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Potential Zoonotic Diseases in Personnel With Contact to Laboratory Rodents

Horatiu V. Vinerean DVM, DACLAM
Director, Laboratory Animal Research
Attending Veterinarian

What is a Zoonotic disease?

- Zoonotic disease: a disease that can be transmitted from animals to humans or from humans to animals.

Examples of Rodent Zoonotic Diseases

Viral

- LCMV (Lymphocytic Choriomeningitis Virus)
- Hantavirus

Bacterial

- Salmonellosis
- Rat Bite Fever
- Leptospirosis

Parasites

- Tape Worms

Potential for Exposure

- Due to the use of SPF animals and extensive serological screening of animals, these diseases are encountered only in the wild rodent population.
- However the potential for introduction into the facility and exposure of animals and humans to these agents does exists.

Lymphocytic Choriomeningitis Virus (LCMV)

- Lymphocytic choriomeningitis, is a rodent-borne viral infectious disease. Mice, hamsters, guinea pigs, and primates, including man, are susceptible to infection. Wild mice are the viral reservoir.
- The disease in humans is usually either asymptomatic or presents with flu-like symptoms, however, severe CNS disease can occur and can lead to death

Mode of Transmission

- Humans can develop LCMV infection from exposure to urine, droppings, saliva, or nesting material of infected rodents.
- LCMV infection can also occur when these materials are inhaled or directly introduced into broken skin or into the nose, eyes, or mouth, and possibly by a bite from an infected animal.
- LCMV infection can be transmitted to fetuses or spread through organs transplanted from an infected donor.

Transplantation Risks

- In the spring of 2005, LCMV was determined to be the cause of three deaths in recipients of organ transplants, all of whom had received organs from the same donor. LCMV was later found in the organ donor's pet hamster.
- Infected hamsters are producing large quantities of virus and present a high zoonotic risk.

Salmonellosis

- There are 2500 known serotypes of *Salmonella, but S. enteritidis* and *S. typhimurium* are most frequent isolated from mice.
- Salmonella is most commonly associated with insufficient hygiene or inadequately cooked food during food preparation.
- Salmonella may be found in the feces of some pets, especially those with diarrhea, with reptiles most likely to harbor Salmonella. Handling these animals exposes humans to infection.

Salmonellosis - Symptoms

- Most common symptoms include diarrhea, fever, and abdominal cramps. The illness could be self limiting, but in some instances the diarrhea may be severe that the patient needs to be hospitalized and treated promptly with antibiotics and fluid therapy.
- Reportable disease in humans.

Rat Bite Fever (Haverhill Fever)

- Rat Bite Fever is a disease condition caused by Strebtobacillus moniliformis, a comensal, G-negative, pleomorphic rod that can exist as non-pathogenic L phase variant in vivo, but it can revert to virulent bacillus form.
- Present in the upper respiratory tracts and oral cavities of **asymptomatic** rats, that can transmit it to mice.

Rat Bite Fever - Mode of Transmission

- Human infection can result from a bite or scratch from an infected or colonized rat, handling infected rats, or ingestion of food or water contaminated with infected rat excreta.

Symptoms of Rat Bite Fever

- Fever, myalgia, arthralgia, vomiting and headache typically occurs within 2--10 days of exposure and is usually followed by a maculopapular rash on the extremities.

Maculopapular rash

Hantavirus

Primary Species:

- Sin Nombre - HPS
- Hantaan - HFRS
- Puumala - Mild HFRS
- Seoul - Mild HFRS

Hantavirus Pulmonary Syndrome (HPS)

- Hantavirus pulmonary syndrome (HPS) is a deadly disease transmitted by infected rodents. Hanta virus is maintained in nature by a wide variety of wild rodents (Cotton rat and deer mice are important reservoirs for the virus).

Hantavirus Pulmonary Syndrome (HPS)

- Sin Nombre, or the “No Name Virus” was the cause of the “Four Corners” outbreak in 1993 (an area of the Southwest shared by New Mexico, Arizona, Colorado, and Utah. A number of previously healthy young adults suddenly developed acute respiratory symptoms; about half soon died)

Hantavirus Hemorrhagic Fever with Renal Syndrome (HFRS)

- Hantaan - HFRS is transmitted by Apodemus species.
- Puumala, carried by the bank vole (Clethrionomys glareolus) & Seoul, carried by rats of the genus Rattus, are both milder forms of HFRS. Disease is most commonly transmitted by rodent respiratory secretions, saliva, urine, and aerosolization of dried fecal matter.
- As far as disease implications in the laboratory setting, numerous cases have occurred in labs outside the U.S., and in personnel involved in field studies, but to date, no laboratory cases have been reported in the U.S.

Distribution* of *Peromyscus maniculatus* and Location of HPS Cases as of July 6, 2005

Total Cases (N=396 in 30 States)

*Rodent distributions from: Burt WH, Grossenheider RP. A Field Guide to the Mammals. 3rd ed. New York, New York. Houghton Mifflin Company. 1980

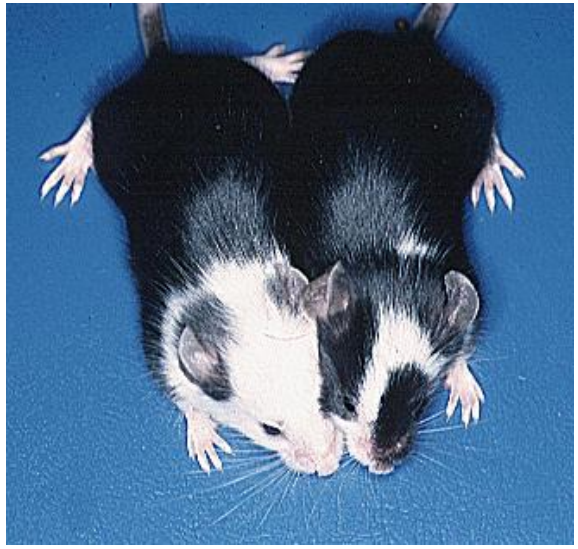
CDC

HPS Symptoms

- Early symptoms include fatigue, fever and muscle aches, especially in the large muscle groups-thighs, hips, back, and sometimes shoulders, headaches, dizziness, chills, and abdominal problems, such as nausea, vomiting, diarrhea, and abdominal pain.
- Four to 10 days after the initial phase of illness, patients experience coughing and shortness of breath, as the lungs fill with fluid.

Leptospirosis

- Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*.



Leptospirosis - Source of Infection

- Many different kinds of animals carry the bacterium; they may become sick but sometimes have no symptoms.
- Leptospira organisms have been found in cattle, pigs, horses, dogs, rodents, and wild animals.

Leptospirosis - Mode of Transmission

- Humans become infected through contact with water, food, or soil containing urine from these infected animals. The disease is not known to be spread from person to person.

Leptospirosis - Symptoms

- Symptoms of leptospirosis include high fever, severe headache, chills, muscle aches, and vomiting, and may include jaundice (yellow skin and eyes), red eyes, abdominal pain, diarrhea, or a rash.
- If the disease is not treated, the patient could develop kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure, and respiratory distress. In rare cases death occurs.

Tape Worms

- Rodentolepsis nana (dwarf tapeworm) has a direct or indirect life cycle, with cockroaches, grain beetle and fleas as intermediate hosts. Humans are susceptible to infections with *R. nana*; since autoinfection can occur (direct life cycle), a heavy parasite load may quickly develop.

- Clinical Signs: Usually there are no external signs of infection. However, catarrhal enteritis, diarrhea, emaciation and chronic weight loss may occur with heavy infestations.

Fungi

- Pneumocystis carinii produces pneumonitis in immunosuppressed animals and can infect immunosuppressed humans.

- Trichophyton mentagrophytes (ring worm) can be transmitted to humans with contact with animals.

Animal Contact Risks

- Commercial suppliers and FIU Laboratory Animal Research Department screen the animals for these zoonotic diseases, so the risk of acquiring any of them at work is infinitesimal.

- However, the importance of PPE on the job cannot be stressed enough. A new disease outbreak is always a possibility, so each animal should be treated as a potential disease carrier.

Prevention of Zoonotic Diseases

- Many rodent diseases are carried by wild rodents. In many cases, disease outbreaks among laboratory rodents are caused by accidental interaction with wild rodents.
- ALWAYS use provided Personal Protective Equipment, wash your hands after handling laboratory animals or their waste.
- In many cases pregnant women and immunosuppressed people are more susceptible to the harmful affects of these diseases.

Prevention of Zoonotic Diseases

- If you become sick and have to see a Physician, tell him/her that you have had contact with animals so this information can be considered when formulating a differential diagnosis.