

REPTILE ZONOSSES: “DON’T KISS YOUR TURTLE”

Orlando Diaz-Figueroa, DVM, MS
Diplomate ABVP (Avian Practice)
Lake Howell Animal Clinic, Maitland, FL

With the growing popularity of exotic pets in the United States, the incidence of zoonotic diseases attributed to these pets should be expected to rise. Veterinarians play an important role in educating the public and should have an understanding of the epidemiology of these potentially devastating diseases. The purpose of this article is to introduce veterinarians to the most common zoonotic diseases encountered in reptile species.

BACTERIAL ZONOSSES

Salmonellosis

Salmonella spp. are gram-negative facultative anaerobes that are ubiquitous in the environment. These bacteria have been isolated from all of the different classes of animals. There are more than 2,400 different *Salmonella* serotypes, and they should all be considered pathogenic. Most animals appear to be asymptomatic reservoirs for this microbe. *Salmonella* spp. is primarily transmitted via the fecal-oral route or from contaminated fomites. Humans that contract salmonellosis from nontraditional species may experience headaches, nausea, vomiting, abdominal pain, enteritis, or septicemia. The incubation of *Salmonella* in humans is approximately 6 to 48 hours. Because of the inherent zoonotic risks associated with nontraditional species (eg, reptiles), ownership should be limited to cases that have adult supervision. Strict hygiene, including hand washing with soap, should be practiced to reduce the risk of exposure.

Individuals who are susceptible to *Salmonella* infections include the elderly, the very young, and those who are immunocompromised because of AIDS or immunosuppressive therapy. People with cirrhosis, diabetes, and sickle cell anemia are also particularly susceptible to severe *Salmonella* infection.

Salmonellosis in people usually manifests itself as diarrhea accompanied by abdominal cramps and fever. *Salmonella* can enter the bloodstream of people, become septicemic and cause meningitis, arthritis and other extraintestinal problems. Antibiotic treatment is usually limited to extraintestinal infection. Antibiotic given to people who have disease limited to the intestinal tract may prolong symptoms and can result in development of antibiotic resistant organisms.

Campylobacteriosis

Campylobacteriosis is a serious zoonosis. Although contaminated food (eg, poultry) is the primary source of *Campylobacter* spp., reptiles, such as chelonians, may harbor *Campylobacter jejuni* or *C. fetus*. The incubation of *Campylobacter* spp. is approximately 2 to 5 days. In general, the disease is self-limiting (10 to 14 days);

however, it may persist in the immunocompetent host. Humans with compromised immune systems should limit contact with reptiles or other species of animals that have been identified as *Campylobacter*-positive.

Mycobacteriosis

Mycobacterium spp. has a cosmopolitan distribution. *Mycobacterium* spp. has been isolated from all of the major classes of animals. Many of the *Mycobacterium* spp. that can infect animals can also infect humans. *Mycobacterium* spp. can be transmitted to humans and herpetofauna through aerosolization of contaminated respiratory secretions or direct skin contact, soil, or water. Pet owners should always practice strict disinfection protocols when handling their pets and limit contact when they have an open wound on their hands. Reptiles and amphibians can harbor *Mycobacterium* species that can also be found as opportunistic pathogens in humans, especially those who are immunocompromised. Examples include *M. marinum*, *M. chelonae*, and *M. abscessus*.

Dermatophilosis

Dermatophilus congolensis is a gram-positive filamentous bacterium with a life cycle that involves the release of spores from the filaments and the development of these spores to form germ tubes and new filaments. In humans and animals it causes exudative dermatitis and, crusty scabs. It has been found in cattle, sheep, horses, and some 18 other animals including seals, lizards, and even in polar bears. Handling of infected animals by humans can result in human disease. It has been isolated from pet Savannah monitor (*Varanus exanthematicus*). In immunocompromised humans it can attack the brain, lungs, and kidneys.

Lyme Disease and Ehrlichiosis

Lizards are also bitten by *Ixodes* ticks that harbor bacterial infections such as *Borrelia*, which causes Lyme disease, and *Ehrlichia*, which causes ehrlichiosis in humans and other animals. While these diseases may not be zoonotic in the sense a human could not casually become infected from contact with the lizard, the ectoparasite of the lizard could, conceivably, vector the disease to humans. A great deal of care must be taken when treating or removing ticks from such animals.

Miscellaneous Bacterial Infection

Reptiles can harbor many other bacteria that potentially are human pathogens, including *Aeromonas* spp., *Citrobacter* spp., *Klebsiella* spp., *Proteus* spp., and *Serratia* spp. Prevention of all such enteric infections depends on meticulous hygiene and sanitation. Reptile cages should be cleaned frequently and waste disposed of in a sanitary fashion. Perhaps the most important means of prevention is hand washing after handling the reptile, its cage, or contents. This is most important for small children and others who are uniquely susceptible to infection.

PARASITIC ZONOOSES

Cryptosporidiosis

Cryptosporidiosis is a common zoonotic pathogen. *Cryptosporidium parvum* is a coccidian protozoan in the family Cryptosporidiidae, suborder Eimeriina. Affected animals may be asymptomatic or present with chronic diarrhea. Individuals with compromised immune systems should limit their contact with *Cryptosporidium*-positive nontraditional species. It has been isolated in many different hosts including mammals, birds, and reptiles. There has been no documented evidence that reptilian cryptosporidiosis is zoonotic.

Trichinella

In 1995, a new species of *Trichinella* (*Trichinella zimbabwensis*) was discovered in farmed Nile crocodiles (*Crocodylus niloticus*) in Zimbabwe, where the mode of transmission was the consumption of the meat of slaughtered crocodiles, used as feed. To determine whether *T. zimbabwensis* affects poikilotherm vertebrates in the wild, monitor lizards (*Varanus niloticus*) and Nile crocodiles were collected in Zimbabwe and Mozambique. In 5 (17.6%) of the 28 monitor lizards from Zimbabwe, *T. zimbabwensis* larvae were identified. For the wild Nile crocodiles from Mozambique, species-level identification was not possible, yet immunohistochemical analysis revealed that 8 (20%) of the 40 animals harbored non-encapsulated *Trichinella* sp. larvae, which probably belonged to *T. zimbabwensis*. This is the first report of *T. zimbabwensis* in wild reptiles, and the findings are consistent with reports that vertebrates with scavenger and cannibalistic behavior are the most important hosts of *Trichinella* spp. The wide distribution of monitor lizards and crocodiles in Africa and the development of national crocodile breeding programs in many African countries should be taken into consideration when evaluating the risk of transmission of this parasite to mammals, including humans.

Pentastomiasis

Pentastomida is a phylum of parasites intermediate between arthropods and annelids. A majority of pentastomes mature in the respiratory tract of reptiles, particularly snakes and varanids lizard. Pentastomes typically have an indirect life cycle. Humans, an aberrant host contract the infection by consuming water or foods contaminated with eggs eliminated in the saliva or feces of snakes, by consuming raw or undercooked snake meat, or by handling infected reptiles and then placing contaminated hands in the mouth. Other intermediate hosts are infected through ingestion of contaminated water, plants, or the snakes themselves. *Amillifer armillatus* is the most common genera identified from pythonids and viperids, *Kiricephalus* spp from culebrids, and *Porecephalus* spp. from boids and crotalids. The former is best known as a human pathogen. Larval and nymphal stages are found in various human organs, most often the mesentery. The infection is often diagnosed coincidentally on x ray because the organism can show up as radio-opaque c-shaped object. At

present, no successful therapy exists against the larval forms in the incidental hosts. In snakes, pentastomes are difficult to treat with anthelmintic drugs because of the extraintestinal location of adult parasites. It may be possible to remove adult worms from the lungs of snakes endoscopically. The fact that humans can serve as incidental hosts for reptilian pentastomes should alert veterinarians to recognize the zoonotic potential of these parasites.

VIRAL ZONOOSES

West Nile virus (WNV) is a mosquito-borne flavivirus (Family *Flaviviridae*) that is transmitted by various species of adult *Culex* mosquitoes to a variety of mammals and birds. It emerged in North America in 1999 when it infected and caused the deaths of people, horses, and birds in New York. By the year 2001, WNV had spread into the southeastern US, including Florida. The continued expansion of WNV in North America presents an emerging threat to human and animal health in the Western Hemisphere.

Reptiles are known to be infected with several mosquito-borne viruses. Western equine encephalomyelitis virus (Family *Togaviridae*) was isolated from blood and found to overwinter in garter snakes (*Thamnophis* spp.) and the Texas tortoise (*Gopherus berlandieri*). Japanese encephalitis virus (Family *Flaviviridae*) was isolated from Chinese rat snakes (*Elaphe rufodorsata*) in Korea. In a survey in Venezuela, tegu lizards (*Tupinambis nigropunctatus*) were found to have antibody against eastern equine encephalomyelitis (EEE; Family *Togaviridae*) and Venezuelan encephalitis viruses (Family *Togaviridae*). In crocodylians, seropositive wild American alligators (*Alligator mississippiensis*) for EEE virus and farmed Nile crocodiles (*Crocodylus niloticus*) in Israel for WNV have been reported. Florida, Georgia, Louisiana, and Idaho have all experienced cases of WNV in alligators. Viremia data implicate the American alligator as a potential amplifying host for WNV in southeastern North America. In 2003, the first human case of WNV infection from a reptile occurred in Idaho. The mode of transmission did not come from the bite of an infected mosquito, but more likely from contact with the blood of infected, imported alligators.

Veterinarians may need to contact reptile owners about the possible role of the reptile in the disease and to encourage owners to house reptiles indoors during epizootic outbreaks. The potential role of reptiles and amphibians in the life cycle and epidemiology of WNV is not known.

Precautionary measures include mosquito abatement through habitat reduction, predation, and appropriate pesticide use; personal protection and use of mosquito repellents during outdoor activities.

TRAUMA (WOUND AND BITES)

All animal bites represent a potential for infection and sepsis. Any wound infection or necrotizing process in a reptile may contain potentially pathogenic organisms. A good example of this is stomatitis in snakes and lizards

which may contain *Staphylococcus* spp., *Shigella* spp., or *Pseudomonas* spp., all which are potentially pathogenic to humans. Envenomation from poisonous reptiles can result in death or permanent disability. No one should keep poisonous snakes as pets, and veterinarians are justified in refusing to treat extremely dangerous animals in their private practice. In many states is illegal to possess such animals without special license.

Most cases of traumatic injury can be prevented by sound husbandry techniques, including appropriate caging and restraint procedures.

MISCELLANEOUS INFECTIONS

Mycotic agents commonly isolated from the diseased reptiles can also cause infection in humans. Zoonotic transmission of fungal agents, although possible, has not been documented.

PREVENTION

Proper cleansing and hygiene is essential for preventing zoonotic infections. Individuals who are immunocompromised for any reason should avoid contact with amphibians, reptiles, and any other animals known to transmit zoonotic infection.

Zoonotic infections from reptiles and amphibians are entirely preventable. In general zoonoses from these animals are rare and they represent a small fraction of all the infectious diseases which occur. Nevertheless, when they do occur, they often engender very negative publicity for reptiles so all hobbyists should be involved in disseminating information to prevent such infection from occurring.

REFERENCES

1. Johnson-Delaney, CA. Reptile zoonoses and threats to public health. In: Mader DR (ed.): Reptile Medicine and Surgery, 2nd ed. Philadelphia: WB Saunders, 2006, pp 1017-1030.