

Vaginal Infections

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Vaginal infection is defined as vaginal microbiota dysbiosis where one or more microbes are dominant to the other microbes present in the vagina. The symptoms of vaginal infection include abnormal vaginal discharge, burning sensation, itching, irritation, and discomfort. Nevertheless, some women with vaginal infection present with fewer symptoms whereas some cases were found to be asymptomatic.

Keywords: vagina ; microbial infection ; insitu gets

1. Introduction

Vaginal infection is a global health issue commonly seen in women at reproductive age. It generally includes bacterial vaginosis (BV), vulvovaginal candidiasis (VVC), and trichomoniasis^{[1][2]}. In 2019, BV was the most prevalent vaginal infection and it was estimated to affect 5% to 70% of the women worldwide^[3]. Studies in 2018 stated that there were around 30% of women aged 14 to 49 were affected in the US^{[4][5]}. The data also mentioned that women who began to engage in sexual intercourse activity at a young age, are commercial sex workers, are unmarried, or had multiple sex partners are more prone to BV^[3]. In a healthy vagina, *Lactobacillus* sp. is present predominantly and it is responsible for producing lactic acid through hydrogen peroxide production in order to maintain the acidity of the vagina. This acidic environment protects the vagina by suppressing the growth of other microorganisms. BV has occurred when the *Lactobacillus* sp. is replaced by other vaginal flora such as *Staphylococcus* sp., *Peptostreptococcus* sp., *Gardnerella vaginalis*, *Mycoplasma hominis*, and the Enterobacteriaceae^[6]. The prevalence of vaginal infections varies based on different demographic parameters. A study in Ethiopia showed a contrary result where candidiasis instead of BV was the most common vaginal infection followed by trichomoniasis. Candidiasis is mostly caused by *Candida* sp. whereas *Trichomonas vaginalis* infection causes trichomoniasis. This study also found that the prevalence of vaginal infections was comparatively higher in non-pregnant women than pregnant women. Moreover, they found that women at the age of 40 and above were more susceptible to BV due to the reduction of oestrogen thus altering the living environment of the *Lactobacillus* sp. ^{[1][1]}. Although vaginal infection may be asymptomatic or present with mild symptoms, the untreated vaginal infection can result in severe gynaecologic and obstetric complications. It also greatly increases the risk of acquiring sexually transmitted infections (STIs) such as acquired immunodeficiency syndrome (AIDS)^[6].

2. Type and Treatment

Vaginal infections have been recognised as a global reproductive health issue that has affected a high number of women at reproductive age. Most of the reported cases are of microbial origin such as pathogenic bacteria, parasites, fungi, or viruses. These vaginal infections are associated with several discomfort and complications that reduce the self-esteem and quality of life of the women. The common types of infection include BV, VVC, trichomoniasis, human immunodeficiency virus (HIV) infection and human papillomavirus (HPV) infection^[7].

BV is characterised by an overgrowth of anaerobic and microaerophilic bacteria, including *Gardnerella vaginalis*, *Atopobium vaginae*, *Bacteroides* spp., etc.^{[8][9][10]}. Being the most prevalent form of vaginitis, BV shows a high global prevalence, ranging from 23% to 29% across regions^[11]. Risk factors for developing BV include douching, sexual intercourse, and poor personal hygiene. Furthermore, BV can be symptomatic or asymptomatic. Infected women usually show symptoms such as thin white vaginal discharge with fishy odour, itchiness, and irritation^{[8][9][12]}. Patients are exposed to complications such as adverse obstetric outcomes and risk of acquiring STIs^{[9][10][13]}. Generally, BV is diagnosed using the Nugent criteria, Amsel criteria, or Hay-Ison criteria^{[9][13]}. The recommended antimicrobial formulations are oral metronidazole, oral clindamycin, oral tinidazole, metronidazole gel, clindamycin cream and clindamycin ovules^{[14][15][16][17]}.

VVC is a fungal infection caused primarily by *Candida albicans*. It is estimated that nearly 75% of women will experience at least one episode of VVC in their lifetime^{[18][19][20]}. The high occurrence has been related to a patient's sexual and hygienic habits, the use of hormones and antibiotics, pregnancy, and immunosuppression. Symptoms of VVC include abnormal vaginal discharge, dysuria, dyspareunia, and vaginal soreness^{[18][21]}. Moreover, the management of VVC is mainly indicated for women with symptomatic infection. Most of the patients respond favourably to oral and topical azole therapies such as fluconazole, clotrimazole, miconazole, tioconazole, butoconazole and terconazole^{[19][21][22][23]}.

Trichomoniasis is caused by a protozoan parasite, *Trichomonas vaginalis*. It is a widespread non-viral STI that affected around 5.3% of women worldwide in 2016, with the majority of the cases being asymptomatic^{[24][25]}. In symptomatic cases, patients may present with yellow-green vaginal discharge, lower abdominal pain, dysuria, and vulvar irritation^{[7][24]}. The infection has been associated with infertility, poor pregnancy outcomes and STIs acquisition^{[7][24][26]}. The mainstay treatment for trichomoniasis is oral metronidazole and tinidazole. Topical formulations are not recommended as they are often insufficient for complete disease eradication, resulting in lower cure rates as compared to the oral formulations^{[27][28]}.

HIV infection is one of the commonest viral STIs. It is estimated that approximately 38 million people were living with HIV at the end of 2019^[29]. Populations who are at elevated risk of infection are intravenous drug users, sex workers, transgender people and men who have sex with men^{[29][30]}. HIV-infected patients usually develop symptoms such as fever, myalgias, and swollen lymph nodes. Additionally, the infection contributes to complications such as liver dysfunction, tuberculosis, and AIDS^{[30][31][32][33]}. In Malaysia, the available antiretroviral drugs are: (1) nucleoside or nucleotide reverse transcriptase inhibitors (e.g., tenofovir); (2) non-nucleoside reverse transcriptase inhibitors (e.g., nevirapine); (3) protease inhibitors (e.g., ritonavir); (4) integrase inhibitors (e.g., raltegravir); (5) CCR5 antagonist (e.g., maraviroc), and (6) fusion inhibitors (e.g., enfuvirtide)^[34].

HPV infection among the vaginal conditions is another common form of viral invasion that resulted in nearly 84% of new cases worldwide in 2018^[35]. Invasion of HPV occurs in the cervical squamous epithelium, particularly the basal layer. The viral particles are retained in the form of episomes in the basal layer, where numbers of virions are increased through the differentiation of epithelial cells^[31]. As the initial response to the acute infection of HPV is mediated by the antimicrobial peptide producing epithelial cells and mucosal natural killer cells, the majority of patients experience mild symptoms during the initial stage of HPV infection such as the development of genital warts. However, infection of high-risk HPV can escape the adaptive and innate immune system of the body. The long-lasting infection causes patients to be vulnerable to implications, including cervical cancer, vaginal cancer and oropharyngeal cancer^{[31][36]}. According to the World Health Organisation (WHO), vaccination is the most effective approach in cervical cancer prevention. Cryotherapy is suggested in the management of precancerous lesions^{[37][38]}.

Despite the availability of treatment, persistent or recurrent infection remains the greatest challenge of vaginal infections^{[13][20][34][39][40]}. This reflects a possibility of treatment failure or reinfection which may be due to the following factors: (1) the presence of antimicrobial-resistant strains; (2) sharing common clinical presentations with other form of vaginitis, leading to misdiagnosis, or (3) poor patient adherence resulting from the limitations of available formulations^{[9][39][41][42][43][44][45][46][47]}. All information has been summarised in Table 1.

Table 1. Type, symptoms, underlying causes, risk factors, diagnosis and treatment of vaginal infections.

Type of Vaginal Infections	Causes	Risk Factors	Symptoms	Diagnosis	Treatment
Bacterial vaginosis (BV)	Caused by overgrowth of anaerobic and microaerophilic bacteria such as <i>Gardnerella vaginalis</i> , <i>Atopobium vaginae</i> , <i>Bacteroides</i> spp., etc.	Douching, sexual intercourse, and poor personal hygiene	Vaginal discharge with fishy odour, itchiness, and irritation	Nugent criteria, Amsel criteria, or Hay–Ison criteria	Oral metronidazole, oral clindamycin, oral tinidazole, metronidazole gel, clindamycin cream and clindamycin ovules

Vulvovaginal candidiasis (VVC)	Caused primarily by <i>Candida albicans</i>	Patient's sexual and hygienic habits, the use of hormones and antibiotics, pregnancy, and immunosuppression	Abnormal vaginal discharge, dysuria, dyspareunia, and vaginal soreness	Positive wet-mount method, microscopic examination of vaginal swab culture, vaginal yeast count	Oral and topical azole therapies such as fluconazole, clotrimazole, miconazole, tioconazole, butoconazole and terconazole
Trichomoniasis	<i>Trichomonas vaginalis</i>	Infertility, poor pregnancy outcomes and sexually transmitted infections (STIs) acquisition	Yellow-green vaginal discharge, lower abdominal pain, dysuria, and vulvar irritation	Microscopic examination of vaginal fluid smear	Oral metronidazole and tinidazole, along with this topical formulation for metronidazole
Human immunodeficiency virus (HIV) infection	Human immunodeficiency virus	Risk of infection are associated with intravenous drug users, sex workers, transgender people, and, gay	Fever, myalgias, and swollen lymph nodes. Additionally liver dysfunction, tuberculosis, and acquired immunodeficiency syndrome (AIDS)	Detection of antibody	Antiretroviral drugs such as tenofovir, nevirapine, ritonavir, enfuvirtide, maraviroc etc.
Human papillomavirus (HPV) infection	Human papillomavirus	lower socioeconomic status, oral contraceptive use, history of multiple sexual partners, high parity, immunosuppression	Genital warts	Pap smear, biopsy	Prophylaxis by vaccine, treatment of wart by Salicylic acid, Trichloroacetic acid etc.

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