

An epidemiological study on vaginitis in 6,150 women of reproductive age in Shanghai

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SUMMARY

The aim of the present study was to determine the prevalence and risk factors for vaginitis, the proportion of pathogens, and cognition of reproductive age patients on the harmful effects of vaginitis, its risk factors, and treatment.

This retrospective study enrolled 6,150 patients admitted to the Shanghai Jinshan Central Hospital from 2011 to 2015 with a chief complaint of abnormal vaginal discharge. A questionnaire was designed to survey the cognition of patients on the harmful effects of vaginitis. Routine gynecological examinations and laboratory tests were performed and the risk factors for contracting vaginitis were analyzed by multi-factor logistic regression analysis.

The positive pathogen rate was 65.63% (4,036/6,150). Trichomonas infections were diagnosed in 1,416 (35.08%) cases including 761 (18.86%) cases of single trichomonas infections, which was significantly higher than the proportion of any other single pathogen infection ($P < 0.05$). From 2011 to 2015, trichomoniasis and chlamydia infections decreased, but bacteria, candida and mycoplasma infections increased. The questionnaire survey showed a low cognition level on iatrogenic and mother-to-child transmission of vaginal infections as well as the risk of ectopic pregnancy and infertility, and on how to prevent vaginal infections. Logistic multifactor regression analysis revealed that advanced age, a low educational level, farmers, childbearing history and a low income were the risk factors for vaginitis.

Women of reproductive age showed a high rate of vaginal infections and more attention should be paid to women with a low education level and income to reduce the incidence of vaginal infections in this population.

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INTRODUCTION

Vaginitis is the most common reproductive tract infectious disease in women of reproductive age and a diverse spectrum of pathogenic organisms are involved. Of these, bacterial vaginosis (BV), candidiasis and trichomoniasis are responsible for the majority of vaginal infections (Workowski *et al.*, 2010). The clinical symptoms mainly include abnormal vaginal discharge, itching, a burning sensation, irritation and discomfort (Haltas *et al.*, 2012). It has been estimated that about 10 million people visit obstetrics and gynecology clinics for these vaginal symptoms each year in the United States (Paavonen and Stamm, 1987), and those not treated or poorly treated had complications from a variety of diseases, such as pelvic inflammatory disease, infertility (Casari *et al.*, 2010) and even the spread

of HIV (Eshete *et al.*, 2013). Epidemiological studies have demonstrated that the prevalence of various vaginosis and pathogenic microorganisms vary in different races and geographical locations. Miller *et al.* (2005) and Sutton *et al.* (2007) investigated the incidence of trichomonas vaginitis in American people by PCR detection, and they found that it was prevalent in 2.3-3.1% of young adults, and that the infection rate was highest in black women. Another study reported a significantly higher incidence of this disease (10.7%) in African people (Klinger *et al.*, 2006). Using a nucleic acid amplification method, (Fang, *et al.*, 2007) detected a 2.9% incidence of trichomonas vaginitis in women of childbearing age in China's Shandong Province (Fang *et al.*, 2007), but the prevalence of BV was estimated to be 20-30% in Asian women (Donders, 2010). The incidence of bacterial vaginosis and vaginal candidiasis is relatively difficult to evaluate accurately due to the fact that most BV patients may have no symptoms (Sobel, 1990), and patients with vaginal candidiasis commonly treat themselves by purchasing antifungal drugs in a pharmacy (Horowitz *et al.*, 1992; Sihvo *et al.*, 2000). Since the treatment of vaginitis is largely dependent on the pathogen, it is of important clinical significance to understand the incidence of vaginitis in specific areas and the proportion of main pathogens and resistances involved.

Key words:

Trichomonas infection, Reproductive tract infection, Reproductive stage, Chlamydia infection, Vaginitis.

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In recent years, many studies have evaluated the risk factors for vaginitis. Klebanoff *et al.* (2010) investigated douching as a risk factor in 3,620 women and found it was associated with BV after adjusting for demographics and sexual activity (Klebanoff *et al.*, 2010). In other studies, having male partners who have sex with other women, and women who have sex with women were found to be risk factors of BA (Donders, 2010), particularly for white American women with black sex partners (Klebanoff *et al.*, 2010). In addition, socioeconomic status, a low level of education, douching and poverty were factors related to trichomonas vaginitis (Sutton *et al.*, 2007).

For vaginal candidiasis, recent antibiotic use, immunodeficiency or diabetes are thought to be risk factors (Buchta *et al.*, 2013; Spinillo *et al.*, 1999; Thoden *et al.*, 2013). Few studies have assessed the cognition of patients on the harmful effects of vaginitis and its risk factors and treatment. In theory, the prevention and control of the disease would benefit from an improvement of cognitive levels and awareness. In the present study, we evaluated the prevalence, pathogens and patients' cognition of the harm, risk factors and treatment of vaginitis, in addition to etiology analyses.

PATIENTS AND METHODS

Subjects

This study was approved by the ethical committee of the Shanghai Jinshan Central Hospital and all participating patients provided informed consent. The study was carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. From January 2011 to December 2015, 6,150 women of reproductive age, who visited our hospital as gynecological outpatients with a chief complaint of abnormal vaginal discharge, were included in our study. The average age was 31.8 ± 7.9 (17-56 years). All patients had a history of sexual intercourse and some of them had symptoms of pruritus vulvae, abdominal pain, soreness, urinary frequency and urgency.

Methods

The patient's medical history was completely recorded. Routine gynecological examination was first performed on all patients, and cervical exfoliated cell smears were collected from those patients with cervical erosions. Cervical or vaginal discharges were sampled using sterile cotton swabs for further processing within 30 minutes. Pathogen identification and drug susceptible tests were performed with Micro Scan Walkaway 40 Plus (Siemens, Erlangen, Germany) for common pathogens. Fungal specimens were inoculated on chromogenic medium culture (Shanghai Kemajia microbial technology, Shanghai, China) at 36°C and its color was observed after 48 h. Mycoplasma were detected with MycoView (Upper Bio-tech Pharma Co., Ltd., Shanghai, China) and Chlamydia infections were diagnosed with an antigen detection kit (Abon Biomedical Co. Ltd., Hangzhou, China).

A questionnaire was designed (Tang, 2010), including general information (age, educational level, marital status, occupation, registered residence, childbearing history, whether menstrual cycle was regular, monthly income) and the cognitive situation of patients on possible reproductive tract infection routes, harm and prevention.

Statistical analysis

SPSS software (Statistics for Windows, version 18.0, Chicago: SPSS Inc.) was used for data analysis. The counting data are displayed as a percentage and difference comparison of them was performed using a χ^2 test. Logistic regression analysis was employed for multi-factor correlation analyses. *P* values <0.05 were considered to be statistically significant.

RESULTS

Proportion of infection pathogeny

The positive rate of pathogens was 65.63% (4,036/6150) and 2,422 cases were single infections including 761 (18.86%) trichomonas infections, the proportion of which was significantly higher than that of any other single pathogen infection ($P < 0.05$). This was followed by 538 (13.33%) cases of bacterial infections, 506 (12.54%) cases of candida infections, 414 (10.26%) cases of mycoplasma and 203 (5.03%) cases of chlamydia infections. 1,415 cases were mixed infections, mainly as 606 (15.01%) bacteria and candida combinations (Table 1).

From 2011 to 2015, the proportion of trichomoniasis and chlamydia infections decreased, and the proportion of trichomonas infections in 2015 was 47.3% of that in 2011, indicating an improvement in Trichomonas management. However, the percentage of bacteria, candida and mycoplasma increased and especially mycoplasma detection was 2.5 times higher (114 isolates, 16.4%) in 2015 than in 2011 (Table 2).

Cognition on reproductive traction infection routes, harm and how to prevent vaginal infections

The cognition on vaginal infective routes, risk factors and how to prevent infections of 6,150 patients were investigated. The result of the enquiry showed that there was a low cognition level on iatrogenic (19.35) and mother-to-child transmission (14.62) of vaginal infections, and a cognitive

Table 1 - Pathogens in 4,036 vaginitis cases.

Pathogens	Number	Proportion (%)
Trichomonas	761	18.86
Bacteria	538	13.33#
Candida	506	12.54#
Mycoplasma	414	10.26#
Chlamydia	203	5.03#
Trichomonas and bacteria	471	11.67
Trichomonas and mycoplasma	97	2.40
Trichomonas and chlamydia	87	2.16
Bacteria and candida	606	15.01
Bacteria and mycoplasma	31	0.77
Bacteria and chlamydia	25	0.62
Candida and mycoplasma	66	1.64
Candida and chlamydia	28	0.69
Mycoplasma and chlamydia	4	0.12
Others	199	4.93
Total	4,036	100.00

Note: #: Compared to trichomonas $P < 0.05$.

Table 2 - Annual distributions of pathogens from 2011 to 2015.

Pathogen	2011	2012	2013	2014	2015	P
Trichomonas	201 (22.6)	188 (20.9)	143 (17.7)	134 (18.1)	95 (13.7)	0.003
Bacteria	103 (11.6)	120 (13.3)	116 (14.3)	103 (13.9)	96 (13.8)	0.621
Candida	98 (11.0)	109 (12.1)	120 (14.8)	83 (11.2)	96 (13.8)	0.177
Mycoplasma	57 (6.4)	58 (6.4)	89 (11.0)	96 (12.9)	114 (16.4)	< 0.000
Chlamydia	60 (6.7)	58 (6.4)	40 (4.9)	30 (4.0)	15 (2.2)	0.000
Trichomonas and bacteria	126 (14.2)	118 (13.1)	87 (10.7)	75 (10.1)	65 (9.4)	0.034
Trichomonas and mycoplasma	20 (2.2)	21 (2.3)	18 (2.2)	15 (2.0)	23 (3.3)	0.562
Trichomonas and chlamydia	20 (2.2)	19 (2.1)	18 (2.2)	14 (1.9)	16 (2.3)	0.985
Bacteria and candida	120 (13.5)	129 (14.3)	118 (14.6)	120 (16.2)	119 (17.1)	0.416
Bacteria and mycoplasma	6 (0.7)	7 (0.8)	5 (0.6)	7 (0.9)	6 (0.9)	0.949
Bacteria and chlamydia	8 (0.9)	5 (0.6)	5 (0.6)	6 (0.8)	1 (0.1)	0.390
Candida and mycoplasma	10 (1.1)	14 (1.6)	12 (1.5)	13 (1.8)	17 (2.4)	0.359
Candida and chlamydia	8 (0.9)	5 (0.6)	6 (0.7)	5 (0.7)	4 (0.6)	0.918
Mycoplasma and chlamydia	2 (0.2)	1 (0.1)	0 (0)	1 (0.1)	0 (0)	0.556
Others	51 (5.7)	48 (5.3)	33 (4.1)	40 (5.4)	27 (3.9)	0.367
Total	890	900	810	742	694	

rate of less than 20% that vaginal infection could result in ectopic pregnancy. The cognitive levels on how to prevent vaginal infections, on the importance of controlling vaginal infections before pregnancy, and the importance of timely treatment with simultaneous partner medication were 24.31%, 35.4% and 30.24%, respectively (Table 3).

From 2011 to 2015, both the awareness of vaginal infection due to iatrogenic transmission and the cognition rate on importance of treatment before pregnancy were significant-

Table 3 - Cognition on reproductive traction route, harm and how to prevent it.

	Number	Cognitive rate (%)
Infective route		
Bad hygiene	5,075	82.52
Unsafe sex	4,688	76.23
Iatrogenic transmission	1,190	19.35
Mother-to-child transmission	899	14.62
Harm		
Pelvic inflammation	3,625	58.94
Cross infection between husband and wife	3,336	54.24
Cervical cancer	3,187	51.82
Infertility	2,535	41.22
Ectopic pregnancy	1,221	19.85
How to prevent		
Maintain good health habits	3,535	57.48
Use contraception	3,498	56.88
Regular sex partners	3,410	55.45
Receive treatment timely	2,177	35.40
Both the husband and wife received treatment	1,860	30.24
Pregnancy after treatment	1495	24.31

ly increased, but poor health habits and unsafe sex were still common and were probably the main reasons for infections, accounting for more than 72.4%. Only 13.7 to 15.2% unawareness of possible vaginal infections might have contributed to mother-to-child transmissions (Table 4).

Single factor analysis of the risk of vaginal infection

Single factor χ^2 tests suggested that the vaginal infection rate was significantly correlated with female age, social level, occupation, childbearing history and monthly income ($P < 0.05$), but was not correlated with marital status or the menstrual cycle ($P > 0.05$). Its onset was typically between 30 and 45 years of age and the incidence in women with education levels below junior middle school, farmers, and a monthly income less than 1,500 RMB could be higher than 70% (Table 5).

Multiple-factor logistic regressive analysis on the risk of vaginal infection

With age, culture level, occupation, marital status, child-bearing history, menstrual cycle, and monthly income as the independent variable, vaginal infection as the dependent variable, multiple-factor logistic regressive analysis was performed, and we found a higher risk for vaginal infection in women between 30 and 45-years old, with education levels below junior middle school, farmers, and a monthly income less than 1,500 RMB (Table 6).

DISCUSSION

The positive rate of pathogens in vaginitis patients was 65.63% (4,036/6,150) in the present study, which was higher than the 49.1% reported for India (Narayankhedkar *et al.*, 2015) and 51.3% reported from the Netherlands (Vahidnia *et al.*, 2015), which might have been due to different pathogen detection sensitivities. In addition, the discovery of pathogens might generally be concealed by medication or vaginal irrigations before the tests.

The detected pathogens in our study were mainly tricho-

Table 4 - Change in cognition on reproductive traction route, harm and prevention from 2011 to 2015 (N (%)).

	2011 (n = 1,240)	2012 (n = 1,268)	2013 (n = 1,237)	2014 (n = 1,152)	2015 (n = 1,253)	P
Infection route						
Bad hygiene	988 (79.7)	1,011 (79.7)	1,025 (82.9)	993 (86.2)	1,058 (84.4)	0.615
Unsafe sex	898 (72.4)	930 (73.3)	918 (74.2)	950 (82.5)	992 (79.2)	0.161
Iatrogenic transmission	203 (16.4)	222 (17.5)	216 (17.5)	242 (21.0)	307 (24.5)	< 0.000
Mother-to-child transmission	180 (14.5)	174 (13.7)	187 (15.1)	167 (14.5)	191 (15.2)	0.894
Harm						
Pelvic inflammation	710 (57.3)	718 (56.6)	730 (59.0)	726 (63.0)	751 (59.9)	0.521
Cross infection between sex partners	642 (51.8)	653 (51.5)	674 (54.5)	672 (58.3)	695 (55.5)	0.336
Cervical cancer	624 (50.3)	643 (50.7)	629 (50.8)	632 (54.9)	659 (52.6)	0.712
Infertility	498 (40.2)	486 (38.3)	520 (42.0)	513 (44.5)	518 (41.3)	0.359
Ectopic pregnancy	236 (19.0)	246 (19.4)	230 (18.6)	243 (21.1)	266 (21.2)	0.555
How to prevent						
Maintain good health habits	697 (56.2)	705 (55.6)	710 (57.4)	715 (62.1)	708 (56.5)	0.484
Use contraception	700 (56.5)	694 (54.7)	706 (57.1)	687 (59.6)	711 (56.7)	0.798
Regular sex partners	667 (53.8)	675 (53.2)	680 (55.0)	676 (58.7)	712 (56.8)	0.591
Receive timely treatment	428 (34.5)	435 (34.3)	426 (34.4)	440 (38.2)	448 (35.8)	0.621
Partner treatments	370 (29.8)	374 (29.5)	368 (29.7)	375 (32.6)	373 (29.8)	0.752
Pregnancy after treatment	250 (20.2)	276 (21.8)	274 (22.2)	306 (26.6)	389 (31.0)	< 0.000

Table 5 - Single factor analysis on the risk of contracting a vaginal infection.

Factors	Total number	Number of infected cases	Infection rate	χ^2	P
Age (years)					
≤ 29	1,545	802	51.91	194.38	< 0.05
30–45	2,897	2,108	72.76		
≥ 46	1,708	1,126	65.93		
Education level					
Junior middle school and below	1,597	1,201	75.20	125.66	< 0.05
High school	2,363	1,570	66.44		
University or above	2,190	1,265	57.76		
Occupation					
Farmer	2,132	1,611	75.56	161.64	< 0.05
Worker	1,645	1,057	64.26		
Other	2,373	1,368	57.65		
Marital status					
Unmarried	2,331	1,542	66.15	0.46	> 0.05
Married	3,819	2,494	65.31		
Childbearing history					
Yes	3,630	2,528	69.64	63.33	< 0.05
No	2520	1508	59.84		
Menstrual cycle					
Regular	3,515	2,304	65.55	0.022	> 0.05
Not regular	2,635	1,732	65.73		
Monthly income (RMB)					
< 1,500	1,870	1,321	70.64	33.05	< 0.05
1,500–2,500	2,483	1,602	64.52		
> 2,500	1,797	1,113	62.60		

Table 6 - Multiple-factor logistic regression analysis on the risk of vaginal infection.

Factors	B	Sb	Wald	P	OR	95% CI
Age	1.214	0.297	16.346	<0.05	0.115	0.831-2.469
Education level	1.113	0.302	15.487	<0.05	0.134	0.754-2.436
Occupation	1.501	0.423	12.802	<0.05	2.504	0.269-0.987
Childbearing history	2.156	0.235	14.886	<0.05	2.376	1.309-12.468
Marital status	1.243	0.285	15.749	>0.05	0.167	0.809-2.125
Monthly income	1.272	0.247	11.573	<0.05	5.682	1.215-28.453
Menstrual cycle	1.381	0.307	16.893	>0.05	0.198	0.492-2.765

moniasis (761 cases, 18.86%), followed by bacteria (538, 13.33%) and candida (506, 12.54%), which is in contrast with one Italian and two other Chinese studies (Caiyan *et al.*, 2012; Casari *et al.*, 2010; Yongjun *et al.*, 2009) in which bacteria were the most common pathogens, followed by candida and trichomoniasis as well as studies in Vietnam (Begum *et al.*, 2003), Bangladesh (Shrestha *et al.*, 2011) and Africa (Mulu *et al.*, 2015), in which candida was the most common infectious etiology, followed by bacteria and trichomoniasis.

These differences might be due to variations of the environment, regional differences, as well as socioeconomic and cultural factors of the study participants. However, the 65.63% pathogen detection rate with 18.86% trichomoniasis cases was very high in our study, indicating that trichomoniasis was the most common genital tract infective disease and active prevention and treatment would be of obvious clinical and social significance.

To our knowledge, few studies have investigated the cognitive status of vaginal infection routes, risks, and how to prevent it in women of reproductive age. Through this study, we first found a low cognition level of patients on iatrogenic and mother-to-child transmission of vaginal infections. Second, a cognitive rate of less than 20% that vaginal infection could result in ectopic pregnancy and infertility was found, and on how to prevent vaginal infection, the cognitive rate on controlling vaginal infection before pregnancy, timely treatment and that a couple should be treated simultaneously were relatively low, which might be due to the fact that this knowledge needs a relative advanced intellectual level.

From 2011 to 2015, we observed a trend of increased vaginal infections caused by iatrogenic transmission, and the corresponding cognition was still at a lower level, which was obviously harmful for prevention of the disease. At the same time, with the risk of ectopic pregnancy, the cognitive rate of about 20% in patients was low, which is in urgent need of improvement.

We further analyzed the related risk factors of vaginitis in the Shanghai area. A single factor X² test showed that the vaginal infection rate was significantly correlated with female age, culture level, occupation, childbearing history and monthly income ($P < 0.05$). After multivariable logistic regression analysis, we found a higher risk for vaginal infection in women between 30 and 45-years of age, with education levels below junior middle school, farmers, and a monthly income less than 1,500 RMB.

Women between 30 and 45 years were mainly married women with a reproductive history and frequent sexual activity, but taking oral contraceptive pills, which might be the reason for enhanced candida infections (Spinillo *et al.*, 1995). Rural women had a higher rate of infectious vagi-

nit, which is in accordance with previous reports (Bhalla *et al.*, 2007; Mulu *et al.*, 2015; Shrestha *et al.*, 2011) and may be the result of poor medical care conditions, lack of health knowledge, fewer medical economic resources and difficulty in timely receiving medical treatment.

In addition, patients with a low education level had a lack of knowledge regarding the seriousness of the disease, which is a risk factor for infectious vaginitis in accordance with other studies (Xu *et al.*, 2015) (Li *et al.*, 2014).

Therefore, based on the findings of our study, we suggest that the control of vaginal infection in women of childbearing age should be carried out from the following three aspects:

- 1) Screening pathogens regularly in married women with a childbearing history and their sexual partners;
- 2) carrying out health education on vaginal infection routes, risks and treatments;
- 3) controlling infection sources, especially *Trichomonas*, which was the main pathogen of vaginal infection and regular provision of metronidazole and other drugs particularly to rural communities.

CONCLUSIONS

The vaginal infection rate, particularly with *Trichomonas* in women of childbearing age in Shanghai, was especially high in rural areas and was associated with income, educational level, age, and childbearing history. Cognition rates on harm, infection routes and how to prevent vaginal infections revealed that more education is necessary to enhance the awareness for preventing pathogen-related vaginitis in the Chinese population.

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