specimens. A common assay uses a nonisotopic chemiluminescent DNA probe that hybridizes specifically with gonococcal 16S ribosomal RNA; this assay is as sensitive as conventional culture techniques. A disadvantage of non-culture-based assays is that *N. gonorrhoeae* cannot be grown from the transport systems. Thus a culture-confirmatory test and formal antimicrobial susceptibility testing, if needed, cannot be performed. Nucleic acid amplification tests (NAATs), including the Roche Cobas® Amplicor, Gen-Probe APTIMA COMBO 2®, and BD ProbeTec™ ET, also detect *C. trachomatis* and are more sensitive than culture identification of either *N. gonorrhoeae* or *C. trachomatis*. The Gen-Probe and BD tests offer the advantage that urine samples can be tested with a sensitivity similar to or greater than that obtained when urethral or cervical swab samples are assessed by other non-NAATs or culture, respectively. Several amplification tests are now available on semiautomated or fully automated platforms.

Because of the legal implications, the preferred method for the diagnosis of gonococcal infection in children is a standardized culture. Two positive NAATs, each targeting a different nucleic acid sequence, may be substituted for culture of the cervix or the urethra as legal evidence of infection in children. Although nonculture tests for gonococcal infection have not been approved by the U.S. Food and Drug Administration for use with specimens obtained from the pharynx and rectum of infected children, NAATs from these sites are preferred for diagnostic evaluation in adult victims of suspected sexual abuse, especially if the NAATs have been evaluated by the local laboratory and found to be superior. Cultures should be obtained from the pharynx and anus of both girls and boys, the urethra of boys, and the vagina of girls; cervical specimens are not recommended for prepubertal girls. For boys with a urethral discharge, a meatal specimen of the discharge is adequate for culture. Presumptive colonies of *N. gonorrhoeae* should be identified definitively by at least two independent methods.

Blood should be cultured in suspected cases of DGI. The use of Isolator blood culture tubes may enhance the yield. The probability of positive blood cultures decreases after 48 h of illness. Synovial fluid should be inoculated into blood culture broth medium and plated onto chocolate agar rather than selective medium because this fluid is not likely to be contaminated with commensal bacteria. Gonococci are infrequently recovered from early joint effusions containing <20,000 leukocytes/μL but may be recovered from effusions containing >80,000 leukocytes/μL. The organisms are seldom recovered from blood and synovial fluid of the same patient.

TREATMENT GONOCOCCAL INFECTIONS

Treatment failure can lead to continued transmission and the emergence of antibiotic resistance. The importance of adequate treatment with a regimen that the patient will adhere to cannot be overemphasized. Thus highly effective single-dose regimens have been developed for uncomplicated gonococcal infections. The modified 2010 treatment guidelines for gonococcal infections from the Centers for Disease Control and Prevention (CDC) are summarized in **Table 181-1**. Rising MICs of cefixime worldwide have led the CDC to discontinue its recommendation of this agent as first-line treatment for uncomplicated gonorrhea. The recommendations for uncomplicated gonorrhea apply to HIV-infected as well as HIV-uninfected patients.

Currently, a single IM dose of the third-generation cephalosporin ceftriaxone is the mainstay of therapy for uncomplicated gonococcal infection of the urethra, cervix, rectum, or pharynx and almost always results in an effective cure. Quinolone-containing regimens are no longer recommended in the United States as first-line treatment because of widespread resistance. A recent multicenter trial of treatment for uncomplicated gonorrhea in the United States showed ≥99.5% efficacy of two combination regimens: (1) gemifloxacin (320 mg, single oral dose) plus azithromycin (2 g, single oral dose) or (2) azithromycin (2 g, single oral dose) plus gentamicin (a single IM dose of 240 mg or, in individuals who weigh ≤45 kg, 5 mg/kg).

Because co-infection with *C. trachomatis* occurs frequently, initial treatment regimens must also incorporate an agent (e.g., azithromycin or doxycycline) that is effective against chlamydial infection. Pregnant women with gonorrhea, who should not take doxycycline, should receive concurrent treatment with a macrolide antibiotic for possible chlamydial infection. A single 1-g dose of azithromycin, which is effective therapy for uncomplicated chlamydial infections, results in an unacceptably low cure rate (93%) for gonococcal infections and should not be used alone. A single 2-g dose of azithromycin, particularly in the extended-release microsphere formulation, delivers azithromycin to the lower gastrointestinal tract, thereby improving tolerability. Azithromycin is effective against sensitive strains, but this drug is expensive, causes gastrointestinal distress, and is not recommended for routine or first-line treatment of gonorrhea. Spectinomycin has been used as an alternative agent for the treatment of uncomplicated gonococcal infections in penicillin-allergic persons outside the United States but is not currently available in this country. Of note, the limited effectiveness of spectinomycin for the treatment of pharyngeal infection reduces its utility in populations among whom such infection is common, such as MSM.

Persons with uncomplicated infections who receive ceftriaxone do not need a test of cure; however, cultures for *N. gonorrhoeae* should be performed if symptoms persist after therapy with an established regimen, and any gonococci isolated should be tested for antimicrobial susceptibility. Persons given an alternative regimen should return for a test of cure targeting the infected anatomic site. This test ideally should be a culture. If culture is not readily available and a NAAT is positive, every effort should be made to perform a confirmatory culture. All positive cultures for test of cure should undergo antimicrobial susceptibility testing. Because of high rates of reinfection with *N. gonorrhoeae* and *C. trachomatis* within 6 months, repeat testing is recommended 3 months after treatment.

Symptomatic gonococcal pharyngitis is more difficult to eradicate than genital infection. Persons who cannot tolerate ceftriaxone and those in whom quinolones are contraindicated may be treated with spectinomycin if it is available, but this agent results in a cure rate of ≤52%. Persons given spectinomycin should have a pharyngeal sample cultured 3–5 days after treatment as a test of cure. A single 2-g dose of azithromycin may be used in areas where rates of resistance to azithromycin are low.

Treatments for gonococcal epididymitis and PID are discussed in **Chap. 163**. Ocular gonococcal infections in older children and adults should be managed with a single dose of ceftriaxone combined with saline irrigation of the conjunctivae (both undertaken expeditiously), and patients should undergo a careful ophthalmologic evaluation that includes a slit-lamp examination.

DGI may require higher dosages and longer durations of therapy (Table 181-1). Hospitalization is indicated if the diagnosis is uncertain, if the patient has localized joint disease that requires aspiration, or if the patient cannot be relied on to comply with treatment. Open drainage is necessary only occasionally—e.g., for management of hip infections that may be difficult to drain percutaneously. Nonsteroidal anti-inflammatory agents may be indicated to alleviate pain and hasten clinical improvement of affected joints.

Gonococcal meningitis and endocarditis should be treated in the hospital with high-dose IV ceftriaxone (1–2 g every 12 h); therapy should continue for 10–14 days for meningitis and for at least 4 weeks for endocarditis. All persons who experience more than one episode of DGI should be evaluated for complement deficiency.