

## Yersinia pestis as a Bioterrorist Agent

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Agent: *Yersinia pestis*, a gram-negative bacillus, may be delivered by aerosol to cause pneumonic plague, or using infected fleas to cause bubonic plague. The organism may remain alive from months to years at freezing temperatures. It may also remain viable in dry sputum, flea feces and buried bodies.

Disease: Pneumonic or bubonic plague

Incubation Period: 2-3 days (pneumonic) and 2-10 days (bubonic)

Signs/Symptoms: In the pneumonic form, the onset of symptoms is acute and fulminant with high fever, chills, headache, malaise, myalgia, and cough. The patients may have lymphadenopathy and blood-tinged sputum. The pneumonia progresses rapidly, resulting in dyspnea, stridor and cyanosis. The terminal events are respiratory failure, circulatory collapse, and bleeding diathesis with mortality of 100% in untreated patients. In the bubonic form, initial symptoms include malaise, high fever, and one or more painful lymph nodes. The vast majority of buboes occur in the groin, as the legs are the most commonly "flea-bitten" part of the body. However, cervical and axillary lymph nodes may also be involved. Up to 80% of patients with bubonic plague also become septic; 5-15% develop pneumonia. Circulatory collapse, hemorrhage and peripheral thrombosis are the terminal events. About half of untreated bubonic cases die.

Diagnosis:

Differential Diagnosis: For the bubonic form, tularemia adenitis, staphylococcal or streptococcal adenitis, meningococcemia, enteric gram-negative sepsis, cat scratch disease, and rickettsioses should be ruled out. In tularemia or cat scratch disease, the inoculation site is usually more evident than in bubonic plague, and the patient will not usually be septic. The differential for pneumonic plague includes tularemia, anthrax and staphylococcal enterotoxin B (SEB) inhalation. Continued deterioration without stabilization effectively rules out SEB. The presence of a widened mediastinum on chest x-ray should alert the physician to the probability of anthrax. Patients with plague have a cough productive of bloody sputum, while those with tularemia generally have a nonproductive cough. Secondary spread may occur with pneumonic plague, but is highly unlikely with anthrax or tularemia.

Pneumonic Plague X-ray (Courtesy Paul Hering, Loyola University).

Diagnostic Tests: Presumptive diagnosis can be made by identification of gram-negative coccobacilli with safety-pin bipolar staining organisms from a lymph node needle aspirate, sputum, cerebrospinal fluid (CSF) or buffy coat smears. *Y. pestis* may be readily cultured from blood, sputum, and bubo aspirates.

Early postexposure (0-24 hours) nasal swabs, sputum, and induced respiratory secretions may be

collected for culture, and for fluorescent antibody (FA) assay. During the clinical phase (24 - 72 hours) blood for serum may be collected in a tiger-top (SST) or red top tube for F1 antigen assay. Blood may be collected in a 3 ml EDTA tube, 3 ml citrate tube, or heparin tube for PCR, in a 3 ml EDTA tube for gram stain of the buffy coat, and in a blood culture bottle or 3 ml citrate tube for culture. Blood for convalescent sera may be collected in tiger-top (SST) or red top tubes for serology.

Send specimens for laboratory confirmation in a triple container along with the General Submission Form (G-1A for bacterial/virologic cultures, G-1B for serologic tests) to the Texas Department of Health Laboratory, 1100 West 49th Street, Austin, TX 78756. Call the laboratory at (512) 458-7318 prior to shipping specimens.

Additionally, the laboratory protocol for this pathogen is available.

Supportive Tests: Chest X-ray reveals a patchy or consolidated bronchopneumonia. Thrombocytopenia, leukocytosis, and elevated liver function tests (LFT's) are common; fibrinogen-fibrin degradation products (DIC) may be noted.

Treatment: Streptomycin 30 mg/kg/day IM in 2 divided doses for 10 days or gentamicin 2.0 mg/kg IV loading dose, then 1.7 mg/kg q8h IV. Alternate treatments are doxycycline 200 mg IV initially , then 100 mg q12h IV for 10-14 days; or chloramphenicol 1000 mg qid IV for 10-14 days (preferred for plague meningitis). Supportive therapy should be provided as required.

Prophylaxis: Tetracycline 500 mg qid po or Doxycycline 100 mg bid po for 7 days or duration of exposure, whichever is longer. Ciprofloxacin 500 mg bid po for seven days may also be used. Other alternatives include ofloxacin, levofloxacin, chloramphenicol, and trimethoprim-sulfamethoxazole.

Infection Control: Although buboes may be aspirated for diagnostic purposes, incision and drainage (I) may pose a hazard to medical personnel. Droplet precautions in addition to standard precautions should be strictly enforced for at least 72 hours after the initiation of effective therapy. Surface decontamination may be accomplished by using 0.5% sodium hypochlorite solution ( 1 part household bleach added to nine parts water).

Report: Immediately report any suspect cases to local health authority at 1-800-705-8868 or the Texas Department of Health at 1-800-252-8239; reports may also be faxed to (512) 458-7616.