Streptococcus pneumoniae, Invasive Pneumococcal Disease (IPD)

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Streptococcus pneumoniae, Invasive Disease (IPD-Invasive Pneumococcal Disease)

Overview[1,2,5]

Streptococcus pneumoniae, also called pneumococcus, is a bacteria that causes an acute infection. Some pneumococcal infections are considered "invasive" when the infection occurs in areas parts of the body that are normally sterile. Invasive pneumococcal diseases (IPDs) include meningitis and bacteremia. Pneumococcal bacteria spread from person-to-person by direct contact with respiratory secretions, like saliva or mucus. Transmission can also occur by autoinoculation in persons carrying the bacteria in their upper respiratory tract. Pneumococcal infections are more common during the winter months and in early spring when respiratory diseases are more prevalent. The period of communicability for pneumococcal disease is unknown, but presumably transmission can occur as long as the organism appears in respiratory secretions.

The major clinical syndromes of pneumococcal disease are pneumonia, bacteremia, and meningitis. *S. pneumoniae* is the leading cause of bacterial meningitis among children less than five years of age and is also a common cause of acute otitis media. Over 90 serotypes have been identified, but only a few serotypes produce the majority of pneumococcal infections. All *S. pneumoniae* isolates from normally sterile body fluids should be tested for antimicrobial susceptibility.[2]

Pneumonia: Pneumococcal pneumonia is the most common clinical presentation of pneumococcal disease among adults. The incubation period is short, about 1 to 3 days. Symptoms generally include an abrupt onset of fever and chills or rigors. Other common symptoms include pleuritic chest pain, productive mucopurulent cough with rusty sputum, shortness of breath, rapid breathing, poor oxygenation, rapid heart rate, malaise, and weakness. Nausea, vomiting, and headaches occur less frequently. In infants and young children, signs and symptoms may not be specific, and may include fever, cough, rapid breathing or grunting.

Bacteremia: Bacteremia without a known site of infection is the most common invasive clinical presentation of pneumococcal infection among children 2 years of age and younger, accounting for approximately 70% of invasive disease in this age group. Infants and young children with blood stream infections typically have non-specific symptoms including fevers and irritability.

Meningitis: Pneumococci cause over 50% of all cases of bacterial meningitis in the United States. Symptoms may include headache, lethargy, vomiting, irritability, fever, nuchal rigidity, cranial nerve signs, seizures, and coma. The case-fatality rate of pneumococcal meningitis is about 8% among children and 22% among adults.

Pneumococcal disease is treated with antibiotics. However, many types of pneumococcal bacteria have become resistant to some of the antibiotics used to treat these infections. Data

indicates pneumococcal bacteria are resistant to one or more antibiotics in 3 out of every 10 cases.

Two pneumococcal vaccines are available in the United States. Pneumococcal conjugate vaccine (PCV13 or Prevnar 13®) protects against 13 serotypes that cause most of the severe illness in children and adults. PCV13 is recommended for all children at 2, 4, 6, and 12 through 15 months old. PCV13 is also recommended for adults 19 years or older with certain medical conditions and in all adults 65 years or older. Pneumococcal polysaccharide vaccine (PPSV23 or Pneumovax 23®), protects against 23 serotypes. PPSV23 is recommended for all adults 65 years or older and for anyone who is 2 years or older at high risk for disease. PPSV23 is also recommended for adults 19 through 64 years old who smoke cigarettes or who have asthma.

For a complete description of *Streptococcus pneumoniae*, Invasive Disease, refer to the following texts:

- *Control of Communicable Diseases Manual* (CCDM), American Public Health Association, 20th ed. 2015.
- American Academy of Pediatrics. *Red Book: 2015 Report of the Committee on Infectious Diseases.* 30th ed. 2015.
- Centers for Disease Control and Prevention, *Epidemiology and Prevention of Vaccine-Preventable Diseases*, 13th ed. 2015.

Case Definition 2017[4]

Background

Invasive pneumococcal disease (IPD) is a notable cause of morbidity and mortality in the US, despite the availability of 7-valent pneumococcal conjugate vaccine (PCV7) and 13-valent pneumococcal conjugate vaccine (PCV13). After introduction of PCV7 in 2000, rates were reduced by 64-77% among adults and older children, and down to less than one case per 100,000 among children under 5 for the included serotypes. In 2010, PCV13 further lowered rates. However, in 2011 there were still more than 35,000 cases and 4,200 deaths from IPD, indicating a need for continued surveillance.

The ability to test for *Streptococcus pneumoniae* using culture independent diagnostic tests (CIDTs) like polymerase chain reaction (PCR)-based testing has become both more available and more common. PCR can be and is used for typing of *Streptococcus pneumoniae*, a key component of surveillance, and integrating CIDT identification into the case definition would increase overall coherence. Similar to the convention with other diseases, it is therefore suggested that a category of "probable" IPD cases be created, to classify CIDT positive but culture negative (or with absent culture results) individuals.

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Clinical Criteria
Invasive Pneumococcal *(Streptococcus pneumoniae)* Disease or IPD causes many clinical syndromes, depending on the site of infection (e.g., bacteremia, meningitis).

Laboratory Criteria for Diagnosis
Supportive: Isolation of *S. pneumoniae* from a normally sterile body site by a CIDT without isolation of the bacteria.

Confirmatory: Isolation of *S. pneumoniae* from a normally sterile body site.

Epidemiologic Linkage
Not required.

Criteria to Distinguish a New Case from an Existing Case
A single case should be defined as a health event with a specimen collection date that occurs more than 30 days from the last known specimen with a positive lab finding.

Case Classification
Probable
A case that meets the supportive laboratory evidence.

Confirmed
A case that meets the confirmatory laboratory evidence.

Comments
The use of CIDTs as stand-alone tests for the direct detection of *S. pneumoniae* from clinical specimens is increasing. Data regarding their performance indicate variability in the sensitivity, specificity, and positive predictive value of these assays depending on the manufacturer and validations methods used. It is therefore useful to collect information on the laboratory conducting the testing, and the type and manufacturer of the CIDT used to diagnose each IPD case. Culture confirmation of CIDT-positive specimens is still the ideal method of confirming a case of IPD.

Information Needed for Investigation
Verify the diagnosis. What laboratory tests were conducted? Obtain results of culture and sensitivity tests. What laboratory conducted the testing and what is their phone number? What are the patient's clinical symptoms? What is the name and phone number of the attending physician?

Establish the extent of illness. Determine if household or other close contacts are, or have been ill, by contacting the health care provider, patient or family members.

Notification

- The local public health agency (LPHA) should immediately contact the District Communicable Disease Coordinator, or the Senior Epidemiology Specialist for the District, or the Missouri Department of Health and Senior Services (MDHSS) - BCDCP, phone (573) 751-6113, Fax (573) 526-0235, or for afterhours notification contact the MDHSS/Emergency Response Center (ERC) at (800) 392-0272 (24/7) immediately if an outbreak of *Streptococcus pneumonia* invasive disease is suspected.
- Contact the Bureau of Environmental Health Services, phone (573) 751-6095, fax (573) 526-7377, and the Section for Child Care Regulation, phone (573) 751-2450, fax (573) 526-5345, if the case is associated with a child care center.
- Contact the Section for Long Term Care Regulation, phone (573) 526-8524, fax (573) 751-8493, if the case is associated with a long term-care facility.
- Contact the Bureau of Health Services Regulation, phone (573) 751-6303, fax (573) 526-3621, if the case is associated with a hospital, hospital-based long-term care facility, or ambulatory surgical center.

Control Measures

Vaccine: PCV13 is recommended for all children younger than 5 years old, all adults 65 years or older, and people 6 years or older with certain risk factors. PPSV23 is recommended for all adults 65 years or older and for people 2 through 64 years old who are at high risk for pneumococcal disease. Visit the Advisory Committee on Immunization Practices (ACIP) website for current pneumococcal vaccine recommendations.

General Information on Pneumococcal Vaccines:

- Pneumococcal vaccines should be deferred during pregnancy. However, the risk of severe pneumococcal disease in pregnant women should be considered when making decisions regarding the need for pneumococcal immunization.
- Children who have experienced invasive pneumococcal disease should receive all recommended doses of pneumococcal vaccines (PCV13 or PPSV23) appropriate for age and underlying condition. The full series of scheduled doses should be completed even if the series is interrupted by an episode of invasive pneumococcal disease.
- As appropriate, persons with uncertain or unknown vaccination status should be vaccinated.
- Persons with moderate or severe acute illness should not be vaccinated until their condition improves.
- For both pneumococcal polysaccharide and conjugate vaccines, a serious allergic reaction to a dose of pneumococcal vaccine or a vaccine component is a contraindication to further doses of vaccine.

➢ See the Pneumococcal Infections section of the Red Book for additional recommendations prevention and control.

- See the Pneumonia section of the Control of Communicable Diseases Manual (CCDM), for "Management of patient".

Child care contacts:
Persons attending or working at child care centers are at moderate risk for infection. Antimicrobial chemoprophylaxis is not recommended for contacts of children with invasive pneumococcal disease, regardless of their immunization status in out-of-home care. Daily chemoprophylaxis is recommended for certain groups, such as children with functional or anatomic asplenia or children with sickle cell anemia (see Red Book for details).

Chemoprophylaxis of Close Contacts:
Because secondary cases of invasive pneumococcal infection are uncommon, chemoprophylaxis is not indicated for other close contacts of patients with such infection.

Isolation of the Hospital Patient:
Standard precautions are recommended, including for patients with infections caused by drug-resistant *S. pneumoniae*.

Laboratory Procedures

Diagnosis of invasive pneumococcal infection is confirmed by culture and isolation of *S. pneumoniae* from a normally sterile body site (e.g., blood, cerebrospinal fluid (CSF), pleural fluid, or peritoneal fluid). Diagnosis can also be confirmed from culture-negative specimens from normally sterile sites using real-time polymerase chain reaction (PCR). The Missouri State Public Health Laboratory does not routinely test for *S. pneumoniae* or perform antimicrobial sensitivity studies.

All *S. pneumoniae* isolates from normally sterile body fluids (e.g., CSF, blood, middle ear fluid, pleural or joint fluid) should be tested for antimicrobial susceptibility to determine the minimum inhibitory concentration (MIC) of penicillin, cefotaxime or ceftriaxone, and clindamycin. Isolates from CSF should also be tested for susceptibility to vancomycin and meropenem. Nonsusceptible status includes both intermediate and resistant isolates. For patients with meningitis caused by an organism that is nonsusceptible to penicillin, susceptibility of rifampin also should be performed. If the patient has a non-meningeal infection caused by an isolate that is nonsusceptible to penicillin, cefotaxime, and ceftriaxone, susceptibility testing to other agents such as clindamycin, erythromycin, trimethoprim-sulfamethoxazole, linezolid, meropenem, and vancomycin should be performed.

Reporting Requirements

Streptococcus Pneumoniae, Invasive Disease (IPD-Invasive Pneumococcal Disease) is a Category 3 disease and shall be reported to the local health authority or to the Missouri

Department of Health and Senior Services within three (3) days of first knowledge or suspicion.

As a Nationally Notifiable Condition, confirmed and probable cases are a **STANDARD** report to CDC. **STANDARD** reporting requires DHSS to report to CDC by electronic transmission via WebSurv within the next normal reporting cycle.

1. For confirmed or suspected cases, complete a "Disease Case Report" (CD-1) and a "Streptococcus Pneumoniae Surveillance Worksheet".
2. For cases in children less than five years of age with a sterile pneumococcal isolate and documented receipt of pneumococcal conjugate vaccine, also complete the CDC "Pneumococcal Conjugate Vaccine Failure Case Report".
3. Entry of the completed CD-1 into WebSurv negates the need for the paper CD-1 to be forwarded to the District Health Office.
4. Send the completed supplemental investigation form(s) to the District Health Office or directly attach the forms to the cases record in WebSurv.
5. All outbreaks or "suspected" outbreaks should be reported as soon as possible (by phone, fax or e-mail) to the District Communicable Disease Coordinator or the District Senior Epidemiology Specialist. This can be accomplished by completing the Missouri Outbreak Surveillance Report (CD-51).
6. Within 90 days from the conclusion of an outbreak, submit the final outbreak report to the District Communicable Disease Coordinator or the District Senior Epidemiology Specialist.

References

1. Control of Communicable Diseases Manual. CCDM. 20th ed, 2015.
2. American Academy of Pediatrics. In: *Red Book*: *2015 Report of the Committee on Infectious Diseases*. 30th ed; 2015.
3. Centers for Disease Control and Prevention. *Epidemiology of Vaccine-Preventable Diseases*. "Pneumococcal Disease". Atkinson W, Hamborsky J Wolfe S, eds. 13th ed. Washington, DC: Public Health Foundation, 2015.
4. Centers for Disease Control and Prevention. *Manual for the Surveillance of Vaccine-Preventable Diseases*. "Pneumococcal". Centers for Disease Control and Prevention, Atlanta, GA, 2014. http://www.cdc.gov/vaccines/pubs/surv-manual/chpt22-lab-support.html.

Web Sites

1. Centers for Disease Control and Prevention, Pneumococcal Disease. http://www.cdc.gov/pneumococcal/index.html.
2. National Foundation for Infectious Diseases (NFID), Pneumococcal Disease. http://www.nfid.org/pneumococcal/.

3. Centers for Disease Control and Prevention, Immunization Schedules. http://www.cdc.gov/vaccines/schedules/index.html.
4. Centers for Disease Control and Prevention, Pneumococcal ACIP Vaccine Recommendations. http://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/pneumo.html.