EXOTIC COMPANION MAMMAL ZOONOSES: SMALL ANIMALS CAN HAVE BIG CONSEQUENCES

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Nearly two thirds of human diseases can be transmitted to animals. As veterinarians, however, we tend to use the term zoonosis when infections are transmitted from animals to humans.

An estimated 75% of emerging infectious diseases are zoonotic, mainly of viral origin, and likely to be vector-borne. Among the major causes of these emerging diseases are alterations in human behavior and modifications to natural habitats, consumption of bushmeat and other wild animals, development of ecotourism, access to petting zoos, and ownership of exotic pets. For exotic pet veterinarians, the latter two are the most important factors to consider.

Bacterial gastroenteritis and dermatophytosis are considered to be the most common zoonoses in exotic pets. Many other zoonotic diseases are diagnosed sporadically, but may have a detrimental outcome for the person who is infected. Besides knowledge of potential zoonotic diseases, it is important to know which measures should be taken to prevent infection. A selection of potential zoonotic agents, which have been found in exotic pet mammals, is given below.

BACTERIAL DISEASES
Salmonella spp

An estimated 3% to 5% of all cases of salmonellosis in humans are associated with exposure to exotic pets. A large portion of these cases are linked to exposure to reptiles, and, to a lesser extent, sugar gliders and hedgehogs. The most common symptoms in humans are headache, malaise, nausea, fever, vomiting, abdominal pain, and diarrhea. Symptoms usually occur within 12 to 24 hours after infection. Although most infections may be treated adequately, mortality in immunocompromised individuals has been described.

In the hedgehog Salmonella typhimurium is the most common pathogen associated with disease in humans. In East Anglia, however, the potential zoonotic S. enteritidis (PT11) has also been isolated from hedgehogs. Human health officials are concerned about the prophylactic use of antibiotics in exotic pets by breeders and wholesalers, as this may lead to antibiotic-resistant Salmonella strains. The use of prophylactic antibiotic treatments should therefore be discouraged and limited to clinical cases, with a proper indication. Care should be taken that the dose, course duration and route of administration are correct to avoid suboptimal therapy.

Streptobacillus moniliformis (Rat Bite Fever)

Streptobacillus moniliformis, the causative agent for rat bite fever, can either be spread through rat bites or through water and/or (unpasteurized) milk contaminated by rats. Although up to 50% of rats have been reported to carry the bacterium in the nasopharynx or excrete it via the urine, infections occur only sporadically. The incubation period is 1 to 10 days in humans. Besides a fever, most human patients show an erythematous rash and arthritis of multiple joints. In severe cases endocarditis may occur. The bacterium seems sensitive to macrolides and tetracyclines.

Francisella tularensis (Tularemia)

The first reports of tularemia are were lemmings in Norway (lemming fever) and Californian ground squirrels in the Californian county Tulare. In the US, wildlife reported to be carriers of the bacterium consist of ground squirrels, cotton-tail rabbits, hares, and jack rabbits. In Europe, rabbits, water rats, and other rodents may carry the bacterium. Transmission occurs usually through tick bites (or other biting insects) [type 2], but may also be associated with hunting (contact) [type 1] or consumption of infected material [type 3]. Airborne infections [type 4] may occur through inhalation of contaminated dust of infected hay. The latter route seems to be the most likely when dealing with privately kept species.

The infection causes ulceroglandular, plaque-like lesions. The incubation period is 2 to 6 days. If left untreated lesions may persist for months. Treatment with aminoglycosides, eg. streptomycin, is recommended for a period up to 14 days. For endemic areas, vaccination may be considered.

Although the infection seems to be most commonly associated with wildlife, a 24-year-old man seroconverted during an outbreak of tularemia in prairie dogs (caused by Francisella tularensis holartica [type B], the less virulent strain); this man only showed atypical signs of the disease.

PARASITIC DISEASES
Baylisascaris procyonis

Baylisascaris procyonis is a roundworm that is commonly found in raccoons (up to 70% and 90% in adults and juveniles, respectively). These animals are increasingly kept as exotic pets in the Netherlands, but also live in close proximity to homes in the US. Raccoons can shed enormous amounts of eggs. When these eggs are consumed by an animal, other than a raccoon, the larvae will migrate through tissues and may eventually invade the eyes and brain (5% to 7% of cases). The latter may lead to severe disease and even death. Currently, there is no effective treatment available for the larval stage of B. procyonis.

Although only a few cases of larval migrans have been reported in humans, it should be discouraged to keep raccoons as pets. For the same reason, feeding raccoons in your back yard is not advised, as this will increase the risk of contaminating the yard with B.
**Encephalitozoon cuniculi**

*Encephalitozoon cuniculi* is a microsporidial infection that is commonly associated with disease in rabbits. In humans, severe neurologic disease has been reported due to infection with *E. cuniculi*. Besides neurologic signs, AIDS patients were shown to display signs of hepatitis and nephritis. *E. cuniculi* could be isolated from the urine of some of these patients. The isolates were identified to be of rabbit origin. It should therefore be discouraged to AIDS patients to keep rabbits as pets.

Treatment of *E. cuniculi* is difficult because of its intracellular location. Albendazole is considered to be very efficacious against *E. cuniculi*, and may eliminate the infection completely.

**VIRAL DISEASES**

**Rabies**

Rabies is caused by a Lyssavirus. The virus replicates in all warm-blooded animals, and infection is fatal in nearly all cases. Transmission of the virus usually occurs when the infected animal is moribund. Each year, between 50,000 and 60,000 people die from rabies. Over 90% of these deaths occur in the tropics, resulting from canine bites. In Northern America, however, bat bites are responsible for more than 90% of human infections in the past 15 years. Of the confirmed rabies cases in animals in Northern America, over 60% consists of raccoons and skunks, and another 20% of different species of bats. In 2005, a rabbit was confirmed to have died from rabies as well.

Veterinarians who work with wildlife and exotic animals should be vaccinated in areas where rabies is endemic. Even when you have been vaccinated, treatment against rabies should commence directly after possible exposure to the virus. Exposure may either consist of a bite from a rabid animal, or contact with saliva of such an animal. It is therefore advised to never touch a bat, whether it is dead or alive. Rabies immune globulin and rabies vaccine are included in the treatment protocol.

Treatment should not only be given to people with known contact to the virus but also when a bat is found within the room of a sleeping person, an unattended child, and/or a mentally disabled or intoxicated person.

During a recent joint OIE/WHO/EU conference the Director General of the World Organization for Animal Health (OIE), Dr. Bernard Vallat said; “It is the prime responsibility of the veterinary profession to apply its knowledge and skills in animal disease control in order to create a buffer between the animal source of the disease and susceptible human beings.”

As exotic animal veterinarians we should at least vaccinate all dogs, cats, ferrets, raccoons, skunks, fennic foxes, and other canids which come into our practice.

**Lymphocytic Choriomeningitis (LCM)**

Lymphocytic choriomeningitis (LCM) is caused by an Arenavirus. LCM is a common infection in laboratory mice, rats, and hamsters, but is rarely transmitted to humans. Approximately 5% of wild house mice are infected with LCM. Excreta of these mice are considered the most likely source of transmission of LCM infections in pet rodents and humans. Approximately 5% of humans have antibodies against LCM, indicating that they have once been infected with the virus. The great majority of LCM infections is benign and may give rise to symptoms such as fever, malaise, coryza, muscular pain, and bronchitis. Meningeal forms are also possible and may include headache, paralysis, and personality changes. In rare instances severe meningoencephalomyelitis may lead to death of the patient.

LCM infections can be passed from a pregnant woman to her unborn child. Intrauterine infections may lead to hydrocephalus and retardation of the infant.

**Monkey Pox**

In 2003, a total of 71 persons were infected with monkey pox. These people had either been in direct contact with prairie dogs or had been on the premises where prairie dogs were kept. The incubation period ranged from 1 to 31 days.

These prairie dogs appear to have been infected by Gambian giant rats and dormice, which had been imported from Ghana. The presence of monkey pox was confirmed in prairie dogs, a Gambian giant rat, some dormice and rope squirrels. Because many of the imported rodents could not be traced, no human cases of monkey pox infection could be directly linked to these other rodents.

This case series illustrates the risk of importing animals and the need for a thorough tracing system of animals during the distribution process from the time of import until the sale to the end-user.

**FUNGAL DISEASES**

**Dermatomycosis**

Dermatophytosis is probably the most common zoonotic disease transmitted by pet exotic mammals. The most common dermatophyte in exotic pets is *Trichophyton mentagrophytes*. Infection may take place either through direct contact with an infected animal, which may be an asymptomatic carrier, or via an infected environment. The typical lesions in humans are centrifugally growing, roughly circular areas of variable erythema, scaling and desquamation. A central healing area may be present. While *Microsporum canis* generally causes a mild inflammation, *T. mentagrophytes* frequently produces more severe lesions.

Infections in humans are generally self-limiting, and respond well to topical imidazole treatment. Terbinafine is an allylamine antifungal that has proven to be effective local as well as systemic, often with a more rapid response time and/or higher response rate than the imidazoles.
PREVENTION OF ZOONOSIS

Of the list of potential zoonotic agents, many are not frequently associated with infections in humans. The humans which are at greatest risk are YOPI's (ie, young [below 5 years of age], old, pregnant, immuno-compromised). It should be advised that people who belong to this group do not keep exotic pets, especially those which are less frequently kept.

The infections which do occur frequently (eg, dermatophytosis, salmonellosis) can often easily be prevented by taking proper hygienic measures. It is surprising to see how little educational information was available in petting zoos before the year 2000. Minimal recommendations should include no eating and drinking while animals are being handled, and washing of the hands after handling animals (ie, facilities should be present). In addition, cages of exotic pets should not be cleaned in sinks where food may be prepared for human consumption.

As practitioners we should function as role models. Wash your hands after each animal examination, wear scrubs or a lab coat when working with animals, do not allow drinking and eating in the clinic (a separate area should be present). Before eating, drinking, or smoking, take of your scrubs and wash your hands. In the Netherlands some practices have developed a “no lab coat” policy. The idea behind this policy is to lower anxiety of the animals while being examined. From a hygienic standpoint, however, this policy should be discouraged as this highly potentiates the risks of transmitting zoonoses.

REFERENCES
