Clothing Factors and Vaginitis

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Associations of clothing factors and vulvovaginal symptoms, signs, and microbiology were sought in 203 women seeking care at a university family medicine clinic. Clothing factors studied were use of panty hose, underwear for sleep, cotton lining panels, and pants vs skirts. Women wearing and not wearing panty hose had similar rates of vaginitis symptoms and signs, but yeast vaginitis was about three times more common among wearers. Relationships of other clothing factors to vaginitis were not found. Nonspecific vaginitis was not found to be related to clothing.

Vaginitis is a commonly encountered problem that often recurs. While diagnosis and treatment of single episodes have been extensively investigated, prevention of vaginitis has received little attention. One preventive technique commonly recommended is the use of clothing that is relatively permeable to air in the genital area.

The relationship of clothing to health has long been a source of speculation. Ancient Greeks and Romans felt warm clothing promoted healthy exchange of "humors" by keeping invisible pores open. The concept of wool or flannel next to the skin for this purpose has persisted up to the present century. In 1878 a German physician, Gustav Jaegar, designed a wool corset to absorb "sexual evaporations," and achieved widespread but temporary fame.[1] More recently, however, a trend toward lighter and less bulky undergarments has made cotton and nylon the fabrics of choice in the industrialized world. It has been proposed that nylon underwear, which is more resistant than cotton to the passage of water and water vapor, permits a genital microclimate favorable to the existence of pathogenic fungi and bacteria.[2,3] Sauer[4] cites in addition the wearing of underwear for sleep as a factor promoting vaginitis. Jaffe and Palmer[5] found that cotton panels improve the comfort of nylon panty hose but did not investigate the microbiology. Elegbe and Botu[6] reported that women wearing loose-fitting clothing had lower rates of positive Candida albicans cultures. In a preliminary analysis of a subset of the data presented here, no statistically significant associations of vaginitis and clothing factors were found.

In the present study, associations of clothing factors with symptoms and signs of vaginitis, clinical vaginitis syndromes, and cultures for common vaginal organisms are examined. The clothing factors studied were (1) panty hose, (2) underwear for sleep, (3) cotton lining panels, and (4) pants vs skirts as outerwear.

Methods

The study occurred between September 1980 and September 1981 at the Family Medical Center of the University of Washington, a primary care practice with patient characteristics closely approximating the demography of the county in which it is located (King). All female patients aged over 18 years whose reason for visit made it likely they would have a pelvic examination were eligible for participation, thus including women with genitourinary complaints as well as women seeking health-screening examinations.

A uniform data base was collected for all subjects by a nurse practitioner who had research and gynecological examination experience. Information obtained included recent clothing use, demographic data, and medical, gynecologic, and sexual history. Women with genitourinary complaints were asked about clothing use prior to the onset

Table 1. Clothing Factors and Clinical Findings				
	Proportion With Clinical Findings			
Clothing Variable (n)	Vaginitis Symptoms	Vaginitis Signs	Yeast Vaginitis	Nonspecific Vaginitis
Panty Hose				
Wearers (110)	.64	.37	.13*	.16
Nonwearers (93)	.56	.40	.04	.26
Sleep Underwear				
Wearers (65)	.55	.37	.09	.16
Nonwearers (139)	.62	.39	.09	.22
Cotton Liner				
Present (173)	.60	.40	.09	.20
Not present (31)	.61	.29	.07	.20
Outerwear				
Pants (151)	.62	.44**	.10	.20
Skirt (51)	.55	.24	.06	.22

*P = .03, Fisher's exact test for difference between wearers and non-wearers
**P = .01, chi-square test with correction factor for difference between pants and skirt wearers

of symptoms, since vaginitis symptoms may have caused a change in dressing habits. Asymptomatic women were asked about use during the week preceding the week of the visit so that a comparable time period would be assessed.

Subjects were asked how many days per week they wore panty hose, but for ease of presentation they were classified later as those who did not wear panty hose or who wore them between one and seven days per week. To describe the use of underwear for sleep, cotton liners, and pants, women were asked to indicate what was most common for them. A detailed description of protocol and microbiologic techniques has already been reported.[7]

Statistical comparisons were made with the chi-square test with Yates' correction or, where warranted by small cell size, Fisher's exact test. For the candida-panty hose relationships, one-tailed tests (t test or Fisher's) were employed (see below). Statistical significance was defined at $P < .05$. Power calculations were performed by the method of Fleiss et al,[8] setting α at .05 and hypothesizing that occlusive clothing would double the rate of abnormal findings. Where the doubled rate would have exceeded 1.0, a 50 percent in-

crease was used instead. It was hypothesized that the more occlusive clothing groups may cut by one half the rate of the normal finding of lactobacillus.

Possible confounding variables were examined by looking at associations of the potential confounder with each of the clothing and clinical outcome variables, using chi-square or t tests. Confounding could occur if the two main variables of interest (clothing and vaginitis) were each related to a third factor, in which case the relationship of interest may be spurious. Potential confounders considered were age, marital status, economic status, race, education level, age at first intercourse, number of sexual partners, frequency of oral and genital intercourse, weight, birth control method, tampon use, and recent use of antibiotics.

Results

A wide variety of age and social conditions was represented among the 203 women entering the study. The mean age was 32 years, but ranged from 18 to 85 years. Eighty-eight percent were white, 35 percent were married, and 17 percent were on public assistance. Cotton-lined underwear was used by 84 percent, 77 percent usually wore

Table 2. Clothing Factors and Microbiologic Cultures			
	Proportion With Positive Culture Results		
Clothing Variable (n)	Lactobacillus sp	Gardnerella vaginalis	Candida albicans
Panty Hose			
Wearers (110)	.68	.58	.22
Nonwearers (93)	.58	.60	.13
Sleep Underwear			
Wearers (65)	.63	.68	.21
Nonwearers (139)	.64	.55	.17
Cotton Liner			
Present (173)	.64	.60	.19
Not Present (31)	.58	.55	.13
Outerwear			
Pants (151)	.66	.57	.19
Skirt (51)	.54	.63	.16

pants rather than skirts, 63 percent used panty hose at least once per week, and 31 percent commonly wore underwear for sleep. No diabetic or immunosuppressed women were included in the study. The women entering the study were demographically similar to the pool of eligible women.[7]

Table 1 shows the distribution of clinical findings among women in each of the clothing groups. Vaginitis symptoms were complaints of irritation or abnormal odor or discharge. Vaginitis signs were reddened external genitalia or a discharge that was green, homogeneous, foul, cheesy, or thin and adherent. Yeast vaginitis was defined by a positive culture for C albicans in the presence of vulvar erythema or a cheesy discharge. Nonspecific vaginitis was defined by Amsel's criteria,[9] ie, at least three of the following four criteria: vaginal pH above 4.5, thin homogeneous discharge, a "fishy" amine odor on application of potassium hydroxide, and clue cells on saline wet mount. Both symptoms and signs of vaginitis were quite common among all clothing groups. As discussed elsewhere,[7] no pathologic diagnosis could be determined for a large number of subjects with vaginal complaints. About 5 percent of the subjects had positive trichomonas cultures and 2 percent harbored chlamydia, proportions too small for more detailed analysis.

Women wearing panty hose were roughly three times more likely to have yeast vaginitis than were nonwearers (relative risk 3.2, 90 percent confidence interval 1.1 to 9.2). The statistical significance ($P = .03$) of this finding was borderline. A one-tailed statistical test (Fisher's exact test) was deemed appropriate in this case, since there was literature support for the difference being in the direction observed and there was no suspicion that panty hose may decrease the likelihood of yeast vaginitis. A two-tailed statistical test (corrected chi-square) would yield $P = .06$. Yeast vaginitis, however, accounted for the minority of vaginal symptoms and signs in both wearers and nonwearers of panty hose who overall had similar rates of vaginal complaints.

Women commonly wearing pants were almost twice as likely to have signs of vaginitis when compared with skirt wearers. However, neither symptoms nor clinical diagnoses were related to this clothing factor. No effect of cotton liners or sleep underwear was evident.

Microbiologic factors studied included cultures for lactobacillus species, Gardnerella vaginalis, Candida albicans, Neisseria gonorrhoeae, Chlamydia trachomatis, and Trichomonas vaginalis. No relationships of clothing to the latter three organisms were found, but the prevalence of the organisms was too small for meaningful conclusions to be drawn. Lactobacillus and G vaginalis were each found in more than one half of the subjects (Table 2), and their prevalence was not asso-

ciated with clothing habits. There was no effect of clothing on the colony count of these organisms. Candida albicans was somewhat more common among panty hose wearers, but statistical significance was not achieved (P = .07, one-tailed t test). Other clothing factors did not appear to influence the rates of organism recovery.

The possibility of confounding by a wide variety of factors was considered, as described in the methods. No factor was found to exert a confounding effect.

Power calculations were performed to estimate the likelihood of type II error (true associations not being found because of inadequate sample size). Concerning the data of Table 1, greater than 90 percent power was present for associations of symptoms and signs with each clothing factor except pants, where power was greater than 80 percent. Panty hose relative to vaginitides had 80 percent or greater power, as did nonspecific vaginitis and sleep underwear. For other relationships power was less than 80 percent, but the actual proportions were so nearly equal that type II error seems unlikely. Regarding the data in Table 2, Lactobacillus and Gardnerella relationships had power of 0.87 or greater in all categories of clothing factors. For C albicans, power was 0.69 for panty hose, 0.68 for sleepwear, and less than 0.60 for the other two factors.

Discussion

Data from this study support the commonly held notion that nylon panty hose predispose to yeast vaginitis. This effect could occur by two general mechanisms: through increasing the likelihood that C albicans will be present in the vaginal flora, or by predisposing the emergence of vaginal inflammation in the presence of the yeast. Both mechanisms may occur, as the rate of yeast recovery was increased among panty hose users but was less strongly affected than the rate of clinical yeast vaginitis.

The only other effect of clothing was that pants wearers were more likely than skirt wearers to have signs of vaginitis on physical examination. This finding, however, is of little clinical significance, as neither symptoms nor microbiologic findings were influenced by outerwear.

An attempt was made to examine the hypothesis that the degree of occlusion present with a given clothing combination is related to vaginitis. The clothing variables were assigned points to estimate the degree of occlusion associated with each, and the sum of these scores was tested as a determinant of vaginitis variables. No significant associations were found. Further analyses along this line should await more specific information on the degree of occlusion present for various dressing patterns.

Although sleep underwear, cotton liners, and outerwear lacked a significant role in vaginitis in the study population, it is possible that certain individuals are sensitive to such clothing factors. In this study the groups were quite heterogeneous. For example, a wide variety of sleep underwear was combined into the "users" group. Similarly, pants of varying fabric and fit were no doubt represented in the pants group. It seems probable that certain subgroups of these factors, through the same mechanisms involved with panty hose, could affect the rate of yeast vaginitis. Nevertheless, in counseling a patient with recurrent yeast vaginitis regarding choice of clothing, it appears most warranted to suggest avoiding panty hose on a trial basis. For other forms of vaginitis, this study does not support recommendations for changes in dressing habits.

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