

Proteus mirabilis

Classification

Aerobic, motile, flagellate Gram-negative rod

Family

Enterobacteriaceae

Affected species

It is likely that most vertebrate species may be colonized by *Proteus* spp.

Frequency

This bacterium is ubiquitous in the environment and is considered a normal part of human gut flora. Unless specifically monitored for and excluded, many animals are likely to carry this organism.

Transmission

Unknown, but probably fecal-oral and environmental spread.

Clinical Signs and Lesions

Generally none. In mice with immune dysfunction, *P. mirabilis* has been described as causing sepsis. *Proteus* is a urease-forming bacterium and may be associated with urinary tract infections. Sporadic outbreaks reported in the literature have described pyelonephritis, splenomegaly, hepatic lesions, and fibrinopurulent exudate in the peritoneal cavity.

Diagnosis

P. mirabilis infection can be diagnosed by the isolation of the organism from lesions or affected organs. The organism grows quickly with a characteristic swarming pattern that tends to overgrow most other bacteria on the plate.

Interference with Research

In immunocompetent mice and rats, there is no known interference with research associated with the carrier state. In C3H/HeJ mice, which have a defect of the innate immune system, *P. mirabilis* has been reported to colonize the lung without producing clinical illness. Laboratories studying the organism or working with animals that will become immunosuppressed or undergo significant surgical alteration

as part of experimental protocols may wish to have animals free of *P. mirabilis*. Animals that have become clinically ill are not suitable for use in research.

Prevention and Treatment

To prevent colonization of animals with *P. mirabilis*, the animals must be raised in strict bioexclusion housing, such as would be necessary for immunodeficient mice.

P. mirabilis is susceptible to most common disinfectants used in animal facilities. Any chemical or mechanical sterilant will also serve to remove *P. mirabilis* from the environment. Many human isolates of *P. mirabilis* are susceptible to the fluoroquinolones (enrofloxacin is a common one in veterinary use) or trimethoprim/sulfa drugs. Treatment is not advised. Treatment of animals with antimicrobials may serve to treat illness, but rarely, if ever, resolves the carrier state, nor will antibiotic treatment eliminate bacteria from the bedding or cage surfaces. Thus, treatment is only recommended to ameliorate clinical signs or as an extra measure of assurance before rederivation. To obtain animals without *P. mirabilis*, animals should be rederived through embryo transfer or hysterectomy into/onto *P. mirabilis*-free dams.

References

- Fox JG, Anderson LC, Lowe FM, Quimby FW, editors. *Laboratory Animal Medicine*. 2nd ed. San Diego: Academic Press; 2002. 1325 pp.
- Fox J, Barthold S, Davissou M, Newcomer C, Quimby F, and Smith A, editors. *The Mouse in Biomedical Research: Diseases*. 2nd ed. New York: Academic Press; 2007. 756 pp.
- Jones JB, Estes PC, Jordan AE. 1972. *Proteus mirabilis* infection in a mouse colony. J Am Vet Med Assoc 161:661-664.
- Kinter LB, McDonald J, Beeuwkes R, Gittes R. 1982. Urolithiasis in rats with diabetes insipidus (Brattleboro strain rats). J Urol 128:1077-1080.
- Maronpot RR, Peterson LG. 1981. Spontaneous proteus nephritis among male C3H/HeJ mice. Lab Anim Sci 31:697-700.
- Percy DH, Barthold SW. *Pathology of Laboratory Rodents and Rabbits*. Ames: Iowa State University Press; 2007. 325 pp.
- Sampath V, Davis K, Senft AP, Richardson TR, Kitzmiller JA, Berclaz PY, Korfhagen TR. 2006. Altered postnatal lung development in C3H/HeJ mice. Pediatr Res 60:663-668.
- Taylor DM. 1988. A shift from acute to chronic spontaneous pyelonephritis in male MM mice associated with a change in the causal micro-organisms. Lab Anim 22:27-34.