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Erysipelothrix rhusiopathiae, Serotype 17, Septicemia in Moose (*Alces alces*) from Algonquin Park, Ontario

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ABSTRACT: *Erysipelothrix rhusiopathiae* septicemia was diagnosed in three of four moose found dead in Algonquin Provincial Park, Ontario, Canada, in the spring of 1989. Type 17 *E. rhusiopathiae* was isolated from liver, lung, kidney, and lymph nodes of affected animals, which were in poor body condition, and suffering hair loss associated with tick (*Dermacentor albipictus*) infestations. Microscopic lesions consisted of mild, multifocal, necrotizing myocarditis, sarcocystosis, and lymph node atrophy. The bacterium may have gained entry to these animals via ingestion of, or percutaneous exposure to, contaminated water, or possibly by the bites of ticks. Malnutrition and tick infestation may have predisposed the animals to infection by this opportunistic pathogen.

Key words: *Erysipelothrix rhusiopathiae*, moose, *Alces alces*, mortality, septicemia, pathology.

Erysipelothrix rhusiopathiae is the causative agent of swine erysipelas (Wood, 1984). In addition, it produces disease in other domestic animals, including cattle (Dreyfuss and Stephens, 1990; Kluge and Perl, 1992), domestic turkeys (Rosenwald and Carstvet, 1984), and sheep (Griffiths et al., 1991), and a broad range of avian and mammalian wildlife (Wood and Shuman, 1981). It is a zoonotic hazard, causing localized skin infections with rare systemic complications in human beings (Gyles, 1993). To our knowledge, *E. rhusiopathiae* has not previously been reported in moose (*Alces alces*), or in other free-living wildlife in Ontario.

Erysipelothrix rhusiopathiae is a slender, gram positive, non-motile, non-spore forming bacterium (Wood and Shuman, 1981), which may survive in soil and water for several weeks (Wood, 1972), and is believed to persist as an inapparent infection in carrier animals (Wood, 1984). Common manifestations of infection with *E. rhusiopathiae* include valvular endocarditis, cutaneous lesions, arthritis, pneumonia and septicemia (Gyles, 1993).

Four moose were found dead in April and May 1989 in the southern portion of Algonquin Park, near the heavily used Highway 60 corridor. Algonquin Park (45°25′ to 46°05′N, 77°30′ to 79°10′W) is a large provincial park on the southern edge of the Canadian Shield in Ontario, Canada; the predominant vegetation type is an ecotone between the boreal forest and Great Lakes mixed deciduous forest (Rowe, 1972).

The four animals included two calves, a 2-yr-old, and a mature animal, all males. All animals had moderately to markedly depleted visceral fat stores, and demonstrated some degree of muscle atrophy. All had moderate to extensive loss of hair, and the two older animals were heavily infested with winter ticks (*Dermacentor albipictus*). In all animals, most prescapular and prefemoral lymph nodes were prominent.

Field necropsies were performed and tissue samples (heart, lung, liver, kidney, peripheral lymph nodes) from these animals were shipped frozen to the wildlife pathology laboratory at the Ontario Veterinary College, University of Guelph, Ontario, Canada. Tissues were thawed, and representative samples were fixed in 10% neutral buffered formalin for histology or were submitted for bacteriological culture. Fixed tissues were embedded in paraffin, sectioned at 6 μm, and stained with hematoxylin and eosin and by the Brown and Brenn Gram stain (Luna, 1968). For bac-

terial culture, tissue samples were streaked on trypticase-soy agar (Oxoid, Unipath Ltd., Basingstoke, Hampshire, England) with 5% sheep blood, and on MacConkey's agar (Becton Dickinson Microbiology Systems, Cockeysville, Maryland, USA).

In two calves and the mature animal, pin-point alpha-hemolytic colonies of rod-shaped bacteria grew from a variety of tissues and were identified as *E. rhusiopathiae* by positive Gram stain, negative catalase reaction, and production of hydrogen sulphide (Carter, 1984). An isolate was serotyped as Type 17 (V. Nørrung, pers. comm.), which previously has been reported only from swine (Wood et al., 1978).

On microscopic examination of the tissues, a mild, multifocal interstitial infiltrate of macrophages and polymorphonuclear leukocytes in association with small foci of myofiber degeneration was seen in the myocardium of the mature animal and in one calf. In the mature animal, slender Gram-positive rods were seen in small cardiac veins and in a single, large, free thrombus. No areas of infarction were detected.

In all animals, there was moderate lymphoid atrophy, with partial hyalinization of cortical follicles, mild paracortical hypocellularity and marked capsular thickening. Small numbers of widely scattered cysts, similar to *Sarcocystis* sp., without inflammatory response, were present in the myocardium of three of the animals. The 2-yr-old, from which *E. rhusiopathiae* was not isolated, was diagnosed as an aspiration pneumonia, based upon the presence of diffuse pulmonary edema and plant material within distal airways.

Although *E. rhusiopathiae* causes a variety of diseases in a number of ruminants, including several species of Cervidae (reindeer (*Rangifer tarandus*), common muntjac (*Muntiacus muntjak*) (Wood and Shuman, 1981); white-tailed deer (*Odocoileus virginianus*) (Bruner et al., 1984); and roe deer (*Capreolus capreolus*) (Eskens and Zschock, 1991)), it was not cited in a survey of diseases of moose in North America (Lankester, 1987).

Several routes of infection with this bacterium have been reported in a variety of species: ingestion of contaminated water or feed, direct infection of open wounds, and transmission by hematophagous arthropods (Wood and Shuman, 1981). Any of these three routes are feasible in our cases. Moose are semi-aquatic, and easily could encounter contaminated water, which they might ingest. Skin abrasions on their limbs, or open wounds caused by insect or tick bites, or by rubbing in response to tick bites, could provide portals of entry. The bacterium has been isolated from several species of Ixodid ticks (Wood and Shuman, 1981). Surveys of *D. albipictus*, the tick which was recovered from these moose, might prove rewarding. All three animals in which *Erysipelothrix* sp. septicemia was diagnosed had experienced some degree of hair loss and fat depletion, and it is possible that the syndrome reflects an opportunistic infection in a debilitated, immunocompromised host.

Endocarditis, often associated with thrombosis, is the cardiac lesion most commonly associated with *Erysipelothrix* spp. infection (Wood, 1984). The multifocal myocarditis seen in these animals may have been the result of microinfarcts associated with septic thrombi such as those seen in one moose, but no such direct association was apparent in the tissue sections examined. *Erysipelothrix rhusiopathiae* infection also causes acute and chronic arthritis in many species, and must be considered as a possible etiology of arthritis reported in moose (Wobeser and Runge, 1975; Timmermann and Lankester, 1978).

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