

Clinical significance of *Trichomonas vaginalis* detected in Papanicolaou smear: a survey in female Social Hygiene Clinic

CME

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Objectives To evaluate the clinical significance of *Trichomonas vaginalis* detected in Papanicolaou (Pap) smears in our local population.

Design Retrospective study.

Setting A sexually transmitted disease clinic in Hong Kong.

Patients All patients having Pap smear, wet mount microscopy, and high vaginal swab culture performed in Tuen Mun Social Hygiene Clinic from April 2005 to December 2006 were recruited.

Main outcome measures Sensitivity, specificity, positive and negative predictive values of the Pap smear for the diagnosis of *Trichomonas vaginalis*.

Results A total of 209 patients had the diagnosis of *Trichomonas vaginalis* in the study period. From among these, the results of 149 patients who had Pap smears, wet mount microscopy, and high vaginal swab culture performed were used in the analysis. Sixty cases were excluded because treatments were initiated before the consultation or because the Pap smear had not been done. Among the *Trichomonas vaginalis* cases with positive Pap smears, 58% (85/146) were symptomatic and 41% (60/146) had concomitant sexually transmitted disease. The respective sensitivity and specificity of the Pap smear in our study were: 98% (128/131; 95% confidence interval, 94-100%) and 96% (440/458; 94-98%). In total, 128 patients were defined as true positives by wet mount microscopy or culture, while 18 were defined as false positives. In our study population, the positive predictive value was 88% (128/146; 95% confidence interval, 82-93%). On comparing the clinical features of patients with true-positive and false-positive Pap smears, the odds ratio for the presence of symptoms and concomitant sexually transmitted disease was 1.9 (95% confidence interval, 0.7-5.1) and 2.0 (0.7-5.8), respectively. There were no statistically significant differences in the univariate analysis by Chi squared testing.

Conclusion Treatment for vaginal trichomoniasis is recommended if *Trichomonas vaginalis* is detected in a Pap smear.

Introduction

Trichomonas vaginalis (TV) is one of the most common sexually transmitted diseases (STDs) worldwide. In the United States, the prevalence of TV is not known, but between 3 and 48% of sexually active women attending various clinics have the infection, whereas 5 million new cases are estimated to occur annually.¹ It is the seventh commonest STD in Hong Kong. From the annual statistics of the Department of the Health in Hong Kong, there were 451 new cases of TV reported by the Social Hygiene Service in 2007,² but it is not a notifiable disease in Hong Kong. The figure, therefore, may underestimate the real situation. There are few data concerning the prevalence of TV in men, as infection is frequently asymptomatic and the organism is rarely detected, unless there has been recent intercourse with an infected woman.

In infected female patients, symptoms include: vaginal discharge, vulvar pruritis, dysuria, and dyspareunia. Classical green, frothy, foul-smelling discharge occurs in 10% of the women, and the red granular 'strawberry' cervix can be identified by the naked eye in less than 2% of patients.³ However, up to 50% of the infected female patients are asymptomatic, depending on the study population, selection criteria, and diagnostic methods used.⁴

Key words
Sensitivity and specificity; Sexually transmitted diseases; *Trichomonas vaginalis*; Trichomonas vaginitis; Vaginal smears

Hong Kong Med J 2009;15:90-3

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If left untreated, chronic TV infection may lead to complications including: pelvic inflammatory disease, premature rupture of membranes, low-birth-weight infants, preterm delivery, and abortion.^{5,6} It had also been shown to increase the risk of transmitting human immunodeficiency virus (HIV) two-fold.^{7,8} Diagnosis of TV is an important public health issue, as asymptomatic patients may act as a reservoir for its transmission to their sexual partners.

Wet mount microscopy and TV culture are regarded as the gold standards for diagnosis. The clinical identification of motile organisms by microscopic inspection of wet mount preparations had a sensitivity of 40 to 75% while TV culture had a sensitivity of 86 to 97%.^{9,10} However, expert personnel and laboratory support are required and they were not readily available. Therefore they were seldom performed in a primary care setting. On the other hand, in primary care, the Papanicolaou (Pap) smear is a commonly performed screening test for cervical cancer. Thus, detection of TV in Pap smear would mean an additional advantage provided the result is accurate. According to the literature, for detection of TV it has a sensitivity of 44 to 79% and specificity of 83 to 99%.^{11,12} Local data are not available and some clinicians are reluctant to treat TV based on Pap smears only, because of possible false-positive results. This study aimed to clarify the situation among our local female patients by evaluating the sensitivity, specificity, and positive and negative predictive values of the Pap smear in the diagnosis of TV.

Methods

Study population and sampling

All patients diagnosed to have TV in the Tuen Mun Social Hygiene Clinic (TMSHC) during the inclusive period April 2005 to December 2006 were reviewed. This Clinic is the only government referral centre for STDs in the New Territories West area.

Wet mount microscopy and high vaginal swab cultures were routinely performed in all new attendees and previously seen patients with new symptoms. The Pap smear was routinely performed in all new attendees and in previously seen patients when indicated. Wet mount microscopy and high vaginal swab culture were used as gold standards for the diagnosis of TV. The Pap smear result was considered as a true positive when this coincided with a positive result from either the wet mount microscopy or high vaginal swab culture. Conversely, a positive Pap smear result was considered a false positive if both tests were negative.

Patients who received treatment for TV or had no simultaneous Pap smear, wet mount microscopy and culture performed were excluded from the study. Patient demographics, clinical symptoms, and

用宮頸塗片法（帕帕尼克拉烏試驗）檢測陰道毛滴蟲的臨床重要性：一所女性社會衛生科診所的調查

目的 評估本地使用宮頸塗片法檢測陰道毛滴蟲 (*Trichomonas vaginalis*) 的臨床重要性。

設計 回顧研究。

安排 香港一所性病門診診所。

患者 研究對象為2005年4月至2006年12月於屯門社會衛生科診所進行宮頸塗片法、濕片檢查法、及上陰道拭子培養的病人。

主要結果測量 宮頸塗片法診斷陰道毛滴蟲感染的敏感性、特異性、陽性預測值，以及陰性預測值。

結果 研究期間共有209位病人有陰道毛滴蟲感染，其中149人曾進行宮頸塗片法、濕片檢查法、及上陰道拭子培養，並納入分析範圍內。有60位因在確診前已接受治療，或並未接受宮頸塗片法檢測而不列為研究對象。有陽性宮頸塗片的毛滴蟲感染個案中，58% (85/146) 出現症狀，41% (60/146) 同時患上性病。本研究分析得出宮頸塗片法的敏感性為98% (128/131；95%置信區間：94-100%)，特異性為96% (440/458；94-98%)。濕片檢查法和上陰道拭子培養把128人確認為正確肯定，另18人為錯誤肯定。陽性預測值為88% (128/146；95%置信區間：82-93%)。把宮頸塗片法正確肯定和錯誤肯定的病人的臨床徵狀作比較，出現症狀及同時患上性病的比數比分別為1.9 (95%置信區間：0.7-5.1) 及2.0 (0.7-5.8)。用Chi squared測試單項變異分析發現並無統計上的顯著差異。

結論 如使用宮頸塗片法發現陰道毛滴蟲感染，應替病人進行陰道毛滴蟲病的治療。

concomitant STDs were reviewed.

Laboratory procedures

Pap smear

The Pap smears were taken by doctors or well-trained nurses; either thin or conventional smears were obtained. The specimen was first screened in an automated cytology machine and abnormal results were interpreted by cytopathologists in the Public Health Laboratory Centre in the Department of Health, Hong Kong. Features of TV in a Pap smear were identified by the characteristic appearance of pear-shaped organisms with flagellae, having the size of white blood cells that encircled cervical epithelial cells.

Wet mount

Direct dark-field microscopic examination of the vaginal secretions was performed in the microscopy room by well-trained nursing officers and the results were confirmed by the case doctors. *Trichomonas vaginalis* was identified by its characteristic movement

TABLE 1. Baseline demographics and characteristics of the 146 patients with positive Pap smear whose results were analysed

	Pap smear		Total (n=146)
	True positive (n=128)	False positive (n=18)	
Age (mean±standard deviation) [years]	41.3±17.8	39.7±19.2	40.5±18.8
Presence of genital symptoms	77 (60%)	8 (44%)	85 (58%)
Concomitant sexually transmitted disease	55 (43%)	5 (28%)	60 (41%)
Presence of inflammation	77 (60%)	12 (67%)	89 (61%)
Presence of cervical cell abnormality	7 (5%)	1 (6%)	8 (5%)

TABLE 2. Spectrum of sexually transmitted diseases in the TV and non-TV cases*

	TV cases (n=149)	Non-TV cases (n=1363)	Total (n=1512)
Age (mean±SD) [years]	40.5±18.8	37.5±15.1	37.8±13.6
Sexually transmitted disease			
NSGI	49 (33%)	525 (39%)	574 (38%)
Syphilis	7 (5%)	165 (12%)	172 (11%)
GC	4 (3%)	61 (4%)	65 (4%)
GW	2 (1%)	169 (12%)	171 (11%)
Others/observation	87 (58%)	592 (43%)	679 (45%)

* GC denotes gonorrhoea, GW genital wart, NSGI non-specific genital tract infection, SD standard deviation, and TV *Trichomonas vaginalis*

TABLE 3. 2x2 Table for the calculation of sensitivity (Sn), specificity (Sp), positive predictive value (PPV), and negative predictive value (NPV)

	Trichomonas +ve	Trichomonas -ve	Total	
Pap smear +ve	128	18	146	PPV: 88%
Pap smear -ve	3	440	443	NPV: 99%
Total	131	458	589	
	Sn: 98%	Sp: 96%		

in the wet film. In TMSHC, the nurse officers did not routinely read the clinical information before the microscopic examination, which minimised one source of potential bias.

Culture

Vaginal secretions were collected and incubated in Feinberg’s medium. Cultures were placed at 37°C and the media sampled and examined for the appearance of motile organisms after culture for 2 days in the Public Health Laboratory of the Department of Health, Hong Kong.

Statistical analysis

Background characteristics were tabulated. Results were analysed for sensitivity, specificity, and positive and negative predictive values using a 2x2 table. Univariate analyses were conducted to investigate the association between clinical characteristics and Pap smear positivity. The Statistical Package for the Social

Sciences (Windows version 15.0; SPSS Inc, Chicago [IL], US) software was used and a P value of less than 0.05 was considered statistically significant.

Results

Background characteristics

According to the clinic record, there were 1512 newly diagnosed STD cases in the study period and 589 Pap smears were performed. A total of 209 patients were labelled to have a diagnosis of TV. Sixty cases were excluded as the Pap smear was not performed or the treatment was initiated before the consultation. Consequently, there were 149 eligible patients having results of a Pap smear, wet mount microscopy, and culture (obtained simultaneously on recruitment). Among the 146 TV cases with positive Pap smears, 58% were symptomatic, having a vaginal discharge or vulvar pruritis at presentation, while 41% of the patients had a concomitant STD (Table 1). The spectrum of diseases in the TV and non-TV patients is shown in Table 2.

Sensitivity, specificity, and predictive value for the diagnosis

Three TV patients were considered to have yielded a false-negative Pap smear result. They had a negative Pap smear but positive wet mount microscopy and culture. Among the 146 TV cases with positive Pap smears, 128 of them were true positives while 18 were false positives. In our study, the sensitivity and specificity for the Pap smear were 98% (95% confidence interval [CI], 94-100%) and 96% (95% CI, 94-98%), respectively. In our study population, the positive predictive value of the Pap smear was 88% (95% CI, 82-93%). The results are summarised in Table 3.

Clinical characteristics and Pap smear positivity

The clinical features of patients with true-positive and false-positive Pap smears are shown in Table 1. Odds ratio and univariate analysis by Chi squared test are shown in Table 4. The odds ratio for the presence of symptoms and concomitant STD was 1.9 (95% CI, 0.7-5.1) and 2.0 (95% CI, 0.7-5.8), respectively. There were no statistically significant differences in the univariate

analyses by the Chi squared testing.

Discussion

In previous studies on the accuracy of the Pap smear in the diagnosis of TV, the reported specificity ranged from 83 to 99% and false-positive results were also described.^{11,12} In our study population, specificity for the Pap smear was 96% (95% CI, 94-98%) and the positive predictive value for the diagnosis of TV was high (reaching 88%). On comparing the clinical characteristics of the true-positive and false-positive groups, the presence of symptoms and concomitant STDs were associated with true-positive smear results (odds ratio=1.9 and 2.0, respectively). However, these associations were not statistically significant when analysed by the Chi squared test.

In our study, 42% of the patients were asymptomatic, and in them detection of TV was incidental. If left untreated, they may have served as a reservoir for transmission to their sexual partners. Moreover, untreated asymptomatic carriers may become symptomatic⁵ and long-term gynaecological and obstetric complications might follow. Moreover, patients with TV are reported to have a higher risk of transmitting HIV infection than non-TV patients.^{6,7}

In view of the high positive predictive value of Pap smears in the diagnosis, and the potential of complications of untreated TV, it is recommended that patients who test positive for TV be treated. The recommended treatment is: metronidazole or tinidazole, 2 g orally as a single dose. An alternative

TABLE 4. Odds ratio and P values of patients tested as true positives according to the Pap smear*

	OR (95% CI)	P value
Presence of symptoms	1.9 (0.7-5.1)	0.3
Presence of STD	2.0 (0.7-5.8)	0.2
Appearance of inflammation on Pap smear	0.8 (0.3-2.1)	>0.5

* CI denotes confidence interval, OR odds ratio, and STD sexually transmitted disease

regimen is to give metronidazole 500 mg orally twice a day for 7 days.^{13,14}

There were several limitations in our retrospective study. Sixty patients with the diagnosis of TV were excluded because they had no Pap smear performed or were in receipt of treatment before the consultation, which may have led to selection bias. Consequent reduction in the sample size may have decreased the statistical power to detect the differences between the true-positive and false-positive Pap smear groups. More prospective studies with Pap smears, wet mount microscopy, and cultures performed simultaneously based on an adequate sample size are needed to further evaluate the sensitivity and specificity of Pap smears in diagnosis of TV in our locality.

In summary, our study has shown a high positive predictive value for detection of TV by Pap smear. Given that potential complications may occur from untreated infection, we recommend that these female patients be treated with a course of metronidazole without resorting to traditional wet mount microscopy or culture tests.

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