Meningococcal Disease (*Neisseria meningitidis*)

Summary

Meningococcal disease is an acute, severe illness caused by the bacterium *Neisseria meningitidis*. Suspected invasive meningococcal disease is a medical and public health emergency. Transmission is through direct exposure to the index patient's oral secretions, not through casual contact. Chemoprophylaxis should only be provided for close contacts of patients with evidence of N. meningitidis in a normally sterile body site.

Keeping vaccination up to date is the best defense against meningococcal disease.

Agent

Neisseria meningitidis is a gram-negative diplococcus with 12 confirmed serogroups based on capsular type.

Serogroup B account for the most cases currently in the United States across all age groups. More than 85% of cases among adolescents and young adults are caused by serogroups B, C, Y, or W, which are potentially preventable with available vaccines.

Transmission

Reservoir**:**

Humans. As many as 10% of adolescents and adults are asymptomatic nasopharyngeal carriers of *N. meningitidis*, most strains of which are not pathogenic.

Mode of transmission:

- *N. meningitidis* colonizes the upper respiratory tract (nasopharynx) and is spread person-to-person through respiratory droplets. Transmission requires close contact, such as coughing, kissing, sharing utensils, intubation or performing aerosol generating procedures without using personal protective equipment.

Period of communicability:

- From the time the person is first infected until meningococci are no longer present in discharges from the mouth and nose. Meningococci usually disappear from the nasopharynx within 24 hours after starting effective antibiotic treatment.

Clinical Disease

Incubation period:

From 1-10 days for invasive disease, usually less than 4 days.

Illness:

Invasive illness frequently results in meningococcemia (sepsis), meningitis, or both. Onset can be insidious and nonspecific but often is abrupt, characterized by fever, chills, malaise, myalgia, prostration, and a rash that initially may be urticarial, maculopapular, or petechial. In fulminant cases, purpura (red or purple discolorations on the skin that do not blanch on applying pressure), limb ischemia, coagulopathy, pulmonary edema, shock, coma, and death can ensue within several hours despite appropriate therapy.

Symptoms of meningococcal meningitis are similar to those associated with acute meningitis caused by other pathogens, including fever, headache, stiff neck, nausea, vomiting, photophobia, and altered mental status. Raised intracranial pressure is a predominant presenting feature among severe and fatal cases of meningococcal meningitis.

Invasive infections can be complicated by septic arthritis, myocarditis, pericarditis, and pneumonia.

Sequelae may include hearing loss, skin scarring, limb or digit amputations, and/or neurologic disability. These occur in approximately 11 to 19% of survivors.

Laboratory Diagnosis

Cultures of blood and cerebrospinal fluid (CSF) are indicated in for patients with suspected invasive meningococcal disease. Cultures of petechial or purpuric lesion scrapings, synovial fluid, and other sterile site specimens may be useful in some patients. Throat or nasopharyngeal cultures are of no value because *N. meningitidis* can be part of normal flora at these sites.

A gram stain of petechial or purpuric lesions, blood or CSF may also be helpful. Bacterial antigen testing from CSF, such as latex agglutination, may support the diagnosis of a probable case with consistent clinical illness. However, this method is not preferred as it commonly results in false-negative results, particularly among serogroup B disease. Antigen tests of urine or serum are unreliable.

PCR can be used and may be especially helpful among patients whose clinical specimens were collected after initiation of antibiotic therapy.

Treatment

It is important that treatment begins as soon as possible.

Treatment priorities are treating shock in cases with meningococcemia and raised intracranial pressure in cases of meningitis. In meningococcemia presenting with shock, early use of inotropic and ventilator support, combined with rapid fluid resuscitation, may reduce mortality.

Empiric therapy (ideally after culture obtained) for suspected meningococcal disease cases should include broad-spectrum antibiotics with a third-generation cephalosporin such as cefotaxime or ceftriaxone. After the diagnosis has been lab-confirmed, definitive treatment can be continued with cefotaxime, ceftriaxone, penicillin G, or ampicillin. Five to seven days of therapy is adequate for most cases of invasive disease. Meningococcal isolate susceptibility to penicillin should be determined before switching to penicillin or ampicillin, as there have been reports of penicillin-resistant, β-lactamase-producing N. meningitidis serogroup Y cases in the U.S.

Additional treatment may be needed to eradicate nasopharyngeal carriage. Ceftriaxone clears nasopharyngeal carriage effectively after 1 dose. If antimicrobial agents other than ceftriaxone or cefotaxime are used for treatment of meningococcal disease, eradication of nasopharyngeal carriage with rifampin (4 doses over 2 days) or single doses of ciprofloxacin or ceftriaxone are recommended prior to discharge from the hospital.

Surveillance

Case Definition:

Confirmed

Detection of *N. meningitidis*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., blood or CSF), using a PCR assay

OR

Isolation of *N. meningitidis*

- From a normally sterile body site (e.g., blood, CSF or less commonly, synovial, pleural, or pericardial fluid); or
- From purpuric lesions

Probable

Detection of *N. meningitidis* antigen

- In formulin-fixed tissue by immunohistochemistry (IHC); or
- In CSF by latex agglutination

Suspected

Clinical purpura fulminans in the absence of a positive blood culture

OR

Gram-negative diplococci, not yet identified, isolated from a normally sterile body site (e.g., blood or CSF)

The following definitions can be used to describe a case of meningococcal disease:

Primary case: A primary case of meningococcal disease is one that occurs in the absence of previous known close contact with another patient with meningococcal disease.

Secondary case: A secondary case of meningococcal disease is one that occurs among close contacts of a primary case 24 hours or more after onset of illness in the primary patient.

Co-primary case: Co-primary cases are two or more cases that occur among a group of close contacts with onset of illness separated by less than 24 hours.

Close contacts: Close contacts of a patient who has meningococcal disease include:

- Household members (including dormitory room, barracks.)
- Childcare center contacts.
- Persons directly exposed to the patient's oral secretions (e.g., by kissing, sharing utensils, mouth-to-mouth resuscitation, endotracheal intubation, or endotracheal tube management.)

Reporting:

Report all suspected or confirmed cases of meningococcal disease immediately to the Epidemiology and Response Division (ERD) at 505-827-0006. Information needed includes: patient's name, age, sex, race, ethnicity, home address, phone number, occupation, and health care provider.

Control Measures

1. Case management

1.1. Isolation: Droplet precautions are recommended until 24 hours after the start of effective treatment, in addition to standard precautions.

1.2. Antimicrobial therapy for meningococcal disease with agents other than ceftriaxone or other third generation cephalosporins might not reliably eradicate nasopharyngeal carriage of *N. meningitidis*. If other agents have been used for treatment, the index patient should receive chemoprophylaxis for eradication of nasopharyngeal carriage before being discharged from the hospital.

2. Contact Management

2.1. Exposed household, school, or childcare contacts must be observed carefully. If a febrile illness develops, prompt medical evaluation should occur.

2.2. Regardless of immunization status, chemoprophylaxis administered as soon as possible (preferably within 24 hours of identification of suspected or confirmed index case) is recommended for:

2.2.a. Household contacts, especially children younger than two years.

2.2.b. People who frequently slept or ate in the same dwelling as the index case during the seven days before onset of illness in the index case.

2.2.c. Childcare, preschool, or nursery school contacts during the seven days before onset of illness in the index case.

2.2.d. Persons with direct exposure to index patient’s secretions (e.g., sharing toothbrushes, kissing, sharing cigarettes or eating utensils) during the seven days before onset of illness in the index case.

2.2.e. Medical personnel who have had intimate exposure, such as mouth-to-mouth resuscitation, or unprotected endotracheal intubation, or suctioning before or less than 24 hours after antimicrobial therapy was initiated.

2.2.f. Passengers seated directly next to the index case during airline flights lasting more than eight hours, or within one seat in any direction on a flight of any duration if the index patient was coughing or vomiting on the flight.

2.3. Chemoprophylaxis may be recommended for laboratory employees:

2.3.a. Who are exposed percutaneously to a *N. meningitidis* isolate.

2.3.b. Who have a mucosal exposure to a *N. meningitidis* isolate.

2.3.c. Who may have been exposed to the organism during specimen handling and identification.

2.4. Rifampin, ceftriaxone, ciprofloxacin, and azithromycin are appropriate for chemoprophylaxis in adults, but rifampin and ciprofloxacin are not recommended for pregnant women. Rifampin or ciprofloxacin are recommended for most children. Rifampin requires 4 doses over 2 days to eradicate nasopharyngeal carriage, but ceftriaxone, ciprofloxacin, and azithromycin only require a single dose.

2.5. Chemoprophylaxis is not recommended for:

2.5.a. Casual contact where there is no history of direct exposure to the index patient's oral secretions (e.g., school or work).

2.5.b. Indirect contacts (whose only contact is with a high-risk contact and not directly with the index case).

2.5.c. Health care personnel without direct exposure to patient's oral secretions

2.6.d. Call the medical epidemiologist on-call at (505) 827-0006 to review the nature and extent of contact for each case if questions exist.

2.6.e. In an outbreak or cluster chemoprophylaxis for people other than people at high risk should be administered only after consultation with a medical epidemiologist.

2.6. Chemoprophylaxis is not indicated more than two weeks after exposure.

2.7. Chemoprophylaxis is not recommended for close contacts of patients with evidence of *N. meningitidis* only in nonsterile sites (e.g., oropharyngeal, endotracheal, conjunctival).

2.8. Vaccination: Because secondary cases can occur several weeks or more after onset of disease in the index case, meningococcal vaccine is an adjunct to chemoprophylaxis when an outbreak is caused by a serogroup prevented by a meningococcal vaccine. For control of meningococcal outbreaks caused by vaccine preventable serogroups A, C, W and Y, the preferred vaccine in adults and children two years and older is a meningococcal conjugate vaccine. For control of outbreaks caused by Serogroup B, preferred vaccine for people 10 through 25 years of age is a meningococcal protein-based vaccine.

3. Prevention

3.1. The main method of preventing meningococcal disease is immunization. Three quadrivalent meningococcal conjugate (Serogroups A, C, W, Y) vaccines and two recombinant (protein-based) serogroup B meningococcal vaccines are available in the U.S.:

3.1.a. MenACWY meningococcal conjugate vaccines: Menactra, Menveo and MenQuadfi.

3.1.b. MenB meningococcal recombinant vaccines: Trumenba and Bexsero.

3.2. Quadrivalent meningococcal conjugate (Serogroups A, C, W, Y) vaccines. The Advisory Committee on Immunization Practices (ACIP) recommends routine vaccination with MenACWY vaccine for all adolescents at age 11 through 18 years.

3.2.a. 1 dose at age 11 or 12 years

3.2.b. Booster dose at age 16 years. Healthy persons who receive the first dose at or after age 16 do not need a booster unless at increased risk for meningococcal disease.

3.3. Recombinant (protein-based) serogroup B meningococcal vaccines

3.3.a. Recommended for persons age 10 years or older who are at increased risk of serogroup B meningococcal disease.

3.3b. Shared clinical decision making for adolescents age 16 through 23 years

3.4. ACIP also recommends vaccination for persons age 2 months or older at increased risk for meningococcal disease due to serogroups A, C, W, or Y.

3.4.a. Persons with persistent complement component deficiencies, including persons taking eculizumab or ravulizumab-cwvz

3.4.b. Persons who have functional or anatomic asplenia, including sickle cell disease

3.4.c. Persons with HIV infection

3.4.d. Microbiologists who are routinely exposed to isolates of N. meningitidis

3.4.e. Persons identified by public health officials to be at increased risk during a meningococcal disease outbreak due to serogroup A, C, W, or Y

3.4.f. Persons who travel to or reside in countries where meningococcal disease is endemic or hyperendemic, including the “meningitis belt” of sub-Saharan Africa or the Kingdom of Saudi Arabia during the annual Hajj and Umrah pilgrimages

Refer to the Advisory Committee on Immunization Practices Vaccine Recommendations and Guidelines for the most updated vaccine-specific recommendations.

4. Outbreak Management

4.1. Outbreak Definition:

4.1.a. Community-based outbreak: Multiple outbreak-associated cases with an incidence of meningococcal disease that is above the expected incidence in a community during a 3-month period.

4.1.b. Organization-based outbreak: 2-3 outbreak-associated cases within an organization during a 3-month period. Examples of an organization-based outbreak include cases in schools, churches, and universities.

4.1.c. In contrast to previous guidance in which a threshold of 3 cases of the same serogroup with an attack rate of > 10 cases per 100,000 population during a 3-month period was used to define both organization and community-based outbreaks, the current guidance does not recommend the use of an absolute threshold.

4.1.d. Strategies to determine whether incidence is above expected in a community are as follows. Incidence during the current 3-month period can be compared with the incidence during a similar time period in previous years. If community incidence has historically been very low, comparisons against

national incidence can be made. Additional supportive evidence of an outbreak should be sought, such as similarity of the strains by molecular typing and common epidemiologic or social characteristics of cases. Consultation with CDC is encouraged if an outbreak is suspected.

4.2. Vaccination

4.2.a. Vaccination is the preferred control measure for meningococcal disease outbreaks of all serogroups commonly seen in the U.S.

4.2.b. Factors to consider when determining the need for vaccination: number of cases, population size, ability to define a target group for vaccination, whether ongoing transmission is likely, feasibility of a vaccination campaign, and timing of potential vaccination in relation to cases.

4.2.c. Decisions to vaccinate should be made on a case by-case basis in consultation with the NMDOH and CDC taking into account all circumstances and epidemiology specific to the outbreak.

4.2.d. During an outbreak caused by serogroup A, C, W, or Y meningococcal disease, CDC recommends vaccination with a MenACWY vaccine for anyone 2 months or older identified as being at increased risk. For persons who received their last MenACWY dose at age ≥ 7 years, an additional dose should be administered if it has been 5 or more years since their last dose.

4.2.e. For outbreaks caused by serogroup B meningococcal disease, CDC recommends vaccination with a MenB vaccine for anyone 10 years or older identified as being at increased risk. Persons who previously completed a MenB primary series may require a booster dose during a meningococcal disease outbreak, depending on the interval since their last dose. The same vaccine brand should be used for all doses — Bexsero and Trumenba are not interchangeable. If someone received one brand and decides to switch to the other, it is recommended they wait at least 1 month between products and then get the full series of the second vaccine.

4.3 Expanded Chemoprophylaxis

4.3.a. Mass chemoprophylaxis is not usually recommended for control of large outbreaks of disease for multiple reasons: cost of drug and administration, difficulty of ensuring simultaneous administration of drugs to substantial populations, drug side effects, and emergence of resistant organisms. In most outbreak settings, these disadvantages outweigh the potential benefit.

4.3.b. Situations in which mass chemoprophylaxis could be successful include those involving limited or closed populations, such as a single school or residential facility. If the decision is made to use mass chemoprophylaxis, it should be administered to all persons ideally within 24 hours of each other.

4.3.c. It is possible that even in a vaccine-preventable, organization-based outbreak, antibiotic distribution may be a timelier intervention, since preventive antibodies take 7–10 days to develop after vaccination. Again, the potential benefit of mass chemoprophylaxis must be weighed against

the possible emergence of antibiotic resistance and the logistics of launching a prophylaxis campaign.

4.4 Other Control Measures

4.4.a. Restricting travel to areas with an outbreak, closing schools or universities, or cancelling sporting or social events are not recommended measures for outbreak control in the US.

4.4.b. A crucial part of managing suspected meningococcal disease outbreaks and promoting early case recognition is educating communities, physicians, and other healthcare personnel about meningococcal disease. Education efforts should be initiated as soon as an outbreak of meningococcal disease is suspected.

References

American Academy of Pediatrics. Kimberlin, DW ed. 2021-2024 Red Book: Report of the Committee on Infectious Diseases.32nd ed. Elk Grove Village, IL: American Academy of Pediatrics; 2021.

Centers for Disease Control and Prevention. Epidemiology and Prevention of Vaccine-Preventable Diseases: *Meningococcal Disease*. 14th ed. https://www.cdc.gov/vaccines/schedules/hcp/index.html. (Accessed 9 May 2023).

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See Meningococcal Disease Fact Sheets (English) (Spanish).