

# Zoonoses of Small Mammals



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## Overview

- Small mammal pets, including rodents (eg, mice, rats, gerbils, hamsters, guinea pigs, chinchillas, degus), rabbits, carnivores (eg, ferrets), insectivores (eg, hedgehogs), and marsupials (eg, sugar gliders), have zoonotic potential, but reported cases are rare.
- Veterinarians should be cognizant of potential zoonoses while pragmatic about actual risk for or incidence of transmission.
  - For example, sugar gliders may develop fatal infections with *Toxoplasma gondii* but cannot pass infectious oocysts in feces, posing negligible risk to owners.
- Zoonoses may range from very mild (eg, cross-species ectoparasitic infection) to potentially life threatening (eg, lymphocytic choriomeningitis).
- Because small mammal pets are largely nontraditional species, knowledge of zoonotic potential (eg, for veterinary practitioners, owners) may be lacking.
  - However, it is important that practitioners review risks with owners.
- Risk for zoonotic infections is increased for some individuals in the home (eg, very young, elderly, immunocompromised/immunosuppressed).

- Zoonotic diseases may be carried and/or transmitted by multiple small mammal pet species (eg, salmonellosis can be transmitted by mice, rats, and hedgehogs<sup>1</sup>) or limited to a particular species (eg, influenza from ferrets).

## Non-Species-Specific *Salmonella*

- *Salmonella* spp (primarily *S enterica* ser Enteritidis and *S enterica* ser Typhimurium) have been associated with outbreaks of septicemic disease and death in rodent and lagomorph colonies.<sup>2</sup>
- Although clinical disease from *Salmonella* spp is most commonly associated with guinea pigs, all small mammal pets can become infected.
- Small mammals may be subclinical (ie, nonclinical) reservoirs; from 2003–2004, 28 cases of *S enterica* ser Typhimurium were reported in rodents purchased at retail pet stores. Human transmission from vacuum-packed feeder mice has also been documented.<sup>3</sup>
- Pet rodents with clinical salmonellosis do not show diarrheal disease; sudden death from septicemia with necrosis in multiple organs is most commonly seen.

- Although the transmission of *Salmonella* spp is historically less from small mammal pets than from reptile pets, veterinarians should stress proper handwashing following handling and caution small mammal placement in households with children under five years of age or immunosuppressed individuals.

## *Yersinia* spp

- *Yersinia pseudotuberculosis* and *Y enterocolitica* may present similarly to *Salmonella* spp in rats, guinea pigs, and chinchillas (Figure 1, next page); they are likely caused by wild rodents shedding the bacteria.
  - Rodents are not considered an important risk for transmission to humans, as rodent and human serovars differ.
- *Yersinia pestis*, the historic cause of the black death, may be transmitted by fleas to wild rodents as sylvatic plague.
  - Although the possibility of transmission from infected fleas from a wild-caught prairie dog exists, reports of zoonotic transmission of this agent from pet rodents to humans are not documented.

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### *Campylobacter* spp

- *Campylobacter* spp (specifically *C jejuni* and *C coli*) have been isolated from several small mammal species, including hamsters and ferrets.
- Approximately 6% of human campylobacteriosis has been attributed to pet exposure, although this is primarily a result of infected dogs, cats, pigs, and chickens.<sup>4</sup>
- *C cinaedi* is normal flora of the hamster intestine and may be a pathogen of humans; however, currently no reports of this disease occurring from interaction with hamsters exist.

### *Mycobacterium* spp

- Mycobacteriosis, diagnosed in various small mammal pets, results from infection by atypical mycobacteria (ie, the *Mycobacterium avium*-intracellulare complex [MAIC; Figure 2] or mycobacteria other than tuberculosis [MOTT]).
- In small mammals, documented mycobacteria include *M genavense* (rabbits, ferrets) and *M celatum* (ferrets).
- *M lepraemurium* may result in skin or generalized infections in laboratory mice but has not yet been reported in pet mice.
- While documentation of transmission of mycobacterial infections from small mammal pets to humans is not yet documented, the transmission of infection from other species warrants caution in maintaining animals with documented infections in houses with small children or immunocompromised individuals.<sup>5</sup>

### *Bordetella bronchiseptica*

- *Bordetella bronchiseptica*, a common pathogen of many animals, may be isolated from subclinical rabbits and dogs.
- In the guinea pig, *B bronchiseptica* can result in an often fatal bronchopneumonia.

- One case of zoonotic transmission of *B bronchiseptica* from rabbit to human has been reported<sup>6</sup>; most reported cases have involved infected dogs.

### Rabies

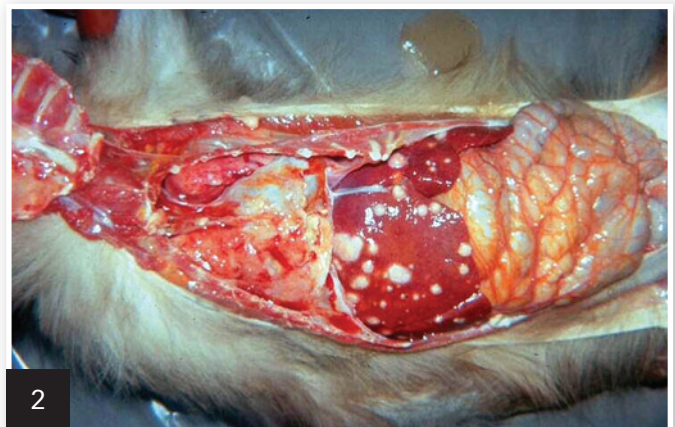
- Rabies, a viral infection resulting in fatal meningoencephalitis in several species, is considered rare in ferrets and extremely rare in rodents and lagomorphs.
- Currently, transmission of rabies from small mammal pets to humans has not been documented.
- Interactions between infected ferrets and humans have been limited by exposure and requirements for postexposure prophylaxis only; there is no documentation of transmission to date.
- Ferrets require annual rabies vaccination.

### Lymphocytic Choriomeningitis

- Mice, rats, guinea pigs, and hamsters may act as reservoirs for lymphocytic choriomeningitis virus (LCMV).
- This arenavirus often results in subclinical infection in susceptible rodent hosts, although wasting disease has been reported in affected hamsters.
- In humans, disease ranges from flu-like symptoms to life-threatening aseptic meningitis.
- The large number of cases associated with hamsters suggests that they may amplify the virus.
- Seroconversion to LCMV to zoo veterinarians bitten by or performing necropsies on infected nonhuman primates has occurred.<sup>7</sup>

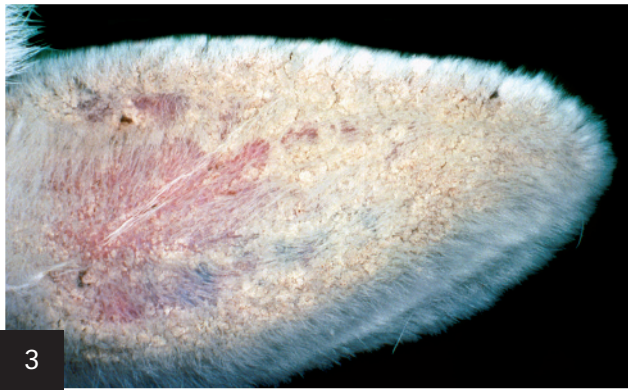


1 Multifocal abscesses showing embolic spread in a chinchilla liver. This is characteristic of gram-negative sepsis, in this case *Y enterocolitica*; *Salmonella* spp infections may present identically.



2 *M avium* infection in an albino ferret

LCMV = lymphocytic choriomeningitis virus, MAIC = *Mycobacterium avium*-intracellulare complex, MOTT = mycobacteria other than tuberculosis



**3** *Sarcoptes scabiei* infection on the pinna of a rabbit. There is marked hyperkeratosis and inflammation of the ear (result of self-mutilation).



**4** Extreme pruritus and self-trauma in a guinea pig infected with *Trixacarus caviae*. Severe pruritus may result in self-mutilation and frenzied behavior.

### Hantavirus

- Hantaviruses are a group of up to 30 bunyaviruses which may cause a severe, even fatal, human illness.
- Transmission from subclinical, infected mice or rats may occur through urine, droppings, or saliva.
- While most cases result from contact with wild rodents, cases have been associated with laboratory outbreaks in Europe and Asia.
  - A recent case of human hantavirus in Wales was traced to two pet rats.<sup>8</sup>

### *Cryptosporidium* spp

- Cryptosporidiosis, a protozoal disease, affects almost all small mammal pets, as well as a range of mammalian, avian, and reptile hosts.
  - Most infections in nonhuman species are subclinical.
- Cryptosporidia are largely species-specific parasites.
  - Although zoonotic human infections are not uncommon, most have been associated with livestock.
  - An outbreak of a rabbit genotype of *Cryptosporidium* spp was reported following ingress of a wild rabbit into a treated water tank.

### Scabies

- Scabies has been reported in more than 300 mammalian species infected with *Sarcoptes scabiei* (Figure 3).
  - Comparable syndromes may result from similar mite species in which adults live in the hyperkeratotic stratum corneum of the epidermis (eg, sarcoptic mites, *Trixacarus caviae* of the guinea pig [Figure 4]).
  - *Cheyletiella parasitivorax* has likewise resulted in human infection.
    - Rabbits are often the main host of *C parasitivorax*.

- Contact transmission between affected pets and humans may result in an itchy, red rash (ie, scabies).
  - Arm skin is particularly susceptible.
- Zoonotic scabies is self-limiting in humans, as sarcoptic mites are unable to complete their life cycle in humans.
  - Lesions are considered a result of dying mites.
- True human scabies, the result of human-specific mites, results in significantly worse lesions.

### Dermatophytosis

- Dermatophytosis has been documented in all small mammals, although it is most commonly identified in rabbits and guinea pigs.
- *Trichophyton mentagrophytes* is the most commonly identified dermatophyte, although *Microsporum canis* may be seen in pet rabbits and guinea pigs, especially those in households with dogs and cats.
- Up to 25% of human dermatophytosis cases are attributed to animal exposure.

### Flea-Related Infestation

- Fleas may occasionally jump from small mammals to humans.
- Most flea cases involve *Ctenocephalides felis* or *C canis* infections in multispecies households.
- Rats, guinea pigs, or other pet rodents can harbor plague-containing fleas in endemic regions.

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## Species-Specific Human Zoonoses

### Ferrets

- Ferrets are easily infected by both type A and B influenza viruses, prompting widespread use of ferrets in influenza research. Natural outbreaks of human influenza A, pandemic human H1N1, and swine origin H1N1 viruses have been documented.



- While cases of human-to-ferret transmission of influenza have been documented, there is only anecdotal information concerning transmission of influenza from ferrets to humans.

### Rats

- *Streptobacillus moniliformis*, the causative agent of rat-bite fever, may result in multisystemic inflammation, abscesses, and septic arthritis.



- Although most bite cases arise from wild rodents, cases have been documented in pets.<sup>9</sup>
- Leptospirosis, particularly *Leptospira interrogans*, may be harbored by rats, especially wild rats or facilities in which exposure to the urine of wild rats may occur.
  - While documented cases are lacking, owners should realize that infected pets may harbor and shed the agent, and as is the case for most bacterial agents, personal hygiene is recommended to prevent infection.
- Poxviral infections have rarely been identified in association with pet rats.
  - A 2009 outbreak of cowpox was seen in four humans.<sup>10</sup>
  - A 2003 outbreak of monkeypox from infected prairie dogs originated in imported Gambian pouched rats.<sup>11</sup>

### Other Risks

#### Allergic Reactions

- Although not a zoonotic disease, allergic reactions may be problematic with rodent or rabbit dander.
  - Allergic reactions have been reported in up to 15% of humans exposed to rodent and lagomorph dander.<sup>9</sup>
- Exposure to aerosolized rat urine may result in severe respiratory allergies in sensitized individuals.
- Ferrets are known for being relatively hypoallergenic.

#### Trauma to Humans

- Traumatic events, similar to those seen with other domestic species, include bites and scratches and may occur with small mammals (eg, rabbits, hamsters, ferrets).
- Resultant breaks in the skin may serve as portals of entry for opportunistic agents.

### Basic Preventive Measures

- Overall risk for zoonotic disease can be reduced by incorporating preventive measures:
  - Preventing high-risk owners from contact with or caring for certain small animal species
  - Encouraging good hygiene practice
  - Educating owners and family members on best practices of handling small mammal pets ■ **cb**

See **Aids & Resources**, back page, for references & suggested reading.

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