

## A CASE OF PLAGUE IN URBAN LOS ANGELES

### BACKGROUND

Plague was first recognized in the United States in San Francisco in 1900, and appeared in Los Angeles County in 1908. The disease was likely introduced to western United States ports via infected rats and humans who traveled on ships from Asia. Outbreaks in rats and subsequent human epidemics followed the introduction of plague to both San Francisco and Los Angeles. Since the early epidemics, sporadic human plague cases in California have been associated with epizootics (animal disease outbreaks), most commonly among California ground squirrels. No previous human cases have been associated with epizootics in wild rabbits in southern California. Despite the presence of sylvatic plague in many areas of the western United States, human infection in an urban setting without known risk behaviors is an urgent public health concern. The last previous human case of *Yersinia pestis* (*YP*) infection in Los Angeles County (LAC) occurred in 1984 in a veterinarian with established exposure to an ill cat.

### CASE PRESENTATION

In April 2006, the Los Angeles County (LAC) Department of Public Health (DPH) received a report from an infectious disease (ID) physician of a positive blood culture for *Yersinia pestis* (*YP*) taken from a woman who lived in an urban area of Los Angeles. This 28 year-old previously healthy female was admitted to a local inpatient medical center with a three day history of fever and a severely painful right axillary swelling (bubo); she had no pulmonary symptoms. All chest radiographs were negative. Her preliminary diagnosis was "probable" abscess due to methicillin resistant *Staphylococcus aureus*.

On the third hospital day, the hospital laboratory reported to the clinician a presumptive identification of *YP* from an admission blood culture. Initially requiring aggressive therapy for shock, she improved enough after excision and drainage of the mass and antibiotic therapy to be discharged six days later. She recovered fully without sequelae. The case was queried in detail by ID consultants regarding any potential plague exposures. Beyond vaguely noting residential infestation with rodents and feral cats, she firmly denied any direct animal contact or travel outside of her densely urban locale. Within hours, LAC DPH was notified of the case by telephone and facsimile, which in turn notified the California state health department and the Federal Bureau of Investigation, because *YP* is category A bioterrorism agent.

### METHODS

Case and contact interviews were conducted in person using a standardized questionnaire. The case and her family were interviewed repeatedly regarding potential exposures to animals and locations enzootic with *YP*; potential exposure sites were evaluated and animals were collected and tested for *YP*. Environmental investigations were conducted including interviews, general environmental assessment, trapping for animals, and serologic tests of animal serum. LAC Public Health Laboratory (PHL) tested the blood isolate by direct fluorescent antibody (DFA), polymerase chain reaction (PCR), and phage lysis. Sera from rabbits and deer mice were tested for plague at the California Department of Health Services (CDHS) Microbial Diseases Laboratory using a hemagglutinin assay (HA). Rabbit carcasses were tested for plague by the Centers for Disease Control and Prevention (CDC). Pulsed field gel electrophoresis (PFGE) analysis was done on human and animal *YP* isolates by CDC. Close contacts of the case and hospital staff were screened and offered prophylactic antibiotics.

### RESULTS

In initial interview, the case denied any travel outside her immediate residence, except to walk her son to the local school. A second interview revealed that the case had visited a large park in Los Angeles that has many wild animals. In the early 1980s surveillance by LAC DPH in this park detected plague positive California mice, a ground squirrel and a Norway rat. The case was unsure of the dates she visited the park but thought it was 3 to 4 weeks prior to her onset, which was outside of the range for *YP* incubation period.

The blood isolate was positive for *YP* by DFA, PCR probes and the phage lysis test. Twelve hospital staff, including surgical residents and laboratory technicians, were screened by the hospital occupational health clinic and offered chemoprophylaxis because respiratory precautions were not taken during aspiration and excision of the bubo or during handling of the specimen in the laboratory. The household contacts were assessed by public health nursing staff—16 persons who lived on the premises were screened and offered antibiotic prophylaxis; 11 received doxycycline for 7 days, 5 received sulfamethoxazole/trimethoprim for 7 days; one person did not take prophylaxis as she was pregnant.

LAC DPH Environmental Health Vector Management staff assessed the property as not being good harborage for rats or ground squirrels, although feral cats were observed. Traps set for rodents inside and outside of the home yielded no competent *YP* vectors. Sera from two feral cats were tested and found negative for *YP*.

Day trapping activities in the local park frequented by the case yielded 34 California ground squirrels, which were flea infested. Serologic tests of squirrel sera showed no antibodies to *YP*.

After extensive re-questioning, the husband of the case reported that he and his friends hunted rabbits in the Mojave area of Kern County in early April 2006; the case did not go hunting and did not skin the rabbit but had handled the raw rabbit meat prior to cooking. On the hunting trip, the husband observed approximately 5 rabbits dead on the ground. A rabbit die-off in that region was also reported in May to California Department of Fish and Game by a local utility worker. Inspection of the hunting site by vector biologists from CDHS, Kern County Environmental Health and LAC Environmental Health revealed signs of a die-off at the time of hunting; five rabbits were obtained for testing. Trapping yielded 25 deer mice (*Peromyscus sp.*) and two jack rabbits. Five deer mice sera were positive by HA and one rabbit carcass was positive by DFA and culture for *YP*. PFGE results showed that the rabbit and human isolates had indistinguishable patterns and were unique when compared with 363 distinct patterns in the CDC database representing over 1,100 PFGE entries.

## CONCLUSIONS

This confirmed human plague case was likely caused by handling the carcass of an infected wild rabbit collected in the area of a recent plague epizootic. Rabbits are known to transmit plague to humans, through either infected fleas or contact with blood when dressing a dead animal. Symptoms were compatible with bubonic plague and development of sepsis, but because the case resides in an urban area, plague was not in the initial differential diagnosis which resulted in inadequate infection control precautions during the hospital stay. Plague should be considered upon clinical assessment of persons who have been in an endemic area or have handled mammals taken from endemic areas. Repeated interviews may be needed to reveal risk factors when disease occurs in a non-endemic area. Public education regarding risk of plague in endemic areas is needed.

Bioterrorism was ruled out early in the investigation, as the case had limited exposure outside the home and an apparently natural infection. Nevertheless, the FBI was informed of the case and investigation as per protocol for cases infected with potential agents of bioterrorism.

## REFERENCES

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