

Tuberculosis in Circus Elephants

by C. Patrick Ryan, DVM, MPH

Veterinary Public Health, Disease Control Programs, MZ-1
Los Angeles County Department of Health Services

Five elephants were traveling in Los Angeles County with a circus for over two months in the summer of 1996. Two of the elephants had been coughing and one had lost several hundred pounds. It was presumed the weight loss was due to an abscessed tooth and the elephant was anesthetized for dental work and died. A necropsy was performed at the California State Diagnostic laboratory in San Bernardino County, a presumptive diagnosis of tuberculosis was made (80% of lung tissue involved, caseous lymphadenitis, acid fast organisms). The San Bernardino County Public Health Laboratory determined the agent to be *M. tuberculosis* using polymerase chain reaction (PCR) and culture.

All five elephants had been leased from a herd of elephants in Illinois in which tuberculosis had been diagnosed two years earlier. The trainer decided to return the remaining coughing elephant to Illinois and obtain a replacement for the dead elephant and the coughing one. The second elephant died in transit and was autopsied at Colorado School of Veterinary Medicine with similar findings and a presumptive diagnosis of tuberculosis.

Once the Los Angeles County Department of Health Services became aware of the situation the remaining three elephants located at the time at a local high school were placed under a hold order along with five ponies adjacent to them. The three elephants and the ponies were isolated from the public and not commingled. Once permission was obtained from various agencies involved (the California Department of Health Services, the California Department of Food and Agriculture, the USDA, and the San Bernardino County Health Department) the three elephants were shipped to Illinois and the five ponies to San Bernardino County.

Five people who were most likely to have had direct contact with the elephants were

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tested for TB by the Los Angeles County Department of Health Services. Only the head trainer, skin tested positive. An earlier skin test was not available for the trainer. The chest radiographs were negative and the individual was placed on the standard six month TB treatment program.

Inverse Zoonosis

Since *M. tuberculosis* is primarily a human pathogen, infections in animals have been called inverse zoonoses. Several domestic species can be infected with *M. tuberculosis* but typically causes progressive disease in the dog and rarely in the cat as it was seen in the United States when TB was common in people. Various species of wildlife are susceptible for *M. tuberculosis* and it can present a problem when people and wildlife intermingle such as in wild animal compounds, zoos and circuses. In 1958, Sweden eradicated TB in their cattle but in 1987 TB was introduced with imported

farmed deer. Since 1991 there has been eleven TB outbreaks in deer herds making it a major disease in deer. Deer parks in the United States and California have experienced TB requiring the depopulation of the herds and the disappearance of the parks.

Human Tuberculosis

The origin of *M. tuberculosis* not known but genetic concordance suggests that *M. tuberculosis* evolved in people from *M. bovis* sometime after the domestication of cattle. In feudal Europe with its poverty and crowded cities, tuberculosis became epidemic and was referred to as the "great white plague". In ancient times, the picture of shriveled and wasted people from TB was called phthisis (Greek to waste away) and consumption. When it became the number one killer it was also referred to as the "captain of all these men of death" and accounted for 25% of all human deaths in the first decade of the nineteenth century. European migrants brought human TB to the colonial United States. When the tuberculin test was introduced in 1907, 80% of the United States human population were positive reactors.

Prosector Risk

When examining animals suspected of tuberculosis precautions should be taken to reduce the risk of inoculation and inhalation of the bacilli during dissection. Autopsies on people not suspected of having TB continue to cause spread. A similar situation can be presumed to occur during necropsies. A simple thing such as wearing gloves and a mask is prudent during all necropsies since the prosector is generally not aware of what he/she is dealing with until after the fact.

Diagnosis

Clinical diagnosis is usually possible only after the disease is advanced and individuals

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begin shedding off the agent. Clinical signs are protean and depend on where the infection is located lungs, GI tract, other I. The tuberculin skin test (cell-mediated immune response) is used as an Indicator of possible infection and its effectiveness has been proven in people, cattle and primates. Tuberculin testing procedures have been applied to a variety of other species but it gives inconsistent results, In people, where the pulmonary form is common, chest radiographs may be useful. A definitive diagnosis requires cultural identification which takes a month or longer.

Control in People

In the early 1900s, several factors in industrialized nations began reducing human TB. In 1882, Koch discovered the causative agent and in 1947 the drug streptomycin became available with isoniazid following in 1952. During the 1950s, TB rates dropped by 75% and TB hospitals began closing their doors for lack of patients.

In 1983, for the first time in this century, the decline of human TB stopped in the United States and began increasing. Various factors accounted for this increase, the most important one being an increase in immigration of infected people. Especially, Asians and Hispanics. Today most human cases are in urban areas with the top three states being New York, New Jersey and California. Between 1985 and 1992, California reported a 52% increase in human tuberculosis. Los Angeles County has 48% more cases than California (Table) People at highest risk are: the homeless, people co-infection with human immunodeficiency virus (HIV) and the foreign born.

1991 Incidence* of Tuberculosis	
United States	10.3
California	16.3
Los Angeles County	24.1

Table 1. 1991 incidence (new cases) of human tuberculosis
 * cases/100,000 population

Control in Animals

In the early 1920s in Los Angeles County, over 30% of the dairy cattle had tuberculosis and it was required that the capital letter "T" be branded on cattle to prevent their sale and movement. Today, in the United States are close to the elimination of TB in cattle. In 1996, three newly infected cattle herds were reported in Texas and one in New Mexico The El Paso milkshed, a 60-mile area from Los Cruces New Mexico to 30 miles southeast of El Paso Texas, presents a problem in final control. Another problem is Imported cattle infected with TB. Several infected cattle in L'S feed-lots in the 1990s were traced to Mexico. In 1992, 613 cases of bovine TB were traced to Mexico and in 1993 Mexico instituted a national bovine TB eradication program.

Zoo animals, circus animals, and wildlife may also be infected and can present a risk to people and other animals. Its presence in native cervids (deer elk) has been documented. In Alpena Michigan, M. bovis has been detected in free-ranging white-tailed deer. The high prevalence suggests white tailed deer in the area may be reservoirs.

Treatment

In people, at least two drugs are required for treatment and when the disease is extensive additional drugs may be used as drug-resistant organisms are emerging Typically isoniazid in addition to at least one other drug are given daily for months.

Due to the serious public health risks, treatment of domestic animals is not recommended. Similar risks exist when dealing with non-domestic animals. In one study, seven of fourteen zookeepers exposed to a Southern white rhinoceros infected with M. bovis were presumed to have been infected via aerosols generated in the cleaning of the rhinoceros barn.

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