



Biosafety Tips

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Biosafety Tips brings you practical approaches to biosafety or “news you can use.” If you are looking for a useful and sensible solution to a biocontainment problem or perhaps a reference to help convince a skeptical researcher of the need for caution, this is the place to look. In this column I will share some biosafety insights for managing a variety of workplace situations. I welcome feedback or suggestions for future topics. Please e-mail any comments or suggestions to karen_byers@dfci.harvard.edu or to Co-Editor Barbara Johnson at barbara_johnson@verizon.net.

Outbreaks of Zoonotic Infections in Rodent Facilities: Part III

The history of infections associated with rodent colonies provides invaluable insights into the development of current standards for animal facilities and husbandry practices. Published reports on LCMV infections in immunodeficient mice were summarized in Volume 10, Number 4 of this journal. In Volume 11, Number 1, the column described an outbreak of hemorrhagic fever with renal syndrome associated with Hantavirus infection that resulted from aerosolization during carcass maceration. This column augments these earlier reports of zoonotic outbreaks in rodent facilities with a summary of 126 cases of occupationally-acquired hemorrhagic fever with renal syndrome (HFRS) associated with Hantavirus infection. These cases were identified in a retrospective survey of 33 animal facilities in Japan; infections occurred at 20 medical schools, one veterinary school, and one pharmaceutical company (Kawamata, et al., 1987). All infected staff members were animal caretakers or researchers who had handled rodents. Surveys were begun in the 1970s and the association between HFRS and laboratory rodents was published in 1978.

Parenteral Exposures

Only two parenteral exposures were recorded. One needle stick occurred during blood collection and the other was a rat bite through a researcher’s glove during a weighing procedure.

Aerosol Transmission

The survey revealed that, with the exception of the two cases of parenteral exposure mentioned above, once an animal colony became infected with HFRS virus, there was a risk of airborne transmission of the virus using the practices in place at that time. The specifics are illustrative.

- A fatal infection in an animal caretaker occurred in a medical college where hanging cages were used to house rodents, and the paper sheets under the cages were changed without taking any precautions, in a manner described as “careless.” The authors assumed high levels of contaminated airborne dust, combined with the low humidity in the room, resulted in inhalation of the pathogen. After the fatality, blood was drawn from 34 of the 1,200 rodents in the room and 28 were seropositive for HFRS. Two other animal caretakers who worked in the same room had subclinical infections.

- Two animal caretakers became infected when they defrosted a freezer used to store rat carcasses. Some of the bags containing carcasses had leaked and it was assumed the cleaning operations aerosolized the virus.

- Further analysis of the 126 laboratory-acquired HFRS infections in this survey revealed that 108 were laboratory researchers performing experiments with rats and 18 were animal caretakers. The authors speculated that the animal caretakers may have had mild subclinical infections and became immune. One example cited was a case of HFRS diagnosed in a physician who entered a contaminated animal room for 10 minutes, but did not handle the animals.

- In one medical school, the rodent serological survey revealed HFRS infection was limited to two rooms where commercially-obtained rats were housed. Breeding of other rats occurred in different rooms of the same facility. Dirty cages from all the rooms were co-mingled in the “dirty” corridor on their way to the facilities’ one wash area, where cages were cleaned, but not sterilized. There was no attempt to segregate the cages from the various rooms. Despite the potential for environmental transmission from these cages, the rodent infections remained localized to the two rooms dedicated to housing the commercially-obtained rats.

Conclusions Made on HFRS Virus Transmission and Control

It is not known how the Japanese rat colonies became infected; however, wild rats were observed in an animal facility where infections occurred. This was considered a probable source since the virus causing HFRS was present in the wild house rat population, and had caused a community outbreak of HFRS in Osaka in the 1970s. In addition to exposure to wild rodents, rodent colonies were potentially contaminated by 1) introduction of infected commercially-obtained rodents, 2) sharing of animals between institutions, and 3) injection of contaminated tumors or cells into rodents. The infectious agent for this disease was first isolated in 1978 and an IFA identification method was published in the literature; making screening rodent colonies easily feasible.

Ask the Experts

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Do you have a biosafety question and you're not sure who to ask? Send your questions to the "Ask the Experts" column and I'll get them answered for you. Drawing from my own experience or that of other experts in the field, we'll try to compile a thorough and comprehensive answer to your question. Please e-mail your questions to jkeene@biohaztec.com or to Co-Editor Barbara Johnson at barbara_johnson@verizon.net or Co-Editor Karen B. Byers at karen_byers@dfci.harvard.edu.

Disinfectants, What Kind and When?

Questions have arisen about the potential for development of resistance to antibiotics and disinfectants in the laboratory along with the use of these agents to clean up spills and decontaminate laboratory surfaces. In addition, there have been concerns about the efficacy of antimicrobial soaps for hand washing. In this article, we will attempt to clear up some of the questions regarding the use and abuse of disinfectants.

Can microorganisms develop resistance to disinfectants, as they seem to do against antibiotics?

The mechanism of action of disinfectants and antibiotics is significantly different. Disinfectants are hazardous

Today, accepted practices for rodent colony maintenance include serological screening, micro-isolator cages or ventilated cage racks, stringent ventilation and humidity control, and husbandry practices that minimize aerosolization. However, we should all remember that rodent colonies present unique occupational environments and the scientific community must always carefully assess the potential for microbial transmission within their colonies.

References

Kawamata, J., Yamanouchi, T., Dohmae, K., Miyamoto, H., Takahashi, M., Yamanishi, K., Kurata, T., & Lee, H. W. (1987). Control of Laboratory Acquired Hemorrhagic Fever with Renal Syndrome (HFRS) in Japan. *Laboratory Animal Science*, 37(4), 431-436.

chemicals that destroy things like proteins, lipids, nucleic acids in living organisms (**all living organisms**—you, me, experimental animals, bacteria, etc.). Destruction of one's proteins by hazardous chemicals is difficult to overcome. Therefore, while there may be some increased tolerance to disinfectants by organisms, the concentrations used generally exceed the lethal dose of the agent and the disinfectant still works.

Antibiotics generally work by interfering in the metabolic pathways of those organisms that are susceptible. Interference with metabolic pathways can be overcome when there are mutant organisms already present in the population and these are actually selected for by the presence of the antibiotic in the environment, at which point the antibiotic is no longer effective (Rice, 2004). Given the mechanism of action of each type of agent, it is much more likely that resistance to antibiotics will develop than true resistance to disinfectants.

What type of disinfectant should be used in the laboratory?

There are two answers to this question, in spite of the fact that the OSHA Bloodborne Pathogen Standard states that an EPA registered disinfectant with Tuberculocidal activity is required. (For a complete list of the EPA registered disinfectants, see www.epa.gov/oppad001/