Chapter 18
Sexually Transmitted Diseases in Females

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18.1 Introduction

Transmission of an infective agent, between sexual partners, through various routes of sexual contact like vaginal, anal or oral, leads to sexually transmitted diseases (STDs), also known as sexually transmitted infections (STIs) [1]. The global incidence of STDs is increasing, leading to increased healthcare costs incurred. According to WHO data, more than one million STDs are contracted every day with more than 376 million cases of 1 of 4 STDs: chlamydia, gonorrhoea, syphilis and trichomoniasis [2]. Women are more vulnerable to acquire these infections because of fragility of the receptive mucosa and lesser awareness regarding the mode of transmission. STDs in females have wider implications, as complications may arise not only in the patient, but infection can also be transmitted to newborns born to afflicted mothers. Since STDs are widely preventable diseases, by means of appropriate treatment of the diseased and counselling regarding the mode of spread of the infection, it is vital that as venereologists, we should be equipped to diagnose these clinically or with the help of point of care (POC) tests and laboratory methods available at our disposal. In this chapter we will discuss clinical presentations, methods of diagnosis and treatment options of commonly encountered STDs in women.

18.2 Bacterial STDs

Common bacterial STIs can present as genital ulcers, cervicitis, vaginitis and urethritis or can lead to pelvic inflammatory disease as a complication.

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18.2.1 Syphilis

Syphilis is caused by a treponeme *Treponema pallidum subsp. pallidum.* It is a delicate, thin, motile and closely coiled organism with tapering ends. Since conventional microscope is unable to visualize its structure due to its thinness, dark ground illumination (DGI) is required for the same. Bending, flexing, translational and corkscrew motility may be seen, with angular movements being characteristic [3].

18.2.1.1 Epidemiology

Between 2014 and 2018, the rates of primary and secondary syphilis in females in the USA escalated from 1.1 to 3 cases per 1,00,000 females. About 1306 cases of congenital syphilis were reported in 2018, which represented 39.7% rise in statistics compared to 2017 data for the same [4].

18.2.1.2 Clinical Features

Syphilis can present as primary, secondary, latent or tertiary syphilis. Latent syphilis, a phase with no clinical features but positive serology, has been divided into early and late latent syphilis, cut off for which is 2 years according to World Health Organization (WHO) and National AIDS Control Organization (NACO) and 1 year according to Centre for Disease Control (CDC). The importance of this distinction lies in the fact the patients in early latent syphilis are considered infectious as they can relapse into secondary syphilis and because organisms in late latent syphilis are considered to divide more slowly, requiring longer duration of treatment for adequate disease eradication [5].

After an incubation period (IP) of 10–90 days, patient develops a papule, which breaks into a superficial ulcer with sharply demarcated, elevated edges and smooth, indurated, non-purulent and avascular base. It is usually painless. Commonest sites include labia and posterior fourchette as these sites suffer microtrauma during intercourse. However, they may be present on cervix and the patient may thus remain asymptomatic. This may be accompanied by firm, bilateral, rubbery and non-tender lymphadenopathy. Chancre usually resolves in 12–21 days [6].

All untreated patients progress to secondary syphilis, which can manifest itself in myriad clinical presentations, but commonest are skin rash (67–92%) and lymphadenopathy (63–100%). Commonest variant is macular or maculopapular eruption. Others include macular (roseola syphilitica), papular, papulosquamous, psoriasiform, lichenoid, pustular, follicular, annular eruptions and specific arrangements of the above in the form of corona veneris (along hairline on the forehead) and necklace of venus (depigmented macules left after resolved lesions over back and sides of the neck) [5].

According to Oslo study of untreated syphilis, 2/3rd of patients in late latency undergo remission due to unintended antibiotic use and 1/3rd progress to tertiary syphilis, which may manifest as benign syphilitic gummas, cardiovascular syphilis or neurosyphilis [7]. Neurosyphilis may however accompany any stage of syphilis and is not an exclusive presentation of tertiary syphilis.

18.2.1.3 Diagnosis

Syphilis can be diagnosed either by direct detection of the organism (by darkfield microscopic examination and histopathological evaluation) or by direct detection of presence of antigen {using direct fluorescent antibody for *T. pallidum* (DFA-TP), enzyme immunoassay (EIA) and polymerase chain reaction (PCR)} or by serological investigations. Serological investigations may be non-treponemal like venereal disease research laboratory (VDRL), rapid plasma regain test (RPR) and toluidine red unheated serum test (TRUST). Treponemal tests include fluorescent treponemal antibody absorption test (FTA-ABS), *T. pallidum* hemagglutination assay (TPHA), *T. pallidum* particle agglutination (TPPA) and *T. pallidum* enzyme immunoassay (TP-EIA) [8].

Darkfield microscopy is the POC test, which if performed correctly, allows direct detection of *T. pallidum* from primary and secondary syphilis lesions, demonstrating its characteristic angular and bending motility [5, 9]. DFA-TP is more sensitive and specific than darkfield microscopy and also can differentiate pathogenic from non-pathogenic treponemes [5]. Histology, if performed, shows endothelial swelling, obliterative endarteritis, infiltration with lymphocytes and plasma cells and silver staining reveals organisms in lower epidermis and around involved blood vessels [10].

Non-treponemal tests provide quantitative titres which fall on appropriate treatment and are thus performed to monitor treatment adequacy. Seroconversion occurs in about 3–6 weeks after infection [11]. Sensitivity and specificity of VDRL and RPR in chancre has been found to be about 62–78% [12]. Treponemal tests remain positive for life, irrespective of treatment. They are reported as reactive or non-reactive and thus cannot differentiate between recent and remote infection or treated or untreated infection [13]. Various rapid serologic tests are available as POC tests, that are mainly treponemal tests and can be used to guide treatment in patients who may not return for follow-up [14]. Some laboratories are now preferring the reverse screening algorithm, in which first a treponemal test is performed and non-treponemal test is used to screen positive samples. Discordance between the test results warrants testing with a second treponemal test to reach diagnostic conclusion and guide treatment. However, no consensus has been reached whether the reverse algorithm should be preferred over the traditional screening procedure or not [15].

18.2.1.4 Treatment

After a presumptive diagnosis (i.e. with a non-treponemal and a treponemal test), patient should be treated with penicillin G, administered parenterally, in preparation, dosage and duration depending on whether the chancre is accompanied by symptoms of neurosyphilis [16]. CDC recommended treatment for chancre is benzathine penicillin G 2.4 million units IM, half in each buttock after sensitivity testing. Recommended regimen for neurosyphilis is aqueous crystalline penicillin G 18–24 million units per day, administered as 3–four million units IV every 4 h or as a continuous infusion, for 10–14 days [17].

Follow-Up Clinical and serological follow-up should be done at 6 and 12 months. The titres should fall fourfold within 6–12 months in patients with adequate treatment [17].According to NACO guidelines, follow-up should be done at 3, 6, 12 and 24 months [16].

18.2.1.5 Partner Management

While partners who have had sexual contact with a patient with chancre in past 90 days should be treated presumptively even if the serological investigations are negative, all partners who had sexual contact >90 days before diagnosis must be examined and investigated and treatment should be based on investigations and clinical stage [17].

Pregnancy All pregnant patients should be treated with penicillin-based regimen. In case of penicillin allergy, desensitization should be done [17].

HIV Co-infection Patients co-infected with HIV should be treated with same regimen as HIV uninfected patients [17].

18.2.2 Chancroid

Chancroid is caused by a Gram negative bacterium *Haemophilus ducreyi*. It is non-motile, non-spore forming, facultative anaerobe with fastidious growth requirements.

18.2.2.1 Epidemiology

Incidence of chancroid is decreasing with less than 100 annual cases since 2000. Less than 20 annual cases have been reported since 2011 with only three cases in 2018 in the United States [18].

18.2.2.2 Clinical Features

After inoculation of the pathogenic organism, usually through intercourse-induced microtrauma, there is localized proliferation of the organism, which usually results in formation of an erythematous and tender papule, which leads to formation of a pustule followed by ulceration of the same within another 2–3 days [19]. According to an experimental human model, inoculation of about 30 colony forming units leads to 95% papule formation rate and 69% pustule formation rate [20].

Ulcer(s), single or multiple, are non-indurated, deep, with irregular and undermined edges, which bleed on touch. These are usually painful [19]. Various clinical patterns like dwarf chancroid, giant chancroid, phagedenic chancroid, pseudogranuloma inguinale like chancroid, serpiginous chancroid, chancroidal ulcers, transient chancroid, follicular chancroid and mixed chancroid may be seen [21].

Ulcer may be accompanied or followed by development of inguinal lymphadenopathy. It usually appears within 7–14 days of development of ulceration. It is unilateral in 3/4th cases. The bubo so formed after suppuration, is unilocular and ruptures with a single sinus opening. Usually accompanying constitutional signs are absent and Groove sign is negative. Apart from lymphadenopathy, psychological impact of pain in ulcer, autoinoculation to other cutaneous sites, balanitis, phimosis and paraphimosis are complications associated with chancroid [21].

18.2.2.3 Diagnosis

According to CDC, probable diagnosis of chancroid is made if all 4 of the below are positive: [22].

1. Presence of painful genital ulcers.
2. Ulcer presentation and lymphadenopathy, characteristic of chancroid.
3. No evidence of *T. pallidum* on darkfield examination or serology, performed at least 7 days after ulcer onset.
4. Negative HSV culture or HSV PCR.

Microscopy, antigen detection, culture, nucleic acid amplification test (NAAT) and serology have been used for confirmation of the diagnosis.

Gram's stain performed on ulcer exudate shows characteristic Gram negative coccobacilli in rail road or school of fish arrangement. It is POC but its diagnostic value is limited due to low sensitivity and specificity. Although not routinely done, direct immunofluorescence antigen detection performed on ulcer exudates has been found to be useful, with relatively higher sensitivity (89–100%) and specificity (63–81%) [23].

Culture is still considered gold standard despite only 80% PCR comparative sensitivity [23]. Gonococcal agar and Mueller–Hinton agar supplemented with 2% bovine haemoglobin and 1% IsovitaleX have been found to be optimal [24].

Clinical laboratory improvement amendments (CLIA) approved combination PCR (multiplex PCR) techniques for *T. pallidum*, *H. ducreyi* and HSV are being

used. However, none of these are FDA approved [25]. Antibody detection has been tried, with sensitivity and specificity of about 55–100% and 23–96% respectively [23, 26].

18.2.2.4 Management

CDC recommends azithromycin 1 g orally in a single dose or ceftriaxone 250 mg IM in a single dose or ciprofloxacin 500 mg orally twice a day for 3 days or erythromycin base 500 mg orally three times a day for 7 days [22].

Follow-Up Patients should be re-examined 3–7 days after treatment. If objective improvement cannot be documented at day 7, then it is advisable to consider the following:

- Incorrect diagnosis
- Non-compliance with treatment
- Co-infection with other STI or HIV
- Resistance to prescribed antimicrobial [22]

Partner Management All sexual partners who had contact with the patient within 10 days of onset of their symptoms should be presumptively treated irrespective of symptoms [22].

HIV Co-infection Patients co-infected with HIV might require longer therapy or repeat courses and thus must be monitored strictly [22].

18.2.3 Lymphogranuloma Venereum (LGV)

LGV is caused by *Chlamydia trachomatis (C. trachomatis)* serovar L1, L2 or L3, intracellular obligate organism. It is more common in men who have sex with men (MSM), with commonest serovar being L1. However, recently, there has been a slow epidemiologic rise in L2b serovar, called Amsterdam strain, especially in MSM [27].

18.2.3.1 Epidemiology

There is paucity of studies to elucidate the burden of disease in women. It is believed that while both men and women are equally affected, acute manifestations are more common in males, while females usually present with late complications as the initial stages of the disease go unnoticed in them [28].

18.2.3.2 Clinical Features

Patients may suffer three stages of the disease. Primary stage reflects the stage of genital ulceration, secondary stage occurs due to involvement of draining lymph nodes (inguinal syndrome), and tertiary stage is stage of complication, seen mainly in MSM and women who were asymptomatic in previous two stages [29].

LGV is characterized by transient, asymptomatic papule or pustule that ulcerates, into usually a single, superficial or deep ulcer with, elevated margins and non-vascular, occasionally indurated base and is variably painful [30]. This however goes unnoticed and this thus may complicate into secondary stage of infection i.e. that of lymphadenopathy, site of which depends on the site of original ulcer and its lymphatic drainage. Most common is inguinal group of nodes which suppurate to form bubo, which can be clinically indistinguishable from bubo of chancroid to inexperienced eye [31]. However, there are clinical pointers that can differentiate the two. Bubo in LGV appears 10–30 days after ulceration and thus ulcer is usually absent when lymphadenopathy develops. It is multilocular and thus it ruptures to form multiple sinuses. Constitutional signs may be present and Groove's sign is present in about 20% patients [21].

Untreated LGV can complicate to tertiary stage of genito-anorectal syndrome with disfiguring ulcerations and tissue hypertrophy called "esthiomene", chronic proctocolitis and rectal strictures [29]. Painful urination, bleeding per rectum, pain during passing stools, abdominal pain and tenesmus may accompany.

18.2.3.3 Diagnosis

Ulcer exudate and lymph node aspirate can be subjected to culture, NAAT and serology. Other tests like histological analysis of ulcer or bubo by Giemsa staining, antigen detection using EIA and rapid assays and immunotyping of isolates can be performed if facilities are available [29].

Cell lines like HeLa 229, baby hamster kidney cells (BHK-21) and McCoy cells are used for culture. However, organism recovery from primary stage is seen in only 30% of samples [32].

NAAT for LGV is a two-step process. The samples are subjected to NAAT for *C. trachomatis.* Positive samples are subjected to LGV-specific serotyping PCR [33, 34]. This technique can correctly identify LGV serovars in 96.6% patients [35]. Complement fixation tests are most commonly performed serological assays for LGV, with a titre of >1:64 being considered significant [32].

18.2.3.4 Management

Recommended regimen comprises of doxycycline 100 mg orally twice a day for 21 days. Erythromycin base 500 mg orally four times a day for 21 days can be given in patients with contraindication to tetracyclines [22].

Partner Management All sexual partners who had sexual contact within 60 days of symptom onset in patient should be evaluated for chlamydial infection and treated presumptively with doxycycline 100 mg twice daily orally for 7 days or azithromycin 1 g single dose orally [22].

Pregnancy Pregnant and lactating women should be treated with erythromycin [22].

HIV All patients with LGV and HIV co-infection should be treated with same regimen as in non-co-infected patients. However, longer treatment may be required and patients and clinicians may notice delay in resolution of symptoms [22].

18.2.4 Donovanosis

The causative organism of donovanosis is *Klebsiella granulomatis*, which is intracellular, Gram negative coccobacilli and is identified as Donovan body in histological specimens. This organism was earlier called *Calymmatobacterium granulomatis.* However, on DNA sequencing, it was found to have 99% genomic similarity with *Klebsiella pneumoniae* and *Klebsiella rhinoscleromatis* and was thus renamed [36].

18.2.4.1 Epidemiology

Donovanosis is endemic in few hotspots like Brazil, Papua New Guinea, Australia and few parts of India [37].

18.2.4.2 Clinical Features

After an IP of 1–4 weeks, it presents as a papule or subcutaneous nodule that ulcerates on progression. Four main variants are recognized:

1. Commonest variant is ulcerogranulomatous which is characterized by beefy red, fleshy, exuberant, non-tender ulcers that bleed on touch.
2. Ulcer with raised and irregular edge is called hypertrophic or verrucous variant. It may have a walnut-like appearance.
3. Necrotic variant is characterized by deep and foul smelling ulcer and is associated with significant tissue loss.
4. Sclerotic variant with formation of excessive fibrosis and scar tissue and thus it is also called cicatricial variant [36].

Autoinoculation may lead to kissing or mirror lesions. Outward progression of ulcers may lead to a “snake like” appearance. Donovanosis may rarely be complicated by pseudoelephantiasis, malignant transformation or secondary dissemination to organs like liver and bones [37].

18.2.4.3 Diagnosis

High degree of suspicion is necessary to evaluate donovanosis in non-endemic countries.

Donovan bodies can be identified, albeit with low sensitivity, on Giemsa staining of the ulcer exudate [38]. Histological examination can be done in cases of diagnostic dilemma, where cytology has failed to reveal Donovan bodies. Bacteria can be found in Giemsa stained smears, both within and outside histiocytes [36]. Ulcer exudate can be cultured on Hep-2 cells and human monocyte co-culture [39]. While PCR may be considered highly sensitive, no FDA approved PCR test is available. PCR-based colorimetric assay has been used for detection of the organism in a study [40]. Indirect immunofluorescence, antigen detection and complement fixation can be done where facilities are available [38].

18.2.4.4 Management

Recommended regimen consists of azithromycin 1 g orally once a week or 500 mg daily for at least 3 weeks and until all lesions have completely healed [22]. Alternative regimens are given for at least 3 weeks and until all lesions have completely healed. Dosages include doxycycline 100 mg orally twice a day or ciprofloxacin 750 mg orally twice a day or erythromycin base 500 mg orally four times a day or trimethoprim-sulfamethoxazole one double-strength (160/800 mg) tablet orally twice a day [22].

Partner Management All sexual contacts within 60 days of symptom onset in patient should be evaluated and offered therapy [22].

Pregnancy All pregnant patients should be treated with macrolide regimen (erythromycin or azithromycin) which can be supplemented with aminoglycoside (gentamycin 1 mg/kg every 8 h IV) if improvement is not noted within few days [22].

HIV While the treatment regimen to be followed is same as the one followed for non-co-infected patients, addition of gentamicin 1 mg/kg every 8 h can be considered in case improvement is not evident in first few days of treatment [22].

18.2.5 Gonorrhoea and Chlamydia

Gonorrhoea is caused by *Neisseria gonorrhoeae*, which is intracellular Gram negative diplococci (ICGND). Chlamydia is caused by *Chlamydia trachomatis*, which is intracellular obligate bacterium. Both these organisms present as cervicitis and/or urethritis, with extragenital complication in untreated cases.

18.2.5.1 Epidemiology

According to CDC 2018 statistics, about 100.4 to 145.8 cases per 100,000 females were reported to have gonorrhoea and 692.7 cases per 100,000 females had chlamydia infection [41, 42].

18.2.5.2 Clinical Features

Patient of cervicitis primarily presents with abnormal vaginal discharge. Profuse to moderate, mucopurulent or mucoid discharge is seen (Fig. 18.1). While profuse, mucopurulent discharge is suggestive of gonorrhoea, scanty to moderate, mucoid discharge is suggestive of chlamydial infection. Usually vaginitis is not present in either of the two. There may be history of associated post-coital or intermenstrual bleeding and dyspareunia. Pain in abdomen may be present. Per speculum examination shows mucoid or mucopurulent discharge at the os with cervical friability on taking a swab [43].

In gonococcal cervicitis, initial colonization starts in urethra, skene's glands and bartholin's glands, after which infection ascends to cervix, and untreated cases may suffer from involvement of uterus and fallopian tubes. Exudation of pus into inflamed fallopian tubes results in formation of pyosalpinx, which if becomes adherent to ovary, may rupture to form tubo-ovarian abscess. Haematological dissemination may lead to disseminated gonococcal infection (DGI) characterized by arthritis, dermatitis, endocarditis, myocarditis, pericarditis, meningitis, pneumonitis, hepatitis and pyelonephritis [43].

Extragenital involvement in gonococcal and chlamydial infections in the form of anorectal and pharyngeal infection may occur due to peno-anal contact, fellatio and cunnilinghus. In a review, the proportions were 0.6–35.8% for rectal gonorrhoea, 0–29.6% for pharyngeal gonorrhoea, 2.0–77.3% for rectal chlamydia and 0.2–3.2%

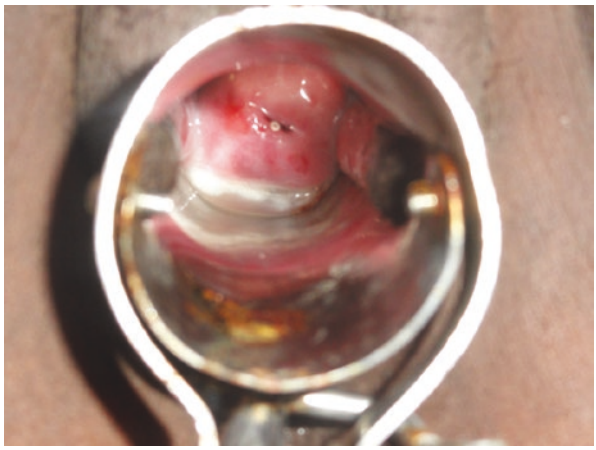

Fig. 18.1 Per speculum examination showing mucopurulent cervical discharge

for pharyngeal chlamydia [44]. Fitz-Hugh–Curtis syndrome is perihepatitis, i.e. inflammation of liver capsule, which can be seen in patients of pelvic inflammatory disease (PID). It is characterized by fever, nausea, vomiting and upper abdominal pain [45]. Conjunctivitis can occur due to autoinoculation in both etiologies [43, 46].

18.2.5.3 Diagnosis

18.2.5.3.1 Gonorrhoea

Gram's staining is the commonest investigation performed and is POC test, which demonstrates polymorphonuclear cells and ICGND. Sensitivity of about 30–50% is reported [43]. Culture helps in assessment of antibiotic resistance, which is its major advantage. Sensitivity is 72–95%. The most commonly used medium is Thayer–Martin agar. Rayon, dacron or calcium alginate swabs must be used for sample collection [47]. Major disadvantage is that culture reports are unavailable before minimum of 48 h. NAAT techniques like polymerase chain reaction (PCR), strand displacement amplification (SDA) and transcription-mediated amplification (TMA) can be used. It is gold standard for diagnosis. Major advantages are provision of highly sensitive (almost 100%) and specific results within hours and ability of the test to produce reproducible results even on non-invasive samples like urine and vaginal swabs, while disadvantage is that antimicrobial resistance cannot be assessed [48, 49]. Several cartridge-based rapid NAAT tests, with almost 100% sensitivity, performed on site at the laboratories, are now available and being used [50].

18.2.5.3.2 Chlamydia

NAAT is gold standard for diagnosis, as it is not only highly sensitive, but co-infection with *N. Gonorrhoeae* can also be detected [49]. Rapid POC assays like the XPert and CT/NG assay (binx io) are available, results of which can be obtained within 90 and 30 min, respectively [51, 52]. Other tests that can be performed if facilities are available include culture, serology, antigen detection and gene probe assays.

18.2.5.4 Management

Treatment is based on isolation of ICGND from cervical or vaginal smears. Specimen should be sent for NAAT in all patients to confirm the diagnosis and to diagnose co-infection [53].

Gonococcal cervicitis is treated with cephalosporins, preferably administered intramuscularly. After surge of fluoroquinolone resistance in gonococcal infections in 2007, CDC's guidelines recommended dual treatment of the patients with a

cephalosporin with either azithromycin or doxycycline, irrespective of whether *C. trachomatis* co-infection was suspected at the time of presentation [54].

Recommended regimen up until recently was ceftriaxone 250 mg IM in a single dose plus azithromycin 1 g orally in a single dose [53]. However, according to CDC update on treatment of gonorrhoea, the recommendation now is Inj. ceftriaxone 500 mg IM single dose, which should be combined with doxycycline 100 mg twice daily for 7 days if chlamydial co-infection is diagnosed or cannot be ruled out [55].

Partner Treatment All sexual partners should be evaluated, tested and presumptively treated with same regimen as the patient, if sexual contact was within 60 days of onset of patient's symptoms [43]. Expedited partner therapy (EPT) is a provision wherein if the partners are unable to visit for evaluation and testing, single oral doses of cefixime 400 mg and azithromycin 1 g can be given to the patient for partner treatment [56].

Pregnancy All patients of gonococcal cervicitis should be treated with ceftriaxone 250 mg IM in a single dose plus azithromycin 1 g orally in a single dose. Patients with chlamydial cervicitis/non-gonococcal cervicitis should be treated with azithromycin 1 g orally in a single dose as doxycycline is contraindicated in second and third trimester. Test-of-cure should be performed in all patients at 3–4 weeks post treatment in chlamydial infection as severe sequelae can occur in mother and neonate if infection persists [43, 57].

HIV Same treatment regimen is to be followed as non-co-infected patients [43, 57].

18.2.6 Bacterial Vaginosis (BV)

Bacterial vaginosis (BV) is not due to one organism. Instead, quantitative imbalance in numbers of lactobacilli and anaerobes like *Gardnerella vaginalis (G. vaginalis)*, *Atopobium vaginae*, *Leptotrichia amnionii*, *Sneathia* and *Megasphaera* species is the aetiology. BV may affect sexually inactive and virgin females as well and thus it is considered sexually enhanced but not necessarily sexually transmitted [58].

18.2.6.1 Epidemiology

According to CDC 2018 statistics, 21.2 million women in the USA had BV with it being commonest vaginal condition in women aged 15–44 years [59]. In an epidemiological study from India, out of 200 women with vaginal discharge, 51% were diagnosed with bacterial vaginosis, 25.5% with candidiasis and 0.03% with trichominasis [60].

18.2.6.2 Clinical Features

The primary complaint is vaginal discharge and malodour. Alkaline pH, after sexual intercourse or during menstruation leads to increased production of amines like putrescine, cadaverine and trimethylamine, by the anaerobic bacteria and thus enhances the malodour. Scanty to moderate, white or grey, homogenous, malodourous is discharge seen, uniformly coating the vaginal walls (Fig. 18.2). Vaginal and vulval erythema may be present. Per speculum examination shows vaginal discharge coating vaginal walls. Cervicitis is not seen [58].

Various complications associated with BV include adverse pregnancy outcomes like premature rupture of membranes, preterm labour, low birth weight baby and spontaneous second trimester miscarriages; odour leading to embarrassment; acquisition of other STI like gonorrhoeae, chlamydia and HIV; PID and post-hysterectomy cuff cellulitis [58].

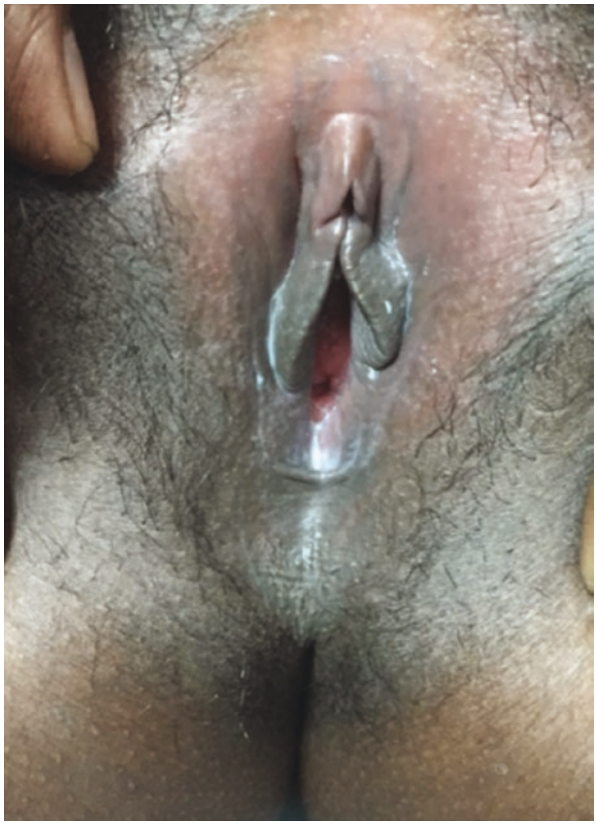

Fig. 18.2 Thin, homogenous, greyish discharge (image courtesy: Dr. Mahima Agarwal)

18.2.6.3 Diagnosis

The diagnosis of BV is based on Amsel's criteria [61], which includes:

- Homogenous, thin discharge, uniformly coating the vaginal walls
- Vaginal pH >4.5
- Positive whiff test
- And presence of clue cells, accounting for >20% of all epithelial cells in the smear.

At least 3 out of these 4 should be present for the diagnosis of BV. When compared with Nugent's criteria, sensitivity is about 90% [62].

When compared with Nugent's criteria (gold standard), Hay/Ison criteria has shown sensitivity of >97% [63, 64]. Culture is of limited value as it may be positive in about 55% of healthy women and it represents the presence of organisms like *G. vaginalis*, which are normally encountered in vaginal flora [65].

Various commercially available molecular diagnostic procedures are now FDA approved.

OSOM BVBlue gives results in less than 10 min, sensitivity and specificity in range of 84–88% and 91–98%, respectively. It detects elevated sialidase levels in the vaginal fluid samples [66]. Affirm VPIII is another FDA approved DNA probe test that detects the concentration of *G. vaginalis* and requires about 60 min to produce results with sensitivity and specificity of 95% and 97%, respectively [67]. Aptima BV is a NAAT that quantitatively detects lactobacilli, *G. vaginalis* and *A. vaginae*, with a sensitivity of about 95% [68]. Another quantitative PCR method is BD Max system that measures lactobacilli like *Lactobacillus jensenii* and *Lactobacillus crispatus* along with *G. vaginalis*, *A. vaginae* and *Megaspheara-1,* with a sensitivity of about 90% and specificity of about 85% [69].

18.2.6.4 Management

Recommended regime is metronidazole 500 mg orally twice a day for 7 days or metronidazole gel 0.75% 5 g intravaginally, once a day for 5 days or clindamycin cream 2%, 5 g intravaginally at bedtime for 7 days [70].

Alternatively, tinidazole 2 g orally once daily for 2 days or 1 g orally once daily for 5 days or clindamycin 300 mg orally twice daily for 7 days or 100 mg ovules intravaginally once at bedtime for 3 days, can be tried [70]. Patients with persistence or recurrence after first episode should be retreated with same recommended regime [71].

Follow-up visits are not required unless the patient has persistent or recurrent symptoms [70]. However, NACO recommends follow-up visit 7 days later to document symptomatic cure [16].

Multiple recurrences, which can be very distressing, can be treated with metronidazole 0.75% gel twice weekly for 4–6 months [72] or with metronidazole or tinidazole 500 mg twice daily for 7 days followed by intravaginal boric acid 600 mg gelatin capsules daily for 3 weeks followed by metronidazole 0.75% gel twice weekly for 4–6 weeks [73] or with metronidazole 2 g plus fluconazole 150 mg orally monthly [74].

Partner Treatment Treatment of asymptomatic sex partners is not recommended [70].

Pregnancy All symptomatic pregnant patients should be treated. In a study it was found that metronidazole 500 mg orally twice daily was as efficacious as topical metronidazole gel and thus pregnant patients can be treated with any oral or topical recommended regimen [70]. NACO, however, recommends treatment with metronidazole 400 mg twice a day for 7 days [16].

HIV HIV co-infected patients should be treated with same regime as non-co-infected patients [70].

Clinical features of the bacterial STIs are summarized in Table 18.1, while the diagnostic modalities and treatment summed in Table 18.2.

Table 18.1 Summary of clinical features of bacterial infections

Disease	Clinical features
Syphilis	Painless, well demarcated, superficial, indurated, ulcer (primary chancre) at the site of inoculation of organism. Secondary syphilis presents as skin rash, which may go unnoticed and untreated patients may progress to tertiary syphilis (gumma or cardiovascular syphilis). Neurosyphilis may accompany any stage
Chancroid	Single or multiple, painful, non-indurated, deep ulcer(s) that bleed on touch. Untreated cases may suffer from unilocular bubo that may rupture to form a sinus
LGV	Transient, superficial, avascular, painless, avascular ulcer followed by development of inguinal bubo (usually) which may rupture to form multiple sinuses. Untreated patients may develop the stage of complication, i.e. genito-anorectal stage
Donovanosis	Usually single, painless, beefy red, indurated ulcer that bleeds on touch
Gonorrhoea and Chlamydia	Moderate to profuse, mucoid/purulent/mucopurulent cervical discharge along with dyspareunia, intermenstrual or post-coital bleeding. Haematological dissemination may lead to DGI and there may be anorectal or pharyngeal involvement depending on mode of sexual activity
Bacterial vaginosis	Moderate, homogenous, grey-white, malodourous vaginal discharge that uniformly coats the vaginal walls

Table 18.2 Brief summary of diagnostic modalities and treatment of bacterial diseases

Disease	Diagnostic modalities	Management
Syphilis	Dark ground illumination; direct antigen detection by EIA, DFA-TP, PCR; treponemal and non-treponemal serological investigations	Inj. Benzathine penicillin 2.4 MU IM single dose for infectious syphilis and 3 doses a week apart for non-infectious syphilis
Chancroid	Gram's stain; antigen detection by direct immunofluorescence; culture; PCR and serology	Azithromycin 1 g orally
LGV	Culture; NAAT; serology; histology and antigen detection using EIA	Doxycycline 100 mg orally twice a day for 21 days
Donovanosis	Giemsa staining; histology; culture; PCR; antigen detection and complement fixation	Doxycycline 1 g once a week or 500 mg daily for at least 3 weeks
Gonorrhoea and Chlamydia	Gram's staining; culture; NAAT; antigen detection and serology (for chlamydia)	Inj. Ceftriaxone 500 mg IM with doxycycline 100 mg twice daily for 7 days
Bacterial vaginosis	Amsel's criteria; Gram's stain using Nugent or Hay/Ison criteria and molecular tests	Metronidazole 500 mg orally twice a day for 7 days

18.3 Viral STDs

18.3.1 Herpes Genitalis

Herpes genitalis is caused by *Herpes simplex virus* 1 and 2 (HSV 1 and 2), double stranded DNA viruses of Herpes viridae family. The virus persists for life in the body of the patient, as latency is a common property shared by all herpes viruses [75].

18.3.1.1 Epidemiology

HSV infection is considered the commonest cause of sexually transmitted genital ulcer disease (GUD) [76]. According to global estimates published in 2015, about 500 million people were infected with HSV [77]. According to CDC statistics, while seropositivity in women for HSV 1 increased from 16.5% to 31.6% when data of years 1999–2010 were compared with that of 2011–2016, seropositivity for HSV 2 decreased from 77.6% to 63.3% in the same period [78].

18.3.1.2 Clinical Features

Herpes genitalis can present as primary genital herpes, first episode non-primary genital herpes and recurrent genital herpes.

Primary genital herpes is associated with erythematous macular or papular lesions in groups, which subsequently vesiculate and lead to multiple, superficial, coalescing ulcers with erythematous, irregular margins and serous, non-indurated and non-vascular base (Fig. 18.3). These ulcers are usually painful. This can be accompanied by external dysuria and lymphadenopathy which is firm, tender and bilateral. Episode may last upto 3 weeks [79]. Concurrent viraemia may coincide with systemic symptoms like fever, headache and malaise in 24% of patients [80]. Various complications include disseminated herpes, encephalitis, aseptic meningitis, hepatitis, cervicitis, pneumonitis, PID and neonatal herpes [81].

First episode non-primary genital herpes occurs in patients who are already seropositive for either HSV1 or 2 and genital inoculation occurs with the other strain without antibodies. The antibodies already present, try to neutralize this virus and thus the episode is less severe than primary episode [82].

Recurrent herpes genitalis occurs five times less commonly if the infecting virus is HSV1. Recurrent episodes are most common in first year after primary episode and decrease in frequency thereafter. Individual episodes are less severe than primary episode in terms of number of lesions, duration required for resolution and constitutional symptoms [79].

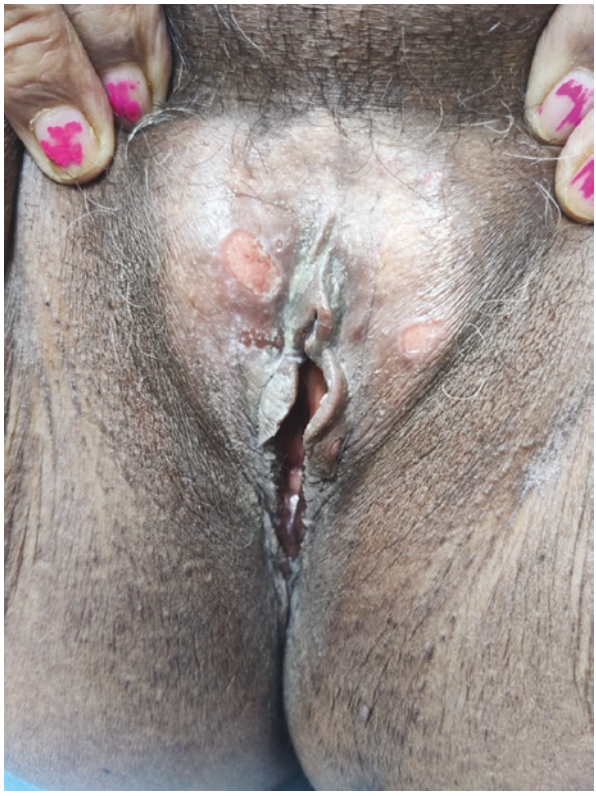

Fig. 18.3 Multiple, well-defined ulcers of Herpes genitalis

18.3.1.3 Diagnosis

Herpes genitalis can be diagnosed using cytological tests (POC), viral culture, viral antigen detection, serological evaluation and molecular tests [83]. Tzanck smear shows acantholytic cells (ballooning degeneration), multinucleate giant cells along with inflammatory cells with an approximate sensitivity of 46.7% (Fig. 18.4) [83]. Viral culture is considered "gold standard". Its specificity is almost 100%, with a variable sensitivity depending upon the type of lesion from which sample is derived (70–80% from a swab from ulcer base) [83]. Immunofluorescence detects infected cells from genital ulcers with specificity of >95% [84]. NAAT, like Aptima HSV 1 and 2, have the highest sensitivities [85].

Serology can be done in the following situations: [22].

- Clinical diagnosis without laboratory confirmation.
- Recurrent or atypical symptoms with negative PCR or culture results.
- Patient whose partner has herpes genitalis.

HerpeSelect ELISA is FDA approved serological test, with a sensitivity and specificity of 96–100% compared to western blot assay, which is gold standard for antibody detection [86].

18.3.1.4 Management

Primary episode can be treated with acyclovir 400 mg orally thrice a day for 7 days [16]. CDC recommends acyclovir 400 mg orally thrice a day for 7–10 days or acyclovir 200 mg orally five times a day for 7–10 days or valacyclovir 1 g orally twice a day for 7–10 days or famciclovir 250 mg orally thrice a day for 7–10 days [22].

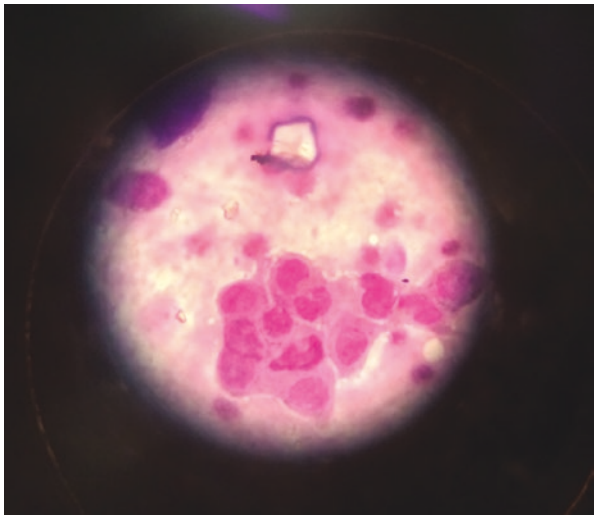

Fig. 18.4 Tzanck smear depicting multinucleate giant cells (100×, oil immersion)

Suppressive therapy can be offered in patients with >6 recurrences in a year. It reduces the frequency of recurrences by 70–80%. Recommended regimens include acyclovir 400 mg orally twice a day or valacyclovir 1 g orally once a day or famciclovir 250 mg twice a day [22]. Episodic therapy can be done with acyclovir 400 mg orally thrice a day for 5 days or valacyclovir 1 g orally once a day for 5 days or famciclovir 125 mg orally twice daily for 5 days [22].

Severe or complicated infection (pneumonia, hepatitis or dissemination) or CNS involvement should be treated with intravenous acyclovir in a dose of 5–10 mg/kg IV every 8 h for 2–7 days or until clinical improvement is observed, followed by oral therapy to complete 10 days of treatment. Encephalitis however has to be treated for 21 days [22].

Partner Management Asymptomatic partners can be offered type-specific serological evaluation. Only symptomatic partners are to be treated [22].

Pregnancy Type-specific serology can help in identifying women at risk of acquisition of infection. All women with no history of genital herpes should be asked to abstain from sexual intercourse in third trimester and also oro-genital contact if history of orolabial herpes is absent. There is approximately 30–50% chance of neonatal transmission near the time of delivery but very low chance (<1%) if infection is acquired before pregnancy or in first trimester. Acyclovir can be safely administered to all women orally or parenterally depending on severity of infection. Women with active lesions or symptoms of prodrome should be delivered by caesarean section to reduce neonatal transmission [22]. American College of Obstetricians and Gynaecologists recommends suppressive therapy from 36th week of gestation in women with history of recurrent genital herpes. Acyclovir 400 mg orally thrice a day or valacyclovir 500 mg orally twice a day is recommended [87]. NACO recommends the acyclovir regimen [16].

HIV In a patient with herpes genitalis, concomitant HIV infection increases viral shedding. Antiretroviral therapy may reduce frequency and severity of symptomatic genital herpes but asymptomatic, subclinical shedding may still occur. Suppressive therapy should thus be considered in these patients as it decreases the severity of clinical manifestations in co-infected patients. Episodic treatment can be considered in patients unwilling for suppressive therapy. Recommended regimen for acyclovir and valacyclovir are same in dosage as HIV uninfected patients but given for 5–10 days [22].

18.3.2 Genital Warts

Genital warts are caused by Human Papillomavirus (HPV), mainly type 6 and 11. HPV is a non-enveloped, double-stranded DNA virus, belonging to Papovaviridae family. Its genome has 6 early-open reading frames (E1,2,4,5,6,7) and 2 late-open

reading frames (L1,2). While the former is responsible for viral replication and encoding proteins, latter encodes viral capsid proteins [87].

18.3.2.1 Epidemiology

In a study conducted in 2013–2014, 42.5% of population in age group 18–59 years was found to be infected with HPV [88].

18.3.2.2 Clinical Features

Anogenital warts are of 3 main morphological variety: acuminate, flat/macular and papular variant. Acuminate warts are primarily seen on mucosal aspect of the genitalia and have an irregular surface and finger-like projections (Fig. 18.5). Flat warts, as the name suggests, are macular and are difficult to clinically distinguish from intraepithelial neoplasia. Third variant, the papular variety, is seen on the extramucosal aspect of genitalia. A rare variant, Buschke-Lowenstein giant tumour, can be seen in immunocompromised patients [89]. Urethral meatus involvement is less common in females compared to males. Instead, cervical warts may be encountered on per speculum examination [90].

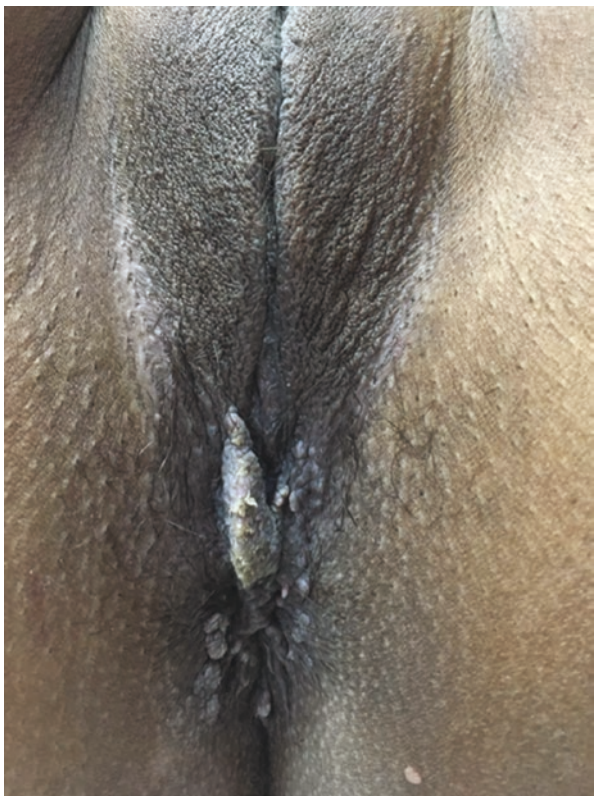

Fig. 18.5 Hyperkeratotic warts (image courtesy: Dr. Mahima Agarwal) over the vulva

About a third of the lesions regress spontaneously in a span of about 4 months [87]. While malignant transformation in a genital wart caused by low risk HPV type (6 and 11) is negligible, in situ carcinoma may occur in warts caused by high risk HPV (like 16 and 18). However, even this transformation is uncommon and may reflect immunosuppressed status of the patient [91].

18.3.2.3 Diagnosis

Genital warts are mainly diagnosed clinically. The doubtful lesions can be subjected to histology, which shows presence of hyperkeratosis, papillomatosis and koilocytosis, i.e. multiple perinuclear vacuoles within the infected cells, along with presence of irregular nuclei [92]. Acetowhite staining technique may be used to diagnose flat or macular warts [89]. Pap smear can be combined with Hybrid capture HPV DNA test 2 (HC2), which is FDA approved to detect HPV; as low as 1 pg HPV DNA/ml can be detected. In a study, its sensitivity for detection of lesions more severe than CIN 2 was 100%, specificity 64.8%, positive predictive value 66.7% and negative predictive value 100% [93]. PCR can also be performed. In a study comparing HC2 with PCR, the sensitivities of the HC2 assay and PCR for the detection of high grade squamous intraepithelial lesions (HSIL) were 85.2 and 74.0%, respectively, and the specificities were 67.2 and 64.1%, respectively [94].

18.3.2.4 Management

CDC has given recommendations to treat external anogenital warts, vaginal warts, urethral warts, cervical warts and intra-anal warts.

External anogenital warts can be treated with imiquimod 3.75% or 5% cream or with podofilox 0.5% solution or with sinecatechins 15% ointment. All these modalities are patient applied, reduce hospital visits and improve compliance. If the patient is willing to visit hospital, then provider administered modalities include trichloroacetic acid (TCA) or bichloroacetic acid (BCA) 80–90% solution or cryotherapy with liquid nitrogen or surgical excision by tangential scissor excision, curettage, laser, tangential shave excision or with electrosurgery [95].

Urethral meatal warts can be removed by cryotherapy or surgically. Vaginal, cervical and intra-anal warts can be treated with cryotherapy or surgically or using TCA/BCA 80–90% solution [95].

NACO recommendations for penile and perianal warts include 20% podophyllin, cryotherapy, electrocautery or surgical excision. Cryotherapy is modality of choice for cervical warts and vaginal warts can be treated with podophyllin 10–25% or TCA 50–75%, using vaginal speculum [16].

Partner Treatment Asymptomatic partners can be screened for presence of warts and other STDs [95].

Pregnancy Podophyllox, podophyllotoxin, imiquimod and sinecatechins are not to be used in pregnancy. Caesarean delivery is indicated only if pelvic outlet is obstructed or if vaginal delivery will lead to excessive bleeding [95].

18.3.3 Molluscum Contagiosum

Molluscum is caused by Molluscum contagiosum virus (MCV), belonging to Molluscipox family. Of the four genotypes, MCV 1 and 2 are encountered most commonly [96].

18.3.3.1 Epidemiology

Molluscum is more commonly seen in children than in adults and in men more than women. Worldwide, the prevalence of molluscum in children aged 0–16 is 8000 per 1,00,000 population [97].

18.3.3.2 Clinical Features

It is characterized by presence of single or multiple, clustered or discrete, skin coloured to pink coloured, firm, round, shiny and umbilicated papules of size about 2–5 mm (Fig. 18.6). In adults, lesions are mainly encountered on lower abdomen, thighs, and genitalia, as the transmission is usually sexual. Similar distribution in children is often from autoinoculation and thus is not always suspicious of abuse [98]. In about 9–47% cases, eczematous plaques may develop around 1–2 lesions, called molluscum dermatitis [99]. Beginning of the end (BOTE) phenomenon refers to development of inflammation around a lesion due to immune response and reflects imminent self-resolution of the lesion [100]. In immunocompromised patients, lesions are larger (giant molluscum), more numerous (>100), resolve slowly and don't respond well to treatment [101].

The lesions usually resolve in 6–9 months, but some lesions persist upto 3–4 years [102].

18.3.3.3 Diagnosis

It is mainly clinical diagnosis. However, it can be subjected to dermoscopy, which shows multilobular, white to yellowish, amorphous structureless areas with central umbilication and peripheral crown of vessels [103]. Histology reveals lobular proliferation of the affected epidermis with presence of eosinophilic intracytoplasmic inclusion bodies, called Henderson Paterson bodies [104].

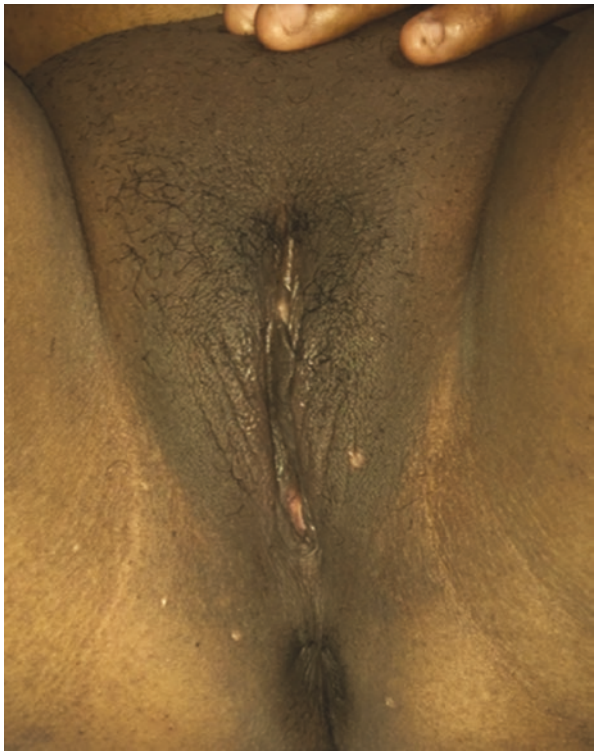

Fig. 18.6 Multiple molluscum contagiosum on the vulva

18.3.3.4 Management

NACO recommends that all the individual lesions should be laid open and their walls cauterized with 25% phenol solution or 30% TCA, after removal of central core [16].

Apart from the mechanical removal (evisceration) of the lesions, various other localized treatments like podophyllotoxin 0.5% cream, imiquimod 5% cream, cantharidin 0.9% solution, tretinoin 0.1% cream, 10% iodine solution, 10% potassium hydroxide solution and tape stripping can be tried. Cryotherapy, oral immunomodulators like ranitidine and zinc can be combined with local treatment [98].

18.3.4 Hepatitis Virus

Hepatitis B virus and hepatitis C virus are sexually transmitted. However, under certain circumstances, hepatitis A virus can also be transmitted sexually. As the name signifies, it primarily affects the liver; however, some non-specific cutaneous findings like polyarteritis nodosa, Gianotti-Crosti disease, lichen planus, porphyria cutanea tarda and prurigo can be seen. The diagnosis relies on seroconversion.

Table 18.3 Summary of clinical features of viral infections

Disease	Clinical features
Herpes genitalis	Multiple, painful, clear to turbid fluid filled vesicles that rupture to form coalescing, irregular and polycyclic erosions over external genitalia. Cervicitis may accompany
Genital warts	Single or multiple, painless, verrucous growths (may be flat or popular or acuminate in morphology) over genitalia
Molluscum contagiosum	Single or multiple, skin to pink coloured, firm, round and umbilicated papules of size about 2–5 mm

Table 18.4 Brief summary of diagnostic modalities and treatment of viral diseases

Disease	Diagnostic modalities	Treatment
Herpes genitalis	Tzanck smear; viral culture; antigen detection using immunofluorescence; serology and NAAT	Acyclovir 400 mg thrice a day for 7 days or valacyclovir 1 g twice a day for 7 days
Genital warts	Clinical diagnosis; histology and PCR	Imiquimod 5%; podofilox 0.5%; sinecatechins 15% ointment; TCA 80–90% and cryotherapy
Molluscum contagiosum	Clinical diagnosis; dermoscopy; crush smear and histology	Extirpation; chemical cautery using TCA 30% or phenol 25% solution; imiquimod 5% cream; podophyllotoxin 0.5% cream; cryotherapy and oral immunomodulators like ranitidine and zinc

Treatment is mainly symptomatic. However, antivirals like lamivudine, adefovir, tenofovir and emtricitabine have been tried [105].

Clinical features of the viral STIs are summarized in Table 18.3 with their diagnostic modalities and treatment summed up in Table 18.4.

18.4 Fungal and Protozoal STDs

18.4.1 Vulvovaginal Candidiasis (VVC)

Vulvovaginal candidiasis may or may not be sexually transmitted. *Candida albicans* (*C. albicans*) is the commonest species. Non-albican species include *C. glabrata*, *C. krusei*, *C. parapsilosis*, *C. guilliermondi* and *C. tropicalis* [106]. Approximately 75% women will have at least 1 episode of VVC in their lifetime with 40–45% developing 2 or more episodes [70].

CDC classifies VVC into uncomplicated (mild-moderate, sporadic or infrequent VVC in non-immunocompromised women, likely caused by *C. albicans.*) and complicated (recurrent or severe VVC or VVC in immunocompromised women or VVC caused by non-albicans candida) VVC. Recurrent VVC is defined as 4 or more episodes in a year [70].

18.4.1.1 Epidemiology

In an epidemiological study from India, out of 100 women with vaginal discharge, 27% had bacterial vaginosis, 25% had trichomoniasis and 22% had candidiasis [107]. According to statistics in the USA, 1.4 million women had vulvovaginal candidiasis [108].

18.4.1.2 Clinical Features

VVC is characterized by scanty to moderate, white, clumped, cheesy, adherent plaques of thick discharge (Fig. 18.7). This is accompanied by vaginal and vulval erythema and excoriations. Associated complaints like vulvar itching, external dysuria and dyspareunia are usually present. Per speculum examination shows adherent discharge over the vaginal walls. Cervicitis is usually not an accompaniment to vaginitis. Perianal involvement, satellite micropustules around labium majus and post thrush vestibulitis may also be present [106].

18.4.1.3 Diagnosis

Investigations including 10% potassium hydroxide (KOH) mount, culture, serological test and molecular diagnostic procedures can be employed to confirm the diagnosis.

10% KOH mount is POC test. After homogenizing with 10% KOH, the discharge is examined under microscope to visualize pseudohyphae (Fig. 18.8). Its sensitivity is only 30–45% [109]. Culture for VVC is performed only if clinical features are suggestive of VVC, but no organism can be visualized on microscopy or in patients with recurrent or persistent infection, in whom either the infecting

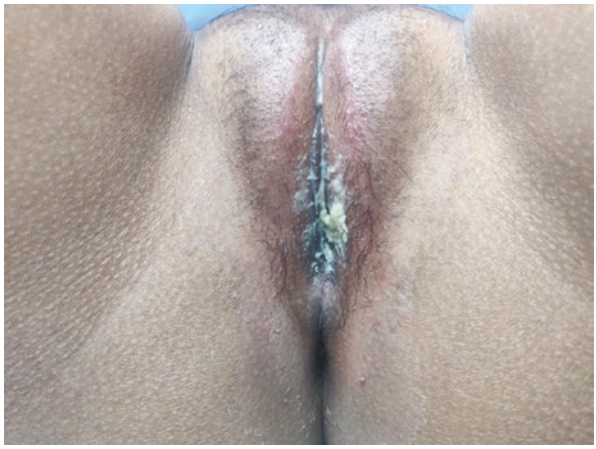

Fig. 18.7 Thick curdy white discharge of vulvovaginal candidiasis

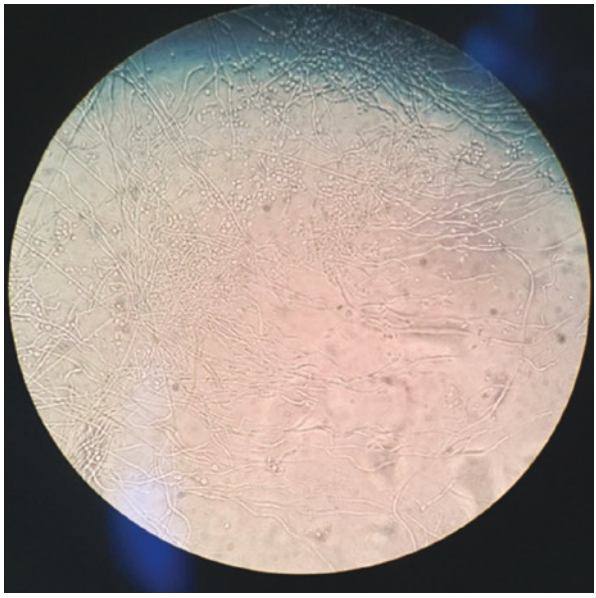

Fig. 18.8 Multiple pseudohyphae seen on 10% KOH examination (10×) from a case of vulvovaginal candidiasis

organism is suspected to be resistant to azoles or is one of the non-albicans species [70]. Various culture media include Sabouraud dextrose agar, Sabouraud brain heart infusion, Potato dextrose agar or broth, blood agar, Yeast nitrogen base and Yeast potato dextrose agar or broth [110]. CHROMagar can be used to detect *albicans* genome (40 fg of *C. albicans* genomic DNA) per 30 μl of serum [111]. Aptima CV/TV is approved by US Food and drug administration for identifying *C. albicans* [112]. Another molecular test, BD MAX, identifies not only candida species (sensitivity 90% and specificity 94%) but also organisms for BV and trichomoniasis [113].

18.4.1.4 Management

Topical formulations in a short course i.e. regimens for 1–3 days are effective for uncomplicated VVC. Clotrimazole 1% cream 5 g intravaginally for 7–14 days or miconazole 2% cream 5 g intravaginally for 7 days or tioconazole 6.5% ointment 5 g intravaginally in a single application can be given [70].

Severe VVC, i.e. presence of extensive vulvar erythema, edema fissures and excoriations, can either be treated with extended topical treatment for 7–14 days or 150 mg fluconazole can be sequentially re-administered after 72 h, i.e. on day 1 and 4 [22]. Recurrent VVC can be treated with either extended topical treatment over 7–14 days or with 100 mg, 150 mg or 200 mg fluconazole administered on day 1,4,7 for mycological remission followed by maintenance with same dose fluconazole weekly for 6 months [70].

Partner Treatment Only symptomatic partners are treated as uncomplicated VVC is generally not considered acquired sexually [70].

Pregnancy Pregnant females should be treated only with topical azoles for 7 days [70].

HIV HIV seropositive patients should be treated with same regimen as non-co-infected patients [70].

18.4.2 Trichomoniasis

It is caused by *Trichomonas vaginalis,* which is a flagellated protozoan parasite that survives in strictly anaerobic environment but in wide range of pH (3.5–8) [114].

18.4.2.1 Epidemiology

Prevalence of trichomoniasis in general population is about 5% in Indian community while it is about 60% in high risk groups [115]. According to statistics in the USA, 3.7 million patients were afflicted with trichomoniasis [116].

18.4.2.2 Clinical Features

It is characterized by profuse, frothy, greenish yellow discharge, along with vulval and vaginal erythema.

It is associated with intense itching or it may be asymptomatic. External dysuria may be present. Per speculum examination shows vaginal discharge and may show strawberry cervix with punctate hemorrhagic points [117].

Patients may also complain of irregular bleeding or post-coital bleeding and pelvic pain. Trichomoniasis may be further complicated by pelvic inflammatory disease, adverse pregnancy outcomes and cervical cancer [117].

18.4.2.3 Diagnosis

Wet mount is the POC test for trichomoniasis with sensitivity of about 60–70%. The organism remains motile in smears for about 10–20 min. Jerky and spinning motility can be observed [118]. Culture on Diamond's media was considered gold standard with sensitivity of upto 95% and specificity of >95%. It requires about 7 days. The InPouch TV culture technique requires about 3 days but has sensitivity of only 80%. However, culture has now been replaced by NAAT [119]. One of the most common PCR based tests, Aptima *T. vaginalis* assay has sensitivity and specificity of 95–100%. It is FDA approved [120]. Other available NAATs include Amplicore,

Xpert TV and NuSwab VG. BD MAX test also detects candida and bacterial vaginosis. It is FDA approved for the same [121]. Rapid antigen hybridization assays are useful mainly for vaginal swabs. AFFIRM VP III involves DNA hybridization and gives results in 45 min with sensitivity and specificity of about 95% [122]. OSOM Trichomonas rapid test uses immunochromatographic technology and gives result in 10 min with sensitivity of 82–95% and specificity of 97–100% [123].

18.4.2.4 Management

Recommended regimens include metronidazole or tinidazole 2 g orally in a single dose [70].

Persistent or recurrent trichomoniasis may be due to reinfection or drug resistance. If reinfection has been ruled out and patient was initially treated with metronidazole 2 g single dose orally, then patients and partner/s can be treated with metronidazole 500 mg orally twice a day for 7 days. Metronidazole or tinidazole 2 g orally daily for 7 days can be tried if the above fails. If the patient still does not respond, then susceptibility testing should be performed. In resistant cases, tinidazole 2–3 g for 14 days with intravaginal tinidazole usually brings about response.

Partner Treatment All concurrent sex partners should be treated presumptively to reduce the risk of reinfection in the patient [70]. NACO recommends treatment of all partners in last 30 days [16].

Pregnancy Pregnant patients should be treated with same regimen as non-pregnant patients [70]. Metronidazole can be safely used in first trimester. NACO recommends treating with metronidazole 400 mg twice a day for 7 days [16]. While screening in asymptomatic patients for trichomoniasis is not recommended, patients co-infected with HIV should be screened in first trimester to reduce vertical transmission of HIV [70].

HIV Single dose metronidazole regimen is insufficient for patients co-infected with HIV. They should thus be treated with metronidazole 500 mg orally twice daily for 7 days [70].

Clinical features of the fungal and protozoal STIs are summarized in Table 18.5, while the diagnostic modalities and treatment are summed in Table 18.6.

Table 18.5 Summary of clinical features of fungal and protozoal infections

Disease	Clinical features
Vulvovaginal candidiasis	Scanty to moderate, white, clumped, thick and curdy white discharge usually accompanied by external dysuria and vulvar itching
Trichomoniasis	Profuse, frothy, greenish yellow discharge, usually accompanied by vulval itching and external dysuria

Table 18.6 Brief summary of diagnostic modalities and treatment of fungal and protozoal diseases

Disease	Diagnostic modality	Management
Vulvovaginal candidiasis	10% KOH examination; culture; serology and molecular tests	Clotrimazole 1% cream 5 gm intravaginally for 7–14 days with fluconazole 150 mg single dose
Trichomoniasis	Wet mount; culture and NAAT	Metronidazole or tinidazole 2 g orally single dose

18.5 Pelvic Inflammatory Disease

Infection and inflammation of upper genital tract in women, i.e. uterus, fallopian tubes and ovaries, is referred to as PID. The commonest organisms responsible are *Neisseria gonorrhoeae* and *Chlamydia trachomatis.* Others include *Mycoplasma genitalium*, *Haemophilus influenzae*, *Streptococcus pneumonia*, *Staphylococcus aureus Escherichia coli*, *Bacteroides fragilis*, group B Streptococci and organisms causing BV [124].

18.5.1 Epidemiology

PID can lead to tubal infertility in upto 30% of the patients [125]. However, with increasing awareness, incidence of PID is showing declining trends. This was exemplified in data provided by National Disease and Therapeutic Index, according to which visits for PID in 2007–2016 declined by 38.3% [4].

18.5.2 Clinical Features

Lower back and abdominal pain, dyspareunia, post-coital or intermenstrual bleeding are main clinical features indicating PID. This may be accompanied by presence of vaginal discharge [124].

18.5.3 Diagnosis

While laparoscopy is the definitive diagnostic modality, it usually is not available and thus sole dependence on it may delay the diagnosis. Thus, ultrasonography can be performed. Presence of thickened and fluid filled tubes are 85% sensitive and 100% specific for PID. Doppler can demonstrate tubal hyperemia [126]. MRI can also be done for the same. However, it is expensive and is thus not performed very frequently [127].

18.5.4 Management

In mild to moderate PID, decision to hospitalize depends on the presence of factors like pregnancy, tubo-ovarian abscess, inability to tolerate oral regimens, or no response to oral regimens, as both parenteral and oral regimes have equal efficacy in this severity spectrum. Recommended parenteral regimes include: cefotetan 2 g IV every 12 h plus doxycycline 100 mg orally or IV every 12 h or cefoxitin 2 g IV every 6 h plus doxycycline 100 mg orally or IV every 12 h or clindamycin 900 mg IV every 8 h plus gentamicin loading dose IV or IM (2 mg/kg), followed by a maintenance dose (1.5 mg/kg) every 8 h. Alternative IM regimens include ceftriaxone 250 mg IM in a single dose plus doxycycline 100 mg orally twice a day for 14 days with or without metronidazole 500 mg orally twice a day for 14 days. If cephalosporins cannot be administered, then levofloxacin 500 mg orally once daily, ofloxacin 400 mg twice daily, or moxifloxacin 400 mg orally once daily with metronidazole for 14 days (500 mg orally twice daily) can be considered [127].

Partner Treatment All sexual partners who had sexual contact with the patient in past 60 days should be evaluated and presumptively treated for gonorrhoea and chlamydia [127].

Pregnancy All pregnant patients should be hospitalized and given parenteral treatment [127].

HIV HIV co-infected patients respond equally well to recommended parenteral and oral regimens as non-co-infected patients [127].

18.6 Conclusion

With female patients forming the bulk of patients attending STI clinics and due to their potential to transmit infection to newborn if infection is perinatal, they are the most important targets of adequate counselling and thus termination of chain of STIs. Adequate knowledge of commonly encountered STIs, POC to aid the clinical diagnosis and provision of appropriate treatment in agreement with latest guidelines is therefore of utmost importance.

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