

Cytology of *Trichomonas Vaginalis*

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Abstract

Trichomonas vaginalis (Figure 1) is a microaerophilic protist parasite occurring globally and causes infections in the urogenital tract in humans, a condition termed trichomoniasis. In fact, trichomoniasis is the most prevalent non-viral sexually transmitted disease with more than 250 million people infected every year. Although trichomoniasis is not life threatening in itself, it can be debilitating and increases the risk of adverse pregnancy outcomes, HIV infection, and, possibly, neoplasias in the prostate and the cervix. Apart from its role as a pathogen, *T. vaginalis* is also a fascinating organism with a surprisingly large genome for a parasite, i.e. larger than 160 Mb, and a physiology adapted to its microaerophilic lifestyle. In particular, the hydrogenosome, a mitochondria-derived organelle that produces hydrogen, has attracted much interest in the last few decades and rendered *T. vaginalis* a model organism for eukaryotic evolution. This review will give a succinct overview of the major advances in the *T. vaginalis* field in the last few years.

Keywords: *Trichomonas vaginalis*; Hydrogenosome; Metronidazole; Non-viral sexually transmitted disease; Trichomoniasis

Introduction

Epidemiology

Although *T. vaginalis* is a worldwide occurring parasite, prevalence rates differ very strongly in different parts of the world. In the Americas, for example, its incidence is calculated to be as high as 180 per 1000 men and women, whereas in South-East Asia estimates are much lower, with 40 to 50 per 1000 men and women [1]. In total, 276 million infections with Tv are believed to occur worldwide and per annum [2]. These numbers are very high indeed, but it is estimated that most Tv infections (up to 80%) are asymptomatic [3]. Importantly, men are infected equally frequently, but 89% of trichomoniasis cases are actually diagnosed in women because of their higher incidence of symptoms, which are sometimes severe and debilitating. The main concern about Tv infections, however, is their predisposing nature for other diseases or sequelae [4], and a number of new studies give justification to this concern. For example, Tv was found to be associated with human papilloma virus infections and cervical cytological abnormalities [5]. Moreover, in a meta-analytical study, strong statistical evidence was presented for an association of an underlying Tv infection and preterm birth [6]. Most importantly, however, evidence for a predisposition for infection with HIV in Tv-infected individuals is mounting. In a meta-study on 31 studies, it was concluded that the risk of HIV acquisition is increased 2- to 3-fold in Tv carriers [7], and it was found that Tv infection increased the risk of HIV infection 2.5-fold in macaques, which serve as a non-human primate model. Accordingly, it was calculated that annual screening for Tv would save US\$553 per woman and lifetime in the prevention of new HIV infections to susceptible male partners in the United States alone [8].

Results and Discussions

Overall, 46% of the women investigated in the present study were infected with *T. vaginalis*. The frequency was higher in the group of non-pregnant women compared to the group of pregnant patients (54% versus 37%) and this difference was statistically significant ($p < 0.05$).

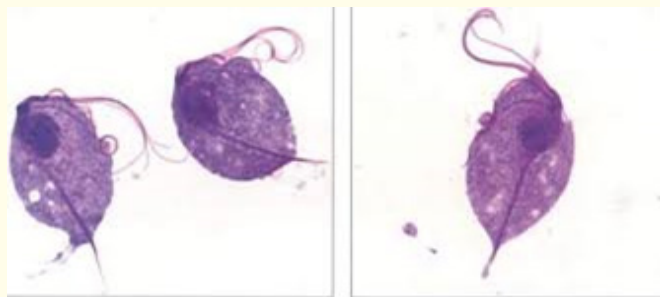


Figure 1: *Trichomonas Vaginalis*.

The prevalence of *T. vaginalis* infection found in the present study was high compared to previous reports in the literature. A study the presence of the infection in 31% of cases examined (78/254); however, in addition to the socioeconomic and cultural characteristics of that population, 47% of whom are illiterate, it is also important to take into consideration that the sensitivity of the diagnostic technique used (i.e. wet mount examination) is considered low [11,12].

However, the prevalence of *T. vaginalis* in the group of pregnant women in the present study was lower than that found in the non-pregnant group. The characteristics of the population receiving care in the latter group (women living in conditions of poverty) may in part justify this finding. Another factor may be the diagnostic technique used, bearing in mind that the specificity of the Pap smear is lower than that obtained with other methods [1]. The frequency of *T. vaginalis* was evaluated in pregnant women where the infection was found in 21.3% of the 400 samples analyzed by polymerase chain reaction (PCR) [3]. In another study infection was detected by wet mount examination in 11.8% of 691 pregnant women (≥ 36 weeks of pregnancy) [5].

Pap smear is considered a highly sensitive technique compared to microscopy, culture and even PCR. Nevertheless, the specificity of this technique is arguable, since false-positive results have been reported in the literature as a consequence of possible diagnostic confusion between *T. vaginalis* and cell remnants [6]. In this case, the experience of the examiner becomes a relevant factor in determining the sensitivity and specificity of the exam. Howel., *et al.* reported a better performance by cytotechnologists in the College of American Pathologists Inter Laboratory Comparison Program in Gynecologic Cytology (CAPPAP program) for evaluation of the presence of the parasite in cervicovaginal smears [7]. Loo., *et al.* reported sensitivity of 98%, specificity of 96% and a positive predictive value of 88% for detection of the parasite in the Pap smear in relation to the gold-standard culture in Feinberg's medium [8].

The indeterminate lesions and the precancerous lesions detected in this study were associated with the presence of *T. vaginalis* in 4.2% of the 359 women analyzed. Donders., *et al.* reported the presence of *T. vaginalis* in 1.3% of cases of atypical squamous cells of undetermined significance (ASC-US) (Bethesda) compared to 0.03% when no malignant lesions were found [9]. Misra and Singh found *T. vaginalis* in 8.1% of cases of low-grade lesions defined according to the Bethesda system [10].

The principal inflammatory changes associated with the presence of *T. vaginalis* in the present study are similar to those reported by Noël and Engohan-Aloghe [13]. There was a high rate of perinuclear halos, nuclear enlargement and adherence of the parasite to vaginal epithelial cells in both studies. No case of ill-defined cytoplasmic border was reported in the aforementioned study; however, according to Lemos., *et al.* that change is characteristic of the presence of the parasite, which was found in 50% of the smears analyzed [14].

In the present study, ill-defined cytoplasmic borders were present in 87% of the infected pregnant women and in 84% of the infected non-pregnant women. Greater importance is now being given to this change as well as to the adherence of *T. vaginalis* to the vaginal epithelial cells, in view of the recent discovery of the pseudocystic or amoeboid form, the form acquired by the parasite when it comes into

contact with the vaginal epithelial cells, at which time the signaling process begins [2]. Blurring of the cytoplasmic border and adherence to the vaginal epithelial cells were found principally in microbiota consisting of cocci and short bacilli.

Bär, *et al.* highlighted the importance of commensal microbiota in providing protection from parasitic protozoan infections at the vaginal mucosa. In the present study, cocci and short bacilli predominated when *T. vaginalis* was present. The infectious agent that was most commonly associated with its presence was the Gram-negative bacteria *Gardnerella vaginalis*, a fact already reported in the literature when clue cells (vaginal epithelial cells coated with coccobacilli) are a constant part of the microbiota, in a pattern referred to as anaerobic [15,16].

T. vaginalis and lactobacilli may compete with one another in the microbiota and *Lactobacillus gasseri* significantly inhibits adherence to the vaginal epithelial cells [15,16]. In the present study, the parasite was present together with lactobacilli in the microbiota of 18% of the pregnant women compared to 8% of the non-pregnant women. This fact may indicate an advantage in favor of the former group, since the presence of lactobacilli could play a role in reducing the cytopathogenic effect of *T. vaginalis* [17,18].

Conclusion

The detection frequency of *T. vaginalis* by cytology was high compared to previous reports in the literature. There is a considerable variation in sensitivity and specificity found in articles in which the different techniques are compared. The ability to detect *T. vaginalis* in vaginal smears was associated with the diagnostic technique used and with the experience of the examiner [12,19]. Evaluating *T. vaginalis*' presence in cases of precancerous lesions and illustrating the adherence of *T. vaginalis* to vaginal epithelial cells under optical and scanning electron microscopy the present study demonstrates that this parasite may potentiate or accelerate the neoplastic process through its contact with the vaginal epithelial cells [13,14]. Adherence of *T. vaginalis* to the host cell may be considered one of the principal inflammatory changes indicative of cytopathogenic development [15].

Bibliography

1. Hirt RP and Sherrard J. "Trichomonas vaginalis origins, molecular pathobiology and clinical considerations". *Current Opinion in Infectious Diseases* 28.1 (2015): 72-79.
2. WHO. "Global incidence and prevalence of selected curable sexually transmitted infections – 2008". (2016).
3. Poole DN and McClelland RS. "Global epidemiology of Trichomonas vaginalis". *Sexually Transmitted Infections* 89.6 (2013): 418-422.
4. Kissinger P. "Trichomonas vaginalis: a review of epidemiologic, clinical and treatment issues". *BMC Infectious Diseases* 15 (2015): 307.
5. Donders GGG., *et al.* "Association of Trichomonas vaginalis and cytological abnormalities of the cervix in low risk women". *PLoS One* 8.12 (2013): e86266.
6. Silver BJ., *et al.* "Trichomonas vaginalis as a cause of perinatal morbidity: a systematic review and meta-analysis". *Sexually Transmitted Diseases* 41.6 (2014): 369-376.
7. Sexton J., *et al.* "Metaanalysis and meta regression in interpreting study variability in the impact of sexually transmitted diseases on susceptibility to HIV infection". *Sexually Transmitted Diseases* 32.6 (2005): 351-357.
8. Lazenby GB., *et al.* "Cost-effectiveness analysis of annual Trichomonas vaginalis screening and treatment in HIV-positive women to prevent HIV transmission". *Sexually Transmitted Diseases* 41.6 (2014): 353-358.
9. Conrad MD., *et al.* "Extensive genetic diversity, unique population structure and evidence of genetic exchange in the sexually transmitted parasite Trichomonas vaginalis". *PLoS Neglected Tropical Diseases* 6.3 (2012): e1573.

10. Conrad M., *et al.* "Microsatellite polymorphism in the sexually transmitted human pathogen *Trichomonas vaginalis* indicates a genetically diverse parasite". *Molecular and Biochemical Parasitology* 175.1 (2011): 30-38.
11. Martin W and Müller M. "The hydrogen hypothesis for the first eukaryote". *Nature* 392.6671 (1998): 37-41.
12. Carlton JM., *et al.* "Draft genome sequence of the sexually transmitted pathogen *Trichomonas vaginalis*". *Science* 315.5809 (2007): 207-212.
13. Leitsch D., *et al.* "Trichomonas vaginalis: metronidazole and other nitroimidazole drugs are reduced by the flavin enzyme thioredoxin reductase and disrupt the cellular redox system: Implications for nitroimidazole toxicity and resistance". *Molecular Microbiology* 72.2 (2009): 518-536.
14. Kulda J. "Trichomonads, hydrogenosomes and drug resistance". *International Journal for Parasitology* 29.2 (1999): 199-212.
15. Pal D., *et al.* "Giardia, Entamoeba, and Trichomonas enzymes activate metronidazole (nitroreductases) and inactivate metronidazole (nitroimidazole reductases)". *Antimicrobial Agents and Chemotherapy* 53.2 (2009): 458-464.
16. Goldman LM., *et al.* "Treatment of metronidazole-resistant *Trichomonas vaginalis*". *Sex Health* 6.4 (2009): 345-347.
17. Sobel R and Sobel JD. "Metronidazole for the treatment of vaginal infections". *Expert Opinion on Pharmacotherapy* 16.7 (2015): 1109-1115.
18. Lindmark DG and Müller M. "Hydrogenosome, a cytoplasmic organelle of the anaerobic flagellate *Tritrichomonas foetus*, and its role in pyruvate metabolism". *The Journal of Biological Chemistry* 248.22 (1973): 7724-7728.

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