The demographic, sexual health and behavioural correlates of *Mycoplasma genitalium* infection among women with clinically suspected pelvic inflammatory disease

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ABSTRACT

Objective *Mycoplasma genitalium* has been identified as a cause of pelvic inflammatory disease (PID), a clinical syndrome associated with inflammation of the female upper genital tract and serious reproductive sequelae. As the demographic, behavioural and sexual risk profile of women with *M genitalium*-associated PID is not well understood, the characteristics of *M genitalium*-infected women presenting with clinically suspected PID were investigated.

Methods Data from 586 participants in the PID Evaluation and Clinical Health Study were analysed. Demographic, sexual history and behavioural characteristics, including age, race, marital status, education level, sexual activity, number of sexual partners, history of sexually transmitted infection (STI), bacterial vaginosis and PID, contraception use, oral and anal sex, age at sexual debut, douching practices and drug, alcohol and tobacco use, were compared between 88 women testing positive and 498 women testing negative for *M genitalium* by PCR in the cervix and/or endometrium. Twenty-two women with *M genitalium* mono-infections were compared with 172 women who tested positive for *Neisseria gonorrhoeae* by culture and/or *Chlamydia trachomatis* by PCR.

Results Age under 25 years, douching two or more times per month and smoking were independently associated with *M genitalium*. Women with *M genitalium* mono-infections were significantly less likely to be African-American (59.1% vs 86.0%, $p = 0.001$) than women with *N gonorrhoeae* and/or *C trachomatis*.

Conclusions Women infected with *M genitalium* had some characteristics commonly associated with PID and other STI. The demographic, sexual and behavioural characteristics of *M genitalium*-positive women were similar to women with chlamydial and/or gonococcal PID.

Mycoplasma genitalium has recently been cited as a possible cause of pelvic inflammatory disease (PID),[1] the inflammation of the female upper genital tract caused by the ascension of organisms from the lower genital tract. As serious sequelae, including tubal factor infertility and chronic pelvic pain frequently follow an episode of PID,[2] it is important to identify correlates associated with PID-causing pathogens. As the risk factors associated with *M genitalium* infection among women with PID have not been studied, we sought to describe the demographic, sexual health and behavioural correlates for *M genitalium* in a population of women with clinically suspected PID. We hypothesise that the risk profile of *M genitalium* will be similar to that for *Chlamydia trachomatis* and *Neisseria gonorrhoeae*.

MATERIALS AND METHODS

Study population

We analysed baseline data of the PID Evaluation and Clinical Health (PEACH) Study, described in detail elsewhere.[3] Women were eligible to participate in the PEACH Study if they had clinically suspected PID, defined by: (1) acute pelvic pain (<30 days); (2) a clinical finding of pelvic tenderness; and (3) evidence of lower genital tract inflammation. For this ancillary study, stored cervical and endometrial specimens were available from a subset of 586 participants and were tested for *M genitalium*.[1] The demographic, behavioural and clinical characteristics of women with available specimens and those without did not differ significantly.

Baseline data collection

As part of the parent study, demographic, sexual history and behavioural characteristics were measured by questionnaire, and cervical swabs and endometrial biopsies were analysed for *N gonorrhoeae* by culture and *C trachomatis* by PCR (Roche Diagnostics, Indianapolis, Indiana, USA).[3] For this subsequent study, these previously collected cervical and endometrial samples stored at −70°C were tested for *M genitalium* using PCR.[1 4]

Statistical methods

Associations between *M genitalium* infection and correlates were assessed with univariate and multivariate logistic regression models, the latter which also included variables measuring *C trachomatis* and/or *N gonorrhoeae* infection. As results for lower and upper genital tract *M genitalium* infection were similar, only results for combined cervical and/or endometrial *M genitalium* are presented. The χ^2 test was used to compare the risk profile of women with *M genitalium* mono-infection with women with *C trachomatis* and/or *N gonorrhoeae*.

RESULTS

Age under 25 years (odds ratio (OR) 2.3, 95% CI 1.3 to 4.1), douching two or more times per month (OR 1.9, 95% CI 1.2 to 3.3) and smoking (OR 1.9, 95% CI 1.2 to 3.1) were significantly associated with *M genitalium* (table 1).

In a multivariate model adjusting for the above variables, age less than 25 years (adjusted odds ratio

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Table 1 Characteristics of study participants and association with *M genitalium* cervical and/or endometrial infection

Characteristic	*M. genitalium* positive N = 88 n (%)*	*M. genitalium* negative N = 498 n (%)†	OR (95% CI)	AOR (95% CI)
Demographics				
Age				
<25 years	71 (18.2)	319 (81.8)	2.3 (1.3 to 4.1)	2.7 (1.5 to 4.7)
≥25 years	17 (8.7)	179 (91.3)		
Race/ethnicity				
African-American	69 (16.2)	358 (83.8)	1.4 (0.8 to 2.4)	–‡
White/Hispanic/other	19 (11.9)	140 (99.1)		
Marital status				
Unmarried	71 (14.7)	411 (85.3)	1.4 (0.6 to 3.1)	–‡
Married	7 (11.3)	55 (88.7)		
Education				
<High school	38 (16.7)	189 (83.3)	1.2 (0.8 to 2.0)	–‡
≥High school	50 (13.9)	308 (86.0)		
Sexual health				
Sexually active				
Yes	78 (15.8)	415 (84.2)	1.6 (0.8 to 3.1)	–‡
No	10 (10.7)	83 (89.2)		
Two or more life time sexual partners				
Yes	10 (17.9)	46 (82.1)	1.3 (0.6 to 2.6)	–‡
No	78 (14.7)	452 (85.3)		
New sexual partner in past month				
Yes	10 (17.5)	47 (82.5)	1.2 (0.6 to 2.5)	–‡
No	78 (14.7)	451 (85.3)		
History of STI§				
Yes	52 (15.0)	295 (85.0)	1.0 (0.6 to 1.6)	–‡
No	35 (15.0)	198 (85.0)		
History of bacterial vaginosis				
Yes	13 (10.0)	117 (90.0)	0.6 (0.3 to 1.0)	–‡
No	73 (16.7)	365 (83.3)		
History of PID				
Yes	23 (12.9)	155 (87.1)	0.8 (0.5 to 1.3)	–‡
No	64 (15.9)	338 (84.1)		
Hormonal contraception use				
Yes	17 (15.6)	92 (84.4)	0.9 (0.5 to 1.8)	–‡
No	61 (15.9)	323 (84.1)		
Rare/occasional condom use¶				
Yes	60 (17.2)	289 (82.8)	1.4 (0.8 to 2.6)	–‡
No	18 (12.5)	126 (87.5)		
Consistent condom use**				
Yes	7 (10.9)	57 (89.1)	1.2 (0.5 to 2.7)	–‡
No	71 (16.5)	358 (83.5)		
Oral sex				
Yes	23 (17.6)	108 (82.4)	1.2 (0.7 to 2.0)	–‡
No	63 (15.0)	356 (85.0)		
Anal sex				
Yes	4 (21.1)	15 (78.9)	1.5 (0.5 to 4.7)	–‡
No	84 (14.8)	483 (85.2)		
Age at sexual debut				
≤15 years	48 (15.8)	255 (84.2)	1.1 (0.7 to 1.8)	–‡
>15 years	40 (14.1)	243 (85.9)		
Behavioural				
Vaginal douche two or more times in past month				
Yes	26 (22.8)	88 (77.8)	1.9 (1.2 to 3.3)	2.0 (1.2 to 3.4)
No	62 (13.1)	410 (86.9)		
Illicit drug use				
Yes	32 (20.4)	125 (79.6)	1.7 (1.0 to 2.7)	–‡
No	56 (13.1)	370 (86.9)		
Current smoker				
Yes	49 (20.2)	194 (79.8)	1.9 (1.2 to 3.1)	2.0 (1.3 to 3.3)

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Table 1 Continued

Characteristic	*M. genitalium* positive N = 88 n (%)*	*M. genitalium* negative N = 498 n (%)†	OR (95% CI)	AOR (95% CI)
No	39 (11.5)	301 (88.5)		
Alcohol use				
Yes	48 (14.8)	277 (85.2)	0.9 (0.6 to 1.5)	−‡
No	40 (15.5)	218 (84.5)		
Alcohol drinks per week				
>7 drinks	13 (19.1)	55 (80.9)	1.4 (0.7 to 2.7)	−‡
≤7 drinks	75 (14.6)	440 (85.4)		

Missing observations: marital status, n = 42; education, n = 1; history of sexually transmitted infection (STI), n = 6; history of bacterial vaginosis, n = 18; history of pelvic inflammatory disease (PID), n = 6; hormonal contraception use, n = 93; condom use, n = 93; oral sex, n = 36; drug use, n = 3; smoking, n = 3, alcohol use, n = 3.
*Percentage of total study population with characteristic that tested positive for *M genitalium*.
†Percentage of total study population with characteristic that tested negative for *M genitalium*.
‡Variables with a p value greater than 0.10 were not included in the multivariate analysis.
§History of *N gonorrhoeae*, *C trachomatis*, or *Trichonomas vaginalis*.
¶Condoms used 0 to 5 out of 10 sexual encounters.
**Condoms used 10 out of 10 sexual encounters. AOR, adjusted odds ratio; OR, odds ratio.

(AOR) 2.7, 95% CI 1.5 to 4.7), douching (AOR 2.0, 95% CI 1.2 to 3.4) and smoking (AOR 2.0, 95% CI 1.3 to 3.3) were independently associated with *M genitalium*. After further adjusting for *C trachomatis* and/or *N gonorrhoeae* infection, age (AOR 3.0, 95% CI 1.4 to 6.2) and smoking (AOR 1.9, 95% CI 1.1 to 3.3) remained significantly associated with *M genitalium*.

Women with *M genitalium* mono-infection (n = 22) were generally similar to women with *C trachomatis* and/or *N gonorrhoeae* (n = 172) (results not shown). The only characteristic that differed between these two groups was race. Women with *M genitalium* mono-infection were significantly less likely to be African-American (59.1% vs 86.0%, p = 0.001) than women with *C trachomatis* and/or *N gonorrhoeae*.

DISCUSSION

Among women with clinically suspected PID, compared with women who tested negative, women positive for *M genitalium* in the cervix and/or endometrium were more likely to have some characteristics and behaviours that are commonly associated with other sexually transmitted infections (STI) and PID, including young age, smoking and douching. Furthermore, the characteristics of *M genitalium* were similar to those of *N gonorrhoeae* and *C trachomatis*. However, *M genitalium* infection was not associated with all traditional markers of STI, including sexual activity, number of sexual partners, new sexual partner, history of STI or PID, condom use, oral and anal sex and age at sexual debut. Our findings are not consistent with other studies that have examined the risk factors for *M genitalium* lower genital tract infection.[5–7] However, all women enrolled in our study had clinically suspected PID. Therefore, they may have had a homogeneity of sexual risk behaviours, which probably biased these variables towards the null.

As patients infected with *M genitalium* may have mild symptoms,[5 7 8] an understanding of risk factors may aid efforts to reduce the acquisition, spread and complications of infection. As clinicians may use certain risk factors to decide who to screen for STI, including *N gonorrhoeae* and *C trachomatis*, and the risk factors for these pathogens and *M genitalium* are largely the same, these same women should also be screened for *M genitalium*. Such screening efforts could help detect and treat uncomplicated lower genital tract *M genitalium* infections, which could ultimately prevent some PID cases.

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Competing interests None.

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