

To Lick One's Wounds: A Case of *Pasteurella canis oralis* Osteomyelitis and *Neisseria animaloris* Infection from Canine Saliva

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ABSTRACT

The complications of wound infections caused by animal related trauma are well known and explored. Of the numerous polymicrobial etiologies, *Neisseria animaloris* and *Pasteurella canis oralis* have been reported only in a limited number of cases. This manuscript explores the rare finding of these species in the case of an 83-year-old male with a diabetic foot wound complicated by infection from the saliva of his pet dog. The case highlights the first instance of *P. canis oralis* without the setting of a penetrating animal bite, emphasizing the vulnerability of open lesions in patients whose comorbidities impair proper wound healing. These bacteria are susceptible to beta-lactams with beta-lactamase inhibitors and can be treated once identified. It is crucial to recognize rare pathogens and initiate appropriate treatment early, and to emphasize proper wound care, especially in the context of pet interactions.

KEYWORDS: animal bites, zoonotic pathogens, osteomyelitis, *Pasteurella* species, *Neisseria* species

INTRODUCTION

Animal bites and scratches are commonly complicated by wound infections that involve skin and soft tissues. These infections tend to be polymicrobial in nature due to contamination with a mixture of aerobic and anaerobic bacteria. However, *Pasteurella* spp. have demonstrated a predominance in infected dog and cat bites.^{1,2} Additionally, a majority of reported *Pasteurella* infections have occurred secondary to not just bites, but also scratches and licks to open wounds from pets.^{3,4} Another group of bacteria frequently isolated from gingiva and oral secretions of healthy canines and felines include the Centers for Disease Control and Prevention group Eugonic Fermenter-4 (CDC Group EF-4) bacteria, such as *Neisseria animaloris* and *Neisseria zoodegmatis*, that are rarely identified as human pathogens secondary to animal bites.⁵

CASE REPORT

An 83-year-old male with history of poorly controlled diabetes mellitus with peripheral neuropathy, hypertension, hyperlipidemia, peripheral vascular disease, and prior osteomyelitis of the right foot status post partial second- and

third-toe amputations, presented from podiatry clinic due to a diabetic left foot infection and clinical suspicion of osteomyelitis and cellulitis with associated critical limb ischemia. The patient stated that his foot had been in this condition for three months prior to presentation. He noted that he would allow his dog to lick his lesions due to the perceived healing properties of saliva. Review of systems was positive for pain in the left hallux but negative for fevers, chills, or other constitutional symptoms. Physical exam of the left foot revealed a black eschar on the distal hallux and lateral fifth submetatarsal region. The hallux eschar was firm, dry, malodorous, probed to bone, and with bordering erythema. The fifth metatarsal eschar was loose and peeled away to expose malodorous, wet, yellow fibrotic tissue with probe to fifth metatarsal head, with peri-wound erythema. Pertinent lab findings included erythrocyte sedimentation rate of 82 mm/hr, C-reactive protein of 55.6 mg/L, and white blood count of $12.2 \times 10^9/L$. Radiograph of the left foot revealed diffuse osteoarthritis with no acute osseous abnormality. Due to cellulitis affecting tissue proximal to the lesions, the patient was started on piperacillin-tazobactam. Wound swab grew specimen on blood and chocolate agar, identified by MALDI biotyper as *Pasteurella canis oralis* and *N. animaloris*, both organisms which are present in canine oral flora. Per organism susceptibility, the antibiotic regimen was narrowed to ampicillin-sulbactam. Additionally, due to history of peripheral vascular disease, the patient underwent CT angiography of abdominal arteries with runoff, which demonstrated calcific aortoiliac disease with calcifications in external iliac, common femoral, deep femoral, and superficial femoral arteries, and occlusion of the left arterial tibial artery. Due to necessity of revascularization prior to any podiatric procedures, the patient was planned for femoral endarterectomy and amputation of left hallux and fifth toe and metatarsal for source control. On hospital day nine, the patient's cellulitis had resolved, with reduced erythema surrounding his eschars. The patient completed a nine-day course of ampicillin-sulbactam prior to amputation and was discharged with appropriate vascular surgery and podiatry follow-up.

DISCUSSION

Pasteurella spp. are easily identified in animal oral flora, and *Pasteurella multocida* has been recognized as the most prevalent zoonotic pathogen transmitted to humans, usually through bites or contact with nasal and oral secretions.⁶ The most common manifestation of animal bite wounds is cellulitis developing within 24 hours with associated

erythema, tenderness, swelling, and serosanguinous to purulent drainage. Abscess and tenosynovitis are additional frequent local complications, although septic arthritis and osteomyelitis may also occur.⁷ Non-injury infections tend to include open wounds that were contaminated by pet saliva. All cases in the literature have reported infections with *P. multocida* but very rarely with *P. canis oralis*, as isolated in our patient.³ All prior cases of *P. canis oralis* infections in humans have been reported in the setting of penetrating dog bites,^{4,8,9} in contrast to our patient who is suspected to have been infected via saliva on an open wound. Unlike *Pasteurella spp.*, *N. animaloris* is a rarer occurrence in humans following animal bites, with only 14 documented cases in the literature.¹⁰ Infections from the above mentioned pathogens typically present with acute-onset cellulitis, with purulent discharge and regional lymphadenopathy, prompting immediate workup and treatment.^{4,5} However, this patient's case was complicated by extensive peripheral vascular disease and diabetic neuropathy, and the patient presented to the ED months after the initial infection and subsequent osteomyelitis. Due to the rarity of the organisms identified in the wound, there were no standardized treatment guidelines; however, in a case review of 13 patients with *N. animaloris*, the most common antibiotic of choice was penicillin V for 10 days.⁵ After review of available literature that reported susceptibility to amoxicillin-clavulanate in both *N. animaloris* and *P. canis oralis*,^{4,10} the patient's infection was treated successfully with nine days of ampicillin-sulbactam prior to amputation.

While these pathogens are rare, they are imperative to recognize in the management of infected wounds in individuals who have close contact with animals. *N. animaloris* especially is expected to be severely underrecognized in animal-associated infections, and is often misidentified as *Pasteurella spp.* or contaminants.⁵ As demonstrated in this report, both *N. animaloris* and *P. canis oralis* can grow promptly on blood and chocolate agar, thus they can be isolated from routine wound cultures. When diagnosis is delayed, there is the possibility of ineffective antibiotic coverage with an increased risk for exacerbation of infection that can lead to complications such as osteomyelitis, sepsis, and possibly death.

CONCLUSION

There is a limited number of published cases on *N. animaloris* or *P. canis oralis* infections isolated from penetrating animal bites, and this appears to be the first reported case of *N. animaloris* and *P. canis oralis* infection transmitted by canine saliva on an open wound. In patients with open lesions complicated by poor wound healing, it is important to emphasize proper wound care especially in the context of house pets. Ultimately, while these bacteria are rare causes of animal-associated infection, they are susceptible to beta-lactamase inhibitors and can be treated appropriately once identified.

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