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Research Article

Vaginal Discharge: Common Causes and Management in Women of Reproductive and Prepubertal Girls in a Primary Care Setting - A Narrative Review

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Abstract

Apart from the physiological form of vaginal discharge (VD), the early detection of pathological VD is important to prevent complications of the underlying diseases which can severely compromise a women's health, fertility, ectopic pregnancy, cervical malignancy, pelvic inflammatory disease (PID) and vertical transmission of disease to the neonate are perhaps the most common clinical scenarios which are required to manage immediately. Partner notification and treatment is an essential part of the management. They may present to a number of different services, including primary care, family planning, genitourinary medicine and gynaecology. Many women express embarrassment, anxiety and taboo to complain in disclosing their problem, leading to self-management, home remedies and purchase of over the counter (OTC) prescriptions, without realizing the inability to differentiate between the normal physiological and pathological VD.

A thorough history, examination and investigations are needed to arrive at a diagnosis and formulation of the management plan. Sexual history should be taken in a sensitive manner to discuss regarding full sexually transmitted infection (STI) screening and other tests should be tailored appropriately to those at high risk. The prevalence of STI has risen in the United Kingdom since the 1990s. Hence, gynaecologists are required to be extra vigilant in the diagnosis and subsequent management of the sequelae.

The three main causes of VD in reproductive aged women are: bacterial vaginosis (BV), vulvovaginal candidiasis (VVC) and trichomonas vaginalis (TV). Discharge of cervical origin is the other important cause of VD with *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG), *Mycoplasma genitalium* (MG) and primary genital herpes simplex can also manifest as VD. These are the most common pathogens isolated. Cervicitis should be suspected in women with purulent endocervical discharge with easily inducing cervical bleeding. To detect specific pathogens causing cervicitis, laboratory testing is essential to identify the organisms involved.

Keywords: *Vulvovaginal candidiasis; Trichomonas vaginalis; Bacterial vaginosis;* Inflammatory Vaginitis; *Neisseria gonorrhoeae; Chlamydia trachomatis*; Pelvic Inflammatory Disease

Introduction

Vaginal discharge (VD) is a common presenting symptom in women of all age groups including children, attending primary care settings, genitourinary medicine, family planning or gynaecology clinics. An appropriate understanding of the normal physiological vaginal discharge and an abnormal discharge is pertinent in terms of effective management.

The normal physiological discharge changes with the phase of the menstrual cycle. The character of the discharge tends to be

clearer with a stretchable consistency at the time of ovulation in midcycle. Thereafter, it is thicker and slightly yellowish in the luteal phase. Normal physiological discharge is not associated with vulval itch, soreness, dysuria and swelling [1]. VD can increase during higher estrogen states, such as ovulation, the luteal phase, puberty and pregnancy. It also increases with estrogen-based therapies such as combined oral contraception and hormone replacement therapies. Many women express embarrassment, anxiety, leading to self-management, home remedies and purchase of over the counter (OTC) prescriptions [2].

Abnormal VD is characterized by a change in colour, consistency, volume or odour and maybe associated with symptoms such as vulval itch, soreness, erythematous, oedematous, discomfort, dysuria, pelvic pain, intermenstrual or post-coital bleeding. The enumerated symptoms are commonly caused by an infection. Almost 70% of all causes are associated with bacterial vaginosis (BV), VVC or TV [3]. Cervicitis is another important cause of VD caused by CT, NG and MG. Cervicitis is suspected in sexually active women found to have purulent endocervical discharge which bleeds on touching [4]. The STIs-chlamydia, gonorrhoea and trichomoniasis can also cause VD and diagnosis requires appropriate laboratory tests to be performed. Partner notification and treatment is an important component of holistic management.

Non-infectious causes: include atrophic vaginitis [1], contact dermatitis due to application of irritants, forgotten tampons, ring pessaries, condoms, douching, cervical polyps, fistulae and genital tract tumours viz, vulva, vagina, cervix, endometrium and fallopian tubes [1]. Inspection involves external inspection of the vulva and perineum. This is followed by inspection of the cervix (visualization) and vaginal mucosa with the aid of Cusco's bivalve speculum. Bimanual examination helps to reveal the size, position, mobility and presence of adnexal masses. High vaginal swabs may help in the diagnosis of any pathogen responsible for the VD.

The patient might be having the feelings of shame, guilt and they are embarrassed about her symptoms, the primary care physician must be as tactful and sensitive to this "culture of silence" as seen from studies conducted in Asia [5]. Primary health care providers can play a major role in health education for women in reproductive age group with relation to physiological and pathological vaginal discharge with provision of an environment of respect, privacy and confidentiality [6-8]. The sexual history is extremely important to identify risk factors for STIs and may have to refer the case to the genitourinary physician for further evaluation and management, more so in patients with risk factors. According to World Health Organization (WHO), early detection of cervical cancer has failed due to lack of priority for women's sexual and reproductive health, attitudes, misconceptions and beliefs that prohibit patients and health care professionals discussing the diseases of the genital tract [9].

Materials and Methods

A review of the published literature on the prevalence and study of the causative organisms of vaginal discharge in women of reproductive and prepubertal age groups was performed using online databases such as MEDLINE, Google Scholar and EBSCOhost. The articles were selected through titles, keywords and abstracts by the second and third authors. The terms used are vulvovaginal candidiasis, trichomoniasis, bacterial vaginosis, inflammatory vaginitis, Neisseria gonorrhoeae, chlamydia trachomatis, pelvic inflammatory disease and treatment.

The results of the search were completed by tracing references from the individual articles. The search was limited to articles published in English and original research manuscripts. Study designs selected for this paper were descriptive cross sectional, qualitative studies and reviews. Data extraction of the studies was compiled and the available titles and abstracts were identified in the different database searches and the selected articles.

Fifty eligible studies were selected based on inclusion and exclusion criteria. They were from Singapore, UK, USA, Nepal, Sri Lanka, India, Iran, Kenya, Republic of China, Switzerland, Australia, Pakistan, Punjab, Peru and Zimbabwe.

Results

Abnormal VD is commonly caused by infection, 70% of all causes are associated with bacterial vaginosis (BV) followed by VVC and TV [10]. BV is the most common and accounts for up to 50% of all infections. Tables I and II summarises the clinical features and the management of these common organisms.

Cervicitis is another feature of VD with *Chlamydia trachomatis and Neisseria gonorrhoeae* pathogens. Cervicitis is suspected in

sexually active women presenting with mucopurulent endocervical discharge and induce cervical bleeding easily [11]. Gonorrhoea is the second most common pathogen causing PID and Fitz-Hugh-Curtis syndrome.

Clinical features with the three common causes of vaginal discharge

A sound menstrual history is pivotal (Table 1) inclusive of her last menstrual period, character of the vaginal discharge, associated symptoms, sexual, medical and drug history particularly recent antibiotics taken and contraceptive usage.

Other important data such as possibility of a foreign body in situ, any recent surgery or instrumentation in the genital area recently. Facilitate a vaginal and speculum examination to visualize the status of the cervix and vaginal mucosa unless the patient is a Virgo intacta. Any history of fever, abdominal pain and pelvic examination reveals abdominal tenderness, mucopurulent discharge and positive cervical excitation test points to upper genital tract pathology.

As most primary care settings have an in-house microscope which can be utilized for wet mounts or saline preparation (wet smear microscopy) or the vaginal discharge specimen sent to outside laboratory. Vaginal secretions obtained from the lateral vaginal walls using a swab and applied to narrow-range pH paper (pH determination). Vaginal pH < 4.5 is suggestive of VVC and pH > 4.5 is suggestive of BV or TV.

Feature	Bacterial vaginosis	Trichomoniasis	Vulvovaginal candidiasis
Symptoms	Thin discharge, bubbly Fishy odour No discomfort or itch	Scanty to profuse or frothy yellow-greenish discharge, Vulval itch, dyspareunia, dysuria, discomfort	Thick white discharge Non offensive odour, vulval itch, dyspareunia, dysuria, discomfort
Signs	No inflammation of vulva	Vulvitis and vaginitis; strawberry cervix	Vulval erythema, oedema, fissuring, satellite lesion
Vaginal pH	>4.5	>4.5	<4.5
Microscopy findings	Presence of “Clue” cells	Motile trichomonads	Yeast and pseudohyphae
Need for testing for other STIs	Consider in women with risk factors for STIs Aged<25 years New sexual partner in the last 3 months No usage of condoms Symptoms or STI in sexual partner	Yes, Trichomoniasis is associated with 2-3 times increased risk of HIV and other STI testing should be performed.	No
Need for retesting	No	Yes, Retesting is recommended in sexually active women. Retesting can be performed as soon as 28 days post treatment to within 3 months	No
Need to treat sexual partner	No	Yes	No

Table 1: Clinical features associated with the three most common causes of vaginal discharge.

Adapted from: Practice Integration and Lifestyle Learning: Singapore Med J 2020.

Study	Year	BV %	Candida %	TV %
Verma A., *et al*. (India)	2012	29.2	21.6	3.0
Fang, Zou, Yang [10] (China)	2007	6.6	3.9	2.9
Sihavang., *et al*. [11] (Laos)	2007	24.5	30.5	3.7
Bhalla., *et al*. [5] (India)	2007	12.8	-	-
Oliveira., *et al*. [12] (Brazil)	2007	20.0	12.5	4.1
Jindal., *et al*. [7] (India)	2007	-	23.4	-
Shobeiri., *et al*. (Iran)	2006	28.5	17.2	18.1
Demba., *et al*. (Gambia)	2005	47.6	-	-
Braham., *et al*. (Iran)	2006	16.2	4.8	6.6
Haytham., *et al*.	1999	-	21.5	15.5
Jumbo., *et al*.	2004	-	29.1	-

Table 2: Incidence of BV, Candida and TV in various countries.

Source: Int J Reprod Contracept Obstet Gynecol 2013 Sept; 2(3):349-354.

In various studies (Table 2), conducted by [13] Fang, Zou and Yang (2007) in Shandong province in China, the prevalence of BV, TV and candidiasis were 6.6, 2.9 and 3.9% respectively. In another study in Hamedan province in Iran conducted by Shobeiri., *et al*. (2006), the prevalence of candidiasis, trichomoniasis and BV were 17.2, 18.1 and 28.5% respectively. [12] Oleveira., *et al.* (2007) in rural areas of Northern Brazil, found 20% of women had BV, 4.1% trichomoniasis and 12.5% candidiasis respectively. [14], found BV diagnosed in 32.8% patients. Highest prevalence was noted in urban slum 38.6% followed by rural 28.8% and urban middle- class community 25.4%. All women with vaginal trichomoniasis were found to have BV, whilst 50% patients had syphilis.

From these different studies conducted in rural slums and urban areas, it can be concluded that BV and candidiasis are the common causes of infective vaginal discharges than trichomoniasis. PID is associated with pathogen positivity as well as BV. About 50% of patients presenting with vaginal discharge are not positive for any pathogen, hence antibiotic therapy should be administered cautiously based on colour, consistency, odour and the amount of discharge and presence of urogenital symptoms and microbial diagnosis whenever possible. Routine microbiological diagnosis, is recommended and treatment is given according to the pathogen isolated.

Treatment	Bacterial vaginosis	Trichomoniasis	Vulvovaginal candidiasis
Recommended regimen	Metronidazole 400 mg orally BD for 7 days Treatment of sexual partners is not recommended	Metronidazole 2 g orally, single dose or tinidazole 2 g orally dose Treat sexual partner	Intravaginal agent: Clotrimazole 100 mg pessary intravaginally daily for 6 days or oral agent: fluconazole 150 mg orally in a single dose Treatment of sexual partner is not recommended
Alternative regimen	Clindamycin 300 mg orally BD for 7 days or tinidazole 3 gm orally once daily for 2 days or tinidazole 1 g orally once daily for 5 days	Metronidazole 400 mg orally BD for 7 days	_

Pregnancy	Metronidazole 400 mg orally BD for 7 days or clindamycin 300 mg orally BD for 7 days	Metronidazole 2 g orally single dose at any stage of pregnancy or metronidazole and nystatin (flagystatin) vaginal pessary every night for 10 nights	Clotrimazole 100 mg pessary intra-vaginally daily for 6 days
Recurrent Infection	First recurrence: retrial of same regimen or trial of an alternative regimen. Multiple recurrences: monthly oral metronidazole 2 g administered with oral fluconazole 150 mg	Differentiate chronic infection from reinfection. If metronidazole 2 g single dose fails, trial of metronidazole 400 mg BD for 7 days also fails, trial of metronidazole or tinidazole 2 g daily for 7 days If the above regimens fail, consider susceptibility testing for metronidazole-resistant trichomoniasis	To achieve mycologic score: topical azole therapy for 7-14 days or fluconazole 150 mg orally every third day for three doses (Days 1,4 and 7). Nystatin pessaries 100,000 units intravaginally for 12-14 nights. Amphotericin B vaginal pessaries 50 mg daily for 14 days For maintenance oral fluconazole (100 mg, 150 mg or 200 mg weekly for 6 months: consider topical treatment intermittently if oral is not feasible.

Table 3: Treatment regimens for the three most common causes of vaginal discharge.

Adapted from: Practice Integration and Lifestyle Learning: Singapore Med J 2020, 61 (6) 297-301.

As for treatment regimens (Table 3), the choice of treatment can be based on the patient's preference, particularly for VVC, a single dose oral fluconazole is as effective as topical azoles. However, the exception to this is oral fluconazole is contraindicated in pregnancy. For the treatment of BV in pregnancy, oral metronidazole or clindamycin can be used. For TV in pregnancy, oral metronidazole or metronidazole and nystatin (flagylstatin) vaginal pessary can be given.

Causes for abnormal vaginal discharge

Although abnormal VD is commonly caused by infections like BV and VVC, there can be non-infective causes as well (Box 1). This article summarizes common infective causes and management in special circumstances like pre-puberty, pregnancy and lactation and post-menopausal women.

Screening for sexually transmitted infections

Women who are at high risk of STI (Box 2) should be offered STI screening, irrespective of the organism. It is also recommended to screen for STI in women who are diagnosed with *TV*. STI screening includes testing for *Chlamydia trachomatis, Neisseria gonor-*

Physiological

- Puberty
- Ovulation (midcycle)
- Pregnancy
- Diabetes mellitus
- Antibiotic therapy
- Immunosuppression

Pathological

- Bacterial vaginosis
- Vulvovaginal candidiasis
- STIs: TV, CT, NG
- Foreign body: Retained tampons, ring-pessaries
- Irritants: Perfumes, deodorants and douching
- Atrophic vaginitis
- Fistulae (recto vaginal/vesicovaginal)
- Tumours of vulva, vagina, cervix, endometrium and fallopian tubes
- Trauma: Perineal repair or vaginal surgery: from granulation tissue

Box 1: Causes of vaginal discharge.

Source: Obstet Gynecol Reprod Med 2020; 30:11-18.

rhoeae and TV. In addition, blood investigations for HIV, syphilis and hepatitis B viruses. When TV is isolated, all sexual partners are concurrently managed and sexual intercourse avoided for at least one week until their partners have completed treatment inclusive of follow up.

Ascending infection causing endometritis/salpingitis/pelvic inflammatory disease
Tubal damage resulting in tubal factor infertility/ectopic pregnancy
Chronic pelvic pain
Bartholin's/Skene's gland abscesses
Perihepatitis (Fitz-Hugh Curtis syndrome

Box 2: Complications of chlamydia and gonorrhoeae.

Source: Current Obstetrics and Gynaecology 2006 16: 211-17.

Recurrence of vaginal infections

It is imperative to identify women with uncontrolled diabetes mellitus and immunosuppression who are likely to be prone for recurrent infections (Box 3). Those requiring contraception are advised to go on hormonal contraception rather than intrauterine devices that can increase colonization and prevalence of BV. If standard treatment strategies fail or symptoms recur, a referral should be considered referral to a gynaecologist.

Recent instrumentation or surgery of genital tract
Retained foreign body
Cervical ectopy or polyp
Suspected tumour of the genital tract
Symptoms of upper genital infection such as fever and lower abdominal pain
Recurrent vulvovaginal candida infections
Pregnant women with abnormal vaginal discharge
Failure of routine treatment strategies as chronic symptoms can be a mimic of a vulval skin or pai disorder

Box 3: Referral to a gynaecologist if the following conditions or diagnoses are present.

Source: Practice Integration and Lifestyle Learning: Singapore Med J 2020, 61 (6) 297-301.

Sexually transmitted infections

Sexually transmitted infections (STIs) (Table 4) incidence have risen in the UK since the 1990s. RTIs are caused by bacterial, parasitic or viral pathogens. These pathogens enter the body through the mucous membranes during unprotected vaginal, anal or oral intercourse with an infected partner. Vigilant diagnosis and treatment of the sequelae is important to prevent morbidity and mortality subsequently. Therefore, STI screening is recommended in high-risk sexually active women or those with TV. Appropriate laboratory diagnosis, partnership notification and treatment is an essential part of the management.

Organism	Clinical features	Diagnosis	Treatment
Chlamydia trachomatis	Age <25 years New or multiple sexual partners Lack of barrier contraception	Nucleic acid amplification tests (NAAT) have high specificity and sensitivity. Enzyme-linked immunosorbent assay (ELISA). Direct fluorescent antibody tests from endocervical samples.	Doxycycline 100 mg twice a day for 7 days Azithromycin 1 g orally in a single dose
Neisseria gonorrhoeae	50 % will be asymptomatic, 50% will report increased or altered VD, lower abdominal tenderness in 25%, dysuria, anal discharge. A mucopurulent cervical discharge in <50% infections Responsible for causing PID and Fitz-Hugh-Curtis syndrome.	Culture of endocervical, urethral and rectal swabs are sensitive and specific.	Ceftriaxone 250 mg im as a single dose Cefixime 400 mg orally as a single dose Spectinomycin 2 g IM as a single dose

Treponema pallidum	Primary chancre, macules develop within 90 days in inoculated sites Secondary syphilis comprises multisystem involvement within 2 years, include generalized polymorphic rash affecting palms and soles. Alopecia, mucocutaneous lesions, uveitis, meningitis, cranial nerve palsies, hepatitis, splenomegaly, periostitis and glomerulonephritis might occur. Late-latent phase:>2 years, tertiary (including gummatous, cardiovascular and neurological involvement). The latter two are often referred as quartenary syphilis.	The organism can be isolated from lesions or nodes using dark ground field microscopy, direct fluorescent antibody test or polymerase chain reaction (PCR). Serological tests like the Venereal Diseases Research (VDRL) Laboratory, the *Treponema pallidum* haemagglutination assay (TPHA)	IM procaine penicillin G 750 mg daily for 10 days IV doxycycline 100 mg BD for 14 days IV erythromycin 500 mg QDS for 14 days IV azithromycin 500 mg daily for 10 days IM ceftriaxone 500 mg daily for 10 days PO (if parenteral infused) amoxycillin 500 mg QDS plus probenecid 500 mg QDS for 14 days
Herpes simplex virus (HSV)	Primary infection have "flu-like" illness with fever and myalgia. Genital lesions are vesicles which rapidly ulcerate and remain painful. VD might reflect vaginal ulcers or cervicitis. Perianal involvement is common. Proctitis symptoms may ensue with inguinal lymphadenopathy. Neonatal herpes occurs with vaginal childbirth.	Detection of viral particles from lesions using electron microscopy or viral culture. Swabs taken from base of ulcers and kept at 4^0 C. Antibody testing is not specific. Type specific ELISA tests may play a role in future.	Supportive treatment include analgesia, saline bath, petroleum jelly. Oral anti-viral treatment reduces the severity and duration of symptoms. Topical treatment is not as effective as oral treatment, latter consists of: Acyclovir 200 mg five times daily for 5 days Famciclovir 250 mg three times daily for 5 days. Valaciclovir 500 mg twice daily for 5 days
Human papilloma virus (HPV)	Anogenital warts (condylomata acuminata) rarely cause physical discomfort. Occur at the posterior fourchette, perineum and perianal region. Occult lesions may occur in the vagina, cervix, urethral-meatus or anal canal. Children born vaginally to such women can develop laryngeal or genital warts.	Naked eye examination is usually sufficient. Examination using a speculum and occasionally a proctoscope will be necessary. Records should include a genital map.	May require physical ablation using surgical excision, cryotherapy, diathermy or laser. <Podophyllin: cytotoxic can cause severe local lesions Podophylotoxin: suitable for home treatment Trichloracetic acid: caustic agent 5-Fluoracil: DNA antimetabolite, can cause severe local lesion Interferones: creams, intralesional or systemic injections, adjuvant to laser therapy

Human immunodeficiency virus (HIV)	Acute seroconversion-infection becomes established, symptoms include fever, flu like illness, lymphadenopathy and rash Asymptomatic infection-few signs and symptoms for up to a decade or more AIDS Significant opportunistic infections or CD4 count less than 200/microlitre	Serological testing for antibodies is the method of diagnosing HIV infection (ELISA) followed by Western Blot assay. Mandatory testing at the first antenatal visit is practiced in Malaysia, those found positive are dealt by the multi-disciplinary team inclusive of obstetricians and paediatricians.	Combination therapy with three or more anti-retroviral therapies called highly active anti-retroviral therapy (HAART), reduces the incidence of Aids and prolongs life. Effectiveness of treatment is monitored by the CD4 T-lymphocyte counts and plasma viral load estimates.

Table 4: Common sexually transmitted infections presenting with vaginal discharge: Treatment Regimens.

Source: E. Kieran, D.P. Hay. Sexually transmitted infections. Current Obstetrics and Gynaecology 2006 16: 218-225.

Pelvic inflammatory disease (PID), subfertility, ectopic pregnancy, cervical malignancy and vertical transmission of the infection to the neonate during childbirth are some of the more morbid sequelae. PID is a consequence of polymicrobial aetiology: combinations of *N. Gonorrhoeae, C. trachomatis,* anaerobic bacteria, facultative gram-negative rods, *H.* hominis and other microbial agents. The rise in incidence of STIs reflects a return to high-risk sexual behaviour associated with ignorance of the human immunodeficiency virus (HIV) epidemic. Acquisition via "sex tourism" and development of drug resistant infections are some of the main causes of this unprecedented rise in sexually related infections.

RTIs include three types of infections viz.:

- STIs such as *chlamydia, gonorrhoeae,* chancroid and human immunodeficient virus (HIV).
- Endogenous infections caused by the overgrowth normally present in the genital tract of healthy women such as bacterial vaginosis (BV) or vulvovaginal candidiasis (VVC).
- Iatrogenic infections which are associated with improperly performed surgical procedures such as unsafe abortion or poorly developed delivery practices.

RTIs are preventable and maybe treatable (Table 5). Morbidity and mortality related to STIs, deprive society of important contributions made by women in terms of economic, sociocultural development. Although RTIs affect women in both underdeveloped and industrialized countries, these sinister infections take their toll on women and their sequelae are especially urgent public health issues in resource-poor areas round the globe.

Infective (Non-sexually transmitted)	Infective (Sexually transmitted)	Non-infective
Candida	Chlamydia trachomatis	Foreign bodies (Retained tampons, condoms etc.)
Bacterial vaginosis (BV)	Neisseria gonorrhoea	Cervical polyps and ectopy
	Trichomonas vaginalis (TV)	Genital tract malignancy
	Herpes Simplex virus	Fistulae
		Allergic reactions and genital tract dermatosis

Table 5: Causes of altered vaginal discharge in women of reproductive age [2] (Ref article 8).

Adapted from: NHS Oxfordshire. Case of Commissioning Group. Investigation and Management of Vaginal Discharge in Adult Women. Version 5-January 2016.

Investigations for women at risk of STIs

HVS is taken for NAAT (Nucleic Acid Amplification Test) to check for chlamydial and gonorrhoeae. These patients include:

- Age less than 25 years
- Change of a partner or those who had more than one sexual partner in last year
- Past history of STI, sharing needles and intravenous drug use
- Women who request to rule out chlamydia and gonorrhoeae.

Consider urine PT to exclude pregnancy and urine dipstick to exclude UTI if indica.

Role of the Primary care physician

An uninterrupted good, thorough history including her menstrual cycles, inclusive of her last menstrual period (LMP) is vital. This is followed by her chief complaint about her VD which include its onset, duration, timing related to menstrual cycle and sexual history, the latter is extremely important to identify risk factors for STIs. Medical practitioners outside the genitourinary clinic can then decide whether they have the resources available to test, treat and perform partner notification for the STI or whether to refer a woman with identified risk factors directly to the genitourinary physician for more comprehensive local service. Also, associated medications/drugs, particularly antibiotics and any form of contraception as enquired. One should enquire of any foreign body in situ, surgery or recent instrumentation carried out recently.

Vaginal swabs will help in the diagnosis of pathogens that may be responsible for the abnormal discharge. Any episodes of fever, abdominal pain or abdominal palpation reveals tenderness in any quadrant of the abdomen, flanks with temperature are recorded. During the speculum examination, observation for the nature, colour, odour, consistency, mucopurulent discharge and any exacerbating factors of the VD are noted. In addition, a cervical smear and cervical excitation tests are also carried out.

In most primary care settings, if an in-house microscope is available, a wet mount with a glass slide is done to see the motile flagellated trichomonas or hyphae of candida. If these facilities are not available, the specimens are sent to an external laboratory. When a lower genital tract infection is suspected, vaginal pH is done from the vaginal secretions. Vaginal pH < 4.5 is suggestive of VVC and > 4.5 of BV or TV. Holistically, combination of clinical history, physical appearance of the discharge and pH, the likely diagnosis of the organism is reinforced.

Patients who are pregnant, may have exaggerated forms of a normal physiological discharge with asymptomatic vaginal microbiome, these cases are referred to an obstetrician and gynaecolgist (O&G) specialist at tertiary care centres. Here mandatory, VDRL for syphilis, HIV, Hepatitis B tests are done and treated if required. Further testing is done in pregnant women who have preterm premature rupture of membranes (PPROM) or evidence of preterm labour.

Characteristic signs that may indicate an infective cause of vaginal discharge

- VVC is characterized by an odourless, white/curdy discharge. Pelvic examination may reveal erythema, vaginal fissuring and/or oedema and excoriation of the vulva.
- BV shows a thin, white/grey, homogenous coating of the vaginal mucosa and vulva with a fishy odour associated with inflammation or soreness.
- TV is evidenced by a greenish-yellow, frothy discharge with a fishy odour. A strawberry appearance of the cervix maybe noticed on pelvic examination.
- *C. Trachomotis/N. Gonorrhoeae* is characterized by an inflamed cervix which bleeds easily on touch with a mucopurulent discharge.
- PID caused by *Chlamydia* or less commonly by gonorrhoeae, are characterized by lower abdominal pain, with or without fever. Adnexal tenderness and cervical excitation maybe found on bimanual examination.

Bacterial vaginosis (BV)

This is the most common cause of VD in women of reproductive age group. BV occurs consequent to an overgrowth of several species of bacteria, it is a polymicrobial clinical syndrome [15]. The overgrowth of bacteria includes anaerobes, *Gardnerella vaginalis* and genital mycoplasmas. Despite BV is associated with increased number of sexual partners, recurrences do not decrease with treatment of the male partner. It is not considered as a STI and partner notification is not required.

Clinical features

Affected women usually present with offensive fishy smelling VD, not associated with vulvovaginal soreness, itch or irritation. On examination, thin, white, homogenous discharge is seen coating the walls of the vagina and vestibule.

Diagnosis

- Using Amsel's criteria. For a positive diagnosis three of the following should be present.
- A thin, homogenous discharge on examination.
- Vaginal pH >4.5 using narrow range pH paper.
- Amine odour (fishy) on adding 10% potassium hydroxide to vaginal fluid on a glass slide, also known as Whiff test.
- at least 20% of epithelial cells covered with bacteria (clue cells) on microscopy of vaginal discharge mixed with saline.
- Using a vaginal Gram-stained smear. The smear can be interpreted microscopically on-site or transported to the laboratory for interpretation. The slides are interpreted by reference to of three criteria: Spiegal, Nugent or Hay and Ison.

Vulvovaginal candidiasis

Vulvovaginal candidiasis (VVC) or "genital thrush" is symptomatic inflammation of the vagina and/or vulva caused by a fungal infection. It is the second most common cause of vaginitis in women of reproductive age after BV [16]. The causative organism in 90% of cases is the yeast infection. There are over 20 *Candida* species. *Candida albicans* 80-89% [17,18] is the most common. Others include *C. glabrata C. tropicalis, C. parapsilosis* and *C. krusei*. Candida is not considered to be a STI and treatment of the male partner is not beneficial. Candida affects many healthy and immunocompetent women and all strata of society. Other risk factors for VVC include hyper-estrogenic state such as pregnancy, hormone replacement therapy, combined oral contraceptive pill use, poorly controlled diabetes mellitus, broad spectrum antibiotic therapy and immunosuppression, local irritants (like soaps, shower gel, feminine hygiene products, tight-fitting garments or synthetic clothing).

Clinical features

Affects many healthy females. The symptoms of vaginal candida inclusive of vulval itching or soreness, curdy white vaginal discharge without a smell, dysuria or superficial dyspareunia. Examination assesses the severity of symptoms and exclude alternate diagnosis.

Diagnosis

- Vaginal secretions collected from the lateral sides of vagina wall using a swab for vaginal pH testing. (In candida infections, the pH is less than or equal to 4.5). In BV or *Trichomonas vaginalis* the pH is > 4.5 and
- High vaginal swab for Gram stain or wet film microscopy
- Mid-stream urine sample (MSU), if UTI is suspected.
- HbA1c test to exclude diabetes mellitus in severe or recurrent infection.
- STI screening in at risk women.

Recurrent vulvovaginal candidiasis (RVVC)

The associated high concentration of reproductive hormones especially oestrogen in pregnancy increases the glycogen content in the vaginal epithelial cells, which increases the risk of colonization and symptomatic candidiasis [19,20]. RVVC is more common in pregnancy as well as decreased response to antifungal therapy compared to non-pregnant women.

Risk factors and pathogenesis

Recurrent VVC is thought to be related to host factors than more virulent strains or reintroduction of the organism to the genital tract.

- Persistence of *Candida sp.* detected by polymerase chain reaction
- Poorly controlled diabetes mellitus
- Endogenous and exogenous estrogen (including pregnancy, HRT and oral contraceptive pill)
- Immunosuppression
- Antibiotic use causing a disturbance in the vaginal flora [21-23].

Chlamydia trachomatis

Chlamydia trachomatis is a gram-negative intracellular organism. But has a unique lifecycle similar to a virus due to its obligate

intracellular growth, It is involved in causing STI, hence partner notification is important in terms of treatment plan. It might also be associated with other STIs, therefore testing for Neisseria gonorrhoea, *Trichomonas vaginalis,* other blood borne STIs such as syphilis and HIV are to be considered. Within the genital tract, the primary site of infection in women is the cervix with the urethra. Other sites that can be infected are the rectum, pharynx and the conjunctiva.

Clinical features

VD, usually purulent in nature, can be a presenting symptom of chlamydia. Other signs and symptoms include post-coital bleeding, intermenstrual bleeding lower abdominal pain. The risk of ascending infection is increased with instrumentation such as termination of pregnancy or intrauterine device insertion, hence pretreatment testing followed by treatment is to be considered. The ascending infection from the endocervix can lead to endometritis, salpingitis, parametritis, oophoritis, tubo-ovarian abscess and/ pelvic peritonitis. Sub-optimal treatment progresses to PID and subsequently resulting in infertility, ectopic pregnancy and chronic pelvic pain.

Chlamydia in pregnancy is associated with miscarriage and preterm delivery. Neonates may contact infection during vaginal birth and present with purulent conjunctivitis or pneumonia.

Diagnosis

The most common method of diagnosing is enzyme immunoassay (EIA). The test has a high specificity, however the sensitivity varies from 60% to 80%. For greater sensitivity, the swab is taken from the cervix along with the urethral swab. Recently, most laboratories have switched from EIA to nucleic acid amplification tests (NAAT).

Trichomonas vaginalis (TV)

This is a major cause of VD in Asia and Africa. Prevalence rates in Africa is as high as 35% and is the most common cause of STI. *T. vaginalis* is a flagellated protozoan, measuring 10-20 µm, organism is found in the vagina, urethra and paraurethral glands. Unlike chlamydia and gonorrhoea, it does not affect any extragenital sites, however it is associated with vaginitis, cervicitis and PID. It is an STI. Cure rates are better if the partner too is treated simultaneously.

Women infected with *T. vaginalis* maybe asymptomatic initially, but if untreated may develop symptoms such as VD, classically described as green and frothy. About 50% will have malodourous discharge and has pH of >4.5. Punctate haemorrhages on the cervix give the appearance of "strawberry cervix" [4].

Clinical features

Signs and symptoms of infection with *T.vaginalis* include vulval or vaginal itching, evidence of vaginitis or a cervicitis on speculum examination. The symptoms may be worse during menstruation.

Diagnosis

The main method is direct visualization of *T. vaginalis* is using wet smear microscopy of a sample of VD on a wet slide using saline. Flagellated, pear-shaped protozoa with their characteristic jerky movements in the presence of numerous leucocytes [24]. The gold standard for *T. vaginalis* diagnosis is culture. This has a better sensitivity than microscopy. A diagnosis of *T. vaginalis* can be reported on a Papanicolou (Pap) smear, although this is neither specific nor sensitive test for *T. vaginalis.*

Neisseria gonorrhoeae

Neisseria gonorrhoeae is a Gram-negative intracellular diplococcus. Gonorrhoea is the second most common pathogen causing PID and Fitz-Hugh-Curtis syndrome. The primary sites of infection in women are the cervix and the urethra. Other sites that might be involved include the rectum, the oropharynx and conjunctiva. Gonorrhoea is an STI and about 30%-40% of women with Gonorrhoea will also be infected with chlamydia, testing for all other STIs may be considered prudent. Also partner notification and treatment is essential. Gonorrhoea during pregnancy is associated with miscarriage, premature labour and neonatal infection.

Clinical features

The signs and symptoms include dysuria, mucopurulent cervicitis and lower abdominal pain. An extremely rare complication is hematogenous dissemination, whereby the diplococcus can disseminate leading to manifestations ranging from joint pain to meningitis or endocarditis.

Diagnosis

Culture of endocervical, urethral and rectal swabs are sensitive and specific for the isolation of *N. gonorrhoeae.* More recently,

NAAT tests have become easily amenable to test for *N. Gonorrhoeae.* NAAT tests performed also yield the diagnosis of chlamydia.

Syphilis

Syphilis is caused by the spirochaete bacterium *Treponema pallidum.* Clinically acquired syphilis is divided into early: primary, secondary and early latent syphilis. Whereas, the late syphilis is late latent, more than 2 years; tertiary (including gummatous, cardiovascular and neurological involvement-the latter two are also sometimes referred as quartenary) syphilis.

Clinical features

The main feature of primary syphilis is formation of chancres, which further develop within 90 days to become popular, indurated and then ulcerate. They are usually painless and can appear anywhere in the body.

Secondary syphilis embraces involvement of other systems within 2 years. Features can vary, classically include generalized polymorphic rash affecting the palms and soles. Alopecia and mucocutaneous lesions, uveitis, meningitis, cranial nerve palsies, hepatitis, splenomegaly, periostitis and glomerulonephritis may occur.

Tertiary syphilis occurs from 4 years in those who have not received any treatment. It manifests in 3 forms: gummatous syphilis, cardiovascular syphilis or neurological syphilis. Vertcal transmission can occur resulting in miscarriage, intrauterine fetal death or congenital syphilis. The latter, manifests in the first 2 years as: rash, periostitis, lymphadenopathy, splenomegaly, glomerulonephritis, neurological or eye involvement and later with stigmata of congenital syphilis interstitial keratitis, Clutton's joints, Hutchison's incisors, mulberry molars, high palatal arch, deafness, frontal bossing, short maxilla, protuberance of mandible, saddle nose deformity and sterno-clavicular thickening. Serological tests may be negative at birth but should be repeated at 4, 8 and 12 weeks.

Diagnosis

The organism is identified from the lesions or nodes using dark field microscopy, direct fluorescent antibody test or polymerase chain reaction (PCR). Serological testing comprises cardiolipin tests such as the Venereal Disease Research Laboratory (VDRL) and more specific tests include *Treponema pallidum* haemagglutination assay (TPHA). Are frequently done.

Special circumstances

Prepubertal vaginal discharge

VD is the most common cause for referral of a prepubertal girl to a gynaecologist [25-27]. The frequent age group is 3-10 years. Physiological vaginal secretion is biologically normal. This occurs in in high estrogen levels in peri-ovulatory phase of menstruating girls in the adolescence.

Vulvovaginitis is a common cause in this age group mainly with non-specific bacterial infection being the most common, less common causes involve foreign bodies and sexual abuse. Besides, the anatomical proximity of anus to the vulva and vagina, labia devoid of fat pads and hypoestrogenic thinned skin with neutral pH predispose the vulvo-vaginal area for infection. This leaves the vulva virtually unprotected from offending agents. Yeast infections are rare in children than in adolescents and adult women. This is often associated with antibiotic use, diabetes mellitus and immunocompromised states [28]. Examination is carried out gently with the child on mother's lap or lying down on the couch in frog leg position in the mother's presence. Inspection with gentle labial separation and use of cotton tipped swabs for culture and sensitivity of any organism. Vulval hygiene and emollients is the cornerstone of management. Antibiotics are given when any pathogen is isolated.

Pregnancy and lactation: vaginal discharge

BV and vaginal colonization with Candida resulting in acute vulvovaginal candidiasis, recurrent infection and treatment failure are common features in pregnancy. BV with symptoms of preterm birth may benefit from low dose metronidazole. This antibiotic may affect the taste of milk, hence small amounts of clindamycin enter breast milk, therefore clindamycin can be given as intravaginal treatment for lactating mothers.

Acute vulvovaginal candidiasis, recurrent infections, treatment failure are common during pregnancy. Topical imidazoles are used for symptomatic VVC In pregnancy. Longer courses are recommended: intravaginal clotrimazole 200 mg miconazole 400 mg for 7 consecutive nights. Care should be taken when applicators are used as they can cause physical injury to the cervix.

Perimenopausal desquamated inflammatory vaginitis (DIV) with vaginal discharge

Bacterial vaginal infections are in two main classes: bacterial vaginosis associated with a fishy smelling discharge and increased

pH, and desquamating inflammatory vaginitis, also associated with an increased pH. Both conditions increase the risk of pelvic inflammatory disease [29]. DIV is an uncommon cause of VD seen mainly in perimenopausal period (50%). Examination of the lower genital tract reveals, vaginal inflammation which may range from focal petechiae, to generalized erythema with mild to profuse purulent discharge. The vestibule shows signs of focal or diffuse erythema. Vaginal adhesions, synechiae and stenosis are extremely rare.

It is important to exclude other causes of purulent vaginitis like TV, Group A Streptococcus, erosive lichen planus, atrophic vaginitis, contact dermatitis, trauma, foreign body and fistula. A high vaginal swab is taken for culture and NAAT for TV.

Both vaginal clindamycin and vaginal corticosteroids are useful. Both have anti-inflammatory effect. Clindamycin 2% vaginal cream, 5 g every night for 3 weeks followed by twice weekly for 2 months. Clindamycin 200 mg vaginal pessary, one every night for 2 weeks followed by twice weekly for 2 months. Hydrocortisone 300-500 mg vaginal pessary once a night for 3 weeks followed by twice weekly for 2 months. Most women will achieve positive response to above regimen whilst some women will need longer term treatment.

The role of reproductive tract infections (RTIs) in health-related development programs

RTIs are a global health problem including both STIs and non-STIs, this is an important concern, as it poses risk for HIV transmission. A cross-sectional study in Hubli, Karnataka state, India was conducted for 656 women of 15-45 years age group. The prevalence of RTIs among women of reproductive age group women was 40.4% based on their symptoms. Majority presented with abnormal vaginal discharge. Laboratory tests revealed a prevalence of 34.3% candidiasis [30].

This is a major problem in developing countries mainly due to limited access to healthcare for RTIs. In many parts of the globe, women depend heavily on reproductive health services particularly family planning (FP) and maternal/child health (MCH) services for their primary healthcare needs. In addition, women in developing countries lack skilled personnel and drugs required to detect and treat RTIs. A response to these issues was the recommendation for the integration of prevention and treatment services for RTIs in women attending FP and antenatal clinics where RTIs are an integral part of fundamental health-related development programs such as child survival, women's health, safe motherhood and HIV prevention.

Discussion

Vaginal discharge and pruritus vulvae are two common complaints for which women present to health facilities all over the world. Genital candidiasis is among the most common causes of the complaint, after bacterial vaginosis, accounting for up to 40% in primary health care settings [31]. Vaginal discharge constitutes a considerable problem for many women causing discomfort, anxiety, quality of life and consuming considerable resources. Some vaginal discharges are normal and can vary with age, use of contraceptives, menstrual cycle and with the estrogen level [32].

The three main causes of VD in reproductive aged women are: bacterial vaginosis (BV), vulvovaginal candidiasis (VVC) and trichomonas vaginalis (TV). Discharge of cervical origin is the other important cause of VD with *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG), *Mycoplasma genitalium* (MG) and primary genital herpes simplex can also manifest as VD. These are the most common pathogens isolated. Cervicitis should be suspected in women with purulent endocervical discharge with easily inducing cervical bleeding. To detect specific pathogens causing cervicitis, laboratory testing is essential to identify the organisms involved.

An informed consent, speculum examination and visualization of cervix along with bimanual examination is done unless the patient declines or she is a virgo intacta. This includes a general inspection of the vulva and perineal region. Bimanual examination will give the examiner an idea about the position, size and mobility of the uterus as well as the presence of adnexal masses. An informed consent, speculum examination and visualization of cervix along with bimanual examination is done unless the patient declines or she is a virgo intacta. This includes a general inspection of the vulva and perineal region. Bimanual examination will give the examiner an idea about the position, size and mobility of the uterus as well as the presence of adnexal masses.

Unfortunately, in Asian countries as a whole, there is an implicit "culture of silence" which leads to delay in seeking help. The vaginal flora is a dynamic ecosystem that can be easily altered. The first

task for a primary care physician is to ascertain whether it is physiological or pathological. The study by [33] concludes factors like increasing age, illiteracy, low socioeconomic status, high parity, induced abortion and place of delivery are all contributory. The study recommends, creating community awareness about health care facilities, referrals to tertiary centres for more comprehensive care. Besides the application of pharmacological agents, general health patient education is given to avoid tight fitting synthetic clothing, panty liners, local irritants such as perfumed products and soap gels, and vaginal douching. These practices increase local genital temperature, humidity and moisture, thus increasing genital infections [1]. The role of probiotics for vaginal health. The three main causes of VD in reproductive aged women are: bacterial vaginosis (BV), vulvovaginal candidiasis (VVC) and trichomonas vaginalis (TV). Discharge of cervical origin is the other important cause of VD with *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG), *Mycoplasma genitalium* (MG) and primary genital herpes simplex can also manifest as VD. These are the most common pathogens isolated. Cervicitis should be suspected in women with purulent endocervical discharge with easily inducing cervical bleeding. To detect specific pathogens causing cervicitis, laboratory testing is essential to identify the organisms involved.

The incidence of problematic vaginal discharge in prepubertal girls is unknown. It is a significant gynaecological complaint in this age group [25,26]. The most frequent age of referral is between 3-10 years. Also, the prepubertal anatomy plays a major etiological role in vaginal discharge. In the prepubertal girls the labia are small, underdeveloped and lacks labial fat pads or pubic hair. The anus is anatomically close to the vagina. This leads to the risk of fecal contamination, which can lead to infection. In addition, the vulval and vaginal skin are hypoestrogenic, hence thin and fragile. All these factors make the vulva and vagina vulnerable to inflammation and infection. The gynaecological examination of the prepubertal girls must be handled with sensitivity and gentleness. Foreign bodies in the vagina are a common cause of vaginal discharge in the paediatric group. Common objects retrieved from the vagina include a ball of tissue paper, beads and crayon. In a study by Smith, 17.6% of patients presented with vaginal discharge [34]. Other causes include infections and dermatological causes such as allergic vulvitis. Vulvar hygiene is emphasized as a first step to address this paediatric issue.

Conclusion

Lactobacilli normally found in the vagina seem to play a pivotal role in maintaining the acidity of the vaginal secretions resulting in an inhibitory effect on opportunistic organisms. Abnormal vaginal discharge is a common, worrisome symptom reported by many women in the reproductive age group and occasionally in prepubertal girls. In the latter group vulval hygiene and the use of appropriate emollients form the cornerstone of successful treatment. Current approach to management of vaginal discharge provides a suboptimal care. Significant time burden is placed on primary care providers.

The vaginal discharge may be physiological or pathological. The common pathogens are due to infections occurring in the cervix (cervicitis) or in the vagina (vaginitis and vaginosis). The knowledge about the causes of vaginal discharge is inadequate and their ability to distinguish physiological from pathological is grossly inadequate. In addition to use of self-medications and cultural taboos, there is delayed diagnosis leading to serious consequences. Culture specific health education and design of innovative health care programmes including family planning, maternal and child health services will ensure early detection of pathological vaginal discharge.

Disclosures

The authors report no conflict of interest concerning materials or methods used in this study.

Conflict of Interest

The authors report no conflict of interests.

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