

# Methicillin-Resistant *Staphylococcus aureus*: A Review

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*Staphylococcus aureus* is a common bacterium and an important cause of disease in many species. Approximately 10% of healthy horses carry *S. aureus* in their noses. This occurrence is termed "colonization," as the bacteria are present without causing any problems. A smaller number are colonized in the intestinal tract or on the skin. *S. aureus* is an "opportunistic pathogen" that can cause disease under certain conditions. One problematic trait of *S. aureus* is its tendency to become resistant to antibiotics. Of particular concern is methicillin-resistant *S. aureus* (MRSA), which is resistant to all beta-lactam antibiotics (penicillin and cephalosporin families) and often many other antibiotics. This makes MRSA infections more difficult to treat.

In humans, MRSA infections are associated with increased illness and death compared to methicillin-susceptible *S. aureus* infections. MRSA is a tremendous problem in human hospitals and is now causing disease in people in the general population. But MRSA has also emerged as an important cause of disease in many animal species, including horses.

Like methicillin-susceptible *S. aureus*, MRSA can colonize horses without causing any problems. Studies have reported carriage rates of 0-5% in horses in the general population, but on some farms the prevalence can exceed 50%. Colonized horses may never have any problems with MRSA, but they are more likely to develop an MRSA infection under certain conditions. Colonized horses are also of concern because they can transmit MRSA to other horses and people. Clinical MRSA infections can occur as sporadic cases or outbreaks.



A wide range of infections can develop. In horses in the general population, skin and soft tissue infections (including wound and surgical site infections) and joint infections are most common. In hospitalized horses, surgical site infections predominate. Invasive device (i.e., intravenous catheter) site infections and bloodstream infections can also occur, as well infections at a variety of other sites.

Despite the obvious concerns about MRSA, it can be a treatable condition. In a multicenter study, over 80% of horses with MRSA infections survived, although they tended to have prolonged hospital stays and often required additional surgeries. While MRSA strains are resistant to many drugs, acceptable antibiotic options usually exist. The key to proper and successful management is early diagnosis of MRSA so that appropriate therapy can be instituted.

Typing of MRSA strains is an important tool for understanding how and why this organism is spreading. In humans, MRSA is separated into community-associated and hospital-associated infections. Care should be taken in directly extrapolating this situation to horses, as there are a number of differences. One major difference is the types of MRSA found in horses. Most reports of MRSA in horses have involved one family (clone) of MRSA. There are various names for this family, depending on the location and typing method. They include USA 500, Canadian epidemic MRSA5, sequence type 8 (ST8), and clonal complex 8. This MRSA strain (or closely related strains) are recognized as a human strain, yet the strain is uncommon in people. Its predominance in horses suggests that it is somehow better adapted to horses than other strains. This strain has been reported in both North America and Europe and is likely widely disseminated internationally.

One MRSA aspect of concern is the potential for transmission between humans and horses, in both directions. People who work with horses appear to be at particularly high risk for MRSA colonization. Studies of equine veterinarians have reported colonization rates of 10-14%. The MRSA clone that predominates in horses has been the most common strain in equine personnel, providing further support for the notion that horses can infect humans.

An outbreak of MRSA skin infections occurred in a teaching hospital in people working with a colonized foal. Therefore, precautions need to be undertaken to reduce the risk of infection of human contacts and to prevent transmission of MRSA on farms or in clinics. Infection control practices that may need to be implemented at the farm or clinic level are variable and depend on the situation. They may include isolation of infected or colonized horses, the use of barriers (gloves, gowns) when handling infected or colonized horses, improvement in general hygiene (especially hand hygiene among farm workers and veterinarians), screening of horses for colonization, limiting contact of different groups of horses, and other related infection control measures.

No current evidence exists that antibiotics are useful for eradication of colonization, but MRSA can be eradicated without the use of antibiotics from farms with infection control practices if adequate time and energy are committed. All aspects of the equine industry need to be aware of this veterinary and zoonotic pathogen, because MRSA is likely to be an increasing concern in equine medicine.

**Contact: Dr. J. Scott Weese, [jsweese@uoguelph.ca](mailto:jsweese@uoguelph.ca),  
Department of Clinical Studies, University of Guelph, Guelph,  
Ontario, Canada.**

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