Meningococcal Disease

Summary

Suspected invasive meningococcal disease is a medical and public health emergency. Quick medical attention is extremely important if meningococcal disease is suspected. Transmission is through direct exposure to the index patient's oral secretions only, not through casual contact. Chemoprophylaxis should only be provided for close contacts of a meningococcal disease case (household members, contacts at daycare centers, and anyone else directly exposed to an infected patient's oral secretions such as through kissing or mouth-to-mouth resuscitation). Keeping vaccinations up to date is the best way to prevent meningococcal disease.

Those at greatest risk for infection and invasive disease include:

- Children under 2 years of age and adolescents/young adults 16-23 years of age.
- Household or close contacts of case patients.
- Persons with persistent complement component deficiencies (e.g., C5—C9, properidin, factor H, or factor D) or functional or anatomic asplenia.
- Those in crowded living conditions, such as college students residing in dormitories or those living in military barracks.
- Day care attendees and workers.
- Microbiologists who work with isolates of *N. meningitidis.*
- Persons traveling to a country where meningococcal disease is epidemic or highly endemic, particularly sub-Saharan Africa.

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

Agent

Neisseria meningitidis is a gram-negative diplococcus with 13 serogroups. Serogroups B, C, and Y each account for approximately one-third of reported cases in the US. Serogroups C, Y and W-135 cause 75% of meningococcal disease among adolescents and young adults, and are prevented by vaccination. Serogroup B currently causes approximately 60% of cases in children 0-59 months. Serogroups A, W, and X exist mainly in developing countries, particularly Africa.

Transmission

Reservoir:

Humans. As many as 10% of adolescents and adults are asymptomatic transient 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 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, usually less than four 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 begin 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 for suspected meningococcal disease should include an extended-spectrum cephalosporin such as cefotaxime or ceftriaxone. After the diagnosis has been lab-confirmed, treatment with penicillin G (300 000U/kg/day; maximum 12 million u/day, divided every 4-6 hours), ampicillin, or continued extended spectrum cephalosporin treatment is recommended.

Chloramphenicol is recommended in the case of a known severe penicillin allergy. Meropenem can be used if chloramphenicol is not available (although penicillin-allergic adults can have cross-reactivity with meropenem).

Some experts recommend susceptibility testing before switching to penicillin. However, resistance of *N. meningitidis* to penicillin is rare in the United States, susceptibility testing is not standardized, and the clinical significance or intermediate susceptibility is unknown. For travelers in areas where penicillin resistance has been reported, cefotaxime, ceftriaxone, or chloramphenicol is recommended.

Five to seven days of therapy is adequate for most cases of invasive disease.

One dose of ceftriaxone eliminates carriage and can be useful for outpatient treatment.

Surveillance

Case Definitions:

Confirmed

- Detection of *N. meningitidis*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., blood, CSF, synovial, pleural, or pericardial fluid), using a PCR test
- Isolation of *N. meningitidis*
- From a normally sterile body site (e.g., blood, CSF, 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.)
- Child care 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.

Case Investigation:

Use the Bacterial Meningitis Invasive Respiratory Investigation (BMIRD) Form to complete the investigation. Information should also be entered into NM-EDSS per established procedures.

Control Measures

1. Case management

   1.1. Isolation: Droplet precautions, in addition to standard precautions, are indicated for 24 hours after the start of effective antimicrobial therapy.

   1.2. Systemic 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 chemoprophylactic antibiotics for eradication of nasopharyngeal carriage before being discharged from the hospital.

2. Contact Management

   2.1. Exposed household, school, or child care 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. Child care, 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.

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, ciprofloxacin, azithromycin, and ceftriaxone 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 <u>not</u> 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

2.5.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.

2.5.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. 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, Y and W-135), the preferred vaccine in adults and children two years and older is a meningococcal conjugate vaccine. For outbreaks caused by Serogroup B, the serogroup B vaccination is recommended.

3. Prevention

3.1. The main method of preventing meningococcal disease is immunization. The licensed vaccines for *N. meningitidis* available in the US are:

3.1.a. Meningococcal polysaccharide vaccine (MPSV4 or Menomune®, 1974;

3.1.b. Meningococcal conjugate vaccines (MCV4: Menactra, 2005 and Menveo, 2010, and

3.1.c. Serogroup B meningococcal vaccine (Bexsero and Trumenba)).

Meningococcal conjugate vaccine (Menactra®, Menveo®, or MenHibrix®) is recommended for children who are between 2 months and 10 years old, if they:

- Have a complement component deficiency disorder.
- Are taking the medicine called Soliris®.
- Have a damaged spleen or their spleen has been removed.
- Have HIV.
- Are traveling to or residing in countries in which the disease is common.
- Are part of a population identified to be at increased risk because of a serogroup A, C, W, or Y meningococcal disease outbreak.

Children 10 years or older should get a serogroup B meningococcal vaccine (Bexsero® or Trumenba®) if they:

- Have a complement component deficiency disorder.
- Are taking a medicine called Soliris®.
- Have a damaged spleen or their spleen has been removed.
- Are part of a population identified to be at increased risk because of a serogroup B meningococcal disease outbreak.

3.2 Preteens and Teens

There are two types of meningococcal vaccines for preteens and teens:

- Meningococcal conjugate vaccines (Menactra® or Menveo®.)
- Serogroup B meningococcal vaccines (Bexsero® or Trumenba®.)

All 11 to 12-year olds **should** be vaccinated with a meningococcal conjugate vaccine (Menactra® or Menveo®), with a booster dose given at 16 years old.
Teens **may** also be vaccinated with a serogroup B meningococcal vaccine (2 or 3 doses depending on brand), preferably at 16 through 18 years old.

Preteens and teens **should** get a serogroup B meningococcal vaccine (Bexsero® or Trumenba®) if they:

- Have a complement component deficiency disorder.
- Are taking Soliris®.
- Are asplenic, functionally or anatomically.
- Are part of a population identified to be at increased risk because of a serogroup B meningococcal disease outbreak.

3.3. Adults

Meningococcal vaccines are recommended for certain groups of adults at increased risk for meningococcal disease. Each meningococcal vaccine is listed below with which groups of adults are recommended to get it.

Meningococcal Conjugate Vaccine Recommendations

Adults should get a meningococcal conjugate vaccine (Menactra® or Menveo®) if they:

- Have a complement component deficiency disorder.
- Are taking Soliris®.
- Are asplenic, functionally or anatomically.
- Are HIV positive.
- Are a microbiologist who is routinely exposed to *Neisseria meningitidis.*
- Are traveling to or residing in countries in which the disease is common.
- Are part of a population identified to be at increased risk because of a serogroup A, C, W, or Y meningococcal disease outbreak.
- Are not up to date with this vaccine and are a first-year college student living in a residence hall.
- Are a military recruit.

Meningococcal Polysaccharide Vaccine Recommendations

Adults 56 years or older should get the meningococcal polysaccharide vaccine (Menomune®) if they are anticipated to only need one dose and they:

- Are traveling to or residing in countries in which the disease is common.
- Are part of a population identified to be at increased risk because of a serogroup A, C, W, or Y meningococcal disease outbreak.
- Have not previously been vaccinated with a meningococcal conjugate vaccine (Menactra® or Menveo®.)

Serogroup B Meningococcal Vaccine Recommendations

Adults of any age should get a serogroup B meningococcal vaccine (Bexsero® or Trumenba®) if they:

- Have a complement component deficiency disorder.
- Are taking Soliris®.
- Are asplenic, functionally or anatomically.
- Are a microbiologist who is routinely exposed to *Neisseria meningitidis.*
- Are part of a population identified to be at increased risk because of a serogroup B meningococcal disease outbreak.

4. Outbreak Management

4.1. Outbreak Definition:

A community-based outbreak is defined as the occurrence of three or more confirmed or probable primary cases of meningococcal disease in a period of

three months or less among persons residing in the same area who are not close contacts and who do not share a common affiliation, with a primary attack rate of 10 or more cases per 100,000 population.

An organization-based outbreak is defined as the occurrence of three or more confirmed or probable cases of meningococcal disease of the same serogroup in period of three months or less among persons who have a common affiliation but no close contact with each other, resulting in a primary disease attack rate of 10 or more cases per 100,000 persons. In some instances, the attack rate will be greater than 10 cases per 100,000 population with only two or three cases. In these situations, vaccination may be considered after only two primary cases are identified. Examples of an organization-based outbreak include cases in schools, churches, and universities.

4.2. Vaccination

When deciding to implement a mass vaccination campaign to prevent meningococcal disease, one must consider whether the cases represent an outbreak or an unusual clustering of endemic cases. Mass vaccination programs are expensive, require considerable public health effort, and may create excessive concern among the public. Because the number of cases in outbreaks is usually not substantial, this determination requires evaluation and analysis of the patterns of disease occurrence.

Vaccination of the population at risk should be considered if the attack rate is greater than 10 cases per 100,000 population, but the actual attack rate at which the decision to vaccinate is made will vary. The following factors should be considered when making the decision to vaccinate:

- Completeness of case reporting and number of possible cases of meningococcal disease for which bacteriologic confirmation or serogroup data are not available.
- Occurrence of additional cases of meningococcal disease after recognition of a suspected outbreak (e.g., if the outbreak occurred two months previously and no additional case have occurred, vaccination might be unlikely to prevent additional cases of meningococcal disease.)
- Logistical and financial considerations.

During an outbreak caused by serogroup A, C, W, or Y meningococcal disease, vaccination with a quadrivalent meningococcal conjugate vaccine is routinely recommended for those 2 months or older identified as being at increased risk because of the outbreak.

Newly licensed serogroup B meningococcal vaccines are an important step forward for controlling serogroup B meningococcal disease, especially in outbreak settings. For outbreaks caused by serogroup B meningococcal disease, vaccination with a serogroup B meningococcal vaccine is recommended for those 10 years or older identified as being at increased risk because of the outbreak.

There are two vaccines that provide protection against serogroup B meningococcal disease: Bexsero® (GlaxoSmithKline) and Trumenba® (Pfizer). In the setting of an outbreak, two doses are needed for Bexsero® and three doses are needed for Trumenba®. Both vaccines are expected to help protect against most serogroup B

meningococcal strains circulating in the United States. The same vaccine brand must 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.

It does not matter which brand someone receives. Neither of these vaccines will prevent all cases and each vaccine may perform better against some strains than others. In some outbreak situations, there may be a stated preference for one brand over the other if lab testing suggests that one vaccine may provide better protection against the specific strain causing the outbreak. However, there is a limited understanding of how well laboratory test results correspond to the actual effectiveness of each vaccine against any particular strain. Until these vaccines are used more broadly in response to outbreaks, actual effectiveness against specific strains remains unknown.

4.3 Other Control Measures

Mass chemoprophylaxis is not 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. 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 at the same time.

4.4 Antibiotic Usage

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.

4.5 Closures and Restrictions

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. 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.

Management of Meningococcal Disease in Child Care Centers

When a case of invasive meningococcal disease is detected in a child care attendee or staff person, the center should work with ERD to provide accurate information about meningococcal disease and the risk of transmission to families and contacts of the index case. Questions regarding the use of chemoprophylaxis or mass immunization should be referred to the ERD at 505-827-0006. Generally, younger children in a child care center would be given chemoprophylaxis after an index case is identified.

References

American Academy of Pediatrics. In: Kimberlin, DW, et al eds. Red Book: 2018 Report of the Committee on Infectious Diseases. 31st ed. Itasca, IL: American Academy of Pediatrics; 2018.

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