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THE COYOTE'S ROLE IN A RABIES EPIZOOTIC

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Abstract. In 1994, the canine rabies epizootic in South Texas was declared a state health emergency; a statewide rabies quarantine was enacted in 1995. Prior to 1988, rabid coyotes (*Canis latrans*) were reported only infrequently in Texas. In 1988, Starr and Hidalgo Counties, located in extreme South Texas, experienced an epizootic of canine rabies resulting in 11 laboratory-confirmed cases of canine rabies in domestic dogs and 6 cases in coyotes. By 1991, the epizootic had expanded approximately 100 miles north of the US-Mexico border and included 10 counties. During the next 3 ½ years, 10 additional counties became involved in the epizootic as it continued to move northward. There have been 644 cases of canine rabies documented in this 20-county area from 1988-95. Antigenic and genetic analysis revealed the ecotype primarily affecting domestic dogs and coyotes in South Texas to be urban Mexican dog (UMD). The epizootic is approaching large metropolitan areas. An increase in vaccination levels of domestic animals would help provide a barrier between rabid wild animals and humans.

Rabies, a fatal viral disease that is transmitted from animals to humans, has become a serious problem in Texas. A canine rabies epizootic (i.e., an epidemic in animals) began in 1988 in South Texas and has continued through June 1995. In July 1994, the ongoing rabies epizootic was declared a state health emergency. Subsequently, in January 1995, a statewide rabies quarantine was enacted

Between 1961 and 1988, only 25 rabid coyotes (*Canis latrans*) were reported in Texas. In 1988, however, a viral ecotype that had been confined to urban dogs became established in the coyote population along the US-Mexico border. This canine strain of rabies is readily transmitted from coyotes to domestic dogs and, subsequently, between domestic dogs (Clark et al. 1994). The transmission capability of the virus is pertinent from a public health standpoint because a rabies outbreak involving domestic animals greatly increases the chances for human exposure, as opposed to an outbreak that is maintained strictly in a wild animal population.

The first case was recorded in Starr County, located in extreme South Texas. Adjacent Hidalgo County became involved by the end of 1988, and these were the only 2 active counties through 1990. In 1991, the epizootic expanded to include 8 additional counties, followed by 4 more counties

between 1992 and 1993 and an increase of 4 new counties in 1994. The northward advance of the epizootic was now approximately 160 miles north of the US-Mexico border. During the first 6 months of 1995, 2 other counties were included in the epizootic. By mid-1995, the northeasterly movement of the epizootic had expanded to include 644 laboratory-confirmed cases of canine rabies in 20 contiguous counties

Methods

Case report form. Each case of animal rabies was investigated by Texas Department of Health (TDH) Zoonosis Control Division (ZCD) personnel. A standardized form, the Zoonotic Incident Case Report (ZICR), was used statewide. The form included date, location and description of the incident that caused rabies to be suspected and the animal's medical history (if known), vaccination status, and any human or domestic animal contacts. The policy of the TDH is to test only animals that have potentially exposed a human or a domestic animal. Active surveillance is not conducted routinely because an adequate sampling is provided under this policy.

Laboratory procedures. Brain tissue specimens were tested for rabies antigen by immuno-

fluorescence microscopy at the TDH Laboratory in Austin. Positive specimens were further tested with a panel of monoclonal antibody (MAB), each directed against a specific antigenic site on the rabies virus nucleocapsid and were evaluated by immunofluorescence microscopy (Smith et al. 1986). Differences in nucleotide sequences were examined by polymerase chain reaction (PCR) techniques (Smith et al. 1984, Smith et al. 1991).

Monoclonal antibody and PCR procedures identified 3 ecotypes common in terrestrial animals in Texas, which were designated as Texas skunk, Texas fox (TF), and urban Mexican dog (UMD). Although the Texas skunk ecotype was distinguished using only MAB techniques, the TF and UMD ecotypes could not be differentiated by MAB. Polymerase chain reaction techniques were required on specimens that were classified, according to MAB results, as Texas fox/Mexican dog (TFMD) to determine if they were the TF or UMD ecotype. The TF ecotype was found in southwest Texas in gray foxes (*Urocyon cinereoargenteus*) and animals infected by contact with gray foxes, and the UMD ecotype was found along the US-Mexico border in dogs, coyotes, and animals infected by dogs and coyotes (Clark et al. 1994).

Results and Discussion

The index case for the canine rabies epizootic in South Texas occurred on 3 September 1988 in Starr County, which is located on the US-Mexico border. A coyote that had fought with 2 vaccinated dogs was submitted for rabies testing and determined rabid by immunofluorescence microscopy. This was the first rabid terrestrial animal reported in the area in 18 years. Four weeks later, another rabid coyote was detected approximately 10 miles north of the index case. It was tested after it attacked 3 unvaccinated dogs.

Two months after the index case, a rabid coyote was reported near Rio Grande City, which is located on the US-Mexico border in south-central Starr County. This coyote also fought with 3 unvaccinated dogs prior to being tested. Three weeks later, the first rabid dogs in Starr County were recorded, both from the Rio Grande City area. By the end of 1988, there were 6 rabid coyotes and 2 rabid dogs reported from Starr County. Hidalgo County, adjacent to Starr County, became involved in the epizootic on 15 November 1988 when a 9-week-old dog was

confirmed positive for rabies. This incident occurred 35 miles southeast of the index case and involved a dog that had been mauled 12 days earlier by a wild animal that was suspected to be a coyote. From mid-November through December 1988, there were 9 rabid dogs recorded in Hidalgo County.

During the first 6 months of 1989, only 1 rabid coyote was reported from Starr County. However, from July through December, 15 rabid dogs (all from the Rio Grande City area), 4 rabid coyotes, and 1 rabid raccoon (*Procyon lotor*) were detected in this county. Hidalgo County continued to have recorded cases of rabid dogs; 19 dogs, 1 coyote, 1 domestic cat, and 1 raccoon were confirmed rabid during 1989. In 1990, the localized Rio Grande City epizootic continued and involved 15 dogs, 3 cats, and 3 coyotes. Two of the dogs had a known attack by a coyote within a month prior to developing clinical signs. In Roma, 15 miles upriver from Rio Grande City, 16 rabid dogs were reported. After state health department officials and local health professionals initiated aggressive rabies control measures, Hidalgo County had no reported rabies cases during 1990.

In 1991, the canine rabies epizootic expanded approximately 100 miles north of the US-Mexico border to include the following 10 counties: Brooks, Duval, Hidalgo, Jim Hogg, Jim Wells, Kenedy, Kleberg, Nueces, Starr, and Zapata. By the end of 1991, there were 25 dogs, 42 coyotes, and a raccoon, cat, skunk (*Mephitis mephitis*), and cow confirmed rabid. A human death attributable to canine rabies also occurred in 1991. The patient, a 55-year-old Starr County woman, had no history of exposure, but laboratory tests determined that she was infected with the canine strain of rabies virus.

Webb and Willacy counties became active in 1992, there were 41 rabid dogs, 70 rabid coyotes, and a rabid bobcat (*Felis rufus*), cat, cow, goat, horse, and raccoon reported from the 12-county area. Cameron County, located in the southernmost tip of Texas, was included in the epizootic in May 1993 when a raccoon with the canine strain of rabies was reported. La Salle County became the northernmost extension of the epizootic in November 1993. During 1993, positive rabies cases in the 14 South Texas counties included 42 dogs, 69 coyotes, 7 cats, 4 raccoons, 1 cow and 1 bobcat.

The northward movement continued in 1994 with the addition of Live Oak and McMullen

counties in March and Frio and Dimmit Counties in September, extending the epizootic approximately 170 miles north of the US-Mexico border. Confirmed rabies cases for 1994 included 32 dogs, 74 coyotes, 7 raccoons, 4 cows, 2 horses, 2 cats, and 1 bobcat. Another human death attributable to canine rabies occurred in South Texas in 1994. The 14-year-old Hidalgo County boy had no history of exposure, but the rabies virus was confirmed to be the UMD strain (Kelley et al. 1995). This second case of human rabies with the Texas canine strain of rabies virus emphasizes the fact that, because it involves the domestic dog population, the canine rabies epizootic is particularly dangerous to humans due to increased exposure rates.

During the first 6 months of 1995, Zavala and Atascosa Counties were included in the leading northern front of the epizootic. Canine rabies cases from January through June 1995 included 29 dogs, 57 coyotes, 10 raccoons, 8 cows, 6 cats, 2 bobcats, and 1 horse. From 1988 through June 1995, the epizootic encompassed 20 South Texas counties and 644 laboratory-confirmed cases of canine rabies consisting of 245 dogs, 327 coyotes, 25 raccoons, 21 cats, 15 cows, 5 bobcats, 4 horses, 1 goat, and 1 skunk (Fig. 1)

From 1989 through 1990, the number of rabid dogs reported in South Texas was greater than the number of rabid coyotes. In 1991, more rabid coyotes than rabid dogs were recorded per year; this trend has remained consistent through mid-1995. The shift in predominant rabid species may be attributed to increased vaccination levels in dogs initiated by increased public awareness and low-cost vaccination clinics. In Starr County, clinics have been sponsored by the Texas Department of Health, the U.S. Army, Rhone Merieux, Inc., the Texas National Guard, and a local veterinary practitioner. Consequently, vaccination levels in Starr County dogs that were exposed to a known rabid animal increased from 18% in 1988 to 50% in 1994.

Management Implications

The northernmost identified case of canine rabies was within 25 miles south of San Antonio. Based on the average spread rate of the epizootic since 1988, it will reach this large metropolitan area by the end of 1995 if it is not controlled. As in many major cities in the United States, San Antonio has an urban coyote population, which combined with an

estimated 75% unvaccinated dog population in the area, forms an explosive combination for the canine rabies epizootic.

To prevent the translocation of animals that play a critical role in the epidemiology of the canine rabies epizootic (and the gray fox rabies epizootic in west-central Texas) to unaffected portions of Texas or to other states/countries, a statewide rabies quarantine was enacted in January 1995 (Rules of the Board of Health, Rabies Control Act). The quarantine prevents movement within or out of Texas of any dogs, cats, or wolf-dog hybrids 3 months of age or older for which a current, official rabies vaccination certificate cannot be produced, plus any coyotes, indigenous foxes, or raccoons.

In addition, the Rabies Control Act was amended in May 1995 to prohibit the transportation or sale (or possession for purposes of transportation or sale) of any dogs or cats 3 months of age or older for which a current, official rabies vaccination certificate or tag cannot be produced, plus any animals that are defined in the Rules of the Board of Health as high risk for transmitting rabies (coyotes, foxes, raccoons, skunks, and bats).

An increased vaccination level in pets and livestock is very important for rabies prevention. Historically, human rabies cases declined when canine rabies cases decreased because of increased vaccination rates, even though rabies cases in wild animals were elevated during the same time period. In the early 1950s, the number of U.S. rabies cases in dogs and humans peaked. In the mid-1950s, dog and human rabies cases declined with the advent of highly effective rabies vaccine for dogs and maintained this lower level through the early 1990s. However, U.S. rabies cases in wild animals peaked in the early 1960s, the late 1970s and early 1980s, and again in the early 1990s.

People do not commonly encounter rabid wild animals; but rabid pets and livestock can bring the disease into the home or ranch area. Rabid domestic animals are 5 (Clark 1988) to 10 (J.C. Mahlow, TDH, pers. commun.) times more likely to come into contact with a human than are rabid wildlife. Vaccinated domestic animals can break the rabies transmission cycle by creating a buffer zone between rabid wild animals and humans. It is also beneficial to decrease the number of stray animals and increase knowledge of bite avoidance techniques. To ensure these actions, rabies education for government

employees, animal control officers, and the general public is essential.

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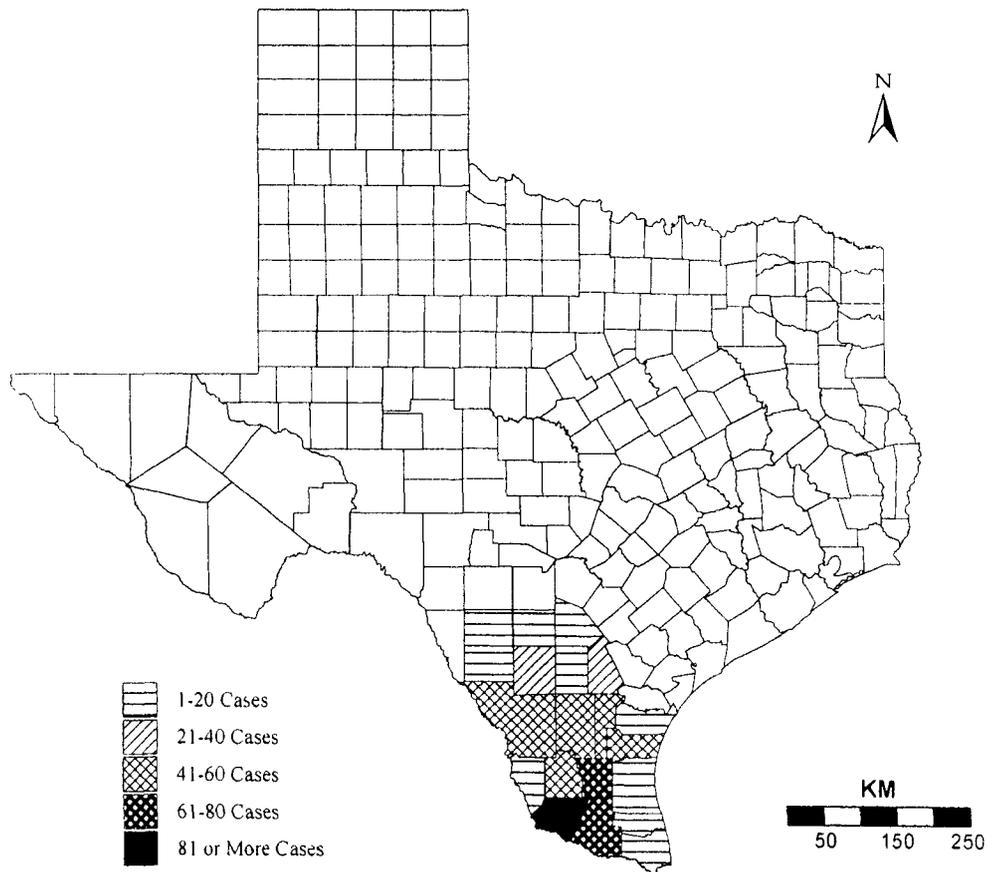


Figure 1. Rabies cases in south Texas during a rabies epizootic, 1988-95.