

EDUCATIONAL PROGRAM TO ENHANCE NURSES' KNOWLEDGE AND PREVENTION REGARDING TRICHOMONAS VAGINALIS IN A MILITARY HOSPITAL

By

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Abstract

Trichomonas vaginalis, a protozoan causing trichomoniasis, is one of the commonest non-viral sexually transmitted infections (STIs) worldwide. It is a motile trophozoite lives in the lower genitourinary tract of females and the prostate and urethra of men and cause of symptomatic vaginitis in women. *T. vaginalis* causes serious complications such as increases risk of human immuno-deficiency virus (HIV) transmission in both women and men with the adverse outcomes during pregnancy. Besides, complications for symptomatic women include vaginitis, endometritis, infertility, and cervical cancer, and for men include urethritis, prostatitis, epididymitis, and infertility. The disorder was underdiagnosed the drug of choice is oral metronidazole for both partners but if this fails, clinicians may use other nitroimidazoles. The study enhanced the nurses' knowledge as to *T. vaginalis*. Setting: Study was done in a Military Hospital. Design: A quasi-experimental study (pre & posttest) was used. Subjects were 63 nursing staff. Study tools: Composed of socio-demographic characteristics of nurses and knowledge questionnaire sheet and pre & posttest.

The results showed statistically significant improvement in the nursing knowledge regarding *Trichomonas vaginalis*. Recommendations: Developing periodic educational program and evaluation regarding *Trichomonas vaginalis* on regular basis, would improve nurse' knowledge and competency to provide high quality nursing care.

Key words: Egypt, *Trichomonas vaginalis*, Nurses, Knowledge, Questionnaires pre & posttest.

Introduction

The genus *Trichomonas* is a common parasite in the digestive system of many birds, animals, including man. *Trichomonas* cells are pear-shaped and may have four flagella anteriorly and a fifth one bordering undulating membrane. A mouth and a basal rod (costa) are found along membrane; an axostyle, a stiff rod of cytoplasm used for support, often protrudes posteriorly (CDC, 2017).

Trichomonas gallinarum or avian trichomoniasis in chickens and turkeys, causes diarrhea, appetite and weight loss, ruffled feathers, and intestinal lesions, and can be fatal.

Tritrichomonas foetus is a pathogenic one in cattle produces bovine or venereal trichomoniasis, temporary infertility or abortion and may invade the unborn calf. Three species of *Trichomonas* (or trich) occur in man: *Trich-*

omonas hominis (intestinalis) in the intestine, *Trichomonas vaginalis* in vagina, and *T. buccalis (tenax)* in mouth (CDC, 2022).

Trichomonas tenax was in humans in atypical locations such as the salivary glands and upper and lower respiratory tracts with bad oral hygiene (El Sibaei *et al*, 2012). Hersh (1985) in Russia reported that *T. tenax* usually caused pulmonary trichomoniasis by aspirated, as being transmitted through exchange of saliva and contaminated water sources, but rarely caused by *T. hominis* or *T. vaginalis*. Szczepaniak *et al*. (2016) in Poland reported the first time of *T. tenax* in salivary glands of a dog. They added high prevalence of trichomoniasis in dogs with periodontal diseases; these parasites should be considered together with bacterial and viral agents in salivary gland infections, especially in in-

dividuals with compromised oral health.

Tritrichomonas foetus is a pathogenic form in cattle cause temporary infertility or abortion and may invade unborn calf (Ondrak, 2016). Cats infected with *T. foetus* may be asymptomatic or may have clinical signs that include malodorous large bowel diarrhea, high-density among young, purebred cats and appropriate handling might be critical (Gookin *et al*, 2017). *T. vaginalis* is the most common non-viral sexually transmitted infection worldwide accounted for 4 to 35% of vaginitis diagnosed in symptomatic women presented in primary care settings in the USA (Anderson *et al*, 2004), in reproductive aged women was estimated as 3 to 5 million cases annually (Ginocchio *et al*, 2012).

Trichomoniasis *vaginalis* was reported in Egypt with an incidence ranged from 28.8% by clinical and microscopic examination up to 91.3% by PCR (Morsy *et al*, 1984; El-Ganayni *et al*, 1992; Sayed el-Ahl *et al*, 2002; Tawfeek *et al*, 2003; Negm and el-Haleem, 2004; El-Gayar and Rashwan, 2007; Hussein *et al*, 2015; Mahmoud *et al*, 2015; Abdel-Magied *et al*, 2017; Kamal *et al*, 2018; Hamdy and Hamdy, 2018; Hegazy *et al*, 2020; Selim *et al*, 2020; Saleh *et al*, 2021; Sallam *et al*, 2021).

Subject and Methods

This study was carried out according to the following 4 designs: 1. Technical, 2. Operational, 3. Administration, and 4. Statistical.

1- Technical design: Included description of study design used, setting, subjects and data collection tool. 1. Research design: A quasi-experimental study design was used to carry out the study, which aimed to enhance nurse knowledge and prevention regarding *T. vaginalis* that in turn increase nurses' competency to provide quality nursing care and health education to patients and families hence increase prevention and decrease morbidity and mortality rates. 2. Setting: Study was done in a Military Egyptian Hospital providing medical services to out- and inpatient Military Personnel and their families as well as civilians. 3. Subjects: All the nursing staff availa-

ble in the study setting during the data collection period and accepted to participate was 63 nurses. 4. Tools for data collection: The utilized data collection was based on the EKB and other concerned published papers.

Tools include: A. characteristics of nursing staff such as: age, sex, marital status, working unit educational qualification, and years of experience. B. Pre/Post-test knowledge questionnaire: This part assessed the Military Nurses' knowledge level, and prevention regarding *T. vaginalis* pre- and post-implementation of the educational program, included 30 multiple choice questions and 15 true and false. It included the following: Definition, cause, prevalence, risk factors, mode of infection, incubation period, affected organ, signs and symptoms, complications, diagnosis, treatment, medication side effects, prevention, and nursing instructions. Scoring system: For each question in the questionnaire the participant was granted one score for correct answer, and zero score for the wrong one. Score was summed up and total divided by the number of the items, given a mean score and these scores were converted into a percent score and computed.

2- Operation Design: It included the preparatory phase, content validity, pilot study and ethical consideration and actual field work. 1. Preparatory phase: During this phase the related national and international literature and the Egyptian Knowledge Bank (EKB), Internet periodicals & journals enabled the preparation of literature review, finalization of data collection tool and developing the educational program. 2- Validity test: The questionnaire and program content was presented to the Experts Committee to ensure clarity relevance, comprehensiveness, reasonability, and time required. Questionnaires were translated into Arabic Language to increase validity and reliability. Once after the official permission, pilot study carried out on six military nurses, represented about 10% study sample and were excluded from the results. 3- Administrative design: An official permission was kindly obtained from

the President of Military Medical Academy and the Director of the Military Hospital was secured to conduct the study. The aim was explained to the director of the hospital and chief nurse to gain the consent and cooperation. Nurses were notified formality about educational program. 4- Statistical design: Data were computerized and analyzed by Statistical Package for Social Sciences, version 23.0 (SPSS Inc., Chicago, USA). Quantitative data were expressed as mean \pm SD, frequency and percentage. P value was considered significant if it was < 0.05 .

Ethical consideration: The approved of the Military Medical Academy Authorities agreed with the Ethical Guidelines of 1975 Declaration of Helsinki (6th Revision, 2008). The study aim was explained to the participants, who were assured that confidentiality, anonymity; wright to withdraw from the study would be guaranteed to any one at any time in addition ethical approval letters were clarified in the study.

Results

The results were shown in tables (1 & 2) and figures (1, 2, 3, 4, 5, 6, 7 & 8).

Table 1: Relation between nurses' knowledge about *Trichomonas vaginalis* as to socio-demographic data (N=63).

Socio-demographic data	Pre-Intervention (n=63)				Post Intervention (n=63)			
	Satisfactory (7)		Unsatisfactory (56)		Satisfactory (53)		Unsatisfactory (10)	
	No.	%	No.	%	No.	%	No.	%
Age (years)								
20-<30 years	5	71.4%	35	62.5%	33	62.3%	7	70.0%
30-<40 years	2	28.6%	19	33.9%	18	34.0%	3	30.0%
≥ 40 years	0	0.0%	2	3.6%	2	3.8%	0	0.0%
χ^2	0.382				0.496			
p-value	0.826				0.780			
Sex								
Male	3	42.9%	12	21.4%	13	24.5%	2	20.0%
Female	4	57.1%	44	78.6%	40	75.5%	8	80.0%
χ^2	1.575				0.095			
p-value	0.209				0.758			
Working Unit								
Emergency Department	2	28.6%	7	12.5%	6	11.3%	3	30.0%
Critical Care Unit	0	0.0%	7	12.5%	6	11.3%	1	10.0%
Operating Room	3	42.9%	31	55.4%	30	56.6%	4	40.0%
Others	2	28.6%	11	19.6%	11	20.8%	2	20.0%
χ^2	2.421				2.500			
p-value	0.490				0.475			
Qualifications:								
Technical Nursing Institute	4	57.1%	31	55.4%	27	50.9%	8	80.0%
Diploma Nursing School	1	14.3%	20	35.7%	19	35.8%	2	20.0%
Bachelor Nursing	2	28.6%	3	5.4%	5	9.4%	0	0.0%
Master Degree	0	0.0%	2	3.6%	2	3.8%	0	0.0%
χ^2	5.336				5.233			
p-value	0.149				0.036*			
Years of experience:								
<5 year	1	14.3%	16	28.6%	10	18.9%	7	70.0%
5-<10 years	4	57.1%	21	37.5%	22	41.5%	3	30.0%
10-<15 years	2	28.6%	14	25.0%	16	30.2%	0	0.0%
≥ 15 years	0	0.0%	5	8.9%	5	9.4%	0	0.0%
χ^2	1.732				12.394			
p-value	0.630				0.006*			

P-value > 0.05 ; *P-value < 0.05 significant; **P-value < 0.001 highly significant

Table 1: Best multiple linear regression models to predict satisfactory *T. vaginalis* knowledge by demographic characteristics.

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	β	Std. Error	Beta			
(Constant)	3.514	1.408			5.804	$< 0.001^{**}$
Age (years)	0.093	0.086	0.110		1.432	0.276
Sexes	0.108	0.088	0.124		1.900	0.189
Working unit	0.106	0.237	0.072		1.097	0.371
Qualifications	2.470	1.357	1.035		3.137	0.015*
Years of experience	1.284	0.837	0.921		3.422	$< 0.001^{**}$

Discussion

Generally speaking, trichomoniasis (*T. vaginalis*) is virtually always sexually transmitted. It is associated with a high prevalence of co-infection with other sexually transmitted diseases and can be identified in 30 to 40% of the male sexual partners of infected women (Rowley *et al*, 2019). Some possible trichomoniasis consequences in women included pelvic inflammatory disease, post-hysterectomy cellulitis, and preterm birth; some possible consequences in men include prostatitis, infertility, and prostate cancer (Shui *et al*, 2016). *Trichomonas vaginalis* in women increased the risk of sexual acquisition of HIV and others STD (Peterman *et al*, 2006).

Apart from *T. vaginalis* sexual transmission, Tamer *et al*. (2009) in Turkey reported a higher rate of trichomoniasis infection in the IUD users means, and added that IUD usage might increase the growth risk of *T. vaginalis* in vaginal mucosa. Salman *et al*. (2017) in Iraq reported that *T. vaginalis* infection significantly correlated with the use of intrauterine contraceptive device and combined oral contraceptive pills, and that great attention should be paid to those women for diagnosis and treatment. Ghallab *et al*. (2021) in Egypt reported significant higher rates of trichomoniasis among IUD users compared to condom or hormonal-based methods.

Clinical manifestations in women ranged from an asymptomatic carrier state to a severe, acute, inflammatory disease. Signs and symptoms were a purulent, malodorous, thin discharge with associated burning, pruritus, dysuria, frequency, and dyspareunia (CDC, 2015). Asymptomatic carriage can occur for prolonged periods of time, thus it is not necessarily possible to ascertain when or from whom the infection was acquired. None of the clinical features of *T. vaginitis* is sufficiently sensitive or specific to allow a diagnosis based upon signs and symptoms alone. The presence of motile trichomonads on wet mount is diagnostic of infection, but this occurs in only 50 to 70% of culture-confirmed. Culture in patients was suggestive with ele-

vated vaginal pH, increased numbers of polymorph nuclear leukocytes and an absence of motile trichomonads and clue cells on wet mount, or when microscopy was not available (El-Okbi *et al*, 2004).

Several rapid antigen tests are now available (ELISA or PCR) for diagnosis of *T. vaginalis* and can be used as an alternative to culture (El-Moamly and Rashad, 2008).

Trichomoniasis treatment is a must to stop symptoms and/or prevent transmission to sexual partners. A single oral dose of a 5-nitroimidazole drug (e.g., Metronidazole[®] or Tinidazole[®]) for non-pregnant women was recommended (Sobel *et al*, 2001), but not treating asymptomatic trichomoniasis in pregnant women given the potentially increased risk of preterm birth associated with antibiotic therapy (Klebanoff *et al*, 2001). Single oral dose therapy proved more convenient, and effective as multiple dose therapy than vaginal administration (Tidwell *et al*, 1994). Sexual partner of an infected woman must be diagnosed for trichomoniasis and concurrent sexually transmitted infections rather than empirically treated. Patients should be instructed to prevent sexual activities until they and their partners have completed treatment and were asymptomatic, which generally took about a week (Seña *et al*, 2007). Follow-up is unnecessary for women who become asymptomatic after treatment or who were initially asymptomatic, given the high efficacy of 5-nitroimidazole drugs. (CDC, 2015) recommended for therapy of recurrent trichomoniasis after failure of a single 2gm dose of metronidazole to give metronidazole 500 mg twice daily for a week (total dose 7gm).

In the present study, the participated nurses were 63 of whom 15 were males and 48 were females, with ages ranged from 20 to \geq 40 years old, and years of experiences ranged from <5 to ≥ 15 years. Chur-Hansen (2002) in Australia reported that detailed qualitative research was a must to understand better the reasons for preferences and attitudes, for both male and female nurses. Nikki and Campo (2010) in USA reported that nursing is a

feminine job with excellence. Al-Agroudi *et al.* (2017) in Egypt reported that the nursing job was only for females since a long time and males joined this job in the last few years, and the average standard ages was 20 to 45 years old. Also, Fagerberg (2004) in Sweden reported a complex interrelationship between the health care organization, individual attributes of nurses (including self-esteem) and patient care, and adequate resources and support for nurses' professional and personal development is a must to ensure high quality patient care, and these are the political issues.

In the present study, as to nurses knowledge on *T. vaginalis* definition & etiology (85.7%) gave high correct of pre-test knowledge on age group when was most prevalent, the ratio of males to females with *T. vaginalis*, but 71.4% of them gave less correct answers in pre-test knowledge on trichomoniasis infective stage. Moreover, nearly all nurses (96.8%) gave the corrected of post-test knowledge on the age group when the infection was prevalent and the ratio of males to females with *T. vaginalis*, and 90.5% of them gave less correct ones of post-test knowledge on trichomoniasis definition. There was a high significant differences in correct answers on knowledge of posttest compared to pre-test ones on each of definition and etiology domain ($P < 0.05$).

WHO (2012) stated the *T. vaginalis* vaginitis is one of the commonest sexually transmitted diseases, with around 120 million women worldwide estimated to suffer from trichomoniasis annually. Forna and Gülmezoglu (2003) in USA reported that trichomoniasis and its treatment were well known at least among partners. Kassem and Majoud (2006) in Libya reported by clinical and wet-mount examination of 2,450 women (mean age 34+/-7) attended gynecologic department, El-Keish Polyclinic, Benghazi City, 328 (13.4%) suffered from viginatis due to trichomoniasis as *vaginalis* discharge (93.10%), burning (81.48%), vulvar pruritus (79.39%), dyspareuria (40.47%), dysuria (21.43%) and strawberry appearance (75.86%).

Madhivanan *et al.* (2009) in India reported that *T. vaginalis* burden of infection at 8.5% was relatively high among a community sample of young aged women (15-30years), with increased HIV risk of transmission associated with adverse pregnancy outcomes. Rabiee *et al.* (2010) in Iran reported that trichomoniasis was recognized as a major sexually transmitted disease (STD) worldwide with the highest prevalence and incidence of STD, the prevalence was strongly related to cultural and social norms in different societies, in relation to sexual partnership, monogamy, or polygamy. Keşli *et al.* (2012) in Turkey reported that in spite of a definite diagnosis of trichomoniasis made by cultivation method, examining the vaginal smear by direct microscope was an important role in diagnosis. They commented that direct microscopic vaginal examination help in deciding whether to begin trichomoniasis treatment.

Wagnapi *et al.* (2015) in New Guinea reported that *T. vaginalis*, *C. trachomatis* & *N. gonorrhoeae* prevalence were high among pregnant women in the coastal areas. They added that the poor clinically based performance suggested that alternative strategies must improve the detection and reduction of sexually transmitted infections and their associated adverse pregnancy outcomes. Bremer *et al.* (2016) in Germany reported that local Public Health Departments (LPHD) were indicated to offer low-threshold access to confidential counseling and testing for sexually transmitted infections for female sex workers. They added that participants (9284) were examined for HIV, *C. trachomatis*, *N. gonorrhoea*, syphilis and *T. vaginalis*, and concluded that participating LPHD varied in terms of performed STI tests and FSW visits was with low positive STI tests, but varied between LPHD reflecting different testing strategies and that testing guidelines must be used by all LPHD to ensure the high quality care for female sex workers (FSW).

de Waaij *et al.* (2017) in south Africa reported that *T. vaginalis* is one of the commonest non-viral sexually transmitted infec-

tion worldwide. They added that vaginal trichomoniasis was highly prevalent in rural areas, especially among single women and those with HIV infection, but often asymptomatic. Masha *et al.* (2018) in Kenya reported that *M. hominis* was independently associated with *T. vaginalis*. But, *M. genitalium* (P= 0.002) & *Ca M. girerdii* (P= 0.001) were exclusively found in *T. vaginalis* women, and that women co-infected with *T. vaginalis* and *Ca M. girerdii* suffered from itching compared to those 22 with *T. vaginalis* without *Ca M. girerdii* (P=0.020). They concluded that *M. hominis* correlated with *T. vaginalis*, and exclusive association was both *M. genitalium* and/or *Ca. M. girerdii* with *T. vaginalis*. Dessì *et al.* (2019) in Italy reported that one of the most intriguing aspects of *T. vaginalis* pathobiology was the complex relationship with intracellular microbial symbionts or a group of dsRNA viruses belonging to family of Totiviridae (*T. vaginalis*), and eubacteria belonging to *Mycoplasma* particular *hominis*. They concluded that identification of a novel *Mollicutes* species (*Candidatus Mycoplasma girerdii*) exclusively associated to *T. vaginalis* opened new perspectives field of the complex series of events taking place in the multifaceted vaginal microbiota, both under normal and pathogenic conditions. Tine *et al.* (2019) in Senegal reported that trichomoniasis is nowadays the most prevalent non-viral sexually transmitted infection in the world, but its epidemiology in Senegal was not well studied. But, *T. vaginalis* among women with vaginal discharge was prevalent among sexually active women. Rajabpour *et al.* (2020) in Tehran found a relation between chlamydia and ectopic pregnancy (P = 0.001), & infertility (P < 0.001), but abortion (P = 0.008), infertility (P = 0.005), and/or ectopic pregnancy (P < 0.001) were associated with gonorrhea. Abnormal vaginal discharge (P = 0.02) and vulvar itching (P = 0.02) were associated with trichomoniasis. They added that overall prevalence rates were high in these patients, which recommended screening programs to

reduce risk of sexually transmitted infections and their effects on the genitourinary symptoms, pregnancy-related complications, and infertility.

Op de Coul *et al.* (2021) in the Netherland reported that the antenatal screening for the HIV, syphilis and HBV was successfully implemented, but data on *C. trachomatis*, *N. gonorrhoeae* *T. vaginalis* among the pregnant women and/or male partners as risky factors were limited. They added that STI prevalence was low among pregnant women and male partners in midwifery practices, except for *Chlamydia trachomatis* among the young women. Amrin and Lakshmi (2021) in India mentioned that vaginal discharge is a common clinical problem with varied etiologies, most common bacterial vaginosis presented as homogenous gray discharge caused by the overgrowth of facultative and anaerobic bacterial species. They added that the vulvovaginal candidiasis was characterized by pruritus and cottage cheese like discharge followed by trichomoniasis associated with copious yellow or green and frothy discharge.

Xu *et al.* (2021) in Zhangye, China studied the symbiotic relationship between *T. vaginalis* and *Mycoplasma hominis*. They reported that of 312 clinical samples from vaginitis women 94, 153, & 48 were *T. vaginalis*, *M. hominis* and *Ca. M. girerdii* positive, respectively. Also, *T. vaginalis* was highly frequent in 17-30-year-old women. Forty samples (83.3%) were positive for *Ca. M. girerdii* and also positive for *T. vaginalis*, which six isolates were successfully cultured including five isolates that showed symbiotic relationships with *Mycoplasma* species.

Tchankoni *et al.* (2021) in Togo gave a standard questionnaire for socio-demographic data and sexual behavior patterns. *T. vaginalis* diagnosis by molecular biology to detect others six sexually transmitted micro-organisms, found that among 310 female sex workers (FSW) with median age 25 (21-32 years), *T. vaginalis* was 6.5% and prevalence of other STI ranged from 4.2% for *N. gonorrhoeae* to 10.6% for HIV. By binary logistic

regression to assess factors associated with *T. vaginalis*, they concluded that females living in Lomé having had sexual intercourse before 18 ages and infected with *C. trachomatis* associated with *T. vaginalis*.

Hernández-Buelvas *et al.* (2021) in Colombia determined *T. vaginalis*-infection dynamics in a retrospective study of 264 women and evaluated associations between risk factors and trichomoniasis. The women suffered from HPV had a greater risk of *T. vaginalis*-infection, high viral-load ($>10^2$) for HPV-16 related to a greater risk of persistent parasite infection; a high viral load ($> 10^2$) for HPV-18 and -33 was related to a lower probability of trichomoniasis clearance. They added that parasite distribution was high in the study population; its coexistence with HPV, and other risk factors influenced parasite infection dynamics, and that routine trichomoniasis diagnosing must be considered regarding populations at risk of infection.

Hawash *et al.* (2022) in Saudi Arabia reported that the burden and risk factors of *T. vaginalis* infection for a cohort of women was unexpectedly high in recruited: 155 women (79 with vaginitis & 76 controls). The high-risk factors included age between 30 & 39 years (~35%), marriage for 10 to 30 years (~62%), non-education (~41%), urban residence (~29%), & employment (~36%). Highly significant differences as to infection distribution among patients were lower abdominal pain (~64%) and abnormal vaginal discharge (38%) as symptoms ($\chi^2 = 20.42$; $p < 0.001$ & $\chi^2 = 5.63$; $p = 0.017$, respectively).

In Egypt, El-Gayar and Rashwan (2007) reported that early diagnosis and treatment of symptomatic and asymptomatic trichomoniasis minimized the risks of cervical neoplastic. El-Sherbini *et al.* (2010) treated patients with metronidazole refractory vaginal trichomoniasis with natural plant extract purified from pomegranate (Roman) was in-vitro studied for its efficacy against *T. vaginalis* on Diamond media. They found that infected women (18/20) who accepted *P. granatum* juice regimen completely cured

with two months followed up. They concluded that *P. granatum* extract (in-vitro & in-vivo) gave very promising results in treating trichomoniasis. Also, El-Sherbini and El Sherbine (2011) found that the resin of *Commiphora molmol* (Mirazid[®]) proved to be new anti-*Trichomonas* agents. CDC (2015) recommended for therapy of recurrent trichomoniasis after failure of a single 2g dose of metronidazole to give more dose as 500mg twice daily for seven days (total dose 7g). If this regimen failed, tinidazole or metronidazole must be administered at the dose of 2g/ day for 5 days (total dose 10g). The regimens were effective in patients with low levels of metronidazole resistance noted in 4% of *T. vaginalis* isolates of women attending STD clinics in six cities in the United States (Kirkcaldy *et al.*, 2012). Besides, Saleh *et al.* (2021) in Egypt concluded that chronic trichomoniasis *vaginalis* was associated with prostate cancer, but it didn't seem that this STI aggravated the cancer status.

Conclusion

The outcome data showed statistically significant improvement in the participated nursing staff knowledge regarding *Trichomonas vaginalis* as disease, prevalence, risk factors, transmission, incubation period, signs & symptoms, pathogenesis, diagnosis, treatments of both partners & pregnancy and prevention, as well as the nursing instructions.

Recommendations

Generally speaking, *Trichomonas vaginalis* had a high recovery rate, but it is still neglected in spite of its association was sexually transmitted diseases (STDs). The health problem awareness must be raised to assess the infection in asymptomatic and pregnant women and its sequel on the maternal and fetal outcomes.

Mandatory regular periodically scheduled educational programs must be planned for nurses with different educational levels to enhance their knowledge regarding trichomoniasis and others nosocomial parasitosis.

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References

- Abdel-Magied, AA, El-Kholya, EI, Abou EIKhair, SM, Abdelmegeed, ES, Hamoudaa, MM, et al, 2017:** The genetic diversity of metronidazole susceptibility in *Trichomonas vaginalis* clinical isolates in an Egyptian population. *Parasitol. Res.* 116, 11:3125-30.
- Al-Agroudi, MA, Megahed, LA, Ibrahim, AM A, Abdallah, EM, Morsy, TA, 2017:** An educational program on re-emerging malaria for nursing staff in a Military Fever Hospital. *JESP* 47, 3:665-72
- Amrin, SS, Lakshmi, GJ, 2021:** Vaginal discharge: The diagnostic enigma. *Indian J. Sex Transm. Dis AIDS* 42, 1:38-45.
- Anderson, M, Klink, K, Cohrsen, A, 2004:** Evaluation of vaginal complaints. *JAMA* 291: 1368-72.
- Bremer, V, Haar, K, Gasowski, M, Hamouda, O, Nielsen, S, et al, 2016:** STI tests and proportion of positive tests in female sex workers attending local public health departments in Germany in 2010/11. *BMC Publ. Hlth.* Nov 21;16 (1):1175. doi: 10.1186/s12889-016-3847-6.
- CDC, 2015:** STD Treatment Guidelines Trichomoniasis. *MMWR. Recomm. Rep. Fact Sheet.*
- CDC, 2017:** Trichomoniasis Treatment and Care. *MMWR Recomm. Rep.* 66(RR-11):1-15.
- CDC, 2022:** Trichomoniasis: CDC Basic Fact Sheet. <https://www.cdc.gov/std>
- Chur-Hansen A, 2002:** Preferences for female and male nurses: the role of age, gender and previous experience-year 2000 compared with 1984. *J. Adv. Nurs.* 37, 2:192-8.
- de Waaij, DJ, Dubbink, JH, Ouburg, S, Peters, RP, Morr e, SA, 2017:** Prevalence of *Trichomonas vaginalis* infection and protozoan load in South African women: A cross-sectional study. *BMJ Open.* 2017 Oct 8;7 (10): e016959. doi: 10.1136/bmjopen-2017-016959.
- Dessi, D, Margarita, V, Cocco, AR, Marongiu, A, Fiori, PL, et al, 2019:** *Trichomonas vaginalis* and *Mycoplasma hominis*: New tales of two old friends. *Parasitology* 146, 9:1150-5.
- El-Gayar, EK, Mokhtar, AB, Awad, SI, Soliman, RH, Hassan, WA, 2016:** The endosymbiotic relationship between *Trichomonas vaginalis* and *Mycoplasma hominis* in Egyptian women, & its correlation with pathogenicity. *PUJ* 9:80-6.
- El-Moamly, AM, Rashad, SM, 2008:** *T. vaginalis* antigens in vaginal and urine specimens by immunochromatography, compared to culture & microscopy. *J. Egypt. Soc. Parasitol.* 38, 2:-573-84.
- El-Okbi, LM, Arafa, M, Salama, MS, Abou-El-Seoud, SM, Mohamad, AA, et al, 2004:** Growth patterns and antigenic analysis of Egyptian *Trichomonas vaginalis* isolates. *J. Egypt. Soc. Parasitol.* 34, 3:841-55
- El-Sherbini, GH, Ibrahim, KM, El Sherbiny, ET, Abdel-Hady, NM, Morsy, TA, 2010:** Efficacy of *Punica granatum* extract on in-vitro and in-vivo control of *Trichomonas vaginalis*. *J. Egypt. Soc. Parasitol.* 40, 1:229-44.
- El-Sherbini, GTM, El Gozamy, BR, Abdel-Hady, NM, Morsy, TA, 2009:** Efficacy of two plants extracts against vaginal trichomoniasis. *J. Egypt. Soc. Parasitol.* 39, 1:47-58.
- El Sibaei, MM, Abdel-Fattah, NS, Ahmed, S A, Abou-Seri, HM, 2012:** Growth kinetics, antigen profiling, and proteinase activity of Egyptian *Trichomonas tenax* isolates derived from patients having oral infections. *Exp. Parasitol.* 130, 4:416-22.
- Elwakil, HS, Tawfik, RA, Alam-Eldin, YH, Nassar, DA, 2017:** The effect of iron on metronidazole activity against *Trichomonas vaginalis* in vitro. *Exp. Parasitol.* 182:34-6.
- Fagerberg, I, 2004:** Registered nurses' work experiences: Personal accounts integrated with professional identity. *J. Adv. Nurs.* 46, 3:284-91.
- Forna, F, G lmezoglu, AM, 2003:** Interventions for treating trichomoniasis in women. *Cochrane Database Syst. Rev.:*CD000218.
- Ghallab, MMI, Alaa, D, Morsy, SM, 2021:** Multiattribute Analysis of *Trichomonas vaginalis* diagnostics and its correlation with clinical complaints and contraceptive methods in a symptomatic Egyptian Cohort. *Infect. Dis. Obstet. Gynecol.* c2021; Online April 2021: 5525095. Doi: 10.1155/2021/5525095
- Ginocchio, CC, Chapin, K, Smith, JS, et al, 2012:** Prevalence of *Trichomonas vaginalis* and coinfection with *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in the United States as determined by Aptima *Trichomonas vaginalis* nucleic acid amplification assay. *J. Clin. Microbiol.* 50:2601-6.
- Gookin, JL, Hanrahan, K, Levy, MG, 2017:** The conundrum of feline trichomonosis. *J. Feline Med. Surg.* 19, 3:261-74.
- Hamdy, DA, Hamdy, HG, 2018:** Prevalence,

- sociodemographic factors and clinical criteria of *Trichomonas vaginalis* infection among symptomatic women in Beni-Suef Governorate, Egypt. JESP 48, 1:139-44.
- Hawash, YA, Ismail, KA, Jaafer, NF, Ahmed, G, Alpakistany, TA, et al, 2022:** Prevalence & risk factors for *Trichomonas vaginalis* infection among women: A population-based controlled study in Saudi Arabia. Clin. Lab. Jun 1; 68(6); doi:10.7754/Clin.Lab.2021.210913
- Hegazy, AR, El Kersh, WM, Moharm, IM, Ammar, AI, Hemida, AS, et al, 2020:** Immunological and cytopathological assessment of *Trichomonas vaginalis* infection in asymptomatic and symptomatic females at Menoufia Governorate, Egypt. Int. J. Curr. Microbiol. App. Sci. 9, 4:686-705.
- Hernández-Buelvas, L, Camargo, M, Sánchez, R, Patarroyo, ME, Patarroyo, MA, 2021:** *Trichomonas vaginalis* follow-up and persistence in Colombian women. Sci. Rep. Nov 19; 11(1):22597. doi: 10.1038/s41598-021-02135-z.
- Hersh, SM, 1985:** Pulmonary trichomoniasis and *Trichomonas tenax*. J. Med. Microbiol. 20, 1:1-10.
- Hussein, AH, Saleh, MH, Nagaty, IM, Ghieth, KA, El-Azab, NA, 2015:** Prevalence, clinical criteria and sociodemographic predictors of *Trichomonas vaginalis* infection in suspected Egyptian women, using direct diagnostic techniques. Iran. J. Parasitol. 10, 3:432-40
- Kamal, AM, Ahmed, AK, Mowafy, NME, Shawki, HE, Sanad, AS, et al, 2018:** Incidence of antenatal trichomoniasis and evaluation of its role as a cause of preterm birth in pregnant women referring to Minia University Hospital, Egypt. Iran. J. Parasitol. 13, 1:58-66.
- Kassem, HH, Majoud, OA, 2006:** Trichomoniasis among women with vaginal discharge in Benghazi City, Libya. J. Egypt. Soc. Parasitol. 36, 3:1007-16.
- Keşli, R, Pektaş, B, Ozdemir, M, Günenc, O, Coşkun, E, et al, 2012:** Microscopic examination of vaginal discharge specimens for *Trichomonas vaginalis* and other micro-organisms in 18-45 age group women. Turk. Parazitol. Derg. 36, 3:182-4.
- Kirkcaldy, RD, Augostini, P, Asbel, LE, et al, 2012:** *Trichomonas vaginalis* antimicrobial drug resistance in 6 US cities, STD Surveillance Network, 2009-2010. Emerg. Infect. Dis. 18:939-42.
- Klebanoff, M, Carey, C, Hauth, J, Hillier, S, Nugent, R, et al, 2001:** Failure of metronidazole to prevent preterm delivery among pregnant women with asymptomatic *Trichomonas vaginalis* infection. N. Engl. J. Med. 345, 7:487-93.
- Madhivanan, P, Bartman, M, Pasutti, L, Krupp, K, Arun, A, et al, 2009:** Prevalence of *Trichomonas vaginalis* infection among young reproductive age women in India: Implications for treatment and prevention. Sex Hlth. 6, 4:339-44.
- Mahmoud, A, Sherif, NA, Abdella, R, El-Genedy, AR, El Kateb, AY, et al, 2015:** Prevalence of *Trichomonas vaginalis* infection among Egyptian women using culture and Latex agglutination: Cross-sectional study. BMC Women Hlth. 15:7. doi:10.1186/s12905-015-0169-2.
- Masha, SC, Cools, P, Descheemaeker, P, Reynders, M, Sanders, EJ, et al, 2018:** Urogenital pathogens, associated with *Trichomonas vaginalis*, among pregnant women in Kilifi, Kenya: A nested case-control study. BMC Infect Dis. Nov 6;18(1):549. doi: 10.1186/s12879-018-3455-4.
- Morsy, TA, Hosni, MA, El Masry, G, 1984:** Clinical and laboratory studies on vaginal trichomoniasis in Egypt. J. Egypt. Soc. Parasitol. 14, 2:329-34.
- Negm, AY, el-Haleem, DA, 2004:** Detection of trichomoniasis in vaginal specimens by both conventional and modern molecular tools. J. Egypt. Soc. Parasitol.34, 2:589-600.
- Nikki, K, Campos, JD, 2010:** The legalities of nursing documentation. J. Men Nurs. 40, 1:7-9
- Ondrak, JD, 2016:** *Tritrichomonas foetus*: Prevention and control in cattle. Vet. Clin. North Am. Food Anim. Pract. 32, 2:411-23.
- Op de Coul, ELM, Peek, D, van Weert, YW M, Morré, SA, Rours, I, et al, 2021:** *Chlamydia trachomatis*, *Neisseria gonorrhoea*, and *Trichomonas vaginalis* infections among pregnant women and male partners in Dutch midwifery practices: Prevalence, risk factors, and perinatal outcomes. Reprod. Hlth. Jun 26; 18(1):132. doi: 10.1186/s12978-021-01179-8
- Peterman, T, Tian, L, Metcalf, C, et al, 2006:** High incidence of new sexually transmitted infections in the year following a sexually transmitted infection: A case for rescreening. Ann. Intern. Med. 145: 564-72.
- Rabiee, S, Fallah, M, Zahabi, F, 2010:** Frequency of trichomoniasis in patients admitted to outpatient clinics in Hamadan (2007) and relationship between clinical diagnosis and laboratory findings. J. Res. Hlth. Sci. 10, 1:31-5.
- Rajabpour, M, Emamie, AD, Pourmand, MR, Goodarzi, NN, Asbagh, FA, et al, 2020:** *Chlam*

- Chlamydia trachomatis*, *Neisseria gonorrhoeae*, and *Trichomonas vaginalis* among women with genitourinary infection and pregnancy-related complications in Tehran: A cross-sectional study. *Int. J. STD AIDS* 31, 8:773-80.
- Rowley, J, Hoorn, S, Korenromp, E, et al, 2019:** *Chlamydia*, gonorrhea, trichomoniasis and syphilis: Global prevalence and incidence estimates, 2016. *Bull. WHO* 97, 8:P548-62.
- Saleh, NE, Alhusseiny, SM, El-Zayady, WM, Aboelnaga, EM, ElBeshbishi, WN, et al, 2021:** *Trichomonas vaginalis* serostatus and prostate cancer risk in Egypt: A case-control study. *Parasitol. Res.* 120, 4:1379-88
- Sallam, TA, Megahed, LA, Ibrahim, SM, Morsy, TA, 2021:** An overview on *Trichomonas vaginalis* with reference to Egypt. *JESP* 51, 2: 26780.
- Salman, ST, Hussein, AA, Doc, P, 2017:** Contraception as a risk factor of *Trichomonas vaginalis* infection among women attending outpatient of Al-Batool Teaching Hospital for Maternity and Children-Baqubah-Iraq. *Al-Kindy Coll. Med. J.* 13, 1:20-6.
- Sayed el-Ahl, SA, el-Wakil, HS, Kamel, NM, Mahmoud, MS, 2002:** A preliminary study on the relationship between *Trichomonas vaginalis* and cervical cancer in Egyptian women. *J. Egypt. Soc. Parasitol.* 32, 1:16778.
- Selim, MA, Fawzy, EM, Abd El-Rahman, E M, Abdel Hady, RS, Badr, MS, et al, 2020:** Evaluation of the effect of some medicinal plants on cultured *Trichomonas vaginalis*. *J. Infect. Dev. Ctries.* 14, 7:793-9
- Seña, AC, Miller, WC, Hobbs, MM, et al, 2007:** *Trichomonas vaginalis* infection in male sexual partners: Implications for diagnosis, treatment, and prevention. *Clin. Infect. Dis.* 44:13-8.
- Shui, IM, Kolb, S, Hanson, C, Sutcliffe, S, Rider, JR, et al, 2016:** *Trichomonas vaginalis* infection and risk of advanced prostate cancer. *Prostate* 76, 7:620-3.
- Sobel, JD, Nyirjesy, P, Brown, W, 2001:** Tinidazole therapy for metronidazole-resistant vaginal trichomoniasis. *Clin. Infect. Dis.* 33:1341-4.
- Szczepaniak, K, Łojczyk, SA, Tomczuk, K, Skrzypek, T, Lisiak, B, et al, 2016:** Canine *Trichomonas tenax* mandibular gland infestation. *Acta Vet. Scand.* Feb 18; 58:15-20.
- Tamer, GS, Ozcan, SK, Yücesoy, SG, Gacar, G, 2009:** The relation between trichomoniasis and contraceptive methods. *Turk. Parazitol. Derg.* 33, 4:266-9.
- Tawfeek, GM, Oteifa, NM, el-Gozy, BR, 2003:** Evaluation of an IgG cystatin capture enzyme-linked immunosorbent assay for the detection of anti-cysteine proteinase antibodies in asymptomatic trichomoniasis patients. *J. Egypt. Soc. Parasitol.* 33, 1:67-83.
- Tchankoni, MK, Bitty, AM, Sadio, AJ, Gbesor-Komlanvi, FA, Ferré, VM, et al, 2021:** Prevalence and factors associated with *Trichomonas vaginalis* infection among female sex workers in Togo, 2017. *BMC Infect Dis.* Aug 9;21 (1): 775. doi: 10.1186/s12879-021-06432-w.
- Tidwell, BH, Lushbaugh, WB, Laughlin, MD, et al, 1994:** A double-blind placebo-controlled trial of single-dose intravaginal versus single dose oral metronidazole in the treatment of Trichomonal vaginitis. *J. Infect. Dis.* 170:242-8.
- Wangnapi, R, Soso, S, Unger, H, Sawera, C, Ome, M, et al, 2015:** Prevalence and risk factors for *Chlamydia trachomatis*, *Neisseria gonorrhoeae* and *Trichomonas vaginalis* infection in pregnant women in Papua New Guinea. *Sex Transm. Infect.* 91, 3:194-200.
- Tine, RC, Sylla, K, Ka, R, Dia, L, Sow, D, et al, 2019:** A Study of *Trichomonas vaginalis* infection and correlates in women with vaginal discharge referred at Fann Teaching Hospital in Senegal. *J. Parasitol. Res.* Apr 1; 2019:2069672. doi: 10.1155/2019/2069672
- WHO, 2012:** Global Incidence and Prevalence of Selected Curable Sexually Transmitted Infections: 2008. Geneva, Switzerland.
- Xu, S, Wang, Z, Zhou, H, Fu, Y, Feng, M, et al, 2021:** High co-infection rate of *Trichomonas vaginalis* and *Candidatus M. girerdii* in Gansu Province, China Healthcare (Basel). Jun 10; 9(6) :706. doi: 10.3390/ healthcare 9060706.

Explanation of figures

Fig. 1: Nurses ages, majority (63.5%) 20-<30 years.

Fig. 2: Female nurses (76.2 %).

Fig. 3: Nurses Working Unit (54%) in operating room.

Fig. 4: Nurses qualifications (55.6%) Technical Nursing Institute.

Fig. 5: Nurses experience (39.7%) 5-<10 years.

Fig. 6: Nurses' satisfactory about *T. vaginalis* (pre & post program).

Fig. 7: Nurses' score knowledge on *T. vaginalis* (pre & post program).

Fig. 8: Life cycle of *Trichomonas vaginalis*.

