Gonorrhea

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Module 1: Pathogen-Based Diseases
Lesson 6: Gonorrhea

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Epidemiology in the United States

Infection with Neisseria gonorrhoeae (gonorrhea) is a significant public health problem in the United States. Based on the estimated incident cases among all ages in 2008, the total lifetime direct medical cost of gonorrhea in the United States was estimated at $162.1 million. A total of 583,405 cases of gonorrhea were reported in the United States in 2018 and this was an increase from the 555,608 reported cases in 2017 (Figure 1).[1] The number of reported gonorrhea cases probably underestimates the true incidence and the reporting has been influenced by changes in screening practices, use of diagnostic tests with different performance characteristics, and reporting practices. In the United States, the rate of gonorrhea declined by 74% from 1975-1997 after implementation of a national gonorrhea control program in the mid-1970s. After 1997, gonorrhea rates declined further, reaching a historic low of 98.1 cases per 100,000 population in 2009.[1] During 2009-2012, the gonorrhea rate increased each year, with 106.7 cases per 100,000 population reported in 2012. A slight decline occurred in 2013, but the rates then increased again during 2014-2018 (Figure 2).[1] In 2018, the gonorrhea rate was 179.1 cases per 100,000 population, an increase of 5.0% from 2017.[1]

Epidemiology by Demographics

There are relative differences in the incidence of gonorrhea based on age, gender, race/ethnicity, geography, or sexual risk activity.[1] Gonorrhea rates have increased among men and women, and in every region of the United States.[1]

- **Sex:** For 2018, the rate of reported gonorrhea cases among males (212.8 cases per 100,000 males) was significantly higher than among females (145.8 cases per 100,000 females).[1] From 2017 to 2018, the rates of reported gonorrhea increased 6.0% among males and 3.6% among females.[1] During 2012-2018, the gonorrhea rate among males increased 102.6%, while the rate among females increased 35.4% (Figure 3).[1] The significant increase among males in recent years is predominantly attributed to marked increase in gonorrhea among men who have sex with men (MSM).[2]

- **Age:** Based on age group, the highest rate of gonorrhea cases in 2018 occurred among persons 20 to 24 years of age, with those 25 to 29 years of age having the second highest case rate (Figure 4).[1]

- **Sex and Age Group:** In 2018, the highest rates of gonorrhea among females were observed among those 20 to 24 years of age (702.6 cases per 100,000 females) and 15 to 19 years of age (548.1 cases per 100,000 females).[1] Among males, the rate was highest among those aged 20 to 24 years of age (720.9 cases per 100,000 males) and 25 to 29 years of age (674.0 cases per 100,000 males) (Figure 5).[1]

- **Race/Ethnicity:** In 2018, the incidence of gonorrhea among different racial/ethnic groups in the United States was by far highest among Black persons, with the next highest rates in American Indian/Alaska Native persons (Figure 6).[1] The rate of gonorrhea in Blacks individuals was
approximately 7.7 times greater than in White individuals. During 2014-2018, the overall gonorrhea rates increased among all racial and ethnic groups.[1]

- **Region and State:** In the United States, in 2018, the highest reported rates of gonorrhea were in the South and the lowest in the Northeast (Figure 7).[1] During 2012-2018, gonorrhea rates had the sharpest increases in the West, but rates have increased significantly in all regions (Figure 8).[1] The seven states with the highest rates by state (in descending order) are Mississippi, Alaska, South Carolina, Alabama, Louisiana, New Mexico, and Missouri; the gonorrhea rate in the District of Columbia (611 per 100,000 population) was markedly higher than the rates in any state (Figure 9).[1]
Gonococcal Antimicrobial Susceptibility

Antimicrobial resistance remains an important consideration in the treatment of gonorrhea.[3,4,5,6,7,8,9] Much of the information regarding antimicrobial susceptibility of *N. gonorrhoeae* isolates in the United States comes from the CDC’s Gonococcal Isolate Surveillance Project (GISP).[3] This microbiologic surveillance project has performed ongoing antibiotic susceptibility testing and tracks minimum inhibitory concentrations (MICs) in clinical isolates from men to determine the antimicrobial concentration needed to kill *N. gonorrhoeae* in the laboratory. Higher MICs indicate the need for higher antibiotic concentrations to effectively treat the bacteria. Increases above a defined cut-off indicate resistance to that antibiotic, and progressive increases in MICs below that cut-off suggest that resistance might eventually emerge. Laboratory-based data demonstrate that more widespread resistance has emerged with some antimicrobials and might develop in the near future with others, thus highlighting the need for ongoing surveillance. The GISP tracks primary antimicrobial drugs used to treat gonorrhea in the United States and *N. gonorrhoeae* susceptibility to 7 antimicrobials: ceftriaxone, cefixime, azithromycin, spectinomycin, ciprofloxacin, penicillin, and tetracycline (Figure 10).[1,3] These specific drugs are tested because they either are currently or were previously used for gonorrhea treatment.

- **Azithromycin**: Gonococcal azithromycin resistance has been tracked since 1992. From 2012-2014, the percentage of isolates with reduced azithromycin susceptibility (MICs ≥2 μg/mL) ranged from 0.3 to 2.5%; during 2014-2018, the percentage of gonococcal isolates with reduced azithromycin susceptibility increased from 2.5 to 4.6%. In 2018, among men who have sex with men, 8.2% of the isolates had elevated azithromycin MIC levels compared to 2.4% among men who have sex with women.[1]

- **Cefixime**: During 2009 through 2017, the proportion of *N. gonorrhoeae* isolates in the United States with elevated cefixime MICs (≥0.25 μg/mL) peaked in 2010 and 2011 at 1.4%. From 2011-2018, the percentage of elevated cefixime MICs (≥0.25 μg/mL) has declined from 1.4 to 0.3%. [1]

- **Ceftriaxone**: During 2009–2018, the percentage of isolates with reduced ceftriaxone susceptibility (defined as MIC ≥0.125 μg/mL) fluctuated between 0.1 and 0.4%. In 2018, the percentage of isolates with reduced susceptibility to ceftriaxone (MICs ≥0.125 μg/mL) was 0.2%. In the GISP program, five isolates have been reported with a ceftriaxone MIC of 0.5 μg/mL. In November 2019, the Southern Nevada Public Health Laboratory identified an *N. gonorrhoeae* isolate with a confirmed ceftriaxone MIC of 1.0 μg/mL from a patient in Las Vegas, Nevada; this isolate has the highest ceftriaxone MIC identified in the GISP to date.[10]

- **Ciprofloxacin**: Fluoroquinolone-resistant *N. gonorrhoeae* is widely disseminated throughout the United States and the world. In 2018, 31.2% of GISP isolates were resistant to ciprofloxacin.[1] Because of these high rates of resistance, fluoroquinolones are no longer recommended as therapy for gonorrhea.[11]

- **Gentamicin**: Gonococcal gentamicin susceptibility has been tracked since 2015.[1] From 2015-2017, the percentage of isolates with a gentamicin MIC value of 8 μg/mL ranged from 66.7 to 75.3%. In 2018 the range of MIC values for gentamicin was expanded to include 0.25 μg/mL on the low end and 64 μg/mL on the high end. In 2018, among all gonococcal isolates tested, 0.02% had a gentamicin MIC value greater than 16 μg/mL.[1]

- **Tetracycline**: In 2018, resistance to tetracycline (MIC ≥2.0 μg/mL) was detected in 25.6% of the gonococcal isolates.[1] Since 2001, the tetracycline gonococcal resistance rates have consistently been greater than 15%.[1]

- **Other Antimicrobials**: In 2017, 51.3 % of isolates were resistant to one or more of the antimicrobials tested, including penicillin, cephalosporins, tetracycline, azithromycin, and ciprofloxacin.[1] In 2018, 4.5% of the isolates showed resistance or elevated MICs to at least 3 antibiotics.[1]
Microbiology and Pathogenesis

Microbiology

Gonorrhea is a common bacterial sexually transmitted disease caused by *N. gonorrhoeae*, an oxidase-positive, gram-negative diplococcus that utilizes glucose, but not sucrose, maltose, or lactose. Every 20-30 minutes *N. gonorrhoeae* divides by binary fission (Figure 11) and infects mucous-secreting epithelial cells.

Pathology

*Neisseria gonorrhoeae* attaches to different types of epithelial cells via a number of structures located on the surface of gonococci (Figure 12), rendering it capable of infecting a wide variety of mucosal surfaces, such as the urogenital epithelium, oropharyngeal tract, and conjunctival tissue.[12] By altering its surface structures, including pili, lipo-oligosaccharide antigens, and protein (porin) antigens, this organism has the ability to evade the host immune response. In addition, *N. gonorrhoeae* employs several other mechanisms of immune evasion that cause inherent resistance to phagocytosis and killing by macrophages and neutrophils.[13] These multiple mechanisms of immune evasion explain how an individual can reacquire identical strains of *N. gonorrhoeae* at multiple distinct times.

Transmission

The transmission of *N. gonorrhoeae* can occur in several ways:

- Male-to-female transmission of *N. gonorrhoeae* via semen occurs at a rate of approximately 50 to 70% per episode of vaginal intercourse with ejaculation; male-to-female transmission of *N. gonorrhoeae* can occur without ejaculation.[14]
- An infected woman can transmit *N. gonorrhoeae* to the urethra of a male sex partner; the rate of transmission is approximately 20% per episode from vaginal intercourse, and it increases to approximately 60 to 80% after four or more intercourse exposures.[15]
- Pharyngeal gonorrhea is readily acquired by fellatio; it is less efficiently acquired by cunnilingus. Gonorrhea can also be transmitted from the pharynx to the urethra during fellatio (and presumably to vagina with cunnilingus).
- Perinatal transmission (mother-to-infant) can occur during vaginal delivery, when the infected mother has not been treated during the perinatal period.
- Rectal intercourse transmission rates have not been quantified, but rectal intercourse appears to be an efficient mode of transmission.
- Gonorrhea is associated with increased susceptibility to HIV acquisition, particularly rectal gonorrhea in men who have sex with men.[16] For men with HIV who are not taking suppressive antiretroviral therapy, urethral gonorrhea is associated with an increase in HIV transmission, due to increased urethral HIV shedding.[17]

Risk Factors for Acquisition

Risk factors and risk markers for acquiring gonorrhea include:

- Multiple or new sex partners
- Inconsistent or incorrect condom use
- Living in an urban area where gonorrhea prevalence is high
- Being adolescent (especially female)
- Having a lower socio-economic status
- Using drugs including alcohol (in association with higher risk sex)
- Exchanging sex for drugs or money
- African American race
Clinical Manifestations

*Neisseria gonorrhoeae* infection can potentially cause an array of clinical syndromes, including urogenital, pharyngeal, and rectal infections in males and females, conjunctivitis in adults and neonates, and uncommonly, disseminated gonococcal infection (DGI). If untreated, gonorrhea can cause pelvic inflammatory disease (PID), tubal infertility, ectopic pregnancy, and chronic pelvic pain.

Genital Infection in Men

**Urethritis**

Urethritis is a common manifestation of gonorrhea in men. Most men develop overt, symptomatic urethritis, but a small percentage will develop asymptomatic (unrecognized) infection. Asymptomatic gonorrhea may act as a reservoir that perpetuates transmission in the community.\(^{18}\) The typical symptoms of gonococcal urethritis, when present, include a purulent or mucopurulent urethral discharge (Figure 13), often accompanied by dysuria. The discharge may also be clear or cloudy. The incubation period ranges from 1-14 days, with most men becoming symptomatic within 2-5 days after exposure (Figure 14).\(^{19}\)

**Anorectal Infections**

Anorectal infection most often occurs in men who have sex with men, with acquisition of rectal *N. gonorrhoeae* occurring through receptive anal intercourse, but it also has been reported in women with gonococcal cervicitis who do not acknowledge rectal sexual contact. These infections may result from perineal contamination with infected cervical secretions. Most patients with anorectal infection are asymptomatic, although proctitis can occur. Symptoms of proctitis include anal irritation, painful defecation, constipation, scant rectal bleeding, painless mucopurulent discharge, anal pruritus, and tenesmus.\(^{20}\) When proctitis is suspected, an anoscopy examination is recommended to assess for inflammation and mucosal injury. The anorectal mucosa may appear normal, but purulent discharge, erythema, or easily induced bleeding may be observable under anoscopy.

Complications of Genital Infection in Men

Men with untreated gonococcal genital infection can develop epididymitis, with typical symptoms of unilateral testicular pain and swelling, and epididymal tenderness. Epididymitis is infrequent following gonococcal infection, but it is the most common local complication of gonorrhea infection in men. When it does occur, epididymitis is often associated with overt or subclinical urethritis. Urethral discharge may or may not be present. Notably, up to 70% of epididymitis caused by a sexually transmitted pathogen are due to *Chlamydia trachomatis*. Other less common complications associated with gonococcal infection in men include inguinal lymphadenitis, penile edema, periurethral abscess or fistula, accessory gland infection (Tyson's glands), balanitis, urethral stricture, and prostatitis, and rarely perirectal abscess.

Genital Infection in Women

**Cervicitis**

Symptomatic gonococcal infection in women most often manifests as cervicitis and/or urethritis, but at least 50% of women with genital gonococcal infection are asymptomatic. Symptoms of cervicitis vary and may include a nonspecific vaginal discharge, intermenstrual bleeding, dysuria, lower abdominal pain, and dyspareunia. Clinically, examination of the cervix may show mucopurulent or purulent cervical discharge and easily bleed with minimal contact. The incubation period in women is variable, but symptoms, when they do occur, usually develop within 10 days of the exposure.\(^{21}\) Seventy to ninety percent of women with genital gonococcal infection have laboratory evidence of urethral infection (urethritis); dysuria may be present, but these women frequently do not have specific urethral symptoms.
**Anorectal Infections**

Anorectal gonococcal infection is uncommon in women, but can occur via anal intercourse. Anorectal infection has been reported in women with gonococcal cervicitis who do not acknowledge rectal sexual contact, presumably these infections result from perineal contamination with infected cervical secretions.

**Complications in Genital Infection in Women**

There are several complications associated with gonorrhea in women:

- **Accessory gland infections**: Infection of female sex accessory glands (Bartholin’s glands or Skene’s glands) is often a unilateral infection. Occlusion of the ducts of these glands due to inflammation may result in the formation of an abscess.

- **Pelvic inflammatory disease (PID)**: If cervical gonococcal infection ascends to the endometrium and/or fallopian tubes, PID may develop, typically causing symptoms that include lower abdominal pain, vaginal discharge, dyspareunia, intermenstrual bleeding, and fever.[22] In some women, PID may also be asymptomatic. Presumptive treatment for PID should be considered if one or more of the following minimum criteria are present on pelvic examination—uterine or adnexal tenderness or cervical motion tenderness. The long-term sequelae of untreated PID can include chronic pelvic pain, tubal infertility, and increased risk for ectopic pregnancy.

- **Perihepatitis (Fitz-Hugh-Curtis Syndrome)**: In situations where gonococcal infection ascends from the cervix, infection may produce inflammation of the liver capsule and the adjacent peritoneum. Most women with perihepatitis have associated PID, but perihepatitis can occur independently. Historically, perihepatitis was attributed only to gonococcal infection, but now it is often associated with chlamydial infection. Gonococcal perihepatitis is characterized by right upper quadrant pain, and may be accompanied by abnormal liver function tests.

**Additional Syndromes Seen in Men and Women**

**Pharyngeal Infection**

Gonococcal pharyngeal infection is most often asymptomatic. The pharynx may be the sole site of infection if the only exposure was receptive orogenital intercourse. Exudative pharyngitis is rare. Symptoms of pharyngeal infection may include pharyngitis, tonsillitis, fever, and cervical adenitis.

**Ocular Infection**

Gonococcal infection of the eye, when it does occur, typically presents as conjunctivitis. Gonococcal conjunctivitis in adults most often results from autoinoculation in persons with genital gonococcal infection. Patients may initially develop a mild non-purulent conjunctivitis, that, if untreated, typically progress to marked conjunctival redness, copious purulent discharge, and conjunctival edema (Figure 15).[23] Less often, the manifestations include an ulcerative keratitis. Untreated gonococcal conjunctivitis can cause complications that may include corneal perforation, endophthalmitis, and blindness.

**Disseminated Gonococcal Infection**

Disseminated gonococcal infection, a systemic gonococcal infection, occurs infrequently and is more common in women than in men. Disseminated gonococcal infection is associated with some gonococcal strains that have a propensity to produce bacteremia without associated urogenital symptoms. In addition, patients with complement deficiency have greater risk of developing disseminated gonococcal infection. Clinical manifestations of disseminated gonococcal infection include skin lesions (Figure 16), arthralgia, tenosynovitis, arthritis (Figure 17), hepatitis, myocarditis, endocarditis, and meningitis. Rates of disseminated gonococcal infection have decreased due to the declining proportion of gonococcal strains prone to disseminate.[24]
**Infection in Children**

Perinatal infections most often occur during childbirth when the neonatal conjunctiva, pharynx, respiratory tract, or anal canal may become infected. Conjunctivitis (ophthalmia neonatorum) is preventable by ocular antimicrobial prophylaxis in the newborn. All cases of gonorrhea beyond the newborn period should be considered possible evidence of sexual abuse. Vulvovaginitis (not cervicitis) is the most common manifestation in prepubescent girls. Signs and symptoms may include vaginal discharge (often purulent or crusting), dysuria, odor, irritation, and pruritus. The anorectum and the pharynx are the most frequently infected sites in abused boys; urethritis is less frequently seen. If specimens are to be collected, proper guidelines for collecting forensic evidence must be followed. When evaluating a child who has potentially suffered sexual abuse, the clinician should consult individual state laws concerning reporting and counseling.
Laboratory Diagnosis

The approach to diagnostic testing for *N. gonorrhoeae* has evolved from traditional cultivation to widespread use of nucleic acid amplification tests (NAATs).[25] Gram’s stain, another non-culture test, is used for the diagnosis of urethral gonorrhea in symptomatic males. Culture is still recommended if antimicrobial resistance is a concern, especially in cases of treatment failure.

Nucleic Acid Detection Tests

There are two types of nucleic acid detection tests: non-amplified tests and amplified tests:

- **Amplified Tests**: The nucleic acid amplification tests (NAATs) include polymerase chain reaction (PCR) (Roche Amplicor; Cepheid GeneXpert CT/NG), transcription-mediated amplification (TMA) (Gen-Probe Aptima), and strand displacement amplification (SDA) (Becton-Dickinson BDProbeTec ET). Amplified tests are FDA-cleared for endocervical specimens from women, urethral specimens from men, and urine specimens from men and women.[25,26,27] Some NAATs are also cleared for vaginal swabs. In May 2019, the FDA cleared two NAATs (Aptima Combo 2 Assay and the Xpert CT/NG) for extragenital diagnostic testing of *N. gonorrhoeae* and *Chlamydia trachomatis* in rectal and pharyngeal samples.[28] Multiple studies have shown NAATs are the most sensitive test to detect *N. gonorrhoeae* infections. At present, antimicrobial susceptibility cannot be determined with NAATs, but research in this area is ongoing.

- **Non-Amplified Tests**: Several non-amplified tests used for *N. gonorrhoeae*, include the DNA probe tests (e.g. Gen-Probe PACE 2 and Digene Hybrid Capture II). A non-amplified test is less likely to be affected by transport conditions than culture, and has the potential for more timely results. These tests are FDA-cleared for endocervical specimens from women and urethral specimens from men. They are not FDA-cleared for pharyngeal, rectal, or urine specimens. The same specimen can be evaluated for *Chlamydia trachomatis* infection.[25] Antimicrobial susceptibility cannot currently be determined with non-amplified tests.

Gram’s Stain

The use of Gram's stain is a non-culture test that can make a presumptive diagnosis of gonorrhea. In the clinical setting, a Gram’s stain to detect *N. gonorrhoeae* is most often performed on a male with purulent urethral discharge. A Gram’s stain on a specimen positive for *N. gonorrhoeae* shows polymorphonuclear leukocytes with intracellular gram-negative diplococci (Figure 18). A Gram’s stain, with proper laboratory technique, has greater than 95% sensitivity and greater than 99% specificity for diagnosing symptomatic male gonococcal urethritis.[25] Thus, the Gram’s stain is considered reliable both to diagnose and to exclude gonococcal urethritis in symptomatic men.[11] The sensitivity of a Gram’s stain is lower for males with asymptomatic urethral infection and thus not considered adequate to rule out infection in asymptomatic men.[11] Performing a Gram’s stain is not recommended on endocervical, pharyngeal, or rectal specimens due to poor sensitivity.[11]

Culture

Obtaining a bacterial culture is the historic standard for detection of *N. gonorrhoeae*. It has several advantages over non-culture tests, including low cost, use for a variety of specimen sites, and antimicrobial susceptibility testing can be performed if *N. gonorrhoeae* is isolated from the specimen. Despite having some advantages, culture is not as sensitive as NAAT and is more laboratory intensive, which has led to infrequent use in modern practice. At present, culture is primarily used for antimicrobial resistance surveillance by collecting specimens from either symptomatic urethral infections or from screen-positive sites of infection prior to treatment.

Diagnosis in Sexual Abuse/Assault
In cases of suspected sexual abuse or assault, the legal standard is to obtain culture samples combined with additional tests in an attempt to identify *N. gonorrhoeae*. Due to the legal complexity of these cases, it is imperative that all positive specimens be retained for additional confirmatory testing. In adults, NAATs are preferred for the diagnostic evaluation of sexual assault regardless of whether penetration occurred with the assault. In evaluating children with suspected sexual abuse, use of culture to detect *N. gonorrhoeae* is recommended. This is because data on use of NAATs for detection of *N. gonorrhoeae* in children are limited, and performance varies with each commercial test. NAATs are an acceptable alternative to culture for vaginal specimens or urine from girls, but consultation with an expert is recommended before using NAATs in this context. This is to minimize the possibility of cross-reaction with nongonococcal *Neisseria* species and other commensals and to ensure appropriate interpretation of results. Culture has been preferred method for urethral specimens or urine from boys and for extragenital specimens (pharynx and rectum) from children of both genders; with the recent FDA clearance of two NAATs for extragenital testing of *N. gonorrhoeae* this preference may change in the future. Gram's stain is inadequate for evaluating prepubertal children for gonorrhea and should not be used to diagnose or exclude gonorrhea.

**Special Diagnostic Considerations with Disseminated Gonococcal Infection**

When evaluating persons with suspected disseminated gonococcal infection, diagnostic testing should consist of (1) obtaining and ordering NAAT and culture for specimens from all applicable urogenital and extragenital mucosal sites, (2) ordering culture for all specimens obtained from disseminated sites of infection (e.g., skin, synovial fluid, blood, or cerebrospinal fluid), and (3) performing antimicrobial susceptibility testing on all *N. gonorrhoeae* isolates obtained in culture specimens.
Screening for Gonococcal Infection

Routine screening for gonococcal infection in women is recommended in order to decrease morbidity as well as to reduce the burden of disease in the community.[11] Urethral infections caused by \textit{N. gonorrhoeae} among men usually produce symptoms that cause them to seek curative treatment soon enough to prevent sequelae, but transmission to others may occur in this interim. Among women, gonococcal infections are commonly asymptomatic until complications (such as pelvic inflammatory disease with resultant risk for infertility and ectopic pregnancy) have occurred. The following summarizes \textit{N. gonorrhoeae} screening recommendations issued by the CDC and the U.S. Preventive Services Task Force (USPSTF) for different patient populations:[11,29]

- **Sexually Active Women Who Have Sex with Men:** The CDC and the USPSTF recommend (1) annual screening for \textit{N. gonorrhoeae} in all sexually active women younger than 25 years of age, and (2) annual screening for \textit{N. gonorrhoeae} in sexually active women age 25 years and older if they are considered to have increased risk for gonococcal infection.[11,29] The most important identified risk factors for gonococcal infection include a new sex partner, multiple sex partners, a sex partner with concurrent partners, or a sex partner with a sexually transmitted infection; additional factors that indicate risk of gonococcal infection include inconsistent condom use in persons not in a mutually monogamous relationship, exchange of sex for money or drugs, one or more previous sexually transmitted infections, or a coexistent sexually transmitted infection. Women diagnosed with \textit{N. gonorrhoeae} infection should have repeat testing approximately 3 months after completing treatment.

- **Women Who Have Sex with Women:** The CDC recommends gonococcal screening for women who have sex with women should occur according to the current screening guidelines for sexually active women who have sex with men.[30]

- **Women Who are Pregnant:** The CDC recommends screening for \textit{N. gonorrhoeae} should be performed at the first prenatal visit for (1) women younger than age 25 and (2) women age 25 years and older who are at increased risk for gonorrhea (e.g. women with a new sex partner, a sex partner who has a sexually transmitted infection, more than one sex partner, or a sex partner with concurrent partners).[30] Additional factors associated with increased risk of gonococcal infection include inconsistent condom use in persons not in a mutually monogamous relationship, exchange of sex for money or drugs, and previous or coexisting sexually transmitted infections. A repeat test for gonococcal infection should be performed during the third trimester for those at continued risk. Pregnant women diagnosed with \textit{N. gonorrhoeae} infection should have repeat testing approximately 3 months after completing treatment[30]

- **Men Who Have Sex Only with Women:** Routine screening for gonococcal infection is not recommended by either the CDC or the USPSTF for men who have sex only with women.[11,29]

- **Men Who Have Sex with Men:** The CDC recommends screening for gonococcal infection in men who have sex with men at least annually, regardless of a history of condom use during sexual contact; the sites tested should correspond with sites involved in sexual activity with other men during the prior year (e.g. urethral testing if insertive intercourse, rectal testing if receptive anal intercourse, and pharyngeal testing with receptive oral intercourse).[30] The USPSTF does not recommend routine screening for gonorrhea in men, including men who have sex with men.[29]

- **Transgender Men and Transgender Women:** The CDC recommends screening for gonorrhea in transgender men and transgender women should be based on age, current anatomy, and sexual practices.[30]

- **Persons with HIV:** The CDC recommends performing routine screening for gonorrhea for persons with HIV who are sexually active; testing for gonorrhea should be performed at the initial evaluation and at least annually thereafter (more frequent screening may be indicated based on risk).[31] The testing should consist of obtaining samples from the anatomic sites of sexual exposure.

- **Persons in Correctional Facilities:** The CDC recommends performing routine gonococcal screening at the initial intake in a correctional facility for women 35 years of age and younger and men younger than 30 years of age.[30]
Treatment

Principles of Treating Gonococcal Infections in Adults and Adolescents

On December 18, 2020, the CDC issued a major update for the treatment of gonococcal infections.[32] The rationale for these updated treatment recommendations for the treatment of gonorrhea were based on concern for the potential impact of dual therapy that included oral azithromycin on commensal organisms and concurrent pathogens (3), in conjunction with the continued low incidence of ceftriaxone resistance and the increased incidence of azithromycin resistance, has led to reevaluation of this recommendation. This update contains several key new recommendations as outlined below:[32]

- For treatment of uncomplicated gonococcal infection of the cervix, urethra, or rectum in persons who weight less than 150 kg (300 lb), the recommended single intramuscular dose of ceftriaxone is increased from 250 mg to 500 mg; for persons who weight 150 kg (300 lb) or greater, the dose should be increased to 1 gram. The rationale for the increased dose of ceftriaxone from 250 mg to 500 mg in persons of normal weight is based on pharmacokinetic and pharmacodynamic data that show ceftriaxone concentrations at 24 hours with the 500 mg dose provides more reliable eradication of *N. gonorrhoeae* than with the 250 mg dose.[33,34] Further, because ceftriaxone produces variable levels in the pharynx, the 500 mg ceftriaxone dose will provide more reliable treatment efficacy with pharyngeal gonorrhea.

- For persons with uncomplicated gonococcal infection of the cervix, urethra, or rectum in whom chlamydia infection has been ruled out, ceftriaxone monotherapy is recommended, which is in contrast to prior recommendation to add azithromycin as dual therapy for all gonococcal infections. The rationale for eliminating the routine use of azithromycin as dual therapy for the treatment of gonorrhea includes concern for the potential impact of azithromycin on commensal organisms and concurrent pathogens, as well as the trend of increasing *N. gonorrhoeae* resistance to azithromycin.[1,35,36]

- For persons with uncomplicated gonococcal infection of the cervix, urethra, or rectum in whom chlamydia infection has not been ruled out, oral doxycycline is added to ceftriaxone for the purpose of treating chlamydia (for nonpregnant persons). Note the recommendation to use of doxycycline in this situation to treat chlamydia is a change from prior recommendation that allowed for the use of either azithromycin or doxycycline to treat chlamydia. This new recommendation is based on emerging data suggesting lower chlamydia treatment efficacy with azithromycin compared with doxycycline, especially with rectal chlamydia.[37,38,39]

- For persons with pharyngeal gonococcal infection, a test-of-cure is recommended 7 to 14 days after treatment, regardless of the treatment regimen used. The prior recommendations was to perform test of cure after treatment of pharyngeal gonococcal infection only if an alternative regimen was used.

The treatment of expedited partner treatment recommendations have changed and the recommended single oral dose of cefixime has been increased from 400 mg to 800 mg and routine dual therapy with azithromycin is no longer recommended; if concurrent chlamydia was not excluded in the source individual who was diagnosed with gonorrhea, then the expedited partner therapy should include oral doxycycline 100 mg for 7 days (for nonpregnant persons).

Uncomplicated Infections of the Cervix, Urethra, and Rectum

For persons with uncomplicated gonococcal infections of the cervix, urethra, or rectum, the 2020 CDC update for the treatment of gonococcal infections recommends treatment with a single intramuscular dose of ceftriaxone 500 mg, with or without oral doxycycline 100 mg twice daily for 7 days depending on whether chlamydia infection has been ruled out.[32] For pregnant persons, oral azithromycin 1 gram should be used in place of doxycycline. If ceftriaxone is not available, the two options are: (1) intramuscular gentamicin 240 mg plus oral azithromycin 2 grams or (2) oral cefixime 800 mg.[32]

Uncomplicated Infections of the Pharynx
Gonococcal infections of the pharynx are more difficult to eradicate than infections at urogenital and anorectal sites. Few antimicrobial regimens can reliably cure greater than 90% of pharyngeal gonococcal infections and ceftriaxone levels are variable in pharyngeal tissue. The CDC 2020 update for the treatment of gonococcal infections recommends treatment of pharyngeal gonorrhea with a single intramuscular dose of ceftriaxone 500 mg, with or without oral doxycycline 100 mg twice daily for 7 days (depending on whether chlamydia infection has been ruled out) (Table 2).[32] For pregnant persons, oral azithromycin 1 gram should be used in place of doxycycline. Note there are no reliable alternative treatments are available for the treatment of pharyngeal gonorrhea.[32] A test-of-cure (using either culture or NAAT) is recommended 10 to 14 days after treatment in all persons with pharyngeal gonorrhea, regardless of the treatment regimen.[32] If the NAAT is positive, effort should be made to perform a confirmatory culture before retreatment. All positive cultures for test-of-cure should undergo antimicrobial susceptibility testing.

Conjunctivitis

In the only published study of the treatment of gonococcal conjunctivitis among adults, all 12 study participants responded to a single 1 gram intramuscular injection of ceftriaxone.[40] Nevertheless, due to concerns for emergence of antimicrobial resistance with *N. gonorrhoeae*, the CDC’s recommendation is to treat with ceftriaxone 1 gram intramuscular injection once and azithromycin 1 gram orally as a single dose (Table 3). In addition, a one-time lavage of the infected eye with saline should be considered.

Disseminated Gonococcal Infection

Disseminated gonococcal infection (DGI) frequently results in petechial or pustular acral skin lesions, asymmetric polyarthritis, tenosynovitis, or oligoarticular septic arthritis. The infection is complicated occasionally by perihepatitis and rarely by endocarditis or meningitis. Because of the possibility of potentially severe sequelae associated with these complications, hospitalization and consultation with an infectious diseases specialist is recommended for persons suspected of having disseminated gonococcal infection. The recommended initial therapy is ceftriaxone 1 gram intramuscularly or intravenously every 24 hours plus azithromycin 1 gram orally in a single dose. The first dose is given ideally after promptly obtaining cultures and NAATs from multiple sites, as indicated, including skin, synovial fluid, blood, and cerebrospinal fluid. The duration of therapy for disseminated gonococcal infection with arthritis-dermatitis syndrome is at least 7 days and the ceftriaxone can transition to oral therapy if antimicrobial sensitivity testing shows an effective oral choice (Table 4).[11] For patients with meningitis, parenteral therapy should continue for 10 to 14 days and with endocarditis parenteral therapy should be given for at least 4 weeks (Table 5).[11]

Allergy to Penicillins or Cephalosporin

Allergic reactions to first-generation cephalosporins occur in less than 2.5% of persons with a history of penicillin allergy and are less common with third-generation cephalosporins such as ceftriaxone and cefixime.[41] Ceftriaxone is contraindicated in patients with a history of IgE-mediated anaphylaxis to penicillin. Although true allergic reactions to third-generation cephalosporins are uncommon among persons who report a history of penicillin allergy, use of ceftriaxone is contraindicated in persons with a history of IgE-mediated penicillin allergy. Given these considerations, expert consultation with an infectious diseases specialist (and possibly also an allergy specialist), is recommended for treating gonorrhea among persons who have documented severe cephalosporin allergy. Cephalosporin desensitization is preferred but impractical in many settings. The recommended treatment in this situation for adults and adolescents is dual treatment with a single doses of intramuscular gentamicin 240 mg plus a single dose of oral azithromycin 2 grams.[11,32] A recent gonorrhea study compared intramuscular ceftriaxone 500 mg versus intramuscular gentamicin 240 mg, both combined with oral azithromycin 1 gram and found an overall 6.4% lower infection clearance with the gentamicin arm and these differences were even more pronounced with pharyngeal and rectal gonorrhea; these data highlight that any regimen used as an alternative to ceftriaxone is likely to have higher failure rates than ceftriaxone.[42]
Gonococcal Infections in Pregnancy

Pregnant persons with *N. gonorrhoeae* infection should be treated with a single intramuscular dose of ceftriaxone 500 mg, with the addition of azithromycin if chlamydia infection was not ruled out.[32] Pregnant persons should not be treated with any fluoroquinolone or any tetracycline drug. Because spectinomycin is not available in the United States, pregnant women who cannot tolerate a cephalosporin should be evaluated by an infectious diseases specialist.

Management of Antibiotic-Resistant Gonorrhea

Although there are no confirmed cases of treatment failure due to cephalosporin-resistant *N. gonorrhoeae* in the United States, the gradual upwards trend of MICs documented by the United States Gonococcal Isolate Surveillance Project (GISP) remains worrisome.[5,6,9,43] Criteria for resistance to cefixime and ceftriaxone have not been defined by the Clinical and Laboratory Standards Institute (CLSI), but isolates with cefixime or ceftriaxone MICs equal to or greater than 0.5 μg/mL are considered to have decreased susceptibility. Only five isolates with ceftriaxone MIC equal to or greater than 0.5 μg/mL have been reported during the history of the GISP. In 2019, one isolate from Nevada was reported with a ceftriaxone MIC or 1.0 μg/mL.[10] Notably, isolates with high-level cefixime and ceftriaxone MICs (cefixime MICs 1.5 to 8 μg/mL and ceftriaxone MICs 1.5 to 4 μg/mL) have been identified in Japan, France, and Spain.[44,45,46,47]

Defining Gonococcal Treatment Failure

Treatment failure should be suspected in patients who have recurrence of symptoms or a positive culture after a documented, appropriate treatment.[11] The majority of cases of suspected treatment failure are reinfection rather than true treatment failure. A true treatment failure should be considered in: (1) a person whose symptoms do not resolve within 3 to 5 days after appropriate treatment, and they report no sexual contact during the post-treatment follow-up period and (2) a person with a failed test-of-cure (i.e. positive culture at least 72 hours or positive NAAT at least 7 days after receiving recommended treatment) when no sexual contact is reported during the post-treatment follow-up period. Risk factors for treatment failure due to resistant organisms include multiple prior treatment courses for gonorrhea, international travel, or pharyngeal disease.

Management of Suspected Gonococcal Treatment Failure

Clinicians who diagnose *N. gonorrhoeae* infection in a person with suspected cephalosporin treatment failure should (1) perform culture and susceptibility testing of all relevant clinical specimens; (2) obtain expert opinion for guidance in clinical management (through the STD Clinical Consultation Network, a local STD/HIV Prevention Training Center clinical expert, the CDC, or an infectious diseases specialist); and (3) report the case to the CDC through state and local public health authorities.[11] Isolates that grow *N. gonorrhoeae* should be saved and sent to the CDC through state public health laboratory mechanisms. Health departments should prioritize notification and culture evaluation for sex partner(s) of persons with *N. gonorrhoeae* infection suspected for cephalosporin treatment failure or persons whose isolates demonstrate decreased susceptibility to cephalosporins. In this setting, a test-of-cure at relevant clinical sites should be obtained 7 to 14 days after retreatment; culture is the recommended test, preferably with simultaneous NAAT and susceptibility testing of *N. gonorrhoeae* if isolated.

- **Antimicrobial Options for Likely Treatment Failure**: For individuals considered to have high likelihood of true treatment failure, especially those with a documented elevated cephalosporin MIC for *N. gonorrhoeae*, the 2015 STD Treatment Guidelines suggested options consist of (1) single dose oral therapy with gemifloxacin 320 mg plus azithromycin 2 grams, or (2) single dose oral therapy with azithromycin 2 grams plus a single intramuscular injection of a 240 mg dose of gentamicin. Note that since May 2015, gemifloxacin has not available for use in the United States because of a legal dispute regarding the license to manufacture and distribute this drug.
• **Investigational Therapy for N. gonorrhoeae:** Several antimicrobials are under investigation that have shown promise in the treatment gonorrhea in phase 2 trials, including single dose oral gepotidacin and single-dose oral zoliflodacin.[48,49] These two agents are now under study in phase 3 trials and both may have a future role in treating drug-resistant gonorrhea, and for treatment of gonorrhea in persons with serious penicillin or cephalosporin allergy. The oral agents solithromycin and delafloxacin showed promising early results, but phase 3 studies have been disappointing and these agents not likely to have a clinical role in the treatment of gonorrhea.[50,51,52,53]

**Follow-Up**

For persons with uncomplicated gonococcal infections of the cervix, urethra, or rectum, a test-of-cure is not recommended following treatment with the recommended regimen. A routine test-of-cure at day 14 after treatment with NAAT or culture is recommended for patients with pharyngeal gonorrhea, regardless of the treatment regimen.[32] Patients who have persistent symptoms should be evaluated by culture for *N. gonorrhoeae*, and any gonococci isolated should be tested for antimicrobial susceptibility. All persons diagnosed with gonorrhea should have repeat testing in 3 months at the anatomic site of exposure, regardless of whether they have symptoms. Infections identified after treatment with one of the recommended regimens usually result from reinfection rather than treatment failure, indicating a need for improved patient education and referral of sex partners. Patients who have persistent infection despite treatment with a recommended regimen and who deny sexual exposure after treatment should be evaluated with culture of clinical specimens and susceptibility testing. Clinicians should promptly notify the local STD program of such cases, and local or state STD programs should notify the CDC.

**Management of Sex Partners**

Recent sex partners (within the 60 days preceding onset of symptoms or gonorrhea diagnosis) should be referred for evaluation, testing, and presumptive dual treatment. The most recent sex partner should be treated regardless of interval from diagnosis. To avoid reinfection, sex partners should be instructed to abstain from unprotected sexual intercourse for 7 days after they and their sex partner(s) have completed antimicrobial treatment and symptoms have resolved.

**Expedited Partner Therapy**

In settings where prompt referral and treatment are unavailable or impractical, providers should consider expedited partner therapy.[54] This entails provision of appropriate antibiotics as well as educational and pharmacy information for the partner. The documentation should include notification that partner(s) have been exposed, information about the importance of treatment, signs and symptoms of potential complications, as well as possible therapy-related potential allergic reactions and adverse effects.[11]

• **Recommended Regimen:** The expedited partner therapy regimen for sex partners of patients with *N. gonorrhoeae* infection is oral cefixime 800 mg with delivery of the prescription to the partner by either the person diagnosed with gonorrhea, a disease investigation specialist, or a collaborating pharmacy as permitted by law; if concurrent chlamydia was not excluded in the source individual who was diagnosed with gonorrhea, then the expedited partner therapy should include oral doxycycline 100 mg for 7 days (for nonpregnant persons).[11,55]

• **State-by-State Legal Status:** It is essential to check with one’s state health department to clarify the policies, as the use of expedited partner therapy is not legal in all states. The CDC maintains an updated information page Legal Status of Expedited Partner Therapy that identifies the legal status of expedited partner therapy in each state in the United States, as well as providing links to each state for more detailed state policies.

• **Follow-Up After Expedited Partner Therapy:** Provision of expedited partner therapy alone is not sufficient and each partner should ideally be seen in follow-up for repeat testing to check for reinfection. Although offering expedited partner therapy to female partners is acceptable, this
approach may result in undertreatment of pelvic inflammatory disease.

- **Contraindications for Expedited Partner Therapy:** The use of expedited partner therapy for gonorrhea is contraindicated in a female partner who have current signs or symptoms that are suggestive of PID. Female partners who have current signs and symptoms suggestive of PID should undergo prompt evaluation by a health care provider. In addition, the use of expedited partner therapy should not be considered a routine partner management strategy in MSM with gonorrhea for several reasons, including the high risk for coexisting infections (especially HIV and syphilis), inadequate data regarding the efficacy of expedited partner therapy in this patient population, and concerns regarding the increased proportion of gonococcal isolates among MSM with reduced susceptibility to cefixime.

**Reporting Requirements**

Laws and regulations in all states require clinicians, laboratories, or both to report persons with gonorrhea to public health authorities.
Patient Counseling and Education

Patient counseling and education should cover the nature of the disease, transmission issues, and risk reduction.

Nature of the Disease

- Genitourinary infection with gonorrhea is most often symptomatic in males and asymptomatic in females.
- Untreated cervical gonorrheal infection in women can result in upper genital tract infection, which may result in pelvic inflammatory disease, tubal infertility, and ectopic pregnancy.
- Untreated urethral gonorrhea in men can result in epididymitis and other less common complications such as penile edema, abscess, and stricture.

Transmission Issues

- *Neisseria gonorrhoeae* is efficiently transmitted from males to females via vaginal intercourse, rectal intercourse, and fellatio.
- *Neisseria gonorrhoeae* can be transmitted from females to males via vaginal intercourse and less efficiently by cunnilingus.
- Patients with gonorrhea are more likely to transmit and acquire HIV.
- Patients and their partners should abstain from intercourse for 7 days after completing treatment and until they and their sex partners have complete resolution of any symptoms.

Risk Reduction

The clinician should provide the following counseling information for the patients as a risk reduction plan:

- Assess the patient’s potential to change behavior,
- Develop individualized risk-reduction plans with the patient,
- Discuss prevention strategies such as abstinence, mutual monogamy with an uninfected partner, use of condoms, and limiting the number of sex partners. Latex condoms, when used consistently and correctly, can reduce the risk of transmission of *N. gonorrhoeae*. 
Summary Points

- Rates of *Neisseria gonorrhoeae* infection have increased in recent years, especially among men who have sex with men and in the southern and western regions of the United States.
- *Neisseria gonorrhoeae* can cause a wide array of urogenital, pharyngeal, and rectal symptoms as well as serious complications, such as pelvic inflammatory disease, tubal infertility, ectopic pregnancy, periurethral fistula or abscess, neonatal conjunctivitis, and rarely, disseminated gonococcal infection.
- Gonorrhea is associated with an increased susceptibility to HIV acquisition as well as an increased risk of HIV transmission.
- Screening for gonorrhea is recommended in sexually active women under 25 years of age and in other persons at high risk of infection.
- Therapy with intramuscular ceftriaxone 500 mg is recommended in all persons (including pregnant women) with uncomplicated gonococcal infections of the cervix, urethra, rectum, and pharynx. If chlamydia infection has not been excluded, then concomitant treatment for chlamydia should be given with doxycycline 100 mg twice daily for 7 days. For pregnant individuals, a single 1 gram dose of oral azithromycin should be used instead of doxycycline to treat chlamydia.
- A test-of-cure is not recommended after treatment of uncomplicated infections of the cervix, urethra, and rectum, but it should be performed in all in persons at 7 to 14 days following the treatment of pharyngeal gonorrhea.
- The majority of cases of suspected treatment failures represent reinfection with *N. gonorrhoeae*, but if true cephalosporin treatment failure is suspected, clinicians should perform culture and sensitivity testing and seek expert consultation.
- Persons who are diagnosed with gonorrhea should receive counseling about the nature of infection, transmission, and risk reduction, and their sex partners should be referred for treatment; expedited partner therapy should be considered where permitted.
Citations


25. Centers for Disease Control and Prevention. Recommendations for the laboratory-based detection of


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• Kidd S, Kirkaldy R, Ye T, Papp J, Trees D, Shapiro SJ. Cephalosporin-resistant Neisseria gonorrhoeae public health response plan. [CDC] -


• Linhart Y, Shohat T, Amitai Z, et al. Sexually transmitted infections among brothel-based sex workers


Scangarella-Oman NE, Hossain M, Dixon PB, et al. Microbiological Analysis from a Phase 2 Randomized Study in Adults Evaluating Single Oral Doses of Gepotidacin in the Treatment of Uncomplicated


Figures

Figure 1 Gonorrhea-Reported Cases by Year, United States, 1941-2018

Figure 2 Gonorrhea—Rates of Reported Cases by Year, United States, 1941-2018

The reported rate is cases per 100,000 population.

Figure 3 Gonorrhea — Rates of Reported Cases by Sex, United States, 2012-2018

Figure 4 Gonorrhea–Rates of Reported Cases by Age Group, United States, 2018

The reported rate is cases per 100,000 population.

Figure 5 Gonorrhea — Rates of Reported Cases by Sex and Age Group, United States, 2018


*Per 100,000 population
Figure 6 Gonorrhea — Rates of Reported Cases by Race/Ethnicity, 2018

**Figure 7 Gonorrhea — Rates of Reported Cases by Region, United States, 2018**

The reported rate is cases per 100,000 population.

Figure 8 Gonorrhea — Rates of Reported Cases by Region, United States, 2012 through 2018

The reported rate is cases per 100,000 population.

Figure 9 Gonorrhea — Rates of Reported Cases by State, United States and Outlying Areas, 2018

NOTE: The total rate of reported cases of gonorrhea for the United States and outlying areas (Guam, Puerto Rico, and Virgin Islands) was 170.3 cases per 100,000 population.


Note: The total rate of reported cases of gonorrhea for the United States and outlying areas (including Guam, Puerto Rico, and the Virgin Islands) was 177.4 per 100,000 population.

Abbreviations: GU = Guam; PR = Puerto Rico; VI = Virgin Islands.
Figure 10A: Antimicrobial Drugs Used to Treat Gonorrhea, GISP 1988 through 2018

Proportional use of ceftriaxone 250 mg increased from 84.0% in 2011 to 98.1% in 2017 but decreased slightly to 96.5% in 2018. Treatment with gentamicin 240 mg increased from 0.2% in 2015 to 1.4% in 2018. NOTE: “Other” includes azithromycin 2g (0.3%), no therapy (0.1%), and other less frequently used drugs (0.8%).

During 2009–2018, the percentage of gonococcal isolates that exhibited elevated ceftriaxone minimum inhibitory concentrations, defined as ≥0.125 µg/mL, fluctuated between 0.1% and 0.4%. In 2018, 0.2% of isolates had elevated ceftriaxone minimum inhibitory concentrations. The percentage of isolates with elevated cefixime minimum inhibitory concentrations (≥0.25 µg/mL) declined from 1.4% in 2011 to 0.3% in 2018. During 2012–2014, the percentage of isolates with elevated azithromycin minimum inhibitory concentrations (≥2 µg/mL) ranged from 0.3% to 2.5% with a sharp increase during 2013–2014 (0.6% to 2.5%); during 2014–2018, the percentage increased from 2.5% to 4.6%.

Figure 10 (Image Series) - Gonococcal Isolate Surveillance Project (GISP), GISP 2009-2018
Image 10C: Prevalence of Tetracycline, Penicillin, or Fluoroquinolone Resistance* or Elevated Cefixime, Ceftriaxone, or Azithromycin MICs)^, by Year

*Resistance: Fluoroquinolone (ciprofloxacin) = MIC ≥1.0 µg/mL; Penicillin = MIC ≥2.0 µg/mL or B-lactamase positive; Tetracycline = MIC ≥2.0 µg/mL. ^Elevated MICs: Azithromycin = MIC ≥1.0 µg/mL (2000-2004); ≥2.0 µg/mL (2005-2017); Ceftriaxone = MIC ≥0.125 µg/mL; Cefixime = MIC ≥0.25

**Figure 10 (Image Series) - Gonococcal Isolate Surveillance Project (GISP), GISP 2009-2018**

**Image 10D: *Neisseria gonorrhoeae* — Distribution of Gentamicin MICs by Year, 2015-2017**

MICs = minimum inhibitory concentrations

*In 2018, the antibiotic susceptibility testing range for gentamicin was expanded from MICs of 1 µg/mL–32 µg/mL in previous years to 0.25 µg/mL–64 µg/mL

**Figure 11 Neisseria gonorrhoeae and Binary Fission**

Transmission electron micrograph (TEM) showing *Neisseria gonorrhoeae* undergoing binary fission.

Source: Centers for Disease Control and Prevention Public Health Image Library (Dr. Wiesner, 1972).
**Figure 12 Neisseria gonorrhoeae**

This illustration shows a three-dimensional computer-generated image of *Neisseria gonorrhoeae* diplococci. The illustration is an artistic recreation based on scanning electron microscopic (SEM) imagery. Note the hair-like appendages extending from the organisms’ exterior; these are type IV pili that promote motility and improve surface adherence.

Source: Centers for Disease Control and Prevention Public Health Image Library (Medical Illustration—James Archer, 2013).
Figure 13 Purulent Urethral Discharge with Gonococcal Infection

Photograph from Negusse Ocbamichael, PA; Public Health—Seattle & King County STD Clinic
Figure 14 Incubation Period with Gonococcal Urethritis

This graph illustrates the timing of onset of urethral symptoms in 44 men following exposure to *N. gonorrhoeae*

**Figure 15 Gonococcal Conjunctivitis**

This photograph illustrates a severe case of gonococcal conjunctivitis. Note the purulent material on the upper and lower lids.

Source: Centers for Disease Control and Prevention Public Health Image Library. CDC, 1977.
Figure 16 Disseminated Gonococcal Infection with Skin Lesions

This patient had disseminated gonococcal infection including multiple cutaneous lesions on the feet (black arrows).

Source: Centers for Disease Control and Prevention Public Health Image Library (J. Pledger and Dr. S. E. Thompson, VDDC, 1979).
Figure 17 Disseminated Gonococcal Infection with Arthritis

This image taken from a woman with disseminated gonococcal infection and right elbow arthritis.

Source: Centers for Disease Control and Prevention Public Health Image Library (Emory, Tom Sellers, 1963).
Figure 18 Urethral Swab Gram's Stain in Patient with Gonorrhea

This Gram's stain of a smear of a urethral discharge in a man diagnosed with acute gonococcal urethritis.

Source: Centers for Disease Control and Prevention Public Health Image Library (Joe Miller, 1979).
Table 1. Update to CDC STD Treatment Guidelines for Gonococcal Infection, 2020
Treatment of Uncomplicated Gonococcal Infection of the Cervix, Urethra, or Rectum

<table>
<thead>
<tr>
<th>Recommended Regimen if Chlamydia infection has been excluded</th>
<th>Recommended Regimen if chlamydia infection has not been excluded</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ceftriaxone</strong></td>
<td><strong>Ceftriaxone</strong> + <strong>Doxycycline</strong></td>
</tr>
<tr>
<td>*500 mg IM as a single dose for persons weighing &lt;150 kg (300 lb)</td>
<td>*500 mg IM as a single dose for persons weighing &lt;150 kg (300 lb) + 100 mg orally twice daily for 7 days</td>
</tr>
<tr>
<td>This regimen is appropriate if chlamydia infection has been excluded.</td>
<td>This regimen is appropriate if chlamydia infection has not been excluded. During pregnancy, azithromycin 1 g as a single dose is recommended to treat chlamydia instead of doxycycline.</td>
</tr>
<tr>
<td>Note: *For persons weighing ≥150 kg (300 lb), 1 g of IM ceftriaxone should be administered.</td>
<td>Note: *For persons weighing ≥150 kg (300 lb), 1 g of IM ceftriaxone should be administered.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alternative Regimen if ceftriaxone is not available</th>
<th>Alternative Regimen if ceftriaxone is not available</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gentamicin</strong> + <strong>Azithromycin</strong></td>
<td><strong>Cefixime</strong></td>
</tr>
<tr>
<td>240 mg IM as a single dose</td>
<td>800 mg orally as a single dose</td>
</tr>
<tr>
<td>If treating with cefixime, and chlamydial infection has not been excluded, providers should treat for chlamydia with doxycycline 100 mg orally twice daily for 7 days. During pregnancy, azithromycin 1 g as a single dose is recommended to treat chlamydia.</td>
<td></td>
</tr>
<tr>
<td>Note: If treating with cefixime, and chlamydial infection has not been excluded, providers should treat for chlamydia with doxycycline 100 mg orally twice daily for 7 days. During pregnancy, azithromycin 1 g as a single dose is recommended to treat chlamydia.</td>
<td></td>
</tr>
</tbody>
</table>
### Recommended Regimen if chlamydia infection has been excluded

**Ceftriaxone**

500 mg IM in a single dose

This regimen is appropriate if chlamydia infection has been excluded.

Note: *For persons weighing ≥150 kg (300 lb), 1 g of IM ceftriaxone should be administered.*

### Recommended Regimen if chlamydia infection has not been excluded

**Ceftriaxone**

500 mg IM in a single dose  

**Doxycycline**

100 mg orally twice daily for 7 days

This regimen is appropriate if chlamydia infection has not been excluded. During pregnancy, azithromycin 1 g as a single dose is recommended to treat chlamydia instead of doxycycline.

Note: *For persons weighing ≥150 kg (300 lb), 1 g of IM ceftriaxone should be administered.*

No reliable alternative treatments are available for pharyngeal gonorrhea. For persons with a history of a beta-lactam allergy, a thorough assessment of the reaction is recommended. For persons with an anaphylactic or other severe reaction (e.g., Stevens Johnson syndrome) to ceftriaxone, consult an infectious disease specialist for an alternative treatment recommendation.

### Table 3. 2015 STD Treatment Guidelines: Gonococcal Infections
#### Treatment of Gonococcal Conjunctivitis

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceftriaxone</td>
<td>1 g IM in a single dose</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>1 g orally in a single dose</td>
</tr>
</tbody>
</table>

Table 4. 2015 STD Treatment Guidelines: Gonococcal Infections
Treatment of Disseminated Gonococcal Infection (DGI): Arthritis-Dermatitis Syndrome

<table>
<thead>
<tr>
<th>Recommended for Treatment of Disseminated Gonococcal Infection (DGI): Arthritis-Dermatitis Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ceftriaxone</strong> + <strong>Azithromycin</strong></td>
</tr>
<tr>
<td>Ceftriaxone 1 g IM or IV every 24 hours + Azithromycin 1 g orally in a single dose</td>
</tr>
</tbody>
</table>

Note: The provider can switch to an oral agent guided by antimicrobial susceptibility testing 24–48 hours after substantial clinical improvement, for a total treatment course of at least 7 days. The duration of treatment of DGI has not been systematically studied and should be determined in consultation with an infectious-disease specialist.

<table>
<thead>
<tr>
<th>Alternative for Treatment of Disseminated Gonococcal Infection (DGI): Arthritis-Dermatitis Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cefotaxime</strong> + <strong>Azithromycin</strong></td>
</tr>
<tr>
<td>Cefotaxime 1 g IV every 8 hours + Azithromycin 1 g orally in a single dose</td>
</tr>
</tbody>
</table>

Note: The provider can switch to an oral agent guided by antimicrobial susceptibility testing 24–48 hours after substantial clinical improvement, for a total treatment course of at least 7 days. The duration of treatment of DGI has not been systematically studied and should be determined in consultation with an infectious-disease specialist.

<table>
<thead>
<tr>
<th>Alternative for Treatment of Disseminated Gonococcal Infection (DGI): Arthritis-Dermatitis Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ceftizoxime</strong> + <strong>Azithromycin</strong></td>
</tr>
<tr>
<td>Ceftizoxime 1 g IV every 8 hours + Azithromycin 1 g orally in a single dose</td>
</tr>
</tbody>
</table>

Note: The provider can switch to an oral agent guided by antimicrobial susceptibility testing 24–48 hours after substantial clinical improvement, for a total treatment course of at least 7 days. The duration of treatment of DGI has not been systematically studied and should be determined in consultation with an infectious-disease specialist.

### Table 5. 2015 STD Treatment Guidelines: Gonococcal Infections

#### Treatment of Disseminated Gonococcal Infection: Meningitis and Endocarditis

| Recommended for Treatment of Disseminated Gonococcal Infection: Meningitis and Endocarditis |
|---------------------------------|---------------------------------|
| Ceftriaxone 1–2 g IV every 12–24 hours | Azithromycin 1 g orally in a single dose |

Note: Therapy for meningitis should be continued with recommended parenteral therapy for 10–14 days. Parenteral antimicrobial therapy for endocarditis should be administered for at least 4 weeks. The duration of treatment of DGI has not been systematically studied and should be determined in consultation with an infectious-disease specialist.
