# Perinatal Transmission of Bacterial Sexually Transmitted Diseases

## Part I: Syphilis and Gonorrhea

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*Sexually transmitted diseases (STDs) have reached epidemic proportions in the United States and have captured the attention of both laypersons and health professionals. Of special concern is that most STDs can be transmitted vertically to the offspring of infected mothers. Since the advent of acquired immunodeficiency syndrome, other STDs have been at risk of being relatively disregarded. This paper, the first of two parts, reviews issues of prevalence, morbidity, mortality, prevention and treatment of syphilis and gonorrhea as they affect the maternal-fetal dyad.* **J FAM PRACT 1990; 30:448-456.**

The incidence of sexually transmitted diseases (STDs) and their complications have risen markedly during recent years. This increase has raised multiple concerns. A major concern is the significant number of young persons who are engaging in early sexual intercourse and experiencing the consequences, including STDs. Significant numbers of teens are less than optimally prepared to protect themselves against STD. Sexually transmitted infections are also gaining attention because of their increasing incidence among adults, improving laboratory techniques for their diagnosis, concern over their reproductive and other chronic sequelae, and the mortality associated with some STDs.[1]

The impact of STDs on pregnancy begins before conception, continues during the prenatal period, and extends beyond birth into the puerperium. Virtually all pathologic organisms that are transmitted sexually can be passed to the fetus and newborn during the perinatal period, often with tragic consequences. In utero, the fetus may be affected by means of infected amniotic fluid with resulting chorioamnionitis and such secondary fetal infections as pneumonia, gastroenteritis, otitis, dermatitis, and conjunctivitis. In addition, the fetus may be infected by hematogenous transmission, resulting in fetal sepsis, meningitis, and encephalitis. Placental and fetal infections have been documented or suggested to be associated with growth retardation and low birthweight, malformations, spontaneous abortion, stillbirth, prematurity, and congenital infectious syndromes.[2] Infection may also occur at parturition.

In the midst of these circumstances, the fetus is a passive victim who cannot communicate symptoms and is dependent on others for diagnosis and treatment. The consequences of sexually transmitted infections upon the conception, growth and development, and birth of the fetus have serious implications and present a major challenge to those providing health care to mothers and their infants. This paper will review syphilis and gonorrhea, two of the four bacterial STDs most problematic during pregnancy.

### SYPHILIS

Since the introduction in the 1950s of penicillin therapy, coupled with prenatal screening for syphilis, the incidence of congenital syphilis in the United States had been relatively low. The recent increase in syphilis associated with drug abuse among women in their childbearing years,

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however, is forcing clinicians to seriously reconsider this congenital infection.

## Epidemiology

The general decline in reported cases of primary and secondary syphilis in the United States after World War II was reversed in the early 1960s,[3] and by 1987 there were 14.6 cases per 100,000 population, the highest rate since 1950.[4,5] Incidence trends are currently greatest among women, blacks, urban dwellers, and in certain geographic locations. Florida, California, and New York together accounted for 57% of all reported cases in 1987.[5]

An increase in primary and secondary syphilis among women of childbearing years is followed shortly by increased morbidity and mortality associated with congenital syphilis. In the second half of 1987 the rate of congenital syphilis in the United States increased by 21% to 10.5 cases per 100,000 live births.[5] The alarming rise in incidence seems closely tied to increasing drug abuse (especially of crack cocaine) among mothers of affected infants. The State of New York, where the incidence of congenital syphilis rose to 357 cases and represented over one half of reported cases in the United States in 1988, has initiated a program to screen all its newborns for congenital syphilis.[6]

Congenital syphilis may be defined provisionally as occurring in every child younger than 12 months of age with one of the following: (1) a reactive nontreponemal serologic test for syphilis confirmed by a reactive treponemal test, (2) a positive dark-field microscopic examination of a nonoral mucous membrane lesion, (3) a positive fluorescent antibody examination for *Treponema pallidum* from a lesion.[7]

Syphilis is a prenatal (intrauterine) infection. It may be transmitted at any time during pregnancy and may be associated with a variable spectrum of outcomes. The stage of maternal syphilis is an important determinant of infectivity. Fetal infection is more likely to occur if the mother has primary, secondary, or early latent syphilis, as earlier stages are associated with higher numbers of circulating treponemes.[8] The risk of fetal transmission is estimated to range from 70% to 100% for untreated primary syphilis to approximately 30% for latent disease (when bacteremic relapses may occur).[9] It is uncommon for women with late syphilis, among whom the number of stillbirths approximates that of the general population, to give birth to a child with congenital syphilis.[8,10] Yet in prenatal cases of untreated primary and secondary syphilis, from 40% to 50% of pregnancies will end in fetal or perinatal death or premature birth.[5,7] Spontaneous abortion is especially likely if the fetus is infected during the first trimester.[10] Surviving fetuses most likely to be severely affected at birth are those infected at or after the 24th week of gestation.[10]

It is not uncommon to miss the diagnosis of congenital syphilis at birth when the newborn may appear normal. Among 460 cases of congenital syphilis recently reported to the Centers for Disease Control (CDC), the mean age of infants was 2.1 months, although, retrospectively, only 12% of these were asymptomatic at birth.[4] It is imperative to document maternal serologic status for syphilis before discharging a newborn from the hospital.[6]

## Spectrum and Diagnosis of Congenital Syphilis

As in adults, congenital syphilis may be classified by stage. The diagnosis should be considered in any neonate or stillborn infant who manifests significant hepatosplenomegaly, abdominal distention, significant renal dysfunction consistent with nephrotic syndrome or glomerulonephritis, hydropic appearance, hemolytic anemia, petechiae, a bullous eruption involving the palms and soles,[10,11] or necrotizing funisitis (umbilical cord inflammation).[12] The prognosis of congenital syphilis evident at birth is much poorer than that manifesting after the first week of life.[13]

Early congenital syphilis may feature a flulike syndrome associated with hemorrhagic nasal discharge (snuffles), a hoarse cry, multinodal lymphadenopathy, purpura, hepatosplenomegaly, ascites, mucocutaneous lesions (including mucous patches), and perioral fissuring (rhagades). Associated skin lesions include maculopapular, papular, bullous, and pustular lesions associated with paronychia.[10] Latent or late congenital syphilis may present to the clinician as a complication of the primary disease (eg, deafness).

It is difficult to describe the natural history of untreated congenital syphilis, but affected children have both the stigmata of early lesions (eg, dental problems) and lesions resulting from ongoing inflammation. Later clinical findings of congenital syphilis include frontal bossing, shortened maxillae and relative mandibular prominence, saddle nose deformity, high palatal arch, Hutchinson's teeth (dysmorphic upper central incisors), interstitial keratitis, mulberry (polycuspid first lower) molars, eighth nerve deafness, and saber shins and osteochondritis of long bones, which may lead to pseudoparalysis.[10,11,14]

Bony involvement, especially of long bones, is the most common manifestation of congenital syphilis. The CDC has reported osteochondritis and periostitis as the most common major signs of congenital syphilis in 460 cases from a 3-year period; jaundice, hepatosplenomegaly, and cutaneous lesions were the most frequent minor signs.[4,11]

A diagnosis of congenital syphilis suggested by the baby's clinical appearance and mother's epidemiologic history and serologic results may be confirmed by dark-

**TABLE 1. INFANTS OF SEROPOSITIVE* MOTHERS WHO SHOULD BE EVALUATED FOR CONGENITAL SYPHILIS**

| |
|---|
| **Any infant whose mother:** |
| Has untreated syphilis or poorly documented history of treatment |
| Was treated late in pregnancy (>20 weeks' gestation) |
| Was treated with an antibiotic other than penicillin |
| Did not have expected decrease in nontreponemal titers post-treatment, or had insufficient serologic follow-up |

**Positive nontreponemal test confirmed by treponemal test.*
*From MMWR.[7,15]*

**TABLE 2. INFANTS OF SEROPOSITIVE MOTHERS WHO SHOULD HAVE CEREBROSPINAL FLUID EXAMINATION**

| |
|---|
| Infants with any signs compatible with congenital syphilis |
| Infants whose mothers' treatment was inadequate, unknown, or occurred after 20 weeks' gestation |
| Infants whose mothers were treated with antibiotics other than penicillin |
| Infants of mothers for whom there is no assurance of adequate follow-up |

*From MMWR.[7]*

field examination of neonatal lesions or pathologic tissue examination. In addition to instances in which maternal serum evaluations are positive, congenital syphilis should be considered in cases of stillbirth and placental hydrops. Microscopic examinations of placenta, infant organs, and umbilical cord, as well as radiologic examinations of long bones and the microhemagglutination assay for antibody to *Treponema pallidum* (MHA-TP) performed on infant serum, may all help substantiate a postmortem diagnosis of congenital syphilis. A confirmed case of congenital syphilis implies the identification of the spirochete by dark-field microscopy, fluorescent antibody, or other specific stains from lesions or tissues. The CDC also defines "compatible cases" (formerly "probable" or "possible") and "unlikely cases" of congenital syphilis, based upon various combinations of history, physical signs, and serologic evidence.[8]

Any infant born to a seropositive mother in the appropriate clinical setting (Table 1) should be evaluated for congenital syphilis. Evaluation should include a thorough physical examination for evidence of congenital syphilis, a serologic test, and long-bone x-ray studies. Serologic testing includes the nontreponemal tests (ie, rapid plasma reagin and VDRL tests), which are used initially, and treponemal tests such as the fluorescent treponemal antibody absorption test (FTA-ABS), hemagglutination treponemal test for syphilis, and the MHA-TP, which are used as confirmatory tests. Neonatal serum is the preferred specimen for both treponemal and nontreponemal serologic study, since cord blood may be contaminated with maternal antibodies. Cord blood, however, remains a readily accessible specimen for purposes of screening high-risk populations.[7] Wherever available, an FTA-ABS should be performed on the 19S-IgM fraction of neonatal serum.[15]

All confirmed or compatible cases of congenital syphilis should have a baseline cerebrospinal fluid (CSF) examination before treatment. Certain other infants born to seropositive mothers should also have a lumbar puncture performed (Table 2).[7] The predictive value of CSF results is controversial, but the VDRL is meaningful when correlated with CSF protein and the cell analysis.[16,17] In a recent report only 5 of 460 cases of congenital syphilis had CSF serologic evidence of neurosyphilis.[4]

## Prenatal Screening

Rational treatment depends on the stage of the disease and the certainty of diagnosis. In the mother, prompt and adequate treatment of primary or secondary syphilis during pregnancy prevents congenital syphilis; however, diagnosis may well be delayed in the group at highest risk. In general, 95% of pregnant women in the United States have at least one prenatal visit[18]; by contrast, according to a CDC survey, only about one half of mothers of infants with congenital syphilis had at least one prenatal visit. Among those who actually did receive prenatal care, the mean gestational age at which they were first seen was rather late (22 weeks), and 8% of these had no serologic test for syphilis done. In addition, 25% of mothers of babies with congenital syphilis had negative tests on serologic examination during the first trimester but no third-trimester serologic test performed.[4] Thus, a negative rapid plasma reagin test early in pregnancy does not assure a disease-free state at delivery.

Congenital syphilis will be controlled when maternal early infectious syphilis is controlled. Thus, the CDC has recommended syphilis screening wherever pregnant women are seen for health care, including those in jail and in drug-addiction treatment programs. Likewise, testing for pregnancy, when appropriate, should be carried out in STD and drug-addiction clinics. Syphilis must always be considered in pregnant women with other STDs.[7]

All pregnant women should be screened with a nontreponemal test at their first prenatal visit; high-risk women who have a significant likelihood of contracting syphilis should be rescreened at the beginning of the third trimester. If the nontreponemal test is positive, the treponemal test is nonreactive, and there is no clinical evidence of syphilis, no treatment is necessary; both tests should be repeated within 4 weeks.[7] Pregnancy is a well-documented cause of false-positive serum cultures for syphilis, including both nontreponemal and treponemal tests[19]; uncertain cases may be clarified by special tests

(eg, Reiter absorptions). False-negative tests also occur because of the prozone phenomenon; this problem may be overcome by testing diluted serum.[20] If, however, any clinical or serologic evidence of syphilis is found, or if the diagnosis cannot be excluded with reasonable certainty, the patient should be treated.[7]

## Treatment and Follow-up

If infected mothers are treated before the 18th week of gestation, syphilitic infection should be prevented. Treatment accomplished during the second or third trimester up until about 2 weeks before delivery should cure an infected fetus.[10]

*Treponema pallidum* remains quite susceptible to penicillin, and when treating the pregnant woman, this drug should be used if at all possible. In patients supposedly allergic to penicillin, a careful history regarding details of previous allergic symptoms should be obtained. Less than 40% of patients with a history of previous therapy with and supposed sensitivity to penicillin actually have a positive skin test reaction, and less than one third of those with a history of penicillin sensitivity reacted to subsequent therapy with it.[21] Penicillin may be given to patients with a history of an allergic reaction if skin test reactions to major and minor determinants are negative, or if skin tests are positive but desensitization to penicillin has been accomplished in a safe setting.[15,22,23]

Recent alarming reports of congenital syphilis in babies whose mothers were treated prenatally for syphilis suggest a need to modify previous treatment strategies. In one report 70% of treatment failures were in patients treated with the recommended single injection of benzathine penicillin.[4] Very recent guidelines continue to recommend pregnant women be treated the same as nonpregnant patients[15]; however, Fiumara[10] has recommended 2.4 million units of benzathine penicillin twice (at least 1 week apart) for early syphilis in pregnant patients. Treatment with alternative antibiotics during pregnancy is generally unsatisfactory, although there is some evidence that ceftriaxone is effective for both incubating and early syphilis.[15,24,25] Careful follow-up is especially important in patients who are treated with antimicrobial preparations other than penicillin.

Babies who are treated for congenital syphilis should receive penicillin (Table 3). Accepted regimens include aqueous crystalline penicillin G (50,000 U/kg intravenously every 8 to 12 hours), or procaine penicillin G (50,000 U/kg intramuscularly daily) for 10 to 14 days.[7,15] For asymptomatic infants whose mothers were treated adequately with penicillin during pregnancy but for whom follow-up is uncertain, experts have recommended treatment with 50,000 U/kg of benzathine penicillin given intramuscularly once.[7]

**TABLE 3. INFANTS WHO SHOULD BE TREATED FOR CONGENITAL SYPHILIS**

**Infants who have:**
- Any clinical or radiologic evidence of active syphilis
- Been born to a seropositive mother whose treatment for syphilis has been dubious or within 2 weeks of delivery or with an antibiotic other than penicillin
- A reactive cerebrospinal fluid VDRL
- Abnormal cerebrospinal fluid white blood cell count or protein regardless of cerebrospinal fluid serum testing results
- A nontreponemal serologic test for syphilis titer that is fourfold (or greater) higher than their mother's
- A positive FTA-ABS-1GS-IgM antibody
- Had an incomplete evaluation or uncertain follow-up

*From MMWR.[7,15]*

Seropositive neonates without clinical evidence of syphilis are problematic because of possible passive transfer of maternal antitreponemal (IgG) antibodies. At least 6 weeks are required for clearance of these antibodies.[9] Comparison of the maternal and neonatal VDRL or rapid plasma reagin titers may be helpful (Table 3), but in equivocal cases or if there is no definite history of adequate treatment of the mother, the seropositive baby probably should be treated promptly rather than waiting 6 to 12 weeks to document a falling titer.[15]

Monthly follow-up is mandatory for a mother treated prenatally for syphilis. Women whose nontreponemal titer does not decrease fourfold (eg, from 1:32 to 1:8) within 3 months or whose titer rises should be retreated.[7] It has been suggested that mothers with previous syphilis should be retreated for residual organisms that might persist during subsequent pregnancies, but it is reasonable to withhold therapy during a pregnancy that is subsequent to documented treatment and proper follow-up and for which there is no evidence of reinfection.[7,9,26] Women treated during the second half of pregnancy are at risk for premature labor if a Jarisch-Herxheimer reaction (fever, myalgias, headache) results.[15]

Seropositive untreated newborns must be followed closely at 1, 2, 3, 6, and 12 months of age. In the absence of infection, nontreponemal titers should be decreasing by 3 months of age and disappear by 6 months. Treponemal antibodies may persist until 1 year of age; certainly if they persist beyond that point, the infant should be treated for congenital syphilis.[15]

Treated newborns should have serologic tests for syphilis performed until they become nonreactive. Repeat quantitative nontreponemal tests should be obtained at least 3, 6, and 12 months after treatment; these babies should become nonreactive or low-titer reactive within 1 year following successful treatment. Those babies with persistent, stable titers should be considered candidates for retreatment. In addition, treated babies should be

followed with a CSF examination at 6-month intervals until nonreactive; a reactive VDRL at 6 months is an indication for retreatment. A thorough developmental evaluation should be performed during the 3rd year of life for all children treated for congenital syphilis.[7]

## GONORRHEA

*Neisseria gonorrhoeae* was first isolated in 1882. Humans are its only natural host. A major impediment to gonorrhea control has been the changing antimicrobial susceptibilities of the organism.[27]

### Resistant Organisms and Epidemiology

In the early years of antibiotic therapy, sulfonamides and later penicillin were used to treat gonorrhea. Sulfonamide resistance was identified in the 1940s.[28] Subsequently, it became apparent that *N gonorrhoeae* was becoming resistant to penicillin as well. The recommended therapeutic dose of procaine penicillin rose from 200,000 U in 1945 to 4.8 million units in 1972.[29]

In the early 1970s chromosomally mediated antibiotic resistance of *N gonorrhoeae* was noted to affect penicillin and tetracycline.[28] Plasmid-mediated resistance, which results in β-lactamase–producing organisms, first appeared in the United States and England in 1976.[27] Since that time, these penicillinase-producing *Neisseria* organisms have become endemic in the United States with case numbers increasing annually.[29]

About 1 million new cases of gonorrhea are reported to the CDC each year, and it is estimated that a similar number go unreported. Incidence of this disease in the United States is subject to many variables. Seasonal peak incidence occurs during the late summer. Rates are higher in unmarried nonwhites, in women of lower socioeconomic status, in the southeastern United States, and in urban areas (especially the urban Northeast). The rate of increase during the 1960s and 1970s was highest among teenagers; currently the age subgroup with the highest incidence is persons 20 to 24 years old, followed by those 25 to 29 years old, and those 15 to 19 years old.[27,28]

Reported prevalence of gonorrhea among pregnant women in a number of studies has varied from 1% to 7.5%.[30] Of 1,700,000 prenatal cultures for gonorrhea performed in the United States in 1979, about 3% were positive. Contamination of the newborn infant usually occurs during passage through the birth canal. It is estimated that about one third of neonates born to infected mothers will acquire gonococcal infection during vaginal delivery.[31]

**TABLE 4. CLINICAL SPECTRUM OF GONORRHEA IN WOMEN**

| Clinical Presentation | Estimated Percentage of Women |
|---|---|
| Pelvic inflammatory disease | 31 |
| Nonspecific symptoms | 23 |
| Abdominal pain | 21 |
| Asymptomatic | 19 |
| Disseminated (gonococcemia) | 1–2 |
| Meningitis | Rare |
| Endocarditis | Rare |
| Subcutaneous abscess | Very rare |

*From Alexander,[28] Anan and Culik,[32] Olsen-Noll et al,[33] and Van Durme et al.[34]*

### Clinical Spectrum of Disease

Among women infected with *N gonorrhoeae*, there is an impressive spectrum of signs and symptoms (Table 4). Up to about 40% of infected women are asymptomatic or have nonspecific symptoms.[28,35] Edwards et al[30] have emphasized the significance of the lack of symptoms and recurrent positive cultures among pregnant women infected with *Neisseria*.

Pregnant women have been reported to be at higher risk of disseminated gonococcal infection, but there is evidence to the contrary.[30] Pelvic inflammatory disease is said to occur rarely during pregnancy, but Blanchard and colleagues[36] cite evidence that it may be more common than has been supposed. They suggest that pathogenetic mechanisms other than ascending infection probably exist. Waters and Roulston[37] have also shown 9% of prenatal cultures positive for gonorrhea were obtained from women with fever, abdominal pain, or both, suggesting the presence of pelvic inflammatory disease.

Prenatal gonococcal infection carries significant risk for the fetus. Edwards et al[30] summarized the evidence for associated adverse outcomes including chorioamnionitis, premature rupture of membranes, premature delivery, and intrauterine growth retardation. Such complications were especially increased among women who were culture-positive for gonorrhea at the time of delivery. Alexander[28] has estimated that the rate of septic abortion associated with gonorrhea is about 35%. *N gonorrhoeae* has been documented as one of the major causes of puerperal sepsis in Ethiopia.[38]

Although most neonatal gonorrheal infection occurs during parturition, contamination of the fetus may occur in utero following rupture of the membranes. Neonatal gonococcal eye[39] and oropharyngeal infections[40] have been documented in infants delivered by cesarean section after rupture of the membranes, and Oppenheimer and Winn[41] have documented deep-tissue *N gonorrhoeae* in-

fection in a stillborn infant. Accidental contamination by an infected mother may occur after the first month of life.

The clinical spectrum of gonorrheal disease in newborns is likewise broad. *Neisseria* primarily infect mucosal columnar and transitional epithelial cells. Anatomic sites that can be directly infected in the neonate include the anal canal, conjuctivae, and pharynx. Clinically apparent neonatal infections of the urethra or vagina occur rarely.[27] Gonococcal gingival abscess has been noted,[42] and reports of scalp abscesses have been increasing since the advent of widespread use of fetal scalp electrodes.[43] Neonatal gonococcal endocarditis has not been reported, although infants are theoretically more susceptible to gonococcemia because of the absence of IgM antigonococcal antibody.[27]

Neonatal gonococcemia commonly results in infection of the joints and skin, and rarely the meninges. Septic arthritis is the most commonly recognized manifestation of gonococcemia in the neonatal period, although the source of the associated septicemia is usually not apparent.[44] Clinical arthritis usually occurs 1 to 4 weeks after delivery. No deaths have been reported among infants with gonococcal arthritis treated with antibiotics. Adequate drainage of infected joints is an important aspect of management, especially if the hips are involved.[27] *N gonorrhoeae* is also associated with neonatal sepsis in the absence of arthritis, and in one study was the third most common pathogen (after *Escherichia coli* and group B streptococcus) recovered from nasogastric aspirates of neonates with suspected sepsis.[45] The pustular and necrotic skin lesions that characterize gonococcemia in adults have not been described in the literature,[27] but such lesions have been seen in both a mother and her infant in the practice of one of the authors. Bradford and Kelley[46] have reported one case of meningitis caused by *N gonorrhoeae* in a 2-day-old infant and have reviewed two other probable cases. The neonatal gonococcal disease best studied is that of the eye; *N gonorrhoeae* was not recovered from any nonoptic site in newborns in the United States until 1971.[27]

## Gonococcal Ophthalmia Neonatorum

Although the incidence of gonorrheal ophthalmic disease has dropped precipitately this century in the United States, it still approaches 50% as the cause of neonatal conjunctivitis in developing nations.[47] Gonococcal neonatal ophthalmia is an acute purulent conjunctivitis that appears mainly during the first week of postpartum life and poses a great risk of serious ophthalmic sequelae as a result of corneal injury.[47,48] If treatment is delayed, ulcerations, anterior synechiae, anterior staphyloma, panophthalmitis, and loss of the eye may result.[27]

The presence of gonococcal neonatal ophthalmia without any signs of inflammation has been documented,[49] and it has been detected at birth or during the first few hours of life in infants born after premature rupture of the membranes, and in an infant delivered by cesarean section after membrane rupture.[39,50] Gonococcal ophthalmia should be ruled out in every case of newborn conjunctivitis. Likewise, because of the continued high annual incidence of gonorrhea in the United States and the evolution of resistant organisms, complacency about this disease must be avoided, for it remains the most serious cause of bacterial conjunctivitis in the newborn, and the resurgence of gonorrhea in adults in the 1960s and 1970s was associated with increased incidence of gonococcal neonatal ophthalmia.[27]

The method of gonococcal neonatal ophthalmia prophylaxis with silver nitrate introduced by Crede[51] in the 1880s resulted in a drop in the proportion of new admissions to schools for the blind in the United States from 28% in 1906 to 11% in 1933, and to less than 0.1% by 1959.[27] And although silver nitrate is still effective, since 1978, new recommendations for gonococcal ophthalmia prophylaxis, which include erythromycin (0.5% ointment) and tetracycline (1% ointment), have been issued and generally accepted.[15,48,52,53] Prophylaxis should be given within 1 hour of birth.

Diagnostic evaluation should be carried out for any case of ophthalmia neonatorum that appears to be more severe than the usual chemical conjunctivitis (after silver nitrate therapy) or that persists longer than 2 to 3 days. A Gram stain showing typical gram-negative diplococci provides presumptive diagnosis, although *N gonorrhoeae* can be confused with nonpathogenic *Neisseria* species,[54] and *N meningitidis* has also been associated with ophthalmia neonatorum.[27]

## Diagnosis and Screening

All pregnant women should be screened at the first prenatal visit for the presence of cervical gonorrhea, especially considering the high incidence of asymptomatic infection. All cases of gonorrhea should be confirmed by culture to facilitate antimicrobial susceptibility testing. Individuals at high risk of infection (eg, adolescents) should be rescreened during the third trimester.[15,28,30] Routine screening should probably be confined to obtaining an endocervical culture; the addition of routine pharyngeal culture has been shown not to be cost-effective.[55] An endocervical culture for gonorrhea should also be obtained from patients with premature rupture of the membranes, intrapartum fever, or septic abortion. Treated mothers should have cervical samples recultured,

**TABLE 5. TREATMENT OF GONORRHEA IN PREGNANCY**

| Infection | Mother | Baby |
|---|---|---|
| Urethral, endocervical, rectal, pharyngeal infection | Ceftriaxone* 250 mg IM once, followed by erythromycin† for 7 days | — |
| Disseminated gonococcal infection | Ceftriaxone 1 g IM or IV q24 h, *or*<br>Ceftizoxime 1 g IV q8 h, *or*<br>Cefotaxime 1 g IV q8 h<br>May be followed by oral therapy (cefuroxime axetil 500 mg BID), when stable, to complete 1 week of therapy | Ceftriaxone (25–50 mg/kg/d) IV or IM, single dose *or*<br>Cefotaxime 25 mg/kg IV or IM q12 h, for 7 days (10–14 days if meningitis is present) |
| Conjunctivitis | Ceftriaxone 1 g IM once | Same as for disseminated gonococcal infection‡ |
| Infant of mother with untreated gonorrhea | — | Ceftriaxone 50 mg/kg (up to 125 mg) IM or IV once |

**A penicillin may be used if certainty exists that penicillinase-producing species is absent.*
*†Erythromycin stearate or base: 500 mg four times daily; erythromycin ethylsuccinate: 800 mg four times daily.*
*‡Evidence[53] exists that a single injection of ceftriaxone (50 mg/kg, up to 125 mg) may be adequate treatment for uncomplicated neonatal gonococcal ophthalmia.*
*IM—intramuscular; IV—intravenous; q—every; BID—twice daily.*
*From MMWR[15] and Med Lett.[26]*

and sexual partners of women with any form of gonorrhea should be treated presumptively. If the sexual partner of the mother is not treated, repeat monthly cultures are appropriate during the prenatal period.[26,27]

Infants of mothers with untreated gonorrhea should be treated presumptively and observed (see below). Infants with documented gonococcal infections at any site (including the eye) should be evaluated for disseminated infection by means of physical examination (especially joints) and cultures of blood and CSF.[15] Infants with positive cultures should have blood and spinal fluid recultured in 3 to 7 days.[56]

## Treatment

The treatment of gonorrhea, once a simple matter, has been complicated by the increasing antimicrobial resistance of *N gonorrhoeae*. In 1988, 36,000 cases of resistant strains were reported in the United States.[57] Although there is concern about increasing chromosomally induced resistance among strains of *N gonorrhoeae* treated with cephalosporins and some have recommended spectinomycin as initial therapy for gonorrhea in adults,[58,59] there is a growing general reliance on newer cephalosporins for the eradication of gonorrhea.

Consensus recommendations for treatment of gonorrhea currently advocate ceftriaxone in both pregnant women and infants (Table 5). Other cephalosporins (eg, cefuroxime axetil plus probenecid, cefotaxime, ceftizoxime) may be used, but data concerning ceftriaxone are currently more abundant.[15] Previous studies have shown that penicillin therapy recommended for the treatment of gonorrhea also eradicates concomitant incubating syphilis[25]; recent preliminary evidence also suggests that ceftriaxone is effective against syphilis.[24,25] Concomitant therapy with erythromycin is recommended for the pregnant woman treated for gonorrhea because of the likelihood of coexisting infection with *Chlamydia trachomatis*. If infection is proven not to be secondary to penicillinase-producing *N gonorrhoeae*, a penicillin may be used in conjunction with probenecid. Spectinomycin is an alternative antimicrobial for women who cannot take a cephalosporin (or penicillin).[15,26]

Treatment of gonococcal neonatal ophthalmia with topical antimicrobial agents alone is insufficient. Either cefotaxime or ceftriaxone may be used; adjunctive saline irrigation is recommended.[15,28] One study of 122 neonates with gonococcal ophthalmia showed no treatment failures with a single dose of ceftriaxone.[60] The use of highly protein-bound ceftriaxone should, however, be avoided in jaundiced newborns, and the drug also tends to cause diarrhea in some infants. Treatment of gonococcal ophthalmia up to 2 weeks after onset is said to be efficacious to prevent blindness. Both parents of an infected newborn should be treated for gonorrhea.[27] Coexisting neonatal ocular infection with *C trachomatis* should be considered, especially if expected clinical improvement does not result.

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