Sexually Transmitted Infections

*Sarah Mermelstein, MD**
Katie Plax, MD

Address

*Division of Adolescent and Diagnostic Medicine, Department of Pediatrics,
Washington University School of Medicine, 660 S. Euclid Ave, Campus box 8116,
Saint Louis, 63110, MO, USA
Email: mermelstein_s@kids.wustl.edu

Published online: 23 August 2016
© Springer International Publishing AG 2016

This article is part of the Topical Collection on *Pediatric Gynecology*

Keywords Sexually transmitted infection · Teens · Adolescent medicine · Chlamydia · Gonorrhea · Human papillomavirus

Opinion statement

High prevalence of sexually transmitted infections (STI) among adolescents is a significant public health concern. New and repeat STI acquisition in teens and young adults remains disproportionate to other age groups. Conversations with adolescent patients should include education about abstinence, use of barrier protection, reducing number of sexual partners, STI screening recommendations, how to access services for testing and treatment, partner treatment, and availability of effective vaccines against STIs such as human papillomavirus and hepatitis B virus. As early detection and prompt intervention is critical to decreasing disease complications, transmission, and overall community prevalence, it is essential to provide greater access to testing and treatment.

Introduction

Adolescence represents a time of tremendous physical, emotional, social, and cognitive development. Throughout this process, teens typically work to establish independence and seek out new experiences that may lead to high-risk behaviors, including sexual experimentation

and exploration. Higher rates of exposure, biologic susceptibilities to sexually transmitted infections (STI), and limited access to care represent significant challenges. Early detection and prompt treatment are vital aspects to decreasing disease burden within the community.

Sexual activity in adolescents

Epidemiology

According to the 2013 Youth Risk Behavior Surveillance Survey, a poll of high school students ages 15–19, 44 % of female and 47 % of male high school students report history of prior sexual activity. Rate of prior sexual activity increases with age, reaching nearly 70 % by age 19. Mean age of sexual debut for males is 16.8 years and for females 17.2 years [1]. While condom use is up among adolescents in the last several decades, consistent use remains low. Of those high school students reporting sexual activity within the last month, 41 % did not use a condom [2].

Despite representing only 25 % of the sexually active population, 15–24-year-olds represent half of new cases of sexually transmitted infections each year [3]. One in four teenage girls has a sexually transmitted infection such as human papillomavirus (HPV), chlamydia, trichomoniasis, herpes simplex, or gonorrhea [4].

History of reexposure and reinfection is high within the adolescent population. One study revealed as many as 40 % of teens diagnosed with chlamydial or gonococcal disease were previously infected with the same organism [5]. History of past STI is a recognized risk factor for acquisition of future human immunodeficiency virus (HIV) infection, often with a lapse between time of first STI diagnosis and HIV seroconversion, suggestive of a missed opportunity for intervention with significant repercussions [6].

Risk factors

Higher prevalence of STIs in the adolescent and young adult populations is likely multifactorial. A number of well-established risk factors have been identified that contribute to these trends, including behavioral and biologic susceptibilities plus physical, financial, or cognitive barriers to accessing care [7–11].

Behavioral risk factors:

- Past history of STI
- Early sexual debut
- Inconsistent condom use
- Multiple sex partners or partner with multiple concurrent sex partners
- Alcohol or drug use
- Sexual abuse or rape
- Sex with older partner
- Exchanging sex for money, drugs, etc.
- Meeting partners on the internet
- New partner within last 60 days

Biologic risk factors:

- Cervical ectopy: a normal phenomenon that occurs in pubertal females leading to protrusion of columnar cells, previously located within the endocervix. In contrast to squamous cells that typically line the outer cervix, columnar epithelium is more susceptible to sexually

transmitted organisms. As puberty progresses, the externalized columnar cells undergo metaplastic changes and are replaced by squamous epithelium.

- Immature immune system: lower levels of secretory IgA in cervical mucus [12].

Obstacles to health care services:

- Inability to pay for testing and treatment
- Lack of transportation
- Limited access to condoms
- Discomfort, distrust of facilities designated for adults
- Conflict with school/work schedules
- Embarrassment
- Concerns about confidentiality

Racial and ethnic disparities

While STIs are seen across all racial, ethnic, and socioeconomic lines, significant disparities exist. Chlamydia, gonorrhea, syphilis, and HIV disproportionately affect youth of color. Rates of chlamydia and gonorrhea are 7- and 15-times higher, respectively, among African American teens than Whites [13]. In 2011, among all YMSM aged 13–24 years with HIV infection, an estimated 58 % were Black; 20 % were Hispanic/Latino [14].

Knowledge of these disparities enables better prevention, care, and treatment access that is culturally relevant and meaningful to the populations with highest risk.

Screening recommendations

Because STI rates are so high and many patients have asymptomatic disease, universal screening in at-risk populations is of critical importance to decrease disease sequelae as well as disease burden within the community. Untreated STIs can lead to significant morbidity, including pelvic inflammatory disease, chronic pelvic pain, ectopic pregnancy, infertility, increased risk of HIV transmission, cervical dysplasia, infertility, and cancer [15].

Please see Table 1 for full STI screening recommendations.

Taking a sexual history

When interviewing teens about sensitive topics, providers should strive to provide an environment that feels safe. This includes interviewing patients alone with full explanation of consent and confidentiality policies and limitations. Thoughtful, nonjudgmental, and developmentally appropriate counseling regarding safer sex practices and risk-reduction should be offered universally to adolescent patients.

Acquisition of a comprehensive sexual history should focus on potential exposures and identification of high-risk behaviors. Questions should explore the following: age of sexual debut, number of partners, gender(s) of partners, use of barrier protection with oral/anal/vaginal intercourse, past history of STI, exchange of money or drugs for sex, sexual abuse, and pregnancy prevention measures.

Table 1. STI screening recommendations

	Chlamydia	Gonorrhea	HIV	Syphilis	Trichomonas	HPV	HBV, HCV
Women	Annual screening of all sexually active women <25 years	Annual screening of all sexually active women <25 years	All females ages 13–64 years should be tested at least once for HIV, although frequency of repeat screening and relation to sexual debut not defined. All women who seek evaluation and management for STIs	Annual screening for women in high-risk populations based on geography, demographics, and drug use history	Consider screening females in high-prevalence communities or in high-risk populations*	PAP smear every 3 years beginning at age 21 with cytology	Women at increased risk
Men	Annual screening for men who have sex with women in high-risk populations*	Annual screening for men who have sex with women in high-risk populations*	All males ages 13–64 years should be tested at least once for HIV, although frequency of repeat screening and relation to sexual debut not defined. All men who seek evaluation and management for STIs	Annual screening for men in high-risk populations based on geography, demographics, and drug use history			Men at increased risk
MSM	At least annually at sites of exposure (urethra, rectum, pharynx), every 3–6 months if higher risk factors*	At least annually at sites of exposure (urethra, rectum, pharynx), every 3–6 months if higher risk factors*	At least annual screening for MSM if HIV-negative or unknown status, although more frequent screening is recommended (3–6 months) if higher risk factors*	At least annual screening, although more frequent screening is recommended (3–6 months) if higher risk factors*			ALL MSM should be screened for HBsAg; men at increased risk for HCV should be screened
HIV-infected persons	At least annually at sites of exposure, more frequently if higher risk factors*	At least annually at sites of exposure, more frequently if higher risk factors*	At least annual screening, although more frequent screening is recommended (3–6 months) if higher risk factors*	At least annual screening, although more frequent screening is recommended (3–6 months) if higher risk factors*	Sexually active women should be screened at least annually	HIV+ women should be screened within 1 year of sexual activity or HIV diagnosis; testing should be repeated 6 months later	Test for HBsAg, anti-HBc and/or anti-HBs; annual HCV serologic testing for HIV+ MSM

*High risk populations include: STI clinic, adolescent clinic, correctional facility, IV drug users, multiple or anonymous partners, sex with illicit drug use
 Abbreviations: MSM men who have sex with men, HIV human immunodeficiency virus, HPV human papillomavirus, HBV hepatitis B virus, HCV hepatitis C virus
 Reference: [16]

Presentation and physical examination

The spectrum of presentations associated with sexually transmitted infections is broad. Patients may be asymptomatic or may present with urethritis, vulvovaginitis, cervicitis, genital ulcers or growths, pelvic inflammatory disease (PID), epididymitis, abdominal pain, enteritis proctitis, hepatitis, arthritis, pharyngitis, rash, or conjunctivitis.

External GU exam for patients with genital lesions, skin changes, penile discharge, or testicular pain should be considered. Speculum and bimanual examination should be considered in female patients with abdominal and/or pelvic pain, purulent discharge, prolonged or heavy menstrual bleeding, concern for retained foreign body, or for Papanicolaou (PAP) screening. Comprehensive examination of oropharynx, skin, and lymph nodes should be included in symptomatic patients or patients with high-risk sexual behaviors.

In many cases, patient-obtained screening tests (vaginal self-swab, urine specimen) provide adequate specimens and may be done without a full GU examination. See Table 2 for differential diagnosis based on presentation.

Delivering results and retesting

When delivering STI results to patients, it is important to be nonjudgmental and provide opportunity for youth to ask questions. If testing is positive, be clear about what the infection is and how they got it. Discuss available resources to get treatment. Take the opportunity again to discuss safer sex, future STI risk, and contraception.

Because of high rates of reinfection among teens, it is recommended that adolescents with positive testing for chlamydia or gonorrhea should be retested approximately 3 months after they receive treatment [17]. Test-of-cure is not recommended.

Treatment

If an STI is suspected and follow-up not certain, presumptive treatment should be administered for at least gonorrhea and chlamydia. Single-dose therapy should be used when available.

The Centers for Disease Control (CDC) and American Academy of Pediatrics (AAP) recommend expedited partner treatment (EPT) for partners exposed to chlamydia or gonorrhea [18]. This practice allows healthcare providers to prescribe treatment for exposed partners without a medical interview or physical exam. This allows for faster treatment, thus decreasing risk for reinfection and/or ongoing transmission. While intramuscular ceftriaxone is part of the preferred first-line regimen for gonorrhea, providers may rather offer oral cefixime—in addition to azithromycin or doxycycline—to heterosexual partners exposed to *Neisseria gonorrhoeae* in cases where access to treatment may otherwise be delayed or unavailable. CDC does not recommend use of this alternate regimen for MSM due to higher risk for coexisting infections.

Most states allow for EPT for exposed sexual partners. More information can be found at: <http://www.cdc.gov/std/ept/legal/default.htm>. See Table 3 for full treatment recommendations.

Table 2. Differential diagnosis based on history

Vaginal discharge

Chlamydia trachomatis
Neisseria gonorrhoeae
 Candidiasis
 Bacterial vaginosis
Trichomonas vaginalis
 Herpes simplex virus (HSV)
Mycoplasma genitalium

Urethral discharge, dysuria

Chlamydia trachomatis
Mycoplasma genitalium
Neisseria gonorrhoeae
Ureaplasma urealyticum
Trichomonas vaginalis

Genital ulcer

Herpes simplex virus (HSV) syphilis (*Treponema pallidum*)
 Chancroid (*Haemophilus ducreyi*)
 Lymphogranuloma venereum (*Chlamydia trachomatis*)
 Granuloma inguinale (*Klebsiella granulomatis*)
 Behcet's
 Viral (EBV)
 Trauma
 Drug reaction

Exophytic processes

Genital warts (human papillomavirus)
 Molluscum contagiosum
 Condylomata lata (*Treponema pallidum*)
 Vestibular papillomatosis
 Seborrheic keratoses
 Skin tags
 Scabies

Abdominal pain

PID
 Cystitis

Epididymitis

Neisseria gonorrhoeae
Chlamydia trachomatis
 Enteric bacteria

Table 2. (Continued)

Asymptomatic
<i>Neisseria gonorrhoeae</i>
<i>Chlamydia trachomatis</i>
HIV
Syphilis (<i>Treponema pallidum</i>)
Human papillomavirus (HPV)
Hepatitis B (MSM)
Hepatitis C (HIV+ MSM)
Herpes simplex virus (HSV)
<i>Trichomonas vaginalis</i>
Hepatitis C (HIV+ MSM)

Differential

Cervicitis

Cervicitis is a condition that occurs when there is inflammation of the uterine cervix, most often infectious in etiology. Most common infections are caused by *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, and herpes simplex virus (HSV). Diagnostic criteria include the following: purulent or mucopurulent endocervical exudate visible in canal and friable cervix with gentle pressure from cotton swab. Presence of >10 WBC/hpf on microscopic examination of vaginal fluid is also suggestive of cervicitis, although not a standardized requirement for diagnosis.

Urethritis

Inflammation of the urethra, or urethritis, most often has an infectious etiology. Common causative organisms are *N. gonorrhoeae*, *C. trachomatis*, and *Mycoplasma genitalium*. Patients most commonly present with dysuria with or without penile discharge, pruritis, or burning.

Because infectious urethritis is overwhelmingly caused by sexually transmitted organisms, empiric treatment for gonorrhea and chlamydia in symptomatic males is recommended.

All sexual partners within the last 60 days should be evaluated and treated for gonorrhea and chlamydia infections.

Pelvic inflammatory disease

PID is a spectrum of inflammatory disorders of the upper female genital tract, including endometritis, salpingitis, and oophoritis. Complications may include tubo-ovarian abscess (TOA), perihepatitis (Fitz-Hugh-Curtis), pelvic peritonitis, formation of scar tissue, increased risk for ectopic pregnancy, and infertility.

Table 3. Sexually transmitted infections CDC treatment guidelines

Disease	Therapy	Alternate therapy
Gonorrhea	Uncomplicated urogenital, rectal, or pharyngeal: •Ceftriaxone 250 mg IM single dose PLUS 1 g of azithromycin orally in single dose	If ceftriaxone is not available: •Cefixime 400 mg orally in single dose PLUS azithromycin 1 g orally in single dose If betalactam allergy •Gemifloxacin 320 mg orally in single dose PLUS azithromycin 2 g orally in single dose
Chlamydia	•Azithromycin 1 g orally in single dose	Doxycycline 100 mg orally b.i.d. × 7 days Pregnancy: •Azithromycin 1 g orally single dose OR •Amoxicillin 500 mg orally t.i.d. for 7 days with retesting 3 months after treatment
Syphilis	Primary, secondary, early latent: •Benzathine penicillin G 50,000 U/kg, 2.4 million units IM in a single dose Late latent: •Benzathine penicillin G 2.4 million units IM every week for 3 weeks Tertiary syphilis: •Benzathine penicillin G 2.4 million units IM every week for 3 weeks Neurosyphilis: •Aqueous crystalline penicillin G 4 million units IV q4h for 10–14 days followed by •Benzathine penicillin G 2.4 million units IM every week for 3 weeks at the completion of IV therapy	Primary and secondary or early latent, penicillin allergy: •Doxycycline 100 mg orally b.i.d. for 14 days OR •Tetracycline 500 mg orally q.i.d. for 14 days Late latent, penicillin allergy: •Doxycycline 100 mg orally b.i.d. for 28 days OR •Tetracycline 500 mg orally q.i.d. for 28 days
Pelvic inflammatory disease (PID)	Outpatient regimen: •Ceftriaxone 250 mg IM in single dose PLUS doxycycline 100 mg orally b.i.d. for 14 days <i>with or without</i> metronidazole 500 mg b.i.d. for 14 days Parenteral regimen: •Cefotetan 2 g IV every 12 h PLUS doxycycline 100 mg orally or IV every 12 h •Cefoxitin 2 g IV every 6 h PLUS doxycycline 100 mg orally or IV every 12 h	Outpatient regimen: •Cefoxitin 2 g IM in single dose PLUS probenecid 1 g orally concurrently in single dose PLUS doxycycline 100 mg orally b.i.d. for 14 days <i>with or without</i> metronidazole 500 mg b.i.d. for 14 days Parenteral regimen: •Ampicillin/Sulbactam 3 g IV every 6 h PLUS doxycycline 100 mg orally or IV every 12 h
Epididymitis	•Ceftriaxone 250 mg IM single dose PLUS doxycycline 100 mg orally b.i.d. for 10 days	For acute epididymitis most likely caused by enteric organisms add: •Levofloxacin 500 mg orally once daily for 10 days OR •Ofloxacin 300 mg orally twice a day for 10 days
Herpes	First episode: •Acyclovir 400 mg orally t.i.d. for 7–10 day OR Recurrent episodes: •Acyclovir 800 mg orally t.i.d. for 2 days OR Daily suppressive therapy (↓ frequency of recurrences by 75 %):	First episode: •Acyclovir 200 mg orally 5x/day × 7–10 days OR •Valacyclovir 1 g orally b.i.d. for 7–10 days OR •Famciclovir 250 mg orally t.i.d. for 7–10 days Recurrent episodes: •Acyclovir 400 mg orally t.i.d. for 5 days OR

Table 3. (Continued)

Disease	Therapy	Alternate therapy
Genital warts, condyloma acuminata	<ul style="list-style-type: none"> •Acyclovir 400 mg orally b.i.d OR •Valacyclovir 500–1000 mg orally once daily External warts (patient administered): <ul style="list-style-type: none"> •Podofilox 0.5 % topical solution b.i.d. for 3 days, then 4 days off; may repeat 4 times this cycle, OR •Imiquimod 5 % cream apply at bedtime 3× per week then wash off in AM for up to 16 weeks 	<ul style="list-style-type: none"> •Valacyclovir 500 mg orally b.i.d. for 3 days OR •Famciclovir 125 mg orally b.i.d. for 5 days <i>Provider applied (mucosal lesions):</i> <ul style="list-style-type: none"> •Cryotherapy •Podophyllin resin 10–25 % •Trichloroacetic acid OR Surgical or laser removal

Adapted from the 2015 CDC Treatment Guidelines [41]

The most common causal organisms are *N. gonorrhoeae* and *C. trachomatis*, although other associated organisms include *Trichomonas vaginalis*, *Gardnerella vaginalis*, *Haemophilus influenza*, *M. genitalium*, enteric gram-negative rods, *Streptococcus agalactiae*, and *Bacteroides fragilis*.

Diagnosis requires the following minimum criteria: lower abdominal pain in a sexually active female with no other identifiable cause and adnexal/uterine tenderness or cervical motion tenderness. Supportive criteria include the following: oral temperature $>38.3^{\circ}\text{C}$, abnormal cervical or vaginal discharge, elevated erythrocyte sedimentation rate or c-reactive protein, laboratory confirmation of *N. gonorrhoeae* or *C. trachomatis* infection, and presence of white blood cells on saline mount of vaginal secretions.

Most patients with PID may be managed as outpatients with parenteral treatment and close follow-up to ensure adequate response to treatment. Follow-up examination should be performed within 72 h. Criteria for hospitalization include the following: all pregnant women with suspected PID, if surgical emergency such as appendicitis or TOA cannot be excluded, limited access to follow-up, inability to tolerate parenteral treatment, inadequate response to oral antimicrobial therapy, or if patient has severe illness including nausea and vomiting, or very high fever.

All sexual partners within the last 60 days should be evaluated and treated for gonorrhea and chlamydia infections.

Epididymitis

Epididymitis is a complex of symptoms that may include scrotal pain, scrotal swelling, and tenderness. Urethral discharge may or may not be present. Most often in adolescents, this condition is caused by *N. gonorrhoeae* or *C. trachomatis* infection. Treatment is with both ceftriaxone 250 mg IM once and doxycycline 100 mg p.o. BID for 10 days. All sexual partners within the last 60 days should be evaluated, tested, and treated for gonorrhea and chlamydia infections.

Sexually transmitted infections

Chlamydia

Chlamydia, caused by the bacterium *C. trachomatis*, is the most commonly reported STI in the USA in all age groups, with highest prevalence in patients less than 25 years of age [19]. Two-thirds of new cases arise in patients ages 15–24 years and an estimated 1 in 20 adolescent females is infected with chlamydia at any time [3, 13].

Presentation is variable; most infected individuals are asymptomatic. In symptomatic women, vaginal discharge, irregular menstrual bleeding, dysuria, and abdominal pain may be present. In men, mucoid or watery penile discharge, dysuria, or testicular pain may occur.

The gold standard for CT testing is now nucleic acid amplification tests (NAAT). First-catch urine, cervical swab, or urethral swab specimens can be obtained for NAAT. CDC recommends female vaginal swab and male first-void urine for optimal specimen collection [20]. Most FDA approved NAATs allow for testing for both *C. trachomatis* and *N. gonorrhoeae* with a single specimen.

Gonorrhea

Gonorrhea is the second most commonly reported STI, caused by *N. gonorrhoeae*. Like chlamydia, prevalence is highest in patients less than 25 years of age [20].

Presentation for infected individuals with gonorrhea is variable, as many are asymptomatic. In symptomatic women, vaginal discharge, irregular menstrual bleeding, dysuria, and abdominal pain are commonly present. In men, mucopurulent discharge, dysuria, or testicular pain can occur.

NAAT is preferred for diagnosis of *N. gonorrhoeae*. First-catch urine, cervical swab, or urethral swab specimens can be obtained for NAAT. CDC recommends female vaginal swab and male first-void urine as optimal specimen sources. NAATs may also be used for testing of extragenital sites (rectum, pharynx), although none have been FDA approved for this purpose at the present time. Culture remains the gold standard in cases when there is concern for antibiotic resistance or prior treatment failure. Treatment failures should be reported to the local health department, as there is growing concern for increasing antibiotic resistant *N. gonorrhoeae* [21, 22].

Quinolones are no longer recommended due to high resistance rates. Oral cephalosporins are no longer recommended due to emerging resistance patterns [21]. Dual treatment with IM ceftriaxone and azithromycin or doxycycline is recommended to slow progression of antimicrobial resistance.

Syphilis

Syphilis is caused by the spirochete *Treponema pallidum*. This infection can present with four stages if left untreated: primary, secondary, latent, and tertiary. Presentation is highly variable and has been called “the great imposter,” as many of the signs and symptoms are nonspecific.

Incubation period is 9–90 days. Primary symptoms occur on average 21 days post-exposure. Primary syphilis involves a chancre, a painless ulcer at site of infection. Characteristics include a sharply demarcated border with a smooth,

red base. Generally, there is a solitary lesion, although multiple lesions can occur. Regional lymphadenopathy may be found with primary syphilis. The chancre typically resolves in 3–6 weeks without treatment and can often go unnoticed and as a result, untreated.

Secondary syphilis typically occurs 4–10 weeks after onset of the chancre. Symptoms include a diffuse, nonpruritic rash that can occur anywhere on the body, including on the palms or soles. Appearance is highly variable and can include macular, papular, annular, or pustular lesions with hyperpigmentation or hypopigmentation.

Latent syphilis occurs after secondary syphilitic symptoms resolve. This stage can last up to 25 years before progressing to tertiary complications. Individuals are asymptomatic during this phase. Latent syphilis is divided into early latent or late latent phases based on proximity to primary/secondary symptoms or last documented negative testing. New seroconversion with documented negative testing or primary/secondary symptoms within the last year is considered early latent phase. A diagnosis of late latent syphilis is applied when primary/secondary symptoms occurred >1 year ago, for those whose last negative testing was obtained >1 year ago or if no prior history of negative testing is available.

Tertiary syphilis is a disseminated infection and can affect any organ system, most commonly with neurologic, ophthalmic, auditory, and cardiac involvement. Gummas—granulomatous lesions—can involve skin, soft tissue, viscera, and bones.

Making a diagnosis of syphilis requires both a nontreponemal test (rapid plasma reagin [RPR] or venereal disease research laboratory [VDRL]) and a treponemal test (fluorescent treponemal antibody absorbed [FTA-ABS], *T. pallidum* passive particle agglutination [TP-PA], enzyme immunoassay, chemiluminescence immunoassay). Darkfield microscopy in early syphilis is highly specific, but insensitive. Anyone with a positive nontreponemal test should receive a treponemal test in order to confirm a diagnosis of syphilis. There are a number of conditions that may lead to false positive nontreponemal results, including pregnancy, autoimmune conditions, immunizations, IV-drug use, and age [23].

Nontreponemal titers should be followed post-treatment. A fourfold decrease in titers (e.g., from 1:64 to 1:16) demonstrates an adequate response to treatment. Most patients will have lifelong reactivity on treponemal testing after a syphilis infection.

Benzathine penicillin is the drug of choice and treatment regimen is based on staging. Sex partners within the last 90 days should be tested and treated.

HIV

While HIV rates in the USA overall are in decline, youth ages 13–24 still account for nearly 10,000 new cases of HIV within the USA each year [24]. The majority of these diagnoses occurred among MSM, particularly African American and Hispanic MSM. CDC recommends screening for all men and women ages 13–64 and routinely for individuals seeking evaluation and treatment for STIs. MSM should be screened at least annually if status is unknown or negative. Counseling that includes risk reduction, screening, and linkage to care for positive youth should remain a priority for providers [25].

Information regarding clinical course and management of HIV infection may be found in more detail elsewhere.

Herpes simplex virus

Herpes simplex viruses are common and result in lifelong viral infection. Two subtypes, type 1 (HSV-1) and type 2 (HSV-2), exist. Historically, HSV-1 has been associated with orofacial disease and HSV-2 with genital disease; however, infection with either serotype has been known to cause disease at both sites [26]. Recurrence is more common in HSV-2.

It is believed that at least 50 million Americans are infected with HSV-2, with estimated prevalence rates of 1.4 % among 14–19-year-olds and 10.5 % among 20–29-year-olds [27]. Most seropositive individuals—nearly 90 %—are either asymptomatic or do not recognize the symptoms, and thus go undiagnosed [28].

Incubation period is 2–12 days. Presentation can include single or multiple vesicles that rupture to form painful, shallow ulcers. Associated symptoms include perineal pain, vulvar edema, serosanguinous vaginal discharge, pruritis, dyspareunia, dysuria or urinary outflow obstruction, or proctitis. The primary episode is often the most severe and may be associated with tender lymphadenopathy and/or viremia with fever, malaise, or myalgias. Recurrences may be less severe and are often preceded by a prodrome that may include burning, tingling, tenderness, or pain prior to eruption of lesions. Without treatment, lesions typically last 8–10 days before spontaneous resolution.

Counseling should include education regarding potential for recurrence, triggers (e.g., stress, fatigue, illness, menses), recognizing prodrome, treatment options and education regarding transmission, asymptomatic shedding, and the importance of condom usage with all sexual activity.

Goal of treatment with systemic antiviral agents is to control symptoms and decrease risk of transmission to partners. There is no treatment to eradicate latent virus. Episodic treatment may be offered to those with new diagnoses or infrequent outbreaks. Treatment should be initiated at onset of prodromal symptoms or within 1 day of appearance of lesions. Daily suppressive therapy may be provided for those with frequent recurrences (≥ 6 /year) or if the patient wants to reduce risk of transmission to uninfected partners.

Routine screening for HSV is not recommended. For symptomatic presentation, HSV-PCR is considered gold standard over viral culture. Serologic testing is available, although is not recommended as a standard screening tool in asymptomatic individuals [29].

Human papillomavirus

HPV accounts for the majority of newly acquired STIs each year. Seventy-nine million Americans are currently infected with HPV and 14 million people become newly infected each year. Most men and women will get at least one type of HPV at some point in their lives [3]. Incubation period is 3 weeks–8 months. Symptomatic HPV presentation typically includes genital warts or cervical dysplasia.

Genital warts present as flat, papular, or pedunculated lesions most commonly around the anus or vaginal introitus. These lesions can spread, get very large, distort anatomy, or obstruct urethral meatus. Approximately 90 % of all HPV cases will spontaneously resolve within 2 years without long-term sequelae. Even

with treatment, some lesions may persist or recur. A small number of warts will undergo malignant transformation and can lead to serious consequences including oral, anal, vulvar, vaginal, penile, oropharyngeal, or cervical cancer.

Diagnosis of anogenital warts is primarily a clinical diagnosis. Treatment may be offered to remove symptomatic warts. This does not eradicate the virus, but may induce wart-free period and likely decreases infectivity. Most warts respond to topical therapy within 3 months. Mucosal warts or very large or coalesced lesions should be referred for removal by a skilled provider with cryoablation, laser ablation, electrocautery, or excision. Partners should be notified and patients should be encouraged to use condoms with all sexual activity to decrease disease transmission.

Papanicolaou (PAP) smear remains the gold standard for cervical cancer screening. Initiation of PAP smears should begin at age 21, regardless of age of onset of sexual activity [30, 31].

Three HPV vaccines, Gardasil (quadrivalent and 9-Valent) and Cervarix (bivalent), have been approved by the FDA for prevention of HPV disease. Only Gardasil has been approved for males. HPV vaccine is recommended by the Advisory Committee on Immunization Practices (ACIP) between 11 and 12 years of age for both males and females; however it can be given as young as 9 and as old as 26 [32]. A three-injection series is administered at 0, 1–2, and 6 months. All three vaccines protect against the two most highly oncogenic subtypes, 16 and 18. Both quadrivalent and 9-valent Gardasil also protect against serotypes 6 and 11, which most commonly cause anogenital warts. 9-valent Gardasil offers 5 additional oncogenic types that primarily affect women (31, 33, 45, 52, and 58).

The vaccine is most beneficial if it is administered prior to sexual debut. Efficacy studies evaluating the vaccines are encouraging—HPV prevalence in teen girls decreased by 56 % in the first 4 years after the vaccine debuted [33]. This suggests potential prevention of tens of thousands of cases of cervical cancer in the future with improved vaccine administration. Despite these data, rates of completion of the three-dose series remain low, a mere 40 % among teenage girls and 22 % among teenage boys [34].

Trichomoniasis

Infection with *T. vaginalis*, a motile protozoan, is increasingly prevalent and now thought to be the most common nonviral STI [35]. This infection affects men and women of all ages.

Incubation period is approximately 5–18 days. Asymptomatic carriage commonly occurs. Presentation in females may include vaginal discharge, odor, perineal irritation or pruritis, irregular bleeding, dysuria, cervicitis, and PID. Most men are asymptomatic, but those infected may present with urethritis, epididymitis, or prostatitis. Infection with *T. vaginalis* has been associated with higher rates of HIV and HSV transmission, cervical neoplasia and adverse pregnancy outcomes [36–38].

Female GU examination often reveals diffusely erythematous, vaginal mucosa; thin, homogenous, “frothy” discharge with pH >4.5 and positive “whiff test” (amine odor test when vaginal fluid combined with 10 % KOH); characteristic “strawberry cervix,” or colpitis macularis, microscopic hemorrhages of the cervix.

CDC recommends screening for trichomonas in HIV-infected females annually. While no formal screening recommendations exist at the present time for screening other patient populations, it is suggested that females in high-risk

populations or with high-risk sexual behaviors also be screened.

Diagnosis can be made using wet mount microscopy of vaginal secretions to detect motile trichomonads, although this has low sensitivity of only approximately 50–65 %, [39, 40] requires a microscope and experienced user, and is time-sensitive. Culture is no longer considered the gold standard; rather, NAAT or antigen-detection systems are preferred.

Conclusions

Acquisition of comprehensive sexual history and provision of standard screening for STIs should be considered standard of care for all healthcare providers caring for youth. Additionally, there needs to be a greater push for universal vaccination against HPV within the adolescent population, as administration rates remain low despite encouraging efficacy data. Providing easier access, routine screening, and prompt treatment for patients and their partners is critical to decreasing disease-related complications and disease burden within the community.

Compliance with Ethical Standards

Conflict of Interest

Sarah Mermelstein and Katie Plax declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

References and Recommended Reading

1. Kann L, Kinchen S, Shanklin SL, Flint KH, Hawkins J, Harris WA, et al. Youth risk behavior surveillance—United States, 2013. *MMWR Surveill Summ.* 2014;63(4):1–168.
2. Abma JC, Martinez GM. Teenagers in the U.S.: sexual activity, contraceptive use, and childbearing, national survey of family growth 2006–2008. *Vital Health Stat.* 2010;23(30):1–47.
3. Satterwhite CL, Torrone E, Meites E, Dunne EF, Mahajan R, Ocfemia MC, et al. Sexually transmitted infections among US women and men: prevalence and incidence estimates, 2008. *Sex Transm Dis.* 2013;40(3):187–93.
4. Forhan SE, Gottlieb SL, Sternberg MR, Xu E, Datta SD, Mcquillan GM, et al. Prevalence of sexually transmitted infections among female adolescents aged 14 to 19 in the United States. *Pediatrics.* 2009;124(6):1505–12.
5. Wilkstrom E, Bloigu A, Ohman H, et al. An increasing proportion of reported Chlamydia trachomatis infections are repeated diagnoses. *Sex Transm Dis.* 2012;39:968.
6. Newbern EC, Anschuetz GL, Eberhart MG, et al. Adolescent sexually transmitted infections and risk for subsequent HIV. *Am J Public Health.* 2013;103:1874.
7. Fortenberry JD. Adolescent substance use and sexually transmitted diseases risk: a review. *J Adolesc Health.* 1995;16:304.
8. Leigh BC. Alcohol and condom use: a meta-analysis of event-level studies. *Sex Transm Dis.* 2002;29:476.
9. Niccolai LM, Ethier KA, Kershaw TS, et al. New sex partner acquisition and sexually transmitted disease risk among adolescent females. *J Adolesc Health.* 2004;34:216.
10. Tilson EC, Sanchez V, Ford CL, Smurzynski M, et al. Barriers to asymptomatic screening and other STD services for adolescents and young adults: focus group discussions, 2004. *BMC Public Health.* 2004;4:21.
11. Gilbert AL, Rickert VI, Aalsma MC. Clinical conversations about health: the impact of confidentiality in preventive adolescent care. *J Adolesc Health.* 2014;55:672.

12. Mcgrath JW, Strasburger VC, Cushing AH. Secretory IgA in cervical mucus. *J Adolesc Health*. 1994;15:423.
13. Torrone E, Papp J, Weinstock H. Prevalence of Chlamydia trachomatis genital infection among persons aged 14–39 years—United States, 2007–2012. *MMWR*. 2014;63:834–8.
14. CDC. HIV surveillance in men who have sex with men (MSM). 2012. Available at <http://www.cdc.gov/hiv/library/slideSets/index.html>. Accessed 30 Mar 2016.
15. Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. *Sex Transm Infect*. 1999;75:3–17.
16. Workowski KA, Bolan GA. Sexually transmitted diseases treatment guidelines, 2015. *MMWR Recomm Rep* 2015;64(3):1–140.
17. Peterman T, Tian L, Metcalf C, et al. High incidence of new sexually transmitted infections in the year following a sexually transmitted infection: a case for rescreening. *Ann Intern Med*. 2006;145(8):564–72.
18. Centers for Disease Control and Prevention. Expedited partner therapy in the management of sexually transmitted diseases. Atlanta: US Department of Health and Human Services; 2006.
19. Centers for Disease Control and Prevention. Sexually transmitted disease surveillance 2012. Atlanta: U.S. Department of Health and Human Services; 2013.
20. Centers for Disease Control and Prevention. Recommendation for the laboratory-based detection of *Chlamydia trachomatis* and *Neisseria gonorrhoeae*—2014. *MMWR Recomm Rep*. 2014;63(RR-2):1–19.
21. Centers for Disease Control and Prevention (CDC). Cephalosporin susceptibility among *N. gonorrhoeae* isolates—United States, 2000–2010. *MMWR Morb Mortal Wkly Rep*. 2011;60(26):873.
22. Centers for Disease Control and Prevention (CDC). *Neisseria gonorrhoeae* with reduced susceptibility to azithromycin—San Diego County, California, 2009. *MMWR Morb Mortal Wkly Rep*. 2011;60(18):579–81.
23. Nandwani R, Evans DT. Are you sure it's syphilis? A review of false positive serology. *Int J STD AIDS*. 1995;6:241–8.
24. Centers for Disease Control and Prevention. HIV surveillance report, 2014; vol. 26. 2015. <http://www.cdc.gov/hiv/library/reports/surveillance/>. Accessed 30 March 2016.
25. CDC. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. *MMWR*. 2006;55(No. RR-14):1–17.
26. Lafferty WE, Downey L, Celum C, Wald A. Herpes simplex virus type 1 as a cause of genital herpes: impact on surveillance and prevention. *J Infect Dis*. 2000;181(4):1454–7.
27. Fanfair RN, Zaidi A, Taylor LD, Xu F, Gottlieb S, Markowitz L. Trends in seroprevalence of herpes simplex virus type 2 among non-Hispanic blacks and non-Hispanic whites aged 14 to 49 years—United States, 1988 to 2010. *Sex Transm Dis*. 2013;40(11):860–4.
28. Fleming DT et al. Herpes simplex virus type 2 in the United States, 1976–1994. *N Engl J Med*. 1997;337:1105–11.
29. Workowski KA, Berman S, Centers for Disease Control and Prevention (CDC). Sexually transmitted diseases treatment guidelines, 2010. *MMWR Recomm Rep*. 2010;59(EE-12):1–110.
30. USPSTF. Screening for cervical cancer. 2012. Available at <http://www.uspreventiveservicestaskforce.org/uspstf11/cervcancer/cervcancers.htm>. Accessed 30 Mar 2016.
31. ACOG Practice Bulletin No. 131. Screening for cervical cancer. ACOG Committee on Practice Bulletins—Gynecology. *Obstet Gynecol*. 2012;120(5):1222–38.
32. Markowitz LE et al. human papillomavirus vaccination: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR*. 2014;1:63. #RR05.
33. Reduction in human papillomavirus (hpv) prevalence among young women following HPV vaccine introduction in the United States, National Health and Nutrition Examination Surveys, 2003–2010. Published June 19, 2013 in *The Journal of Infectious Diseases*. First author Lauri E. Markowitz, MD, Centers for Disease Control and Prevention, Atlanta.
34. Reagan-Steiner S, Ynkey D, Javarajah J, Elam-Evans L, Singleton J, Curtis R, et al. National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years—United States, 2014. *MMWR*. 2014;64(29):784–92.
35. Van der Pol B. Trichomonas vaginalis infection: the most prevalent nonviral sexually transmitted infection receives the least public health attention. *Clin Infect Dis*. 2007;44(1):23–5.
36. Wang CC, McClelland RS, Reilly M, Overbaugh J, Emery SR, Mandalia K, et al. The effect of treatment of vaginal infections on shedding of human immunodeficiency virus type 1. *J Infect Dis*. 2001;183(7):1017–22.
37. Gottlieb SL et al. Incidence of herpes simplex virus type 2 infection in 5 sexually transmitted disease (STD) clinics and the effect of HIV/STD risk-reduction counseling. *J Infect Dis*. 2004;190:1059–67.
38. Chernes TL et al. The associations between pelvic inflammatory disease, Trichomonas vaginalis Infection, and positive herpes simplex virus type 2 serology. *Sex Transm Dis*. 2006;33(12):747–52.
39. Krieger JN, Tam MR, Stevens CE, Nielsen IO, Hale J, Kiviat NB, et al. Diagnosis of trichomoniasis. Comparison of conventional wet-mount examination with cytologic studies, cultures, and monoclonal antibody staining of direct specimens. *JAMA*. 1988;259(8):1223–7.
40. Radonjić IV, Dzamić A, Mitrović SM, Arsic Arsenijević VS, Popadić DM, Kranjčić Zec IF. Diagnosis of *T. vaginalis* infection: the sensitivities and specificities of microscopy, culture, and PCR assay. *Eur J Obstet Gynecol Reprod Biol*. 2006;126(1):116–20.
41. CDC. Sexually transmitted diseases treatment guidelines, 2015. *MMWR Morb Mortal Wkly Rep*. 2015;64:1–137.