MENINGOCOCCAL DISEASE

(Meningococcal Meningitis, Meningococcemia)

REPORTING INFORMATION

- **Class A:** *Report immediately via telephone* upon recognition of a case, a suspected case or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report immediately via telephone to the local public health department in which the reporting health care provider or laboratory is located. Local health departments should report immediately via telephone the case or suspected case and/or a positive laboratory result to the Ohio Department of Health (ODH).
- Reporting Form(s) and/or Mechanism:
  - *Immediately via telephone.*
  - The local health department should enter the case into the Ohio Disease Reporting System (ODRS) within 24 hours after the telephone report.
  - CDC National Bacterial Meningitis and Bacteremia Case Report (form 52.15) is available for use to assist in local health department disease investigation and contact tracing activities. Information collected from the form should be entered into ODRS and not sent to ODH, unless otherwise requested.
- Key fields for ODRS reporting include: import status (whether the infection was travel-associated or Ohio-acquired), date of illness onset, types of infection (meningitis, primary bacteremia, etc.) and the reason not vaccinated or the vaccine information if previously vaccinated.

AGENT

Neisseria meningitidis is a Gram-negative diplococcus bacterium with at least 13 serogroups known to cause invasive disease (e.g. A, B, C, W, X, Y). Serogroups B, C and Y are the most prevalent in Ohio. Group A has frequently been associated with epidemics in other parts of the world.

CASE DEFINITION

Clinical Criteria

Clinical purpura fulminans in the absence of a positive blood culture.

Laboratory Criteria for Diagnosis

- Gram-negative diplococci, not yet identified, isolated from a normally sterile body site (e.g. blood, cerebrospinal fluid [CSF]).
- Detection of *N. meningitidis* antigen in formalin-fixed tissue by immunohistochemistry (ICH) or in CSF by latex agglutination.
- Detection of *N. meningitidis*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g. blood, CSF), using a validated polymerase chain reaction (PCR) assay.
- 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.

Case Classification

Suspected:

- A case that meets the clinical criteria; *or*
- Gram-negative diplococci, not yet identified, isolated from a normally sterile

body site (e.g. blood, CSF).

Probable:
- Detection of *N. meningitidis* antigen in formalin-fixed tissue by immunohistochemistry (ICH) or in CSF by latex agglutination.

Confirmed:
- A case that is laboratory confirmed by either culture or PCR.

Not a Case: This status will not generally be used when reporting a case, but may be used to reclassify a report if investigation revealed that it was not a case or if *N. meningitidis* was identified from a non-normally sterile site.

Comment
Meningococcal disease outbreaks can be defined as three or more probable or confirmed cases. For information regarding specific criteria for institutional and community outbreaks, please visit: https://www.cdc.gov/vaccines/pubs/surv-manual/chpt08-mening.html.

SIGNS AND SYMPTOMS

Invasive meningococcal infection usually results in meningococcemia and/or meningitis. Onset is abrupt in meningococcemia with fever, chills, malaise, myalgia, limb pain, prostration and a rash which can be macular, maculopapular, petechial or purpuric. The progression of disease is usually rapid. In fulminant cases, purpura, limb ischemia, coagulopathy, pulmonary edema, shock, coma and death can ensue within several hours despite appropriate therapy. Meningococcal meningitis is indistinguishable from acute meningitis caused by other bacterial pathogens and presents with altered mental status, seizures in some patients and meningeal irritation. Individual symptoms vary widely from patient to patient; infants and small children may exhibit only fever and vomiting. The classical symptoms of headache, stiff neck and confusion occur in less than half of patients. Invasive meningococcal infections may be complicated by arthritis, myocarditis, pericarditis and endophthalmitis. Less common manifestations of meningococcal disease include conjunctivitis, pneumonia, febrile occult bacteremia, septic arthritis and chronic meningococcemia. The overall case fatality rate is 10%, but is higher in adolescents. Sequelae associated with meningococcal disease occur in 10%-20% of survivors and include hearing loss, neurologic disability, digit or limb amputations and skin scarring.

DIAGNOSIS

A Gram-stained smear from a normally sterile body site showing Gram-negative diplococci raises suspicion of invasive meningococcal disease. Diagnosis is confirmed by a culture of the blood and/or spinal fluid. Clinical laboratories should send all *N. meningitidis* isolates from normally sterile sites to the ODH Laboratory for serogroup analysis. Please fill out a WI VPD Submission Form found at: http://www.odh.ohio.gov/pdf/IDCM/frmwivpd.pdf. Presumptive evidence of invasive meningococcal disease can be obtained with PCR or antigen testing from a normally sterile body site. Leftover CSF or blood from patients with negative culture results who were given antibiotics prior to specimen collection can be sent to a public health laboratory for PCR testing. Please contact the VPD Epidemiology Program at 614-995-5599 to arrange for testing.

Positive antigen test results from urine or serum samples are unreliable for diagnosis

of meningococcal disease. These results should not be reported. Further testing from a normally sterile site is necessary for diagnosis of invasive *N. meningitidis*.

EPIDEMIOLOGY

Source

The upper respiratory tract of humans. Asymptomatic colonization is frequent and provides the focus from which the organism is spread. It is estimated that 5%-10% of people are asymptomatic carriers; less than 1% of carriers will progress to invasive disease.

Occurrence

Incidence peaks among persons in three age groups: infants and children <5 years, adolescents and young adults aged 16-21 years and adults aged ≥65 years. Child care centers, preschools and military camps experience the majority of outbreaks. Pre-teens, adolescents, college freshmen who live in dorms and travelers to countries where meningococcal disease is endemic are at an increased risk. The incidence is higher during the winter and spring in the United States.

Mode of Transmission

Person-to-person through droplets of infected respiratory secretions.

Period of Communicability

The exact period of communicability is unknown, but is probably throughout the duration of the presence of the organism in the upper respiratory tract of those with invasive disease and in contacts who have become asymptomatically colonized with meningococci.

Incubation Period

2-10 days, most commonly 3-4 days.

PUBLIC HEALTH MANAGEMENT

Case

Treatment

Hospitalization is usually required for parenteral antibiotic treatment and vigorous supportive care. Treatment for invasive disease does not eliminate nasopharyngeal carriage of the organism in the index case. It is imperative that carriage of the organism be eradicated before the patient is discharged from the hospital by administering rifampin in the same dosage as noted below.

Isolation

The Ohio Administrative Code (section 3701-3-13, (O)) states that “a person with meningococcal disease shall be isolated until twenty-four hours after the initiation of effective antimicrobial therapy.” This includes droplet precautions for 24 hours in hospitalization.

Contacts

Investigation

Identification of contacts is important to determine those requiring chemoprophylaxis. **High-risk** contacts for whom chemoprophylaxis is recommended include:

- Household contacts, especially young children less than 2 years old,
- Child care, nursery school, preschool and babysitting contacts in the 7

days before onset of illness,
- Anyone who had direct contact with the case's oral secretions through kissing or sharing toothbrushes or eating utensils any time during 7 days before onset of illness,
- Anyone who performed mouth-to-mouth resuscitation on or was unprotected during oral intubation of the case any time during 7 days before onset of illness,
- Anyone who frequently sleeps or eats in the same dwelling as the case 7 days before onset of illness and
- Passengers seated directly next to the case during airline flights lasting more than 8 hours.

Low-risk contacts for whom chemoprophylaxis is not recommended include:
- Persons having only casual contact with the case and no direct contact with oral secretions (e.g., school or work mates),
- Persons who had contact only with a high-risk contact (i.e., no direct contact with the case) and
- Health care personnel who did not have contact with the case's oral secretions.

Prophylaxis

All household and child care or preschool contacts should receive prophylaxis, preferably within 24 hours of diagnosis of the index case. Prophylaxis of high-risk contacts should not be delayed for confirmation of *N. meningitidis* in the index case; it can several days for the organism to grow in culture. Nasopharyngeal cultures are not recommended for screening contacts. They are of no value in making decisions related to prophylaxis.

Rifampin, ceftriaxone and ciprofloxacin are equally effective for prophylaxis. The drug of choice for most children is rifampin. Another appropriate drug is azithromycin:
- Rifampin is administered twice daily for two days: adults 600 mg per dose; children >1 month of age, 10 mg/kg (maximum 600mg); and children <1 month of age 5 mg/kg. Rifampin is not recommended for pregnant women.
- Ceftriaxone is administered IM in a single dose: adults 250 mg; children <15 years of age 125 mg.
- Ciprofloxacin given to adults in a single oral dose of 500 mg is also effective in eradicating meningococcal carriage. Presently, ciprofloxacin is not recommended for persons younger than 18 years of age or for pregnant women.
- Azithromycin (not routinely recommended) 10mg/kg (maximum 500mg).

Prophylaxis is not completely effective and exposed contacts should remain under medical supervision for one month.

Prevention and Control

Three quadrivalent (A, C, W and Y), one bivalent (C and Y) and two serogroup B vaccine formulations are currently available in the United States. Vaccine is indicated to control outbreaks of disease proven to be caused by one of the serogroups represented in the vaccine. In an outbreak, the serogroup should be determined and the population at risk delineated by neighborhood, school, dormitory or other reasonable boundary. Although endemic disease is very uncommon, older children, adolescents and young adults constitute a higher

proportion of cases during outbreaks and may warrant vaccination during an outbreak. Contact the VPD Epidemiology Program at (614) 995-5599 if two or more cases occur within two weeks of each other within a county or nearby communities.

Meningococcal vaccination (serogroups A, C, W, and Y) is recommended for the following groups:

- Routine vaccination of adolescents aged 11-18 years (a single dose administered at age 11 or 12 with a booster dose at age 16 for those who received the first dose before age 16).
- Routine vaccination of persons ≥2 months of age at increased risk for meningococcal disease including:
    - Persons with complement component deficiency (C3, C5-9, properdin, factor D and factor H, or who are taking eculizumab [Soliris]),
    - Persons with anatomical or functional asplenia (including sickle cell disease),
    - Microbiologists routinely exposed to isolates of *Neisseria meningitidis*,
    - Persons identified as at increased risk because of a serogroup A, C, W, or Y meningococcal disease outbreak,
    - Unvaccinated or incompletely vaccinated first-year college students living in residence halls,
    - Unvaccinated or incompletely vaccinated military recruits, and
    - Persons who travel to or reside in countries where meningococcal disease is hyperendemic.

Two serogroup B meningococcal vaccines are currently licensed by the Food and Drug Administration (FDA). In February 2015, the Advisory Committee on Immunization Practices (ACIP) recommended the routine use of the meningococcal B vaccines for persons ≥10 years who are at increased risk for serogroup B meningococcal disease. The recommendations do *not* apply to children <10 years, first-year college students living in residence halls, military recruits, travelers, or all adolescents.

Meningococcal vaccination (serogroup B) is recommended for the following groups:

- Persons with persistent complement component deficiencies (C3, C5-9, properdin, factor D and factor H, or who are taking eculizumab [Soliris],
- Persons with anatomic or functional asplenia (including sickle cell disease),
- Microbiologists routinely exposed to isolates of *Neisseria meningitidis* and
- Persons identified as at increased risk because of a serogroup B meningococcal disease outbreak.

In June 2015, the ACIP also recommended that a MenB vaccine series may be administered to adolescents and young adults aged 16-23 years to provide short term protection against most strains of serogroup B meningococcal disease. The preferred age for MenB vaccination is 16-18 years (recommendation category B; for individual clinical decision making).

The six meningococcal vaccines available in the United States are:

- Meningococcal Polysaccharide Vaccine (MPSV4) was licensed in 1981 and

is a quadrivalent polysaccharide vaccine protecting against serogroups A, C, W and Y. It is approved for use in persons aged ≥2 years.

- Meningococcal Conjugate Vaccine (MenACWY-D) was licensed in 2005 and is a quadrivalent conjugate vaccine protecting against serogroups A, C, W and Y. It is approved for use in persons aged 9 months-55 years.
- Meningococcal Conjugate Vaccine (MenACWY-CRM) was licensed in 2010 and is a quadrivalent conjugate vaccine protecting against serogroups A, C, W and Y. It is approved for use in persons aged 2 months-55 years.
- Meningococcal Conjugate Vaccine (Hib-MenCY-TT) was licensed in 2012 and is a bivalent conjugate vaccine protecting against serogroups C and Y as well as *Haemophilus influenzae* type b. It is approved for use in children aged 6 weeks-18 months.
- Meningococcal Recombinant (MenB-4C) was licensed in 2015 and is a recombinant vaccine protecting against serogroup B. It is approved for use in persons aged 10-25 years.
- Meningococcal Recombinant (MenB-FHbP) was licensed in 2014 and is a recombinant vaccine protecting against serogroup B. It is approved for use in persons aged 10-25 years.

The most current Advisory Committee for Immunization Practices (ACIP) vaccine recommendations can be found at: http://www.cdc.gov/vaccines/hcp/acip-recs/index.html.

Ohio School Requirement: Beginning with the start of the 2016-2017 school year, all students entering the 7th and 12th grade are required to be vaccinated against meningococcal disease. One dose of meningococcal (serogroups A, C, W, and Y) vaccine is required prior to entry in the 7th grade. A second dose of meningococcal (serogroups A, C, W, and Y) vaccine is required prior to entry into the 12th grade. This is a progressive requirement.

Ohio College Requirement: The Ohio Revised Code (ORC) Section 1713.55 states that beginning with the academic year that commences on or after July 1, 2005, an institution of higher education shall not permit a student to reside in on-campus housing unless the student (or the student's parent if the student is younger than 18 years of age) discloses whether the student has been vaccinated against meningococcal disease and hepatitis B by submitting a meningitis and hepatitis B vaccination status statement. The student is NOT required to have the vaccinations, just disclose whether they have or not.

What is meningitis and meningococcal disease?
Meningitis is an infection of the fluid of a person's spinal cord and the fluid that surrounds the brain. People sometimes refer to it as spinal meningitis. Meningitis is usually caused by a viral or bacterial infection. Knowing whether meningitis is caused by a virus or bacterium is important because the severity of illness and the treatments differ. Viral meningitis is generally less severe and resolves without specific treatment while bacterial meningitis can be quite severe and may result in brain damage, hearing loss or learning disability. For bacterial meningitis, it is also important to know which type of bacteria is causing the meningitis because antibiotics can prevent some types from spreading and infecting other people. Before the 1990s, *Haemophilus influenzae* type b (Hib) was the leading cause of bacterial meningitis, but new vaccines being given to all children as part of their routine immunizations have reduced the occurrence of invasive disease due to *H. influenzae*. Today, *Streptococcus pneumoniae* and *Neisseria meningitidis* are the leading causes of bacterial meningitis.

Meningococcal disease is an invasive infection caused by *Neisseria meningitidis* bacteria.

What are the signs and symptoms of meningococcal disease?
Meningococcal disease commonly causes meningitis, known as meningococcal meningitis. The symptoms of meningococcal meningitis include a sudden onset of fever, headache and stiff neck. It is often accompanied by nausea, vomiting, photophobia (increased sensitivity to light), and altered mental status (confusion). The symptoms of meningococcal meningitis can appear quickly or over several days, typically developing 3-4 days after exposure. Newborns and infants may not exhibit the classic fever, headache and stiff neck symptoms; they may appear to be slow or inactive, irritable, vomiting or feeding poorly. Meningococcal meningitis is very serious and can be fatal with death occurring in as little as a few hours. In non-fatal cases, permanent disabilities can include hearing loss and brain damage.

Another common form of meningococcal disease is a bloodstream infection called meningococcemia. This is a more dangerous and deadly form of meningococcal disease where the bacteria enter the bloodstream and multiply, causing damage to the blood vessels and bleeding into the skin and organs. Symptoms of meningococcemia include fatigue; vomiting; cold hands and feet; cold chills; severe aches or pains in the muscles, joints, chest or abdomen; rapid breathing; diarrhea and a dark purple rash in the later stages. Meningococcemia is very serious and can be fatal with death occurring in as little as a few hours. In non-fatal cases, permanent disabilities can include amputation of toes, fingers or limbs and severe scarring as a result of skin grafts.

How is meningococcal disease diagnosed?
Early diagnosis and treatment are very important. If meningococcal disease is suspected, samples of blood or cerebrospinal fluid are collected and sent to the laboratory for testing. It is important to identify meningococcal disease because antibiotics can help prevent severe illness and reduce the chances of a close contact developing the disease.

If *Neisseria meningitidis* bacteria are present, they can be grown (cultured). Growing the bacteria in the lab is important for confirming the presence of the

bacteria, identifying the specific type of bacteria causing the infection and deciding which antibiotic will work best. Other tests can sometimes detect and identify the bacteria if the cultures do not.

Can meningococcal disease be treated?
Yes, meningococcal disease can be treated with a number of effective antibiotics. It is important that treatment be started as soon as possible. If meningococcal disease is suspected, antibiotics are given right away. Antibiotics should reduce the risk of death, but sometimes the infection has caused too much damage to the body for the antibiotics to prevent death or serious long-term problems.

Depending on how serious the infection is, other treatments may be necessary. These can include breathing support, medications to treat low blood pressure and wound care for parts of the body with damaged skin.

Is meningococcal disease contagious?
Yes, the bacteria are spread through the exchange of respiratory and throat secretions (i.e., coughing, kissing). Fortunately, it is not as contagious as what causes the common cold or the flu. The meningococcal bacteria are not spread by casual contact or by simply breathing the air where a person with meningococcal disease has been.

Sometimes the *Neisseria meningitidis* bacteria have spread to other people who have had close or prolonged contact with a patient with meningococcal disease. People in the same household or day care center or anyone with direct contact with a patient's oral secretions (such as a boyfriend or girlfriend) would be considered at increased risk for acquiring the infection. People who qualify as close contacts of a person with meningitis caused by *N. meningitidis* should receive antibiotics to prevent them from getting the disease. The health department investigates each case of meningococcal disease to make sure all close contacts are identified and receive antibiotics. This does not mean the close contacts have the disease; it is to prevent the disease.

Are there vaccines against meningococcal disease?
Yes, there are vaccines against some serogroups of meningococcal disease, but they do not cover all serogroups ("strains") of *Neisseria meningitidis*. Serogroups B, C, and Y are the major causes of meningococcal disease in the United States. Serogroups C, W, and Y cause 73% of all meningococcal disease in cases $\geq$11 years of age. Serogroup A is a type that causes epidemics in Africa. Like with any vaccine, meningococcal vaccines are not 100% effective, so there is still a chance for infection in persons who have been vaccinated. People should know the symptoms of meningococcal disease since early recognition and quick medical attention are extremely important.

There are three kinds of meningococcal vaccines available in the United States:

- Meningococcal conjugate vaccines (MenACWY-D, MenACWY-CRM, and Hib-MenCY-TT).
- Meningococcal polysaccharide vaccine (MPSV4).
- Serogroup B meningococcal vaccines (MenB-FHbp and MenB-4C).

Meningococcal conjugate vaccines MenACWY-D and MenACWY-CRM protect against serogroups A, C, W, and Y, while Hib-MenCY-TT protect against serogroups C, Y and *Haemophilus influenazae* type b. The meningococcal polysaccharide vaccine (MPSV4) also protects against serogroups A, C, W, and Y. Serogroup B

meningococcal vaccines (MenB-FHbp and MenB-4C) only protect against serogroup B. For more information on specific vaccine recommendations, please visit the CDC Pink Book on Meningococcal Disease found at: http://www.cdc.gov/vaccines/pubs/pinkbook/mening.html.

For more information, please visit the following websites:
CDC Meningococcal Disease Information http://www.cdc.gov/meningococcal.

CDC Meningococcal Vaccination
https://www.cdc.gov/vaccines/vpd/mening/index.html

CDC Traveler's Health Meningococcal Disease
http://wwwnc.cdc.gov/travel/yellowbook/2014/chapter-3-infectious-diseases-related-to-travel/meningococcal-disease.