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Gesellschaft für Versuchstierkunde
Society for Laboratory Animal Science

Expert Information

From the Working Group on Hygiene

Implication of infectious agents on results of animal experiments

Pneumonia Virus of Mice

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Pneumonia Virus of Mice

Background

- Pneumonia Virus of Mice (PVM) was originally discovered in 1939 by researchers Horsfall and Hahn at The Rockefeller University as part of an attempt to identify pathogens from human clinical samples that would replicate in lung tissues of inbred mice. Interestingly, PVM was isolated from lung tissue from control mice, which yielded an infectious isolate after undergoing serial mouse-to-mouse passages.[1,2]

Prevalence

- Prevalence in laboratory animals in North America and Europe for PVM is very low; for mice 0,1% (NA 0,1%; EUR 0,1%) and for rats 0,10% (NA 0,06%; EUR 1,24%).[3]

Host species

- Mainly mouse, rat, but antibodies to PVM have been detected in hamster[3], African hedgehog (*Atelerix arbiventris*)[5], dog[6], grey squirrel.[7]
- While members of the order *Rodentia* are generally assumed to be the natural hosts of PVM, the host range of PVM is still largely unknown.[4]

Properties

- PVM is labile in the environment and rapidly inactivated at room temperature.[8]
- Two main characterized strains of PVM in general lab use[9]
- The original studies by Horsfall and co-workers were performed on an isolate known as strain 15, which was at that time highly pathogenic in mice. Since that time, the PVM strain 15 has reportedly undergone tissue-culture passage, thus losing some of its pathogenicity *in vivo*, although the extent and which isolates are affected, remains uncertain.[9]
- PVM strain J3666 has been reportedly maintained in mice with minimal tissue-culture passage, and has recently been shown to be highly pathogenic in nearly all inbred strains of mice.[10]

Susceptibility

- The susceptibility of mice and rats may be increased by a variety of local and systemic stressors, and immune responsiveness is strain dependent.[11]

Organotropism

- Respiratory tract[8]

Clinical disease

- Asymptomatic in immunocompetent animals[8,12]
- Chronic pneumonia and death in athymic (*Foxn1^{nu}*) mice[13,14]

Pathology

- Produces an interstitial pneumonia with virus demonstrated in the bronchial epithelium but also in the alveolar walls and alveolar macrophages in germ-free athymic and euthymic mice[15,16]

- Causes hydrocephalus after intracerebral inoculation of neonatal mice.[17]
- Replicates effectively in lung tissue of all inbred strains of mice and can generate severe viral bronchiolitis and pneumonia in experimentally infected rodent models, with features including prominent granulocyte recruitment, pulmonary oedema, and respiratory dysfunction.[10]
- PVM infection causes epithelial regressive lesions (deciliation, degeneration, necrosis, and exfoliation) and inflammatory granulocytic/mononuclear infiltrations, with very little epithelial hyperplasia.[10]

Morbidity and mortality

- Morbidity: low morbidity from less than 25% (in mice) to 62% (in rats) and 45% (in hamsters)[18]
- Mortality: none, except in immunodeficient and/or experimentally infected mice[8]

Zoonotic potential

- A recent, detailed study showed that it is highly unlikely PVM is zoonotic.[19]

Interference with research

Oncology

- Lowers the prevalence of leukaemia in male F344/NCr rats.[20]

Teratology

- No data

Infectiology

- PVM infection exacerbates *Pneumocystis murina* pneumonia in Prkdc^{scid} mice.[21]

Immunology

- Pulmonary eosinophilia is an immediate response to infection with PVM accompanied by the production of macrophage inflammatory protein-1-alpha (MIP-1a).[22]
- PVM infection is associated with a massive influx of activated CD8 T cells into the lungs and may suppress T cell effector functions in the lungs.[23]

Interactions with other infectious agents

- No data

Toxicology

- No data

Physiology

- Increases the susceptibility to diabetes induction by streptozotocin in BALB/cByJ male mice.[24]
- Causes significant decreases in body weights of F344/NCr rats but not of B6C3F1 mice.[20, 25]

Cell biology

- No data

Assisted reproductive technology

- No data

Special considerations

- The human pathogen, hRSV, and the mouse pathogen, PVM, can induce similar disorders in their natural hosts. As such, the mouse data that are available are compared and contrasted to what is currently understood about pneumovirus infection in a human host.[26]
- Exploration of PVM infection as a model for the study of respiratory virus replication and the ensuing inflammatory response within a natural host and the evolutionarily relevant host-pathogen relationship[9]

Updated by Nadine Kaiser, Mainz, May 2018

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