

MOUSE PARVOVIRUSES

Division of Animal Resources
University of Illinois, Urbana

Background: There are two important parvoviruses of mice: minute virus of mice (MVM) and mouse parvovirus type-1 (MPV-1).

Minute virus of mice (MVM) is an important infectious agent in laboratory mice. It is a ssDNA virus of the family *Parvoviridae*. Multiple strains have been described.

Mouse parvovirus type 1 (MPV-1) is a recently recognized and important infectious agent in laboratory mice. It is a ssDNA virus of the family *Parvoviridae* and was formerly known as orphan parvovirus. Three isolates of one serotype have been identified.

Transmission: The parvoviruses require rapidly dividing cells (such as GI, skin, and lymphoid organs) to survive. They are shed in urine and feces and may be transmitted via respiratory routes. They are highly contagious and shed virus for an undetermined time after infection. Direct contact with affected animals is probably required, but transmission has not been well characterized.

It is important to realize that it is not known if intermittent shedding of the virus occurs when mice harboring virus in the intestines are exposed to environmental or experimental stressors.

MVM has been reported as a common contaminant of transplantable tumors and mouse leukemia virus stocks.

Clinical Signs: Mouse strains vary in their susceptibility to MVM. Natural parvovirus infections of immunocompetent and immunocompromised mice generally result in no overt clinical disease or pathology. Viral replication occurs in the pancreas, small intestine, lymphoid organs, and liver that persists for several weeks after infection. MVM also replicates in the kidneys.

Experimental infection with MVM will result in severe damage to multiple organs in the developing fetus and in neonates.

Diagnosis: Diagnosis is usually based on serology, via ELISA or IFA or both. MVM and MPV-1 may cross-react during the IFA test due to similar non-structural proteins in the viruses.

Effects on Research: The parvoviruses have similar effects on research. They can reduce the rate of transplantable tumor take by direct oncolysis or modulation of immune response to tumor cells, interfere with the selection of new transplantable tumor phenotypes, and cause a reduction in viral or

chemical tumorigenesis. In immunological studies, they can interfere with the modulation of lymphocyte mitogenic responses, interfere with ascites production, result in cryptic infection of lymphocytes, and interfere with the humoral antibody spectrum. They can interfere with infectious disease studies and cell biology studies by modifying interventional interaction and causing immunosuppression of the host. They can also result in altered patterns of rejection of skin allografts. A newly identified rat parvovirus (RPV-1) may suppress lymphoid tumor development.

Prevention: To prevent this disease, obtain replacement stocks from sources that are known to be free of disease. Tumor lines should be assessed for infection using MAP tests or other appropriate tests. Personnel working with infected animals should not enter rooms that contain naïve animals.

Eradication: The most effective way to eradicate parvovirus infections is to cull the colony and obtain clean replacement stock. However, this is not always a feasible option when working with valuable mice.

Caesarian rederivation or embryo transfer can be used to produce offspring that have not been exposed to the virus. Repeated serological evaluations should be performed prior to reintroduction of the mice into a naïve population.

A breeding moratorium of at least 8 weeks can also be used to prevent the spread of the virus from young weanling animals to younger naïve animals. The animals should be housed in microisolator caging and handled with standard microisolator techniques. This method requires repeated serologic testing and strict adherence to a zero-tolerance for breeding policy. It is important to note that transgenic and knockout mice often have altered immune systems that may allow them to sustain the infection for longer periods of time or to develop a carrier state. In these cases, the breeding moratorium would not be the appropriate means of eradication.

References:

- Baker, DO. 1998. "Natural Pathogens of Laboratory Mice, Rats, and Rabbits and Their Effects on Research." *Clinical Microbiology Reviews*. 11:231-266.
- Shek, WR et al. 1998. "Characterization of mouse parvovirus infection among BALB/c mice from an enzootically infected colony." *Laboratory Animal Science*. 48: 294-297.
- Tattersait, P and Cotmore SF. 1986. "The rodent parvoviruses." In *Viral and Mycoplasma Infections of Laboratory Rodents*. ed. Bhatt, PN et al. Academic Press Inc. pp 305-348.