Review of Methicillin-Resistant Staphylococcus aureus in Horses and Veterinary Personnel who Work With Horses

Maureen E. C. Anderson, DVM, DVSc; and J. Scott Weese, DVM, DVSc, Diplomate ACVIM

Methicillin-resistant Staphylococcus aureus remains an important zoonotic and equine pathogen worldwide. Equine veterinarians need to be aware that MRSA is present in the equine population so that further dissemination of this pathogen can be curbed. Veterinary personnel who work with horses seem to be at increased risk of MRSA colonization, but close attention to routine infection-control measures such as hand hygiene may help decrease this risk. Authors’ address: Department of Pathobiology, University of Guelph, Guelph, Ontario N1G 2W1, Canada; e-mail: mander01@uoguelph.ca (Anderson). © 2008 AAEP.

1. Introduction
Methicillin-resistant Staphylococcus aureus (MRSA) is one of the most important hospital-associated pathogens in human medicine, and it is now also recognized as a community-associated and zoonotic pathogen.1–6 Although capable of infecting (i.e., causing clinical disease) or colonizing (i.e., producing a subclinical carrier state) numerous species, MRSA has been isolated with particular frequency in certain livestock species, namely horses5–9 and more recently, pigs.10,11 Personnel, including veterinarians, who work with these species need to be aware of the potential for transmission of MRSA to and from their patients and what they can do to prevent it to help avert wider dissemination of this important pathogen in both human and animal populations.

2. Biology of MRSA
S. aureus is a commensal bacterium that colonizes the anterior nares of ~30% of people,12–14 and it has been found to colonize the same site in ~7% of horses.8 This bacterial species has a wide variety of virulence factors at its disposal, making it an excellent opportunistic pathogen capable of causing a broad range of clinical disease from superficial skin and soft-tissue infections to necrotizing pneumonia.15,16 The acquisition of the mecA gene by S. aureus results in the production of a unique bacterial cell wall protein called PBP2a; this renders the organism resistant to not only methicillin but all beta-lactam antimicrobials. An MRSA isolate is, therefore, inherently resistant to all penicillins, cephalosporins, carbapenems, and monobactams, but it may also carry a variety of resistance genes to other antimicrobial classes depending on the specific strain. Oxacillin-resistant S. aureus is synonymous to MRSA. Colonization with MRSA of people in the general population has been estimated between 0.2 and 3.5%.15,14,17,18
Molecular typing methods have shown that the MRSA isolates obtained most commonly from horses are not the same types as those most commonly found in humans. One particular type of MRSA, designated CMRSA-5 or USA500 depending on the region, and a few closely related strains seem to account for the majority of equine MRSA isolates. This MRSA type is actually relatively uncommon in people, which suggests that it may be somehow adapted to survival in horses. The Panton-Valentine leukocidin (PVL) genes, which are associated with many highly virulent community-associated MRSA infections in humans and the USA300 community-associated MRSA clone, have not been found in any MRSA isolate from horses thus far. There are also recent reports from Europe of sporadic equine cases and outbreaks involving a sequence type 398 (ST398) MRSA clone. This clone has been associated with food animals and is spreading in the general human population in some European countries.

3. MRSA in Horses

Clinically, there is no way to differentiate an MRSA infection from an infection caused by a methicillin-susceptible strain of S. aureus. Culture and antimicrobial susceptibility testing are, therefore, required to detect MRSA and determine an appropriate course of treatment; specific patient and infection factors (e.g., tissue affected, mixed infection, etc.) must also be considered. Studies have shown that most MRSA isolates from horses are still susceptible to common antimicrobials outside the beta-lactam class, although they are frequently resistant to more than just this one class, particularly tetracycline and gentamicin. The use of drugs such as vancomycin, which are of major importance in the treatment of MRSA infections in human medicine, is unnecessary in most of these cases and may be dangerous in terms of promoting the development of vancomycin resistance in numerous commensal bacterial species. It is also important to consider the correlation between in vitro test results and treatment response in vivo. For example, MRSA isolates can rapidly develop resistance to fluoroquinolones in vivo, even when in vitro testing initially indicates susceptibility to agents in this class. Therefore, fluoroquinolones are not recommended for treatment of human MRSA infections, and it is reasonable to extend this recommendation to horses as well.

If it is suspected that a horse has an MRSA infection based on isolation of this pathogen from other animals with which the horse has had direct or indirect contact, a culture specimen must still be collected for submission prior to commencing any antimicrobial therapy, in order to confirm the diagnosis. It is also important to monitor the outbreak isolate for changes in antimicrobial susceptibility over time. In a highly suspected case, first-line antimicrobial therapy should be based on culture and susceptibility results from other isolates from the same outbreak. Empirical therapy for MRSA in horses is not recommended; an infection should not be treated as MRSA unless the pathogen has been isolated from the horse or from another animal that may have directly or indirectly transmitted it to the horse, in which case antimicrobial susceptibility results should be available.

Colonization of horses is usually detected by culture of a swab inserted 8–10 cm into one naris and withdrawn in contact with the nasal mucosa. Like in humans, colonization of other body sites may occur, but this has not been adequately investigated in horses. It seems that the majority of horses are not persistently colonized and will clear the MRSA on their own if reexposure can be prevented. Therefore, drug therapy is not advocated unless clinical signs of infection are present. Risk factors for MRSA infection and colonization have not been investigated in horses as extensively as they have in humans. Studies have identified colonization as a risk factor for infection in horses. Administration of antimicrobials (ceftiofur or aminoglycosides) in hospitals, administration of antimicrobials within 30 days of hospital admission, admission to the neonatal intensive care unit or a non-surgical service, and residence on a farm with >20 horses or any farm on which a horse was previously identified as colonized with MRSA have been identified as risk factors for colonization in horses. Identification of MRSA (both infection and colonization) in horses is important in the community setting and in veterinary hospitals to implement effective infectious disease control protocols, such as quarantine and screening of horses entering the hospital or returning to a barn. Isolation or cohorting of infected and colonized horses should help to prevent widespread dissemination of MRSA in the subclinical form and, therefore, the number of potential infections. Large horse farms and boarding stables are similar to human long-term care facilities in terms of the potential for disease transmission; animals are housed in close contact with a relatively small group of common caretakers, and there is frequent veterinary contact and antimicrobial use.

4. MRSA in Personnel who Work With Horses

A study of veterinary personnel attending a veterinary internal medicine conference identified working with large animals (including horses) as a significant risk factor for MRSA colonization: 15.6% of large-animal personnel were positive for MRSA on a single nasal swab compared with only 4.4% of small-animal personnel. Furthermore, 13 of 15 (87%) isolates from large-animal personnel were consistent with CMRSA-5 based on PFGE, which supported the hypothesis that the high prevalence was a result of contact with horses. Another study of veterinarians and veterinary students in the Netherlands found a 4.6% prevalence of MRSA.
colony among those who had contact with livestock compared with 0% prevalence among students with no livestock contact and 1.0% prevalence among the general population in that country.29 It is important to note, however, that this study did not evaluate contact with horses specifically and that a previous survey of healthy horses in the Netherlands failed to show the presence of MRSA.30

Clinical MRSA infection of personnel associated with direct contact with colonized horses has also been reported. One incident involved infection of a tattoo site of a veterinary resident with a CMRSA-5 strain that was indistinguishable from that isolated from two horses that were recently under the resident’s care.6 The most convincing evidence of horse-to-human transmission was a report describing an outbreak of MRSA skin infections in three neonatal foal intensive-care unit personnel after close contact with a foal that was found positive for MRSA on a nasal swab collected on admission, despite contact precautions including gowns and gloves.31 Colonization of 10 other personnel in the hospital, all of whom had had contact with the affected foal, was also detected. All of the MRSA isolates from the infected and colonized individuals as well as the foal and its mare were indistinguishable from one another and were consistent with CMRSA-5.31

Previously, the only significant risk factor for MRSA colonization of horse personnel identified was regular contact with >20 horses.5 In 2006, a study was undertaken at the Convention of the American Association of Equine Practitioners in San Antonio, Texas to evaluate the prevalence of MRSA colonization among veterinary personnel who worked with horses and to identify risk factors for MRSA colonization in this group.12 Risk factors evaluated were related to contact with the human healthcare system, amount and types of contact with horses, and personal hand hygiene. Colonization with MRSA was found in 26 of 257 (10.1%) study participants, which is a higher prevalence than that found in studies of the general population.13,14,17,18 Independent risk factors for colonization were diagnosis of MRSA colonization or infection in the last year (odds ratio [OR] = 8.41; 95% confidence interval [CI] = 1.51–49.92; p = 0.015) or treatment of a horse diagnosed with MRSA in the last year (OR = 3.27; 95% CI = 1.05–10.11; p = 0.039). Hand washing with soap and water between cases considered potentially infectious (OR = 0.27; 95% CI = 0.11–0.72; p = 0.009) and between farms (OR = 0.35, 95% CI = 0.14–0.98, p = 0.047) were found to be protective factors. These data support previous suggestions that equine veterinary personnel are at an increased risk of colonization with MRSA. It was also the first study to show a statistically significant association between hand hygiene practices and a measurable clinical outcome (decreased prevalence of MRSA colonization) in veterinary medicine.

In contrast to veterinary medicine, hand hygiene in the human healthcare setting has been studied extensively, and it is considered to be one of the most important infection-control tools in human medicine.33,34 Among the principle means of hand hygiene, which include the use of soap and water, antibacterial soap and water, and alcohol-based hand rubs, alcohol-based products consistently show superior ability to reduce bacterial counts on the hands of healthcare workers.34 Under experimental conditions, Traub-Dargatz et al.35 showed an equivalent to superior effect of use of alcohol-based hand sanitizers compared with antibacterial soap and water after routine physical examination of horses. These alcohol-based products can also be combined with emollients to help prevent drying and damage to the skin, which often occurs with frequent hand washing.34 However, alcohol-based hand sanitizers are only meant to be used when hands are not visibly soiled.35 In large-animal veterinary practice, visible dirt and debris are commonly present on the hands, which may necessitate mechanical removal using soap and water.

References and Footnotes


*Anderson MEC. Unpublished data, January 2006.

Weese JS. Personal communication, 2008.