

PLAGUE ICD-9 020; ICD-10 A20

(Peste)

1. Identification—A specific zoonosis involving rodents and their fleas, which transfer the bacterial infection to various animals and to people. Initial signs and symptoms may be nonspecific with fever, chills, malaise, myalgia, nausea, prostration, sore throat and headache. Lymphadenitis often develops in those lymph nodes that drain the site of the bite, where there may be an initial lesion. This is bubonic plague, and it occurs more often (90%) in lymph nodes in the inguinal area and less commonly in those in the axillary and cervical areas. The involved nodes become swollen, inflamed and tender and may suppurate. Fever is usually present.

All forms, including instances in which lymphadenopathy is not apparent, may progress to septicemic plague with bloodstream dissemination to diverse parts of the body that include the meninges. Endotoxic shock and disseminated intravascular coagulation (DIC) may occur without localizing signs of infection. Secondary involvement of the lungs results in pneumonia; mediastinitis or pleural effusion may develop. Secondary pneumonic plague is of special significance, since respiratory droplets may serve as the source of person-to-person transfer with resultant primary pneumonic or pharyngeal plague; this can lead to localized outbreaks or devastating epidemics. Though naturally acquired plague usually presents as bubonic plague, purposeful aerosol dissemination as a result of deliberate use would be manifest primarily as pneumonic plague. Untreated bubonic plague has a case-fatality rate of about 50%–60%.

Plague organisms have been recovered from throat cultures of asymptomatic contacts of pneumonic plague patients. Untreated primary septicemic plague and pneumonic plague are invariably fatal. Modern therapy markedly reduces fatality from bubonic plague; pneumonic and septicemic plague also responds if recognized and treated early. However, one report stated that patients who had not received adequate therapy for primary pneumonic plague within 18 hours after onset of respiratory symptoms were less likely to survive.

Visualization of characteristic bipolar staining, “safety pin” ovoid, Gram-negative organisms in direct microscopic examination of material aspirated from a bubo, sputum or CSF are each suggestive, but not conclusive, evidence of plague infection. Examination by FA test or antigen capture ELISA is more specific and is particularly useful in sporadic cases. Diagnosis is confirmed by culture and identification of the causal organism from exudate aspirated from buboes, from blood, CSF or sputum, or by a 4-fold or greater rise or fall in antibody titre. Slow growth of the organism at normal incubation temperatures may lead to misidentification by automated systems. The passive hemagglutination test (PHA) using *Yersinia pestis* Fraction-1 antigen is most frequently used for serodiagnosis.

Medical personnel should be aware of areas where the disease is endemic and entertain the diagnosis of plague early; unfortunately, plague is often misdiagnosed, especially in travellers who develop illness after returning from an endemic area.

2. Infectious agent—*Yersinia pestis*, the plague bacillus.

3. Occurrence—Plague continues to be a threat because of vast areas of persistent wild rodent infection; contact of wild rodents with domestic rats occurs frequently in some enzootic areas. Wild rodent plague exists in the western half of the USA; large areas of South America; central, eastern and southern Africa; central, southwestern and southeastern Asia, and extreme southeastern Europe near the Caspian Sea. While urban plague has been controlled in most of the world, human plague has occurred in the 1990s in several African countries that include Botswana, the Democratic Republic of the Congo, Kenya, Madagascar, Malawi, Mozambique, the United Republic of Tanzania, Uganda, Zambia and Zimbabwe. Plague is endemic in China, India, Lao People's Democratic Republic, Mongolia, Myanmar and Viet Nam. In the Americas, foci in northeastern Brazil and the Andean region (Brazil, Ecuador and Peru) continue to produce sporadic cases and occasional outbreaks including an outbreak of pneumonic plague in Ecuador in 1998.

Human plague in the western USA is sporadic (12–14 cases a year since 1900), with only single cases or small common source clusters in an area, usually following exposure to wild rodents or their fleas. No person-to person transmission has occurred in the USA since 1925, although secondary plague pneumonia has occurred in about 20% of bubonic cases in recent years; 5 instances of primary plague pneumonia through cat-to-human transmission have been recorded.

4. Reservoir—Wild rodents (especially ground squirrels) are the natural vertebrate reservoir of plague. Lagomorphs (rabbits and hares), wild carnivores and domestic cats may also be a source of infection to people.

5. Mode of transmission—Naturally acquired plague in people occurs as a result of human intrusion into the zoonotic (also termed sylvatic or rural) cycle during or following an epizootic, or by the entry of sylvatic rodents or their infected fleas into human habitat; infection in commensal rodents and their fleas may result in a domestic rat epizootic and flea-borne epidemics of bubonic plague. Domestic pets, particularly house cats and dogs, may carry plague infected wild rodent fleas into homes, and cats may occasionally transmit infection through bites, scratches or respiratory droplets; cats develop plague abscesses that have been a source of infection to veterinary personnel.

The most frequent source of exposure that results in human disease worldwide has been the bite of infected fleas (especially *Xenopsylla cheopis*, the oriental rat flea).

Other important sources include the handling of tissues of infected animals, especially rodents and rabbits, but also carnivores; rarely airborne droplets from human patients or household cats with plague pharyngitis or pneumonia; or careless manipulation of laboratory cultures. Person-to person transmission by *Pulex irritans* fleas ("human" flea), is presumed to be important in the Andean region of South America and in other places where plague occurs and this flea is abundant in homes or on domestic animals. Certain occupations and lifestyles (including hunting, trapping, cat ownership and rural residence) carry an increased risk of exposure.

In the case of deliberate use plague bacilli would possibly be transmitted as an aerosol.

6. Incubation period—From 1 to 7 days; may be a few days longer in those immunized who develop illness. For primary plague pneumonia, 1–4 days, usually short.

7. Period of communicability—Fleas may remain infective for months under suitable conditions of temperature and humidity. Bubonic plague is not usually transmitted directly unless there is contact with pus from suppurating buboes. Pneumonic plague may be highly communicable under appropriate climatic conditions; overcrowding facilitates transmission.

8. Susceptibility—Susceptibility is general. Immunity after recovery is relative; it may not protect against a large inoculum.

9. Methods of control—

A. Preventive measures: The basic objective is to reduce the likelihood of people being bitten by infected fleas, having direct contact with infective tissues and exudates, or of being exposed to patients with pneumonic plague.

1) Educate the public in enzootic areas on the modes of human and domestic animal exposure; on rat-proofing buildings, preventing access to food and shelter by peridomestic rodents through appropriate storage and disposal of food, garbage and refuse; and the importance of avoiding flea bites by use of insecticides and repellents. In sylvatic or rural plague areas, the public should be advised to use insect repellents and warned not to camp near rodent burrows and to avoid handling of rodents, but to report dead or sick animals to health authorities or park rangers. Dogs and cats in such areas should be protected periodically with appropriate insecticides.

2) Survey rodent populations periodically to determine the effectiveness of sanitary programs and to evaluate the potential for epizootic plague. Rat suppression by poisoning (see 9B6) may be necessary to augment basic environmental sanitation measures; rat control should always be preceded by measures to control fleas. Maintain surveillance of natural foci by bacteriologic testing of sick or dead wild rodents and by serological studies of wild carnivore and outdoor ranging dog and cat populations in order to define areas of plague activity. Collection and testing of fleas from wild rodents and their nests or burrows may also be appropriate.

3) Control rats on ships and docks and in warehouses by rat-proofing or periodic fumigation, combined when necessary with destruction of rats and their fleas in vessels and in cargoes, especially containerized cargoes, before shipment and on arrival from locations endemic for plague.

4) Wear gloves when hunting and handling wildlife.

5) Active immunization with a vaccine of killed bacteria confers some protection against bubonic plague (but not primary pneumonic plague) in most recipients if administered in a primary series of 3 doses with doses 1 and 2 given 1–3 months apart followed by dose 3 after 5–6 months; booster injections are necessary every 6 months if high risk exposure continues. After the third booster dose, the intervals can be extended to every 1 to 2 years. Immunization of visitors to epidemic localities and of laboratory and fieldworkers handling plague bacilli or infected animals is justifiable but should not be relied upon as the sole preventive measure; routine immunization is not indicated for most persons resident in enzootic areas. Live attenuated vaccines are used in some countries; they may produce more adverse reactions, without evidence that they are more protective. Commercial plague vaccine is no longer available in the USA.

B. Control of patient, contacts and the immediate environment:

1) Report to local health authority: Case report of suspected and confirmed cases universally required by *International Health Regulations*, Class 1 (see Reporting). Because of the rarity of naturally acquired primary plague pneumonia, even a single case should initiate prompt suspicion by both public health and law enforcement authorities of deliberate use.

2) Isolation: Rid patients, and especially their clothing and baggage, of fleas, using an insecticide effective against local fleas and known to be safe for people; hospitalize if practical.

For patients with bubonic plague (if there is no cough and the chest X-ray is negative) drainage and secretion precautions are indicated for 48 hours after start of effective treatment. For patients with pneumonic plague, strict isolation with precautions against airborne spread is required until 48 hours of appropriate antibiotherapy have been completed and there has been a favorable clinical response (see 9B7).

3) Concurrent disinfection: Disinfect sputum and purulent discharges and articles soiled therewith. Terminal cleaning of bodies and carcasses should be handled with strict aseptic precautions.

4) Quarantine: Those who have been in household or face-to face contact with patients with pneumonic plague should be provided chemoprophylaxis (see 9B5) and placed under surveillance for 7 days; those who refuse chemoprophylaxis should be maintained in strict isolation with careful surveillance for 7 days.

5) Protection of contacts: In epidemic situations where human fleas are known to be involved, contacts of bubonic plague patients should be disinfested with an appropriate insecticide.

All close contacts should be evaluated for chemoprophylaxis.

Close contacts of confirmed or suspected plague pneumonia cases (including medical personnel) should be provided with chemoprophylaxis using tetracycline (15–30 mg/kg) or chloramphenicol (30 mg/kg) daily in 4 divided doses for 1 week after exposure ceases.

6) Investigation of contacts and source of infection: Search for people with household or face-to-face exposure to pneumonic plague, and for sick or dead rodents and their fleas. Flea control must precede—or coincide with—antirodent measures.

Dust rodent runs harborages and burrows in and around known or suspected plague areas with an insecticide labeled for flea control and known to be effective against local fleas. If non burrowing wild rodents are involved, insecticide bait stations can be used. If urban rats are involved, disinfest by dusting the houses, outhouses and household furnishings; dust the bodies and clothing of all residents in the immediate vicinity. Suppress rat populations by well planned and energetic campaigns of poisoning and with vigorous concurrent measures to reduce rat harborages and food sources.

7) Specific treatment: Streptomycin is the drug of choice, gentamicin can be used when streptomycin is not readily available; tetracyclines and chloramphenicol are alternative choices. Chloramphenicol is required for treatment of plague meningitis. All are highly effective if used early (within 8–18hours after onset of pneumonic plague). After a satisfactory response to drug treatment, reappearance of fever may result from a secondary infection or a suppurative bubo that may require incision and drainage.

C. Epidemic measures:

- 1) Investigate all suspected plague deaths with autopsy and laboratory examinations when indicated. Develop and carry out case-finding. Establish the best possible facilities for diagnosis and treatment. Alert existing medical facilities to report cases immediately and to use full diagnostic and therapeutic services.
- 2) Attempt to prevent or mitigate public hysteria by appropriate informational and educational releases through the press and news media.
- 3) Institute intensive flea control in expanding circles from known foci.
- 4) Implement rodent destruction within affected areas only after satisfactory flea control has been accomplished.
- 5) Protect all contacts as noted in 9B5.
- 6) Protect fieldworkers against fleas; dust clothing with insecticide powder and use insect repellents daily. Antibiotic prophylaxis should be undertaken for those with close documented exposure (see 9B5).

D. Disaster implications: Plague could become a significant problem in endemic areas when there are social upheavals, crowding and unhygienic conditions. See preceding and following paragraphs for appropriate actions.

E. International measures:

- 1) Notification within 24 hours by governments to WHO and to adjacent countries of the first imported, first transferred or first non imported case of plague in any area previously free of the disease. Report newly discovered or reactivated foci of plague among rodents.
- 2) Measures applicable to ships, aircraft and land transport arriving from plague areas are specified in *International Health Regulations* (currently).
- 3) All ships should be free of rodents or periodically deratted.
- 4) Rat-proof buildings at seaports and airports; apply appropriate insecticides; eliminate rats with effective rodenticides.
- 5) For international travellers, international regulations require that prior to their departure on an international voyage from an area where there is an epidemic of pulmonary plague, those suspected of significant exposure shall be placed in isolation for 6 days after last exposure. On arrival of an infested or suspected infested ship, or an infested aircraft, travellers may be disinfected and kept under surveillance for a period of not more than 6 days from the date of arrival.

Immunization against plague cannot be required as a condition of admission to a territory. These measures, outlined in the *International Health Regulations*, are currently under revision.

- 6) WHO Collaborating Centres.

F. Measures in the case of deliberate use:

Y. pestis is distributed worldwide; techniques for mass production and aerosol dissemination are thought to exist; the fatality rate of primary pneumonic plague is high and there is a real potential for secondary spread. For these reasons, a biological attack with plague is considered to be of serious public health concern. In some countries, a few sporadic cases may be missed or not attributed to a deliberate act. Any suspect case of pneumonic plague should be reported immediately to the local health department. The

sudden appearance of many patients presenting with fever, cough, a fulminant course and high case-fatality rate should provide a suspect alert for anthrax or plague; if cough is primarily accompanied by hemoptysis, this presentation favors the tentative diagnosis of pneumonic plague.

For a suspected or confirmed outbreak of pneumonic plague, follow the treatment and containment measures outlined in 9B.

Depending on the extent of dissemination, mass prophylaxis of potentially exposed populations may be considered.

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Tomado de: Heymann, D.L. Control of Communicable Diseases Manual. Eighteenth Edition, American Public Health Association, 2004, pp. 444 – 450.