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accelerating drug development. exactly.

Staphylococcus aureus

Classification

Gram positive, non-motile cocci, often found in grape-like (staphylo-) clusters

Family

Staphylococcaceae

Affected Species

All known mammalian species, including common laboratory rodent and lagomorph species, are susceptible to colonization with *S. aureus*. Due to its ability to colonize a wide range of species, *S. aureus* can be readily transmitted from one species to another, including from humans to animals and *vice versa*.

Frequency

Common to rare, depending on type of housing, contact with humans, and initial health status of the animal.

Transmission

S. aureus is transmitted through aerosol or direct contact with fomites, infected animals, or infected people. Approximately 30% of healthy humans carry *S. aureus* in their nasopharynx or on their skin. In a laboratory rodent setting, it is more likely for humans to infect animals rather than vice versa.

Clinical Signs and Lesions

In healthy, immunocompentent animals, *S. aureus* colonization of the skin, intestinal tract, or nasopharynx is generally asymptomatic. The majority of findings of *S. aureus* will fall into this case. In some healthy animals, *S. aureus* may be isolated from an abscess or lesion. In these cases, the *S. aureus* isolated from these animals is frequently a secondary invader of a wound, rather than the primary cause of disease.

In several situations, *S. aureus* colonization of the skin is associated with disease conditions that may be largely governed by the overall state of sanitary husbandry, rather than entirely due to the presence of a normally non-pathogenic bacterium. For example, in gerbils kept in less than ideal conditions, *S. aureus* has been associated with an acute, diffuse, suppurative dermatitis. The disease is primarily seen in young gerbils, and presents with a moist dermatitis on the face, nose, feet, legs, and ventrum. In hamsters, *S. aureus* has been found as a mixed bacterial component in abscesses. In rabbits, *S. aureus* is associated with an acute septicemic disease in newborn kits. *S. aureus* may also be isolated from abscesses, mastitis, pododermatitis, and genital tract infections.

In susceptible strains of mice or rats, or immuno-compromised or immunodeficient animals, *S. aureus* may cause pyogenic (abscessing) infections of the conjunctiva and adnexa of the eye, the skin and adnexa, or the genital tract. The classic example of this is preputial gland abscesses in C57BL/6 background mice. *S. aureus* is considered the classic opportunist, taking advantage of broken skin or other entry sites to cause an infection. Infection of an open wound or damaged skin may also be caused by *S. aureus*. However, it is more common to isolate mixed colonies of staphylococci (skin) and gram-negative bacteria (fecal) from such infected wounds.

Diagnosis

The presence of *S. aureus* as a component of the normal flora of a healthy laboratory rodent is a finding of little significance. The organism is readily cultured from nasopharynx or skin, or by culture of suspicious lesions. Staphylococci have a characteristic glistening, opaque, yellow to white appearance on blood agar. Patterns of α or β hemolysis may also be visible. Further identification of staphylococcal isolates is available using commercial test kits. *S. aureus* isolates may also be identified by phage typing or by 16S ribosomal DNA typing. The characteristic *S. aureus* histopathologic lesion is the presence of Splendore-Hoeppli material surrounding a dense mass of cocci in an abscess (also known as botryomycosis).

Interference with Research

In general, colonization of an animal with *S. aureus* does not affect that animal's suitability for use in research,

surgery, or teaching. The presence of *S. aureus* in animals may interfere with the study of staphylococci in the laboratory setting. The presence of clinical signs in an individual animal may render it unsuitable for use, or result in its euthanasia for welfare reasons.

Prevention and Treatment

To prevent transmission of *S. aureus* to animals, the animals must be raised in strict bioexclusion housing, such as would be necessary for immunodeficient mice. In fact, exclusion of *S. aureus* is one of the primary reasons that many immunodeficient strains must be raised in isolators or micro-isolation type caging. As rodent *S. aureus* usually originates from humans, animal care workers must keep all skin completely covered and use a HEPA-filtered respirator or N95 mask. Phage typing has linked infections of laboratory animals to movement of animal care workers between facilities. Normal animal work precautions will keep humans from acquiring *S. aureus* from animals.

Restriction fragment length polymorphism analysis and culture of *S. aureus* isolates from several barrier rodent rooms revealed the isolates of *S. aureus* present in each of these barrier rooms to have different RFLP types and to be exquisitely antibiotic-sensitive. The RFLP results are no doubt due to the establishment of a particular *S. aureus* within a colony. If the colonization sites are occupied, it would be difficult for another *Staphylococcus* to gain entry. The antibiotic sensitivity is due to the lack of antibiotic pressure applied within a rodent barrier room, unlike human clinical isolates.

S. aureus is susceptible to most common disinfectants used in animal facilities. Any chemical or mechanical sterilant will also serve to remove *S. aureus* from the environment. However, *S. aureus* is resistant to drying and may remain infectious for weeks on dried skin or secretions. 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. To obtain a *S. aureus*-free colony, animals should be rederived through embryo transfer or hysterectomy into/onto *S. aureus*-free dams.

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