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Human Plague — Four States, 2006

Plague is a zoonotic disease caused by the bacterium *Yersinia pestis*. In 2006, a total of 13 human plague cases have been reported among residents of four states: New Mexico (seven cases), Colorado (three cases), California (two cases), and Texas (one case). This is the largest number of cases reported in a single year in the United States since 1994. Dates of illness onset ranged from February 16 to August 14; two (15%) cases were fatal. The median age of patients was 43 years (range: 13–79 years); eight (62%) patients were female. Five (38%) patients had primary septicemic plague, and the remaining eight (62%) had bubonic plague. Two (15%) patients developed secondary plague pneumonia, leading to administration of antibiotic prophylaxis to their health-care providers. This report summarizes six of the 13 cases, highlighting the severity and diverse clinical presentations of plague and underscoring the need for prompt diagnosis and treatment when plague is suspected.

Case 1. On February 17, a man aged 39 years from Travis County, Texas, was hospitalized with a 1-day history of high fever, delirium, nausea, and vomiting. Although lymphadenopathy was not detected on the initial examination, a prominent axillary bubo was noted later. Blood cultures yielded *Y. pestis.* The patient recovered after treatment with multiple antibiotics, including gentamicin, doxycycline, ciprofloxacin, and levofloxacin. Before his illness, the patient had hunted rabbits in Lea County, New Mexico, and skinned the rabbit carcasses. Cultures from one of the carcasses yielded *Y. pestis* that was indistinguishable from the clinical isolates when subtyped by pulsed-field gel electrophoresis (PFGE).

Case 2. On April 17, a woman aged 28 years received the first diagnosis of plague in Los Angeles County, California, since 1984. The woman was hospitalized with fever, septic shock, and a painful right axillary swelling; blood cultures grew *Y. pestis.* She responded to treatment with gentamicin and levofloxacin. Although symptoms were compatible with bubonic plague, the diagnosis had not been suspected because the patient did not report traveling outside her urban Los Angeles neighborhood. Later, health-care providers learned that the patient had handled raw meat from a rabbit that had been killed in Kern County, California, and transported to her home. An environmental investigation in Kern County revealed evidence of die-off among jackrabbits and cottontails; rabbit carcasses collected in the area yielded *Y. pestis*. PFGE patterns of isolates from the patient and rabbits were indistinguishable. A total of 16 medical contacts and family members and friends who had visited the patient's residence received antibiotic prophylaxis.

Case 3. On May 17, a woman aged 54 years from Bernalillo County, New Mexico, went to a local urgent care center with a 4-day history of fever, severe abdominal pain, and bloody stools. No lymphadenopathy was noted. While being evaluated, the patient began vomiting blood and experienced acute respiratory distress. She was transferred to a regional hospital but died within a few hours of arrival. Blood and lung cultures obtained at autopsy yielded *Y. pestis*; however, no histologic evidence of plague pneumonia was discovered. One of the patient's dogs and a rock squirrel (*Spermophilus variegatus*) that had been trapped by investigators on her property had serologic evidence of past infection with *Y. pestis.*

Case 4. On May 25, a man aged 45 years from Santa Fe County, New Mexico, went to a hospital emergency department with a 3-day history of nausea, vomiting, and fever to 104°F (40°C). Initial chest radiographs revealed right lower lobe infiltrates; he was admitted with a diagnosis of pneumonia. The patient was treated with gentamicin but was not placed in respiratory isolation. On hospital day 1, the patient required intubation for respiratory distress. On hospital day 2, blood cultures drawn at admission yielded *Y. pestis.* The patient remained on mechanical ventilation for 4 weeks and eventually recovered. At least 37 hospital workers who had contact with the patient before he was intubated received postexposure prophylaxis with doxycycline. Both of the patient's dogs had serologic evidence of past *Y. pestis* infection. *Y. pestis* was isolated from

fleas (*Anomiopsyllus nudatus*) combed from a woodrat (*Neotoma micropus*) that was trapped by investigators on the patient's property.

Case 5. On July 9, a man aged 30 years from La Plata County, Colorado, went to a hospital emergency department with a 3-day history of fever, nausea, vomiting, and right inguinal lymphadenopathy. He was discharged home without treatment. Three days later, the man returned and was hospitalized with sepsis and bilateral pulmonary infiltrates. Plague was considered immediately, and the patient was placed in respiratory isolation. He was treated with gentamicin and recovered. Five hospital workers were administered doxycycline prophylaxis because of exposures before respiratory isolation had been initiated. Cultures of blood and a lymph node aspirate grew *Y. pestis.* One of the patient's dogs had serologic evidence of past *Y. pestis* infection. *Y. pestis* was recovered from fleas of two species (*Aetheca wagneri* and *Pulex simulans)* collected near the patient's home. A plague epizootic had been noted in the area, and four other human plague cases have been reported from La Plata County since July 2005.

Case 6. On July 18, a woman aged 43 years from Torrance County, New Mexico, went to a local clinic with a 1-day history of vomiting, diarrhea, abdominal pain, and fever. The patient reported a recent dog bite and was treated for presumed cellulitis. The next day, the woman returned to the clinic because of worsening symptoms and pain in the left side of her groin. She was transported by ambulance to the emergency department, where inguinal lymphadenopathy was noted and plague was suspected. She was admitted to the hospital, placed in the intensive care unit, and administered gentamicin and doxycycline. *Y. pestis* was isolated from blood cultures. Despite treatment, she died on July 22. Animals trapped on the patient's property, including four mice (*Peromyscus* spp.) and five rock squirrels, did not have laboratory evidence of infection with *Y. pestis.*

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Editorial Note: The natural reservoir of plague is wild rodents. Human infection usually is acquired through the bites of infected rodent fleas and has an incubation period of 1–6 days (*1*). Plague also can be contracted from handling infected animals, especially rodents, lagomorphs (e.g., rabbits or hares), and domestic cats, or through close contact with patients with pneumonic plague. However, person-to-person transmission is extremely rare; the last such transmission in the United States was reported in 1925. During 1990–2005, a total of 107 cases of plague were reported in the United States (CDC, unpublished data, 2006), a median of seven cases per year. The increased plague activity in 2006 is consistent with the predicted relationship between climate and the frequency of human plague in the southwestern United States. Two consecutive February-March periods with high precipitation and an intervening cool summer predicts increased cases of plague the next summer; this effect is thought to lead to increased reproduction and survival rates among rodents and fleas (*2*).

The principal forms of plague are bubonic, septicemic, and pneumonic (*3*). All of these forms can be accompanied by fever and systemic manifestations of gram-negative sepsis. Bubonic plague is distinguished by the presence of a bubo (i.e., one or more enlarged, tender, regional lymph nodes). Patients with septicemic plague often have prominent gastrointestinal symptoms, including nausea, vomiting, diarrhea, and abdominal pain (*4*), and patients with pneumonic plague have dyspnea, chest pain, and a cough that can produce bloody sputum. During 1990–2005, a total of 81 (76%) of 107 plague cases in the United States were classified as primary bubonic plague, 19 (18%) as primary septicemic plague, and five (5%) as primary pneumonic plague; two (2%) were not classified (CDC, unpublished data, 2006). Eleven (10%) cases were fatal. In 2006, five (38%) of the 13 patients had primary septicemic plague, underscoring the need for clinicians to consider this diagnosis in patients who do not have an obvious bubo. Septicemic and pneumonic plague progress rapidly and are usually fatal without prompt treatment; bubonic plague has a mortality rate of 50%–60% if untreated.

In the United States, nearly all fatal plague cases are associated with delays in diagnosis and treatment. In its early stages, plague is treatable with appropriate antibiotics. Health-care providers should consider a diagnosis of plague in persons who 1) have unexplained fever, suspected sepsis, or pneumonia with or without lymphadenopathy or a clas-

sic bubo, and 2) live in or have traveled to a plague-endemic region (e.g., the western United States) (*3*). When plague is suspected, appropriate antibiotic treatment should be initiated immediately and not delayed for laboratory confirmation. Drugs effective against plague include streptomycin and the tetracyclines. Although not approved by the Food and Drug Administration (FDA) for treatment of plague, gentamicin is more readily available than streptomycin and has been used successfully (*5*). Fluoroquinolones are used empirically to treat critically ill patients and have demonstrated activity against *Y. pestis* but are not FDA approved for this indication (*6*).

The majority of exposures to plague occur in the peridomestic environment (*3*); free-roaming pets that bring infected rodent fleas into the home have been suspected as a potential source of human infections. Persons residing in areas where plague is endemic should keep their dogs and cats free of fleas through regular use of flea treatments and by keeping them indoors. Year-round rodent control should be conducted, including rodent proofing of structures and eliminating food sources (e.g., pet food or garbage) and harborage (e.g., piles of wood or debris) in the peridomestic environment. Persons who participate in outdoor recreational activities, particularly rabbit hunting (*7*), in areas of epizootic plague activity also are at risk for plague. Personal protective measures include using insect repellents, wearing protective clothing, and avoiding sick or dead animals. In areas of epizootic plague activity, public health officials should treat rodent habitats with insecticides and should educate the public regarding plague prevention and control. Health-care providers and veterinarians should be educated regarding the manifestations and diagnosis of plague. Antibiotic prophylaxis might be indicated for close contacts (who come within 2 m) of patients with plague pneumonia (*5*). Appropriate respiratory droplet precautions should be taken when treating patients with suspected plague who have evidence of respiratory involvement (*8*).

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