

Methicillin-resistant *Staphylococcus aureus* in a neonatal alpaca

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Abstract – A 6-hour-old alpaca was presented for evaluation of respiratory difficulty. As part of routine surveillance, methicillin-resistant *Staphylococcus aureus* (MRSA) was identified from a nasal swab taken upon admission to the hospital. No signs of MRSA infection were noted. The MRSA strain recovered was a human epidemic clone that has been associated with horses. Methicillin-resistant *S. aureus* colonization can occur in camelids, and the potential animal and public health risks require consideration.

Résumé – *Staphylococcus aureus* résistant à la méthicilline chez un alpaga nouveau-né. Un alpaga âgé de 6 heures a été présenté pour l'évaluation d'une difficulté respiratoire. Dans le cadre d'une surveillance de routine, *Staphylococcus aureus* résistant à la méthicilline (SARM) a été identifié à partir d'un écouvillonnage nasal au moment de l'admission à l'hôpital. Aucun signe d'infection par le SARM n'a été noté. La souche de SARM récupérée provenait d'un clone épidémique humain qui a été associé aux chevaux. La colonisation par *S. aureus* résistant à la méthicilline peut se produire chez les camélidés et les risques potentiels pour la santé animale et humaine exigent une évaluation.

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Methicillin-resistant *Staphylococcus aureus* (MRSA) is a well-known pathogen in humans, with infections responsible for considerable morbidity and mortality worldwide (1). More recently, MRSA has also been documented in several veterinary species, raising concerns for both animal health and zoonotic transmission. Infection and colonization have been documented in a wide range of animal species, particularly household pets (2), horses (3,4), and food-producing animals (5–7), with different clones predominating in different animal species.

A 6-hour-old female alpaca was presented to the Ontario Veterinary College Health Sciences Centre (OVC-HSC) for evaluation and treatment of respiratory distress. Parturition was prolonged and the cria began open-mouth breathing shortly after birth. Ketoprofen (Anafen; Merial, Baie-d'Urfé, Quebec) and ceftiofur (Excenel; Pfizer Animal Health, Kirkland, Quebec) were administered; the cria was referred because of progressive weakness, respiratory difficulty, and inability to nurse. On pre-

sentation, the cria was recumbent, weak, tachypneic [60 breaths/min; reference range (RR): 20 to 30 breaths/min] with open-mouth breathing, and hypoglycemic [3.3 mmol/L; RR: 5.2 to 9.4 mmol/L (8)]. Thoracic radiographs revealed an interstitial pattern. With gloved hands, a sterile tomcat catheter was used to assess patency of the nasal passages. The catheter was easily passed through the right nostril, but could only be advanced 2 to 3 cm in the left nostril. As part of a routine surveillance program in place in the Large Animal Clinic, nasal swabs were taken at the time of admission from the cria and accompanying healthy dam and screened for MRSA, as has been previously described (4). Supportive care over the next 36 h consisted of a plasma transfusion from the dam, intranasal oxygen, intravenous fluids with dextrose supplementation, partial parenteral nutrition, ketoprofen, and ceftiofur. Based on a lack of improvement and poor prognosis the cria was euthanized and a necropsy performed. The dam was discharged 2 d after admission and another MRSA surveillance nasal swab was taken.

Methicillin-resistant *S. aureus* was isolated from enrichment broth from the admission surveillance nasal swab for the cria, but was not isolated from the admission or discharge swabs from the accompanying dam. The isolate was categorized as *spa* type 7 (Ridom t064) (9–11) and did not contain genes encoding the Panton-Valentine leukocidin (PVL) toxin, consistent with Canadian epidemic MRSA-5 (CMRSA-5). Necropsy revealed choanal atresia and diffuse interstitial lung disease. Hyaline eosinophilic fibrillar protein plaques were present within the terminal bronchioles, suggestive of dysplastic surfactant production. There were no necropsy findings suggestive of MRSA infection. Once MRSA results were available, several attempts

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were made to contact the client; however, these were unsuccessful. Therefore, additional information regarding the presence of other animal species at the same premises, number and occupation of humans in contact with the cria after birth, and MRSA status of humans and animals in contact with the cria or its environment could not be obtained.

To the authors' knowledge, this is the first published report of the isolation of MRSA from a camelid. The MRSA clone that was identified here, CMRSA-5 (also known as USA500), is a human epidemic clone that accounts for a small percentage of human infections (12). This sequence type 8 (ST8) clone has also been shown to predominate in studies of MRSA in horses internationally, with evidence of transmission between humans and horses (3,13).

Determination of MRSA colonization, a dynamic state where the organism is replicating on or in the body in the absence of disease, versus transient contamination is difficult to determine. Typically, identification of MRSA from a mucosal surface is considered colonization (14,15); however, definitive classification as colonization is difficult and probably requires serial sampling. This cria was euthanized shortly after admission, so only a single nasal swab was taken. Thus, colonization is presumed but not confirmed. Although 2 MRSA-colonized horses were later determined to be housed in a separate part of the hospital, there was abundant physical (separate area of the hospital) and procedural (general infection control practices, minimal cross-contact of personnel) separation from these horses, and there was no evidence of MRSA transmission from those horses to any other horses during this time. Further, multiple precautions were taken as per normal practice to reduce the risk of sample and animal contamination including the use of gloves when collecting the nasal sample and when having contact with the animal's mucous membranes (eyes, nose, mouth). The animal in this report was 6-hours-old at the time MRSA was detected. Colonization of individuals of this age is not unprecedented, as MRSA colonization and infection have been documented in neonatal foals 24-hours-old (3,13,16). In humans, MRSA colonization has been documented within the first several hours after birth (17).

No follow-up information was available from the farm, so potential sources of infection could not be investigated. Numerous sources must be considered. Since this clone is endemic in horses in the region (3,18), exposure from horses must be considered; however, we were unable to determine if there were any horses on the farm. Similarly, exposure to humans who work with horses must be considered, given the potentially high colonization rates that have been identified in horse personnel (3,18). Exposure from the referring veterinarian or veterinarians/staff from the OVC-HSC must also be considered, given the contact with the cria and the reportedly high MRSA rates in veterinary personnel, particularly equine and swine veterinarians (19,20). Exposure to MRSA from the dam cannot be dismissed. While the dam was negative on 2 nasal swabs, there is no information about screening of alpacas and common reservoir sites, and it is possible that the dam could have been colonized at other sites such as the gastrointestinal tract and perineum. Environmental exposure to contaminated

bedding or equipment, or housing shared with colonized or infected animals have been suggested as potential sources of MRSA exposure (21). Considering the clone identified, negative MRSA colonization status of the dam, and close contact with humans, a human source is suspected but cannot be confirmed.

The finding of MRSA in a neonatal alpaca highlights the increasingly broad recognized host range and narrow window of time needed for potential colonization by this pathogen. Although colonization was only suspected in this case and MRSA was not responsible for the animal's illness, MRSA colonization remains an important contributor to overall human and animal health, as both a risk factor for subsequent infection (4) and as a source of infection for other animals or humans (3). From a veterinary occupational health standpoint, colonization of critically ill neonates is of particular concern because of their tendency to require very intensive care with close and prolonged contact. This was demonstrated in an outbreak of MRSA infections in humans who worked with a colonized neonatal foal (13).

It is reasonable to assume that MRSA colonization in non-equine veterinary species may pose similar infection and zoonotic risks. Hand hygiene (washing with soap and water or using an alcohol-based hand sanitizer) during and between patient care, biosecurity, and targeted use of barrier contact precautions are recommended measures to reduce MRSA transmission among animals and staff in veterinary medicine (22). Due to the well-documented health effects of MRSA infections in humans and veterinary species, and the potential for both nosocomial and zoonotic transmission, veterinary staff and clients should be aware of this pathogen and take appropriate precautions with at-risk species.

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