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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

Mycoplasma pulmonis

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Mycoplasma pulmonis

Background

- *M. pulmonis* is the causal agent of murine respiratory mycoplasmosis (MRM), formerly murine chronic respiratory disease (CRD) in mice and rats.[1]
- MRM disease frequently goes undiagnosed due to its asymptomatic nature.[2]

Prevalence

- The prevalence of *M. pulmonis* among laboratory mouse and rat colonies decreased substantially during the last 30 years.[3]
- Antibodies against *M. pulmonis* were found in 0.08% of mouse sera and 3.6% of rat sera supplied by more than 100 western European institutions over a period of 18 months.[4]
- Among 56 institutional animal facilities from south Korea, *M. pulmonis* positive results were obtained in 1.8% of mice tested.[5]
- The contamination of mice and rats with *M. pulmonis* and other microorganisms correlates in Korea with hygienic conditions and decreases in barrier systems.[6]
- In 2007, more than 20% of mouse colonies and 40% of rat colonies in Taiwan were seropositive for *M. pulmonis*.[7]
- 22% of analysed mouse colonies in India were seropositive for *M. pulmonis*.[8]
- In pet rats, 70.49% of animals were seropositive for *M. pulmonis*.[9]
- Antibodies against *M. pulmonis* were found in 25%[10] and 72.9%[11] of wild Norway rats, respectively.
- *M. pulmonis* can also be a contaminant of transplantable tumours.[12]

Host species

- Rats and mice are primary hosts, rarely found in guinea pigs and hamsters.[1]
- Hamsters are susceptible to experimental infections.[13]
- *M. pulmonis* is common in wild populations of rats[10,11] and mice.
- Sometimes, *M. pulmonis* is found in rabbits.[14]

Properties

- Pleomorphic bacteria without a cell wall.
- *Mycoplasmas* are mucosally associated, residing predominantly in the respiratory and urogenital tracts.
- Transferred between animals by direct contact and aerosol or across the placenta.[16,17]
- Transmission via cell lines and transplantable tumours.[12]
- Mycoplasmal strains differ widely in ability to produce respiratory lesions.[18]

Susceptibility

- Immunocompetent and immunodeficient mice and rats can be infected.[19,20]
- Rat strains differ in susceptibility to infection with *M. pulmonis*: LEW rats are more susceptible to intranasal infection than F344 rats.[21-23] LEW rats show more severe lesions in the respiratory tract.

- WIS rats have a greater resistance to maternal *M. pulmonis* infection than SD rats.[24]
- Mice strains also differ greatly in resistance to infection with *M. pulmonis*.[25]
- Resistance to murine respiratory mycoplasmosis is controlled by multiple genes.[26-28]

Organotropism

- Upper and lower respiratory tract, nasopharynx, lung[21]
- Middle ear[29]
- Reproductive tract can be affected.[30-32]
- Various joints under experimental conditions in mice and rabbit.[33-35]

Clinical disease

- CRD starts with abnormal breathing sounds: “snuffling” in rats and “chattering” in mice, an indication for catarrhal rhinitis.[36]
- A clinically inapparent suppurative otitis media often exists simultaneously.
- Sneezing, inflammation of eyes and middle ears with torticollis.[36]
- The pulmonary disease is characterized by polypnea, inactivity, humped posture, rough coat, and reduced weight gains.[36]
- Reduced fertility due to purulent inflammation of the reproductive tract.[32,37,38]
- SCID mice develop wasting disease and severe arthritis after intranasal inoculation of *M. pulmonis*.[33]

Pathology

- Rhinitis: squamoid changes of respiratory epithelium.
- Otitis media: squamoid changes of olfactory epithelium, infiltration of mononuclear cells and neutrophils in the lamina propria.[39]
- Laryngotracheitis
- Bronchopneumonia with bronchiectasis: neutrophilic exudate in airway lumina, hyperplasia of airway epithelium, peribronchial and -vascular lymphoid hyperplasia/infiltration, mixed neutrophilic and histiocytic exudate in alveoli39
- Acute bronchopneumonia in combination with other pneumotropic infections like sialodacryoadentitis virus[40], Sendai virus[41], or *Chlamydia pneumoniae*.[42]

Morbidity and mortality

- Morbidity (occurrence of respiratory tract lesions) and mortality depends on the dose of *M. pulmonis*.[29]
- Exacerbation of MRM by sialodacryadenitis virus[43] and Sendai Virus in rats[44] is described.
- Higher morbidity of *M. pulmonis* infection in combination with immunodeficiency.[20]
- Increasing NH_3 concentration (25 to 250 ppm) was positively correlated with increasing prevalence of lung lesions of MRM in *M. pulmonis*-infected rats.[38,45,46]

Zoonotic potential

- Zoonotic potential is unclear, presence of *Mycoplasma pulmonis* in humans seems to correlate with handling of rats in laboratories or as a pet.[9]

- Statistical analysis shows a greater risk for *M. pulmonis* colonizing individuals who are exposed to infected rats in animal facilities.[47]

Interference with research

- Animals that carry *M. pulmonis* are generally not suitable for experiments.

Oncology

- No data

Teratology

- No data

Infectiology / Interactions with other infectious agents

- Coinfection of laboratory rats with *M. pulmonis* and *Chlamydia pneumoniae* are documented.[42]
- In populations of wild Norway rats, coinfections with *M. pulmonis* and *Filobacterium rodentium* (formerly CAR bacillus) are often found.[11]
- *Filobacterium rodentium* is a frequent co-pathogen of *M. pulmonis*.[10]

Immunology

- *M. pulmonis* affects the host immune system: increase in total lymphocytes and polymorphonuclear leukocytes[48]; increase in IFN-gamma and IL-4[49], stimulates both B and T lymphocytes.[50]
- *M. pulmonis* influences the lymphocytes response in rats in dependence of the strain.[21]
- Delay or prevention of antigenic recognition, derangement of immune regulation and evasion of effector mechanisms.[51]
- B and/or T lymphocytes protect against dissemination of *M. pulmonis* from the airways.[19]

Toxicology

- Studies on chemically induced lymphoma can be misinterpreted by *M. pulmonis* disease and lesions, the disease can be interpreted as lymphoma.[52,53]

Physiology

- Genital tract: Genital mycoplasmosis affects pregnancy outcome.[37,54]
- Chronic mycoplasmal infections interfere with gerontologic studies, nutrition, toxicology and behavioural research.[36]

Cell biology

- No data.

Assisted reproductive technology

- *M. pulmonis* infection influences fertilization and development of mouse eggs in vitro.[55]

Special considerations

- Experimental intracerebral inoculation induces hydrocephalus in neonate rats and hamsters.[13]
- Intra-articular injection of mycoplasmas induces a chronic synovitis in rabbit knees and is a convenient model for synovitis.[35]
- *M. pulmonis* infection is a model to study intrauterine infection during pregnancy.[56]

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