or upper respiratory tract. Five patients were to be seen by their pediatrician on the day of data collection for a chief complaint of infection, specifically a “cold,” “impetigo,” or “ear infection.” Only 4 children had received antibiotics recently, but not within the previous 2 weeks.

### CULTURES

There were no positive cultures for *G. vaginalis* from the urethra, glans, or rectum in any of the boys in this study. Power analysis performed to yield a power of 0.8 necessitated a sample size of 140 patients, assuming the incidence was greater than or equal to 1/100. Because of financial and time constraints, the study was terminated when a sample size of 99 was achieved. Because the actual sample size was less than originally planned, a confidence interval was used to determine the significance of the finding. Given the actual sample size, the estimated range is 0 to 0.05 if a 95% confidence interval is used.

To provide an estimate of the recovery rate of *G. vaginalis*, medical records of women with a diagnosis of bacterial vaginosis were reviewed. Information services generated a list of cases with a diagnosis of bacterial vaginosis in 1997. Because there is no singular *International Classification of Diseases, Ninth Revision (ICD-9)* code for bacterial vaginosis, combination ICD-9 codes of 616.10 (vaginitis) and 41.84 (other anaerobes) or 41.85 (other gram-negative organisms) were used to generate the case list. There were 750 women with a diagnostic code 616.10, and 181 had an additional code of 41.84 or 41.85. From this list, the first 40 cases with the combination codes whose medical records were available were reviewed. This sample of 40 women were considered a positive control group. Twelve of the 40 women had routine vaginal cultures performed and 11 of those cultures were positive for *G. vaginalis*.

### COMMENT

Since the isolation of *G. vaginalis*, more than 40 years of research has failed to determine clearly its role as a pathogen in both the male and female urogenital systems. Most research has been done in the adult population, much
of it surrounding the issues of colonization, pathogenicity, and sexual transmissibility. The findings of this study provide preliminary evidence that \textit{G} vaginalis is not an organism that commonly colonizes the urogenital or gastrointestinal tract in asymptomatic prepubertal boys. Both circumcised and uncircumcised children were included in the study. Unfortunately, the influence of circumcision status as a factor in isolation of the organism as reported in studies of adults\textsuperscript{13,17} could not be explored because all cultures were negative.

Failure to identify \textit{G} vaginalis in any of the subjects raised a concern of a possible error either in the culture method or laboratory identification of the organism. Appropriate steps were taken in rapid transport and selection of appropriate culture medium to provide controls for those aspects of the study that might be sources of error for false-negative cultures.\textsuperscript{2,3,5} Because of the fastidious nature of the organism, cultures were transported within 1 hour of collection and were stored using PDC-100 Amies-modified medium. This medium has been used by others who subsequently isolated \textit{G} vaginalis from urethral swabs.\textsuperscript{16} Human blood–bilayer-polysorbate medium was selected based on a prior study of its sensitivity. Totten et al\textsuperscript{6} found that human blood–bilayer-polysorbate medium was more sensitive than \textit{V} cholerae in asymptomatic males,\textsuperscript{16,17,19} there were no positive cultures in these asymptomatic prepubertal boys. The incidental finding of \textit{G} vaginalis in this sample of boys with no urogenital symptoms would have provided evidence of an asymptomatic colonization postulate similar to that supported by research in adults. Considering the findings in this study paired with the little we know about differences in the genital tracts of prepubertal boys and men,\textsuperscript{29} it does not seem prudent to apply the concept of asymptomatic colonization to prepubertal boys until further studies confirm or refute these findings. Because cultures were obtained at only one point in time, the question of transient colonization remains a possibility.

Unlike the findings of Holst,\textsuperscript{26} there was no evidence of the rectum as a reservoir of the organism in this sample. In that study, \textit{G} vaginalis was found on rectal swab in 2 children, 1 of whom was a 3-year-old boy, but information regarding isolation of organisms from the child’s urethra or coronal sulcus was not available on review of the reported data. Holst concluded that \textit{G} vaginalis harbored in the rectum could be an endogenous source for nonssexual transmission of the organism. The rectum as reservoir might explain bacterial vaginosis or isolation of \textit{G} vaginalis from the vaginas of prepubertal girls or even in genital cultures of diapered boys, but generalizability of these data to prepubertal boys as explanation of urogenital disease seems unfounded. In fact, evidence of the rectum as a reservoir in \textit{G} vaginalis balanitis was not confirmed in adult males with positive urethral cultures who had negative rectal cultures concurrently.\textsuperscript{18} Likewise, Lam et al\textsuperscript{19} reported no positive cultures from the rectum in men with positive urogenital cultures.

Because all of the boys in this study were free of urogenital symptoms, the findings of this study do not provide any information about the significance of \textit{G} vaginalis in the prepubertal boy with urogenital symptoms. Infection has been identified as the most common cause of balanitis in the pediatric age group, primarily due to propagation of normal flora.\textsuperscript{41} However, the role of \textit{G} vaginalis as a possible pathogen in urogenital infection, specifically balanitis, in the prepubertal boy has not been adequately addressed in the literature. While there are reported cases of \textit{G} vaginalis balanitis in adult males,\textsuperscript{11,17,23} to our knowledge, there are no published reports of the organism in boys. Edwards\textsuperscript{42} has indicated that the symptoms of \textit{G} vaginalis balanitis are milder than those associated with other infection, yet in 51 cases of mild balanitis, \textit{G} vaginalis was not isolated.\textsuperscript{25} In the target case, which prompted the present study, the child with \textit{G} vaginalis balanitis had edema, erythema, and purulent exude with a foreskin that was only partially retractable. Based on this case, if the organism was pathogenic rather than an incidental finding, symptoms of \textit{G} vaginalis balanitis in prepubertal boys may not be mild, as cited by Edwards.\textsuperscript{42}

The findings of this study provide no answers to questions of possible sexual abuse in symptomatic prepubertal boys in whom \textit{G} vaginalis is isolated. The presence of urethral discharge has been identified as an important diagnostic clue in the detection of certain sexually transmitted infections in males,\textsuperscript{33} but the significance of \textit{G} vaginalis is still controversial.\textsuperscript{31} Specific cultures for \textit{G} vaginalis are not currently recommended in evaluation of children for sexual abuse,\textsuperscript{44} and there is agreement that an incidental finding of \textit{G} vaginalis in an asymptomatic prepubertal girl should not be considered evidence of sexual abuse.\textsuperscript{28,29,32} Likewise, if \textit{G} vaginalis is isolated in a prepubertal boy who is symptomatic, this should not be considered evidence of sexual abuse. Most researchers do believe, however, that nonssexual transmission of sexually transmitted disease is infrequent.\textsuperscript{35,96}

Isolation of \textit{G} vaginalis in prepubertal girls with vaginal discharge or other vulvovaginal symptoms, while not diagnostic, should arouse suspicion of possible sexual abuse.\textsuperscript{33,36,47,48} The American Academy of Pediatrics\textsuperscript{99} pro-

\begin{table}
\centering
\begin{tabular}{|c|c|c|}
\hline
Race & Circumcised & Uncircumcised & Total \\
\hline
African American & 44 & 37 & 81 \\
White & 8 & 8 & 16 \\
American Indian & 1 & 0 & 1 \\
\hline
Toilet habits† & & & \\
Potty trained & 24 & 18 & 42 \\
Partially potty trained & 4 & 4 & 8 \\
Diapers & 26 & 23 & 48 \\
\hline
\end{tabular}
\caption{Circumcision Status by Race and Toilet Habits of 98 Subjects}
\end{table}

\( \chi^2 = 0.958, P = .62. \)
\( \chi^2 = 0.289, P = .86. \)
vides guidelines for the determination of child abuse in cases where bacterial vaginosis is found in prepubertal girls, but the finding of G. vaginalis in prepubertal boys with urogenital symptoms is not addressed.

Until more research data are available on the prevalence of G. vaginalis in prepubertal boys, its significance as a sexually transmitted organism in this age and sex group is unclear. Because it is known that the prevalence of sexual abuse in boys is underestimated and perhaps underreported, it would seem that isolation of G. vaginalis in a symptomatic prepubertal boy would raise a suspicion of sexual abuse as it does with symptomatic prepubertal girls.

In conclusion, no evidence was found of G. vaginalis colonization of the urethra, glans, or rectum in this sample of asymptomatic prepubertal boys with no history of suspected or known sexual abuse. Before cultures for G. vaginalis in pubescent boys can be fully interpreted, further studies that include asymptomatic and symptomatic abused and nonabused boys are needed.

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