

Feline Plague in New Mexico: Risk Factors and Transmission to Humans

MILLICENT EIDSON, MA, DVM, LAUREN A. TIERNEY, MS, DVM, O. J. ROLLAG, DVM, THOMAS BECKER, MD, TED BROWN, MS, AND HARRY F. HULL, MD

Abstract: The epidemiologic features of 60 cases of feline plague from 1977–1985 in New Mexico are reviewed. The most frequent clinical presentation was lethargy, anorexia, fever, and enlarged lymph nodes or abscesses. A history of hunting rodents was reported in 75 per cent of all cases. Five human plague cases were associated with five feline cases. Recommendations are presented for preven-

tion of plague infection and transmission to humans, including restraining cats from roaming and hunting by neutering and keeping them indoors, treating them for fleas, and seeking medical care for febrile illnesses, especially when accompanied by enlarged lymph nodes. (*Am J Public Health* 1988; 78:1333–1335.)

Introduction

Plague is a clinically important disease of humans and cats caused by the bacterium *Yersinia pestis*. The disease is important because exposure to plague-infected cats places cat owners, veterinarians, and veterinary staff at risk of acquiring a potentially fatal infection.

Enzootic plague in rodents occurs only in the western half of the United States, but plague may be spread nationwide by a plague-infected cat transported from plague-endemic areas. From 1936–1986, cases of human plague have been reported from California, Washington, Oregon, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico, and Texas, although some of these cases have not developed symptoms or been diagnosed until reaching other states.*

Prior to 1980, only eight cases of plague had been confirmed in cats in this country.^{1–4} The first case in New Mexico was confirmed in 1977, resulting in the initiation of statewide feline plague surveillance. By reviewing New Mexico's confirmed cases between 1977 and 1985, the intent of this study was to characterize factors which predispose the cat to plague infections, and to examine subsequent risks to human contacts.

Methods

Between September 1977 and December 1985, New Mexico veterinarians were requested to report suspected cases of feline plague to the Epidemiology Office of the New Mexico Health and Environment Department, and to submit laboratory specimens for confirmation to the New Mexico Veterinary Diagnostic Services. Laboratory confirmed plague cases met one of the following criteria:

- a four-fold increase in passive hemagglutination (PHA) titer between acute and convalescent sera,
- a single titer of 1:32 or greater with symptoms,
- isolation of *Y. pestis* from culture material, or
- positive fluorescent antibody (FA) stain for *Y. pestis* in clinical or pathologic materials.

From the Office of Epidemiology (Eidson, Rollag, Hull) and the Community Services Bureau, Environmental Improvement Division (Brown), New Mexico Health and Environment Department, Santa Fe; Tufts University School of Veterinary Medicine, Boston (Tierney); Department of Medicine, University of New Mexico, Albuquerque (Becker). Address reprint requests to Millicent Eidson, DVM, Office of Epidemiology, NMHED, P.O. Box 968, Santa Fe, NM 87504–0968. This paper, submitted to the *Journal* November 3, 1987, was revised and accepted for publication March 16, 1988.

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*Quan TJ, Centers for Disease Control Plague Branch, Fort Collins, CO: based on CDC publications.

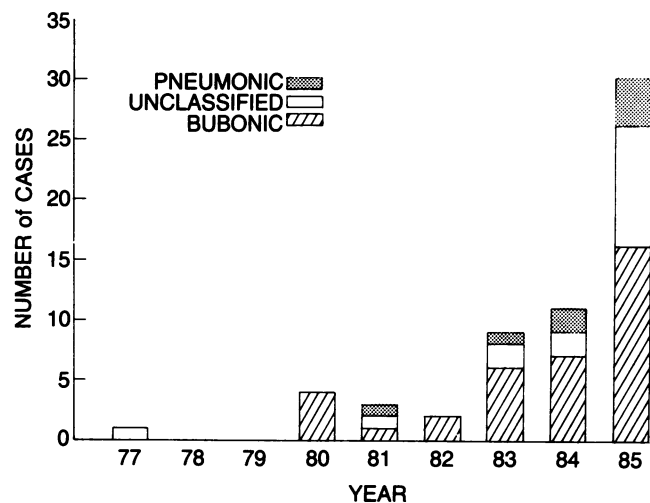


FIGURE 1—Reported Cases of Feline Plague in New Mexico, 1977–85 (n = 60)

Only cases which had been laboratory confirmed were included in this review.

A case of bubonic plague had one or more enlarged lymph nodes at clinical or pathologic examination. Cases were defined as pneumonic if they had clinically or radiologically diagnosed pneumonia. The pneumonia was defined as secondary if there was clinical or laboratory evidence of bubonic or septicemic infection, and primary if it appeared the source of the infection was direct inhalation of organisms from another pneumonic case. Cases with neither buboes or pneumonia were defined as unknown, presumably septicemic, plague.

During 1985, a standard interview was administered to owners and veterinarians from all 1985 laboratory-confirmed feline plague cases. This interview focused on risk factors for cats acquiring plague, including predatory habits, rodent contacts, and flea control measures. Rodent and flea surveys were also conducted around feline case homes, with live trapping of rodents for identification and serological testing for plague infection, and with flea collection from rodent burrows for species identification and plague testing. When possible, risk factor information for the 1977–1984 cases was reconstructed from case and laboratory reports.

Results

Feline plague was confirmed in 60 domestic cats in New Mexico between 1977 and 1985 (Figure 1). Half of these cases were reported in 1985. Sixty-five per cent of cases (39/60)

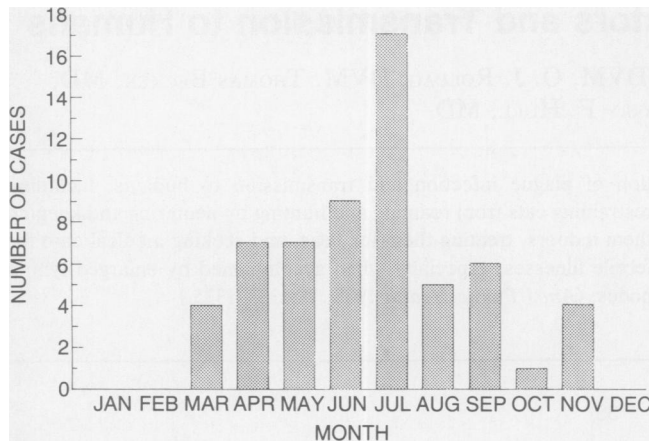


FIGURE 2—Seasonal Reports of Feline Plague in New Mexico, 1977–85 (n = 60)

were bubonic, 13 per cent (8/60) pneumonic, with three of the eight secondary to previous bubonic infection, and 27 per cent (16/60) neither bubonic nor pneumonic. Seventy-one per cent of bubonic cases presented with submandibular lymphadenopathy. Lethargy, anorexia, and high fever were frequently observed signs, with 45 per cent of cases (24/60) having all three clinical signs reported. Fifteen per cent (9/60) of the feline cases died, with an additional 23 per cent (14/60) euthanized.

The peak monthly incidence of feline plague between 1977 and 1985 was in July (Figure 2); no cases were reported from December through February. Affected cats ranged in age from three months to 15 years, with a mean age of three years. Neutering status was established for only 12 of the 60 cases (five females, seven males). In the 48 cats with unknown neutering status, 25 were male.

Seventy per cent (42/60) of the cases resided in rural locations, and the remainder in suburban locations. No cases were from strictly urban settings. Three-fourths of the cases (45/60) were reported to be rodent hunters; no owners reported that their cats did not hunt. Descriptions of rodents brought into households by cats included deer mice (*Peromyscus* species), rock squirrels (*Spermophilus variegatus*), prairie dogs (*Cynomys* species), and chipmunks (*Eutamias* species).

Information on fleas, flea control, and sleeping patterns was available only for the 30 1985 cases; one-fourth (7/28) reported seeing fleas on their cat prior to illness; six of 30 owners used flea control the week prior to illness; about half allowed their cats in the house (8/15) or to sleep with people (6/15).

All of the fleas trapped from areas around homes with plague-infected cats were rodent fleas. When looked for, fleas were not found on the cats or in the home in any cases, but were found near the homes in nine cases. The species of fleas found included: rock squirrel fleas (*Diamanus montanus*, *Hoplopsyllus anomalus*), prairie dog fleas (*Opisocrostitis hirsutus*, *Opisocrostitis tuberculatus cynomuris*), field mouse fleas (*Rhadinopsylla sectilis*, *Monopsyllus wagneri*, *Megarthroglossus divisus*), and ground squirrel fleas (*Thrassius bacchi*). Plague positive rodents were found in the area for three cases, and the species included rock squirrels (*Spermophilus variegatus*) and rabbits (*Sylvilagus auduboni*).

Five persons associated with five of the 1977–1985 feline cases developed plague. The first confirmed New Mexico

feline case was associated with a case of bubonic plague in a child bitten and scratched by the cat.^{2,5,6} In 1980, two children who were owners of two feline cases (with discharging abscesses) became ill with bubonic plague one and four days after their cats. The owner of a 1983 feline plague case developed plague after she had allowed her hunting cats to sleep with her and found flea bites around her waist five days before her onset of symptoms. Also in 1983, bubonic plague was diagnosed in the owner of a hunting pneumonic feline case, six days after the cat's death.

Prophylactic treatment of veterinary staff and/or owners with tetracycline was advised in over one-third of the feline cases (22/60). None of the prophylaxed human contacts developed plague. No one received prophylaxis for bites or scratches from plague-infected cats.

Discussion

As in humans, most feline cases are the bubonic form of plague. Submandibular and cervical nodes may become infected because of inoculation of *Y. pestis* organisms into oral lacerations or inter-dental crevices during ingestion of infected rodents, or from invasion of the organism through epithelial cells. When more distal nodes are involved, infection probably develops via percutaneous inoculation of *Y. pestis* by means of a flea bite.

Secondary pneumonic infections develop from spread of organisms from the lymph nodes or blood to the interstitium of the lungs, and then to the alveolar spaces. Primary pneumonic infections result from direct inhalation of organisms from oral lesions or from close contact with another pneumonic case. Primary pneumonic infections are rare in humans or cats and none of the New Mexico feline pneumonic cases were believed to be primary pneumonic plague.

The incubation period in the New Mexico cases could not be established because exposure could not be verified. In experimental infection the incubation period for plague in cats has been 24–48 hours.⁷

One hundred one human plague cases were documented in New Mexico from 1977 to 1985 compared to the 60 feline cases. The case fatality rate of 15 per cent (9/60) in cats was similar to the rate of 16 per cent (16/101) in humans during the same time period.

It is not known if the recent increase in feline plague cases in New Mexico is a result of higher incidence of infection, improved surveillance, or increased awareness on the part of veterinarians. The incidence of human plague appears to follow a five-year-cycle, possibly related to epizootics in host rodents with high mortality. The seasonal distribution of feline and human plague cases probably reflects reduced outdoor activities in the winter of rodents, rodent fleas, pets, and humans due to cold, snow, and shorter daylight hours. Dog and cat fleas do not appear to be involved in plague transmission, and are uncommon in plague endemic areas in New Mexico.

Based on the descriptive behavior of cases, a primary risk factor for feline plague appears to be hunting and ingesting rodents in plague-endemic areas. Evidence of fleas or flea bites on the cats was noted much less frequently by owners, but this may reflect observation bias. Finding plague-infected rodents and fleas near so few case homes may reflect incomplete feline plague case investigations, ingestion of dead rodents by predators, or dead rodents hidden away in burrows.

Any factor which increases cats' roaming and hunting should be a risk factor for their acquiring plague. The predominance of male cases and those for which neutering status was uncertain may reflect the tendency of unneutered cats to roam more, particularly if they are male.

Feline plague infection appears to be an important risk factor for human plague infection. Between 1977 and 1985 five New Mexico citizens developed plague after their cats. In four of the five cases, the *Y. pestis* organism could have been transmitted directly from the cats to their human contacts, via draining abscesses, bites, or pneumonic discharges. In one of the cases finding flea bites on the human case supports mechanical transmission of the plague organism by the fleas either from the infected cats or the rodents in the area. In addition to these New Mexico cases of human plague related to feline cases, there have been 10 others reported in the literature, three of whom died.^{1,8,9} The feline infection was laboratory confirmed in five cases^{3,8,10-12} and in feline contacts of the feline cases in two other cases.¹³⁻¹⁵ Four of the 10 human cases involved veterinarians.^{9,11,15-17}

Prevention of plague infection is important because the timely diagnosis required for effective treatment of plague-infected cats and human contacts is often difficult. Clinical signs are variable and may be similar to those of other diseases. However, any outdoor hunting cat from the Western US with a high fever and/or lymphadenopathy or sublingual abscesses should be considered a potential plague case. Confirmation of the feline case in time for human prophylaxis is most likely with a fluorescent antibody test (FA) on a lymph node aspirate.

Owners who live in plague-endemic areas should prevent their cats from hunting by keeping them indoors, eliminate harborage for rodents, such as wood piles, junk piles, or garbage, and dust cats with 5 per cent carbaryl or other approved insecticide flea powders weekly during the summer months.⁶ Flea collars are not considered to be as effective as regular dusting.

Veterinarians and their staffs can reduce their risk of acquiring plague by treating cats for fleas as soon as plague is suspected, isolating suspected cases to prevent human and

cat contact with draining abscesses and pneumonic aerosols, and using a mask and gloves when handling live or dead cats suspected to have plague.

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