Plague

Table of Contents

Plague

Plague is a potential bioterrorism weapon. The key identifying sign for pneumonic plague is the acute onset of a bloody, productive cough in an otherwise healthy individual. If you suspect that you are dealing with a bioterrorism situation (simultaneous multiple cases reinforce this suspicion), contact your District Communicable Disease Coordinator and consult your emergency procedure manual.

Overview[1,2]

Plague is an infectious disease of animals and humans caused by a bacterium named *Yersinia pestis*. People usually get plague from being bitten by a rodent flea that is carrying the plague bacterium or by handling an infected animal. Plague is transmitted from animal to animal and from animal to human by the bites of infective fleas. Less frequently, the organism enters through a break in the skin by direct contact with tissue or body fluids of a plague-infected animal, for instance, in the process of skinning a rabbit or other animal. Plague is also transmitted by inhaling infected droplets expelled by coughing, by a person or animal, especially domestic cats, with pneumonic plague.

The pathognomic sign of plague is a very painful, usually swollen, and often hot-to-the touch lymph node, called a bubo. This finding, accompanied with fever, extreme exhaustion, and a history of possible exposure to rodents, rodent fleas, wild rabbits, or sick or dead carnivores should lead to suspicion of plague. Once a human is infected, a progressive and potentially fatal illness generally results unless specific antibiotic therapy is given.

As soon as a diagnosis of suspected plague is made, the patient should be isolated, and local and state health departments should be notified. Confirmatory laboratory work should be initiated, including blood cultures and examination of lymph node specimens if possible. Drug therapy should begin as soon as possible after the laboratory specimens are taken. The drugs of choice are streptomycin or gentamycin, but a number of other antibiotics are also effective.

Transmission of plague from person to person is uncommon and has not been observed in the United States since 1924 but does occur as an important factor in plague epidemics in some developing countries.[1]

Plague is characterized by periodic disease outbreaks in rodent populations, some of which have a high death rate. During these outbreaks, hungry infected fleas that have lost their normal hosts seek other sources of blood, thus increasing the increased risk to humans and other animals frequenting the area.[1] Outbreaks in people still occur in rural communities or in cities. They are usually associated with infected rats and rat fleas that live in the home.

In North America, plague is found in certain animals and their fleas from the Pacific Coast to the Great Plains, and from southwestern Canada to Mexico. Most human cases in the United States occur in two regions: 1) northern New Mexico, northern Arizona, and southern Colorado; and 2) California, southern Oregon, and far western Nevada.

Yersinia pestis is a potential bioterrorism weapon, with the organism most likely being disseminated via an infectious aerosol. The result would probably be a cluster of cases of pneumonic plague. Infected persons would present with fever, headache, weakness, and rapidly developing severe pneumonia with cough, chest pain, dyspnea, and tachypnea (particularly young children). Cough could be productive of bloody, watery, or, less commonly, purulent sputum. Prominent gastrointestinal symptoms - including nausea, vomiting, diarrhea, and abdominal pain - might be present. Chest x-ray findings could be variable but bilateral infiltrates or consolidation can commonly occur; pleural effusions might be seen. Massive mediastinal adenopathy might occur rarely. Complications could include septicemia and meningitis. If appropriate antibiotic therapy is not instituted soon after symptom onset (i.e., within 24 hours), the probability of death can be extremely high.

Yersinia pestis used in an aerosol attack could cause cases of the pneumonic form of plague. One to six days after becoming infected with the bacteria, people would develop pneumonic plague. Once people have the disease, the bacteria can spread to others who have close contact with them. Because of the delay between being exposed to the bacteria and becoming sick, people could travel over a large area before becoming contagious and possibly infecting others. Controlling the disease would then be more difficult. A bioweapon carrying *Yersinia pestis* is possible because the bacterium occurs in nature and could be isolated and grown in quantity in a laboratory. Even so, manufacturing an effective weapon using *Yersinia pestis* would require advanced knowledge and technology.[2]

For a more complete description of Plague, refer to the following sources:

- *Control of Communicable Diseases Manual*. (CCDM), American Public Health Association. 19th ed. 2008.
- American Academy of Pediatrics. *Red Book: 2012 Report of the Committee on Infectious Diseases.* 29th ed.

Case Definition[3]

Clinical description
Plague is transmitted to humans by fleas or by direct exposure to infected tissues or respiratory droplets; the disease is characterized by fever, chills, headache, malaise, prostration, and leukocytosis that manifests in one or more of the following principal clinical forms:

- Regional lymphadenitis (bubonic plague)
- Septicemia without an evident bubo (septicemic plague)
- Plague pneumonia, resulting from hematogenous spread in bubonic or septicemic cases (secondary pneumonic plague) or inhalation of infectious droplets (primary pneumonic plague)
- Pharyngitis and cervical lymphadenitis resulting from exposure to larger infectious droplets or ingestion of infected tissues (pharyngeal plague)

Laboratory criteria for diagnosis
Confirmatory:

- Isolation of *Yersinia pestis* from a clinical specimen, or
- Fourfold or greater change in serum antibody titer to *Yersinia pestis* fraction 1 (F1) antigen.

Presumptive:

- Elevated serum antibody titer(s) to *Yersinia pestis* fraction 1 (F1) antigen (without documented fourfold or greater change) in a patient with no history of plague vaccination, or
- Detection of F1 antigen in a clinical specimen by fluorescent assay.

Case Classification
Confirmed: A clinically compatible case with confirmatory laboratory results.
Probable: A clinically compatible case with presumptive laboratory results.
Suspect: A clinically compatible case without presumptive or confirmatory laboratory results.

Information Needed for Investigation

Verify the diagnosis. What laboratory tests were conducted and what were the results? Refer to the Case Definition above and the Laboratory Procedures section.
Establish the extent of the illness. Determine if household members, travelling companions, co-workers, or other close contacts are, or have been ill. Are there any other persons with a similar illness? Has the patient traveled to a known endemic area?
Determine the source of the infection: What is the occupation of the case? Would other co-workers be at risk of acquiring plague? Determine if household members, travelling companions, co-workers, or other close contacts require treatment or prophylaxis. Review recent travel history of case. For ten days prior to onset of illness obtain the date of departure, destinations, length of stay, routes, activities, or other details that would identify the time and location of infection.

Notification

- Contact the District Communicable Disease Coordinator, the Senior Epidemiology Specialist, or the Department of Health and Senior Services Situation Room (DSR) at 800-392-0272 (24/7) immediately if an outbreak of Plague is suspected.
- Contact the Bureau of Environmental Health Services at (573) 751-6095 and the Section for Child Care Regulation at (573) 751-2450 if the case is associated with a child care center.
- Contact the Section for Long-Term Care Regulation at (573) 526-8524, if the case is associated with a long-term care facility.
- Contact the Bureau of Health Services Regulation at (573) 751-6303, if the case is associated with a hospital, hospital-based long-term care facility, or ambulatory surgical center.

Control Measures

If terrorist activity is suspected:

- Contact appropriate law enforcement authorities.
- Contact the District Communicable Disease Coordinator.
- Complete the Plague Case Investigation Report (CDC 56.37).

NOTE: Because plague is not endemic in Missouri, the occurrence of a case necessitates that bioterrorism *must* be considered. If the case has a remarkable travel history or is employed in an occupation that is prone to exposure, a bioterrorism event may be less likely, but the occurrence of a single case of plague *must still be reported immediately* to the District Communicable Disease Coordinator. As part of the follow-up and in order to determine if the case resulted from a bioterrorist event, determine **all** activities of the case within the previous ten days, particularly attendance at events with large numbers of people.

General:

- Isolation and provision of appropriate medical care to known/suspected plague cases.
- Identification, antibiotic prophylaxis, and continued surveillance of asymptomatic persons with potential exposure to aerosolized *Yersinia pestis* if still within the incubation period. Ensure those who become symptomatic (especially with fever and cough) are isolated and receive immediate medical evaluation/treatment.
- Identification, antibiotic prophylaxis, and continued surveillance of asymptomatic persons having household, hospital, or other close contact (<two meters) with untreated pneumonic plague patients if still within the incubation period. Ensure those who become symptomatic (especially with fever and cough) are isolated and receive immediate medical evaluation/treatment.
- Provision of community-wide surveillance for additional cases.
- Provision of information to health care providers and the public.

Laboratory Procedures

Plague is characterized by massive growth of *Yersinia pestis* in tissues. The organism has a bipolar (safety-pin) appearance and can be visualized either with Wayson staining or Gram staining of infected tissue.

- A fluorescent antibody test for the presence of *Yersinia pestis* performed directly from infected tissue, bubo aspirate, sputum, CSF or blood specimen is available at the Missouri State Public Health Laboratory (SPHL). A positive direct fluorescent antibody test is presumptive evidence of *Yersinia pestis*.
- Specimens can also be cultured for the presence of the organism. Culture isolates suspected of being *Yersinia pestis* should be submitted to the SPHL for confirmation and forwarding to CDC**.**
- A single positive serologic test by passive hemagglutination assay or enzyme immunoassay in an unvaccinated patient who has not previously had plague also provides presumptive evidence of infection. Seroconversion and/or a fourfold difference in antibody titer between two serum specimens obtained four (4) weeks to three (3) months apart provide serological confirmation.

Additional information on laboratory procedures can be obtained from the District Communicable Disease Coordinator or from the SPHL web site at: http://health.mo.gov/lab/btct.php (5/12)

Reporting Requirements

Plague is a Category 1(A) disease and shall be reported to the local health authority or to the Missouri Department of Health and Senior Services **immediately** upon knowledge or suspicion by telephone, facsimile or other rapid communication.

1. For all cases of plague, complete a Disease Case Report form (CD-1) and the Plague Case Investigation Report (CDC 56.37).
2. Entry of the completed CD-1 into WebSurv negates the need for the paper CD-1 to be forwarded to the District Health Office.
3. Send the completed Plague Case Investigation Report to the District Health Office.
4. All outbreaks or "suspected" outbreaks must be reported as soon as possible (by phone, fax, or e-mail) to the District Communicable Disease Coordinator. This can be accomplished by completing the Missouri Outbreak Surveillance Report (CD-51).
5. Within 90 days from the conclusion of an outbreak, submit the final outbreak report to the District Communicable Disease Coordinator.

References

1. Centers for Disease Control and Prevention. "CDC Information on Plague." http://www.cdc.gov/ncidod/dvbid/plague/info.htm (5/12)
2. Centers for Disease Control and Prevention. Emergency Preparedness and Response. Frequently asked questions about Plague: http://www.bt.cdc.gov/agent/plague/faq.asp (5/12)

3. Centers for Disease Control and Prevention. Case Definitions for Infectious Conditions Under Public Health Surveillance. MMWR 1997; 46 (No.RR-10). "Plague," 1996 http://www.cdc.gov/osels/ph_surveillance/nndss/casedef/plague_current.htm (5/12)
4. *Control of Communicable Diseases Manual*. American Public Health Association. 19th ed. 2008. "Plague" (Pestis). Heymann, David L., editor. 19th ed. Washington, DC: 463 - 471.
5. American Academy of Pediatrics, "Plague." In: Pickering, Larry K., editor. *Red Book*: 2009 Report of the Committee on Infectious Diseases, 28th ed. Elk Grove Village, IL, 522-524.
6. Centers for Disease Control and Prevention. Prevention of Plague – Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1996:45 No. RR-14: 1-15. http://www.cdc.gov/mmwr/PDF/RR/RR4514.pdf (5/12)

Other Sources of Information

1. Dennis, David T and Paul S. Mead. "Yersinia Species, Including Plague." Gerald L. Mandell, John E. Bennett, & Raphael Dolin, Eds. Principles and Practice of Infectious Diseases, 7th ed. Pennsylvania: Churchill Livingstone Elsevier, 2010: 2943-2949.
2. Borio, Luciana and Noreen A. Hynes. "Plague as a Bioterrorism Weapon." Gerald L. Mandell, John E. Bennett, & Raphael Dolin, Eds. Principles and Practice of Infectious Diseases, 7th ed. Pennsylvania: Churchill Livingstone Elsevier, 2010: 3965-3970.
3. Poland, Jack D. and David T. Dennis. "Plague." Bacterial Infections of Humans Epidemiology and Control, 3rd ed. Eds. Alfred S. Evans and Philip S. Brachman. New York: Plenum, 1998: 545 – 558.
4. Risi, George F. "Plague (*Yersinia pestis*)." APIC Infection Control and Applied Epidemiology Principles and Practice. Ed. Russell N. Olmsted. St. Louis: Mosby, 1996: 72-1–72-3.
5. The Merck Veterinary Manual. 10th Ed. Editor: Cynthia M. Kahn. Whitehouse Station, NJ: Merck & Co., Inc., 2010.

Web Sites

1. Centers for Disease Control and Prevention. CDC Plague Home Page. http://www.cdc.gov/ncidod/dvbid/plague/index.htm (5/12)
2. Centers for Disease Control and Prevention, Emergency Preparedness and Response, Plague Information: http://www.bt.cdc.gov/agent/plague/index.asp (5/12)
3. Missouri Department of Health and Senior Services, Emergency Response and Terrorism. http://health.mo.gov/emergencies/ert/med/plague.php (5/12) http://health.mo.gov/emergencies/readyin3/ (5/12)
4. Infectious Diseases Society of America (IDSA). Yersinia pestis (Plague): Current, comprehensive information on pathogenesis, microbiology, epidemiology, diagnosis, and treatment. http://www.idsociety.org/Plague (5/12)
5. Inglesby, Thomas V., et al, for the Working Group on Civilian Biodefense. The Journal of the American Medical Association, JAMA May 3, 2000; 283(17): 2281-90. "Plague as a biological weapon." http://jama.ama-assn.org/cgi/content/full/283/17/2281 (5/12)