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## **BRUCELLA SUIIS BIOTYPE 4: A CASE OF GRANULOMATOUS NEPHRITIS IN A BARREN GROUND CARIBOU (*RANGIFER TARANDUS GROENLANDICUS* L.) WITH A REVIEW OF THE DISTRIBUTION OF RANGIFERINE BRUCELLOSIS IN CANADA**

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**ABSTRACT:** Severe granulomatous nephritis caused by *Brucella suis* biotype 4 was found in a barren ground caribou (*Rangifer tarandus groenlandicus*) from Northwest Territories, Canada. A review of the distribution of human and animal cases of brucellosis in northern Canada indicated that *B. suis* biotype 4 is distributed widely and is probably enzootic in most Canadian caribou herds.

### **INTRODUCTION**

Caribou and reindeer (*Rangifer tarandus*) are primary hosts of *Brucella suis* biotype 4. Although infected caribou do not necessarily exhibit gross lesions, published reports from Alaska and Siberia have documented abortion, metritis, mastitis, bursitis, arthritis, orchitis and epididymitis caused by this organism (Davydov, 1965; Neiland et al., 1968). Abscesses have been seen in various organs including the kidney (Dieterich, 1981). One report mentions granulomas in lymph nodes and parenchymatous organs of infected reindeer (Davydov, 1965), but similar lesions are not described in the North American literature. In Canada, serological evidence of *Brucella* infection has been reported in the Kaminuriak caribou herd and the Mackenzie River Delta reindeer herd, but no lesions were found (Broughton et al., 1970). The present report describes an unusual renal lesion caused by *B. suis* biotype 4 in a caribou from the eastern arctic mainland of Canada, and reviews the known occurrence of rangiferine brucellosis in the Canadian arctic.

### **MATERIALS AND METHODS**

A single frozen caribou kidney and adjacent renal lymph node were forwarded to the Ani-

mal Pathology Laboratory from the nursing station at Repulse Bay, Northwest Territories (66°32'N, 86°15'W). A local hunter had shot the adult caribou and, on butchering it, noted that the kidney looked abnormal and "felt as if there were rocks inside it." The kidney and lymph node were examined grossly and portions were fixed in 10% buffered formalin, sectioned at 6  $\mu$ m, and stained with hematoxylin and eosin for light microscopic examination. Special histological staining procedures included Ziehl-Neelsen, Brown-Brenn, and Grocott methods (Luna, 1968).

Kidney tissue was ground and plated on blood agar and MacConkey's agar, and incubated aerobically at 37 C. Another portion of the kidney was homogenized with an equal volume of sterile 0.85% saline and a small amount of the suspension was swabbed onto a blood agar plate, two tryptose agar plates containing 1% dextrose, 5% bovine serum, bacitracin (25,000 I.U./liter), polymyxin B (6,000 I.U./liter) and cycloheximide (100 mg/liter), and two tryptose agar plates containing the same antibiotics plus ethyl violet (1:800,000). These were incubated at 37 C in 10% CO<sub>2</sub>.

### **RESULTS**

The renal capsule could not be peeled from the nodular cortical surface of the pale yellow kidney. It was difficult to cut through the organ because of its very hard, gritty texture. There were extensive amorphous areas of mineralization throughout the renal cortex and medulla, and only the renal pelvis was spared (Fig. 1). These lesions were confluent at one pole of the kidney, but multifocal at the other.

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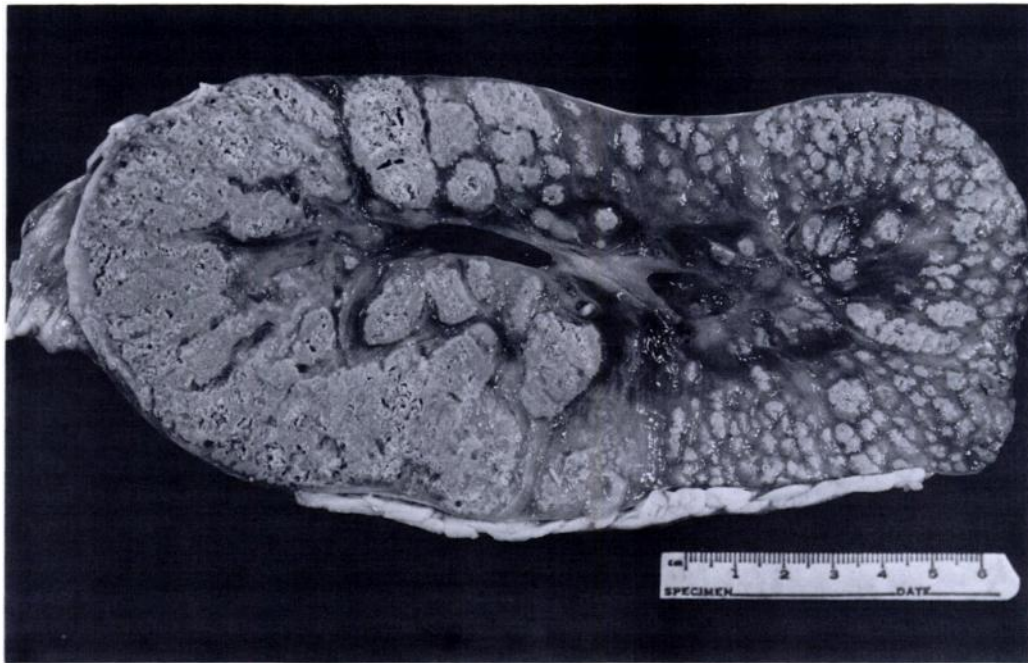


FIGURE 1. Longitudinal section of kidney of barren ground caribou demonstrating granulomatous nephritis caused by *Brucella suis* biotype 4.

Microscopically, the mineralized foci of caseous necrosis were surrounded by large numbers of plasmacytes, macrophages and epithelioid cells and there was extensive fibrous connective tissue between the granulomas. There were no normal nephron units remaining; few glomeruli were seen and the only remaining renal tubules were greatly dilated and filled with proteinaceous material and cellular debris. The renal pelvis appeared unaffected. The renal lymph node also contained large aggregates of macrophages and epithelioid cells, and many of the macrophages had hemosiderin in their cytoplasm. Special stains failed to demonstrate acid-fast organisms or mycotic agents.

A pure, confluent growth of translucent colonies was observed on all plates, except the MacConkey's agar, after 5 days incubation. Small, Gram-negative coccobacilli from these colonies were agglutinated rapidly by *Brucella abortus* and *B. suis* antisera (Difco Ltd., Detroit, Michigan 48232, USA). These bacteria were identi-

fied as *B. suis* biotype 4 by standard procedures (U.S. Department of Agriculture, 1965; Alton et al., 1975).

#### DISCUSSION

The pattern of lesions indicated a hematogenous route of infection, but the reason that one kidney was affected diffusely and the other had appeared grossly normal is not known. It was notable that large numbers of *B. suis* biotype 4 were found in such a chronic lesion. This caribou may have shed the bacteria in its urine during the course of infection. Most reports of this disease refer to the reproductive losses and debilitation due to articular lesions, but little is known about the morbidity and mortality that might be caused by visceral lesions in adult caribou.

Caribou are used widely for food by people in northern Canada and there have been proposals to harvest caribou commercially as is done at the reindeer enterprise in the Mackenzie River Delta. Recognition and documentation of the range

TABLE 1. Reports of brucellosis in people and animals in northern Canada.

Location and year	Site <sup>a</sup>	Source	Bacteriology and/or serology	Reference
Bathurst Inlet, N.W.T. <sup>b</sup> (66°45'N, 108°02'W); 1953, 1954	1	2 humans (clinical cases)	<i>B. melitensis</i> <sup>c</sup> isolated agglutination titers: 1:100 and 1:6,400	Matas and Corrigan (1953), Toshach (1955)
Coppermine, N.W.T. (67°50'N, 115°05'W); 1954	2	1 human (clinical case)	serum agglutination test titer: 1:200	Toshach (1963)
Cambridge Bay, N.W.T. (69°07'N, 105°03'W); 1955	3	1 human (clinical case)	<i>B. melitensis</i> or <i>B. suis</i> 2 <sup>c</sup> isolated serum agglutination titer: 1:1,600	Toshach (1963)
Fort Chimo, Que. (58°06'N, 68°24'W); 1955	4	1 of 128 people (sero-survey)	slide agglutination titer: >1:8	Greenberg et al. (1958)
Pond Inlet, N.W.T. (72°41'N, 78°00'W); 1955	5	1 of 57 people (sero-survey)	slide agglutination titer: >1:8	Greenberg et al. (1958)
Bathurst Inlet, N.W.T.; 1955	1	1 of 42 people (sero-survey)	slide agglutination titer: >1:8	Greenberg et al. (1958)
Bathurst Inlet, N.W.T.; 1959	1	1 human (clinical case)	<i>B. melitensis</i> or <i>B. suis</i> 2 <sup>c</sup> isolated serum agglutination titer: 1:800	Toshach (1963)
Bathurst Inlet, N.W.T.; 1960	1	1 human (clinical case)	serum agglutination titer: 1:800	Toshach (1963)
Bathurst Inlet, N.W.T.; 1961	1	1 human (clinical case)	serum agglutination titer: 1:800	Toshach (1963)
Frobisher Bay, N.W.T. (63°45'N, 68°31'W); 1969	6	1 human (clinical case)	<i>B. suis</i> biotype 1 <sup>c</sup> isolated	Health and Welfare Canada (unpublished data)
Frobisher Bay, N.W.T.; 1973	6	1 human (clinical case)	<i>B. suis</i> biotype 1 <sup>c</sup> isolated	Kein et al. (1974)
Mackenzie River Delta, N.W.T.; 1960–1969	7	148 out of 1,692 reindeer (survey)	tube agglutination titers ≥1:25	Broughton et al. (1970)
Kaministiquia caribou herd range; 1966–1968	8	14 out of 320 caribou (survey)	tube agglutination titers ≥1:25	Broughton et al. (1970)
Coppermine, N.W.T.; 1981	2	1 caribou with carpal hygroma	<i>B. suis</i> biotype 4 isolated	G. Wobeser (unpublished data)
Gary River, N.W.T. (65°55'N, 100°47'W); 1982	9	1 muskox ( <i>Ovis moschatus</i> ) with carpal hygromas	<i>B. suis</i> biotype 4 isolated	Gates et al. (1984)

TABLE 1. Continued.

Location and year	Site <sup>a</sup>	Source	Bacteriology and/or serology	Reference
Churchill, Man. area (58°45'N, 94°07'W); 1983	10	1 caribou with orchitis	<i>B. suis</i> biotype 4 isolated	Animal Pathology Laboratory (unpublished data)
Coppermine, N.W.T.; 1983	2	1 caribou with hygro-ma and mastitis	<i>B. suis</i> biotype 4 isolated	Animal Pathology Laboratory (unpublished data)
Frobisher Bay, Clyde River (70°27'N, 68°33'W), Arctic Bay (73°02'N, 85°11'W), and Pangnirtung (66°08'N, 65°43'W); 1983	6 11 12 13	43 caribou (serosurvey)	Complement fixation tests: 15 sera $\geq$ 1:80, 2 sera at 1:5	M. Ferguson, N.W.T. Wildlife Service, and Animal Diseases Research Institute, Nepean, Ontario (unpublished data)
Spence Bay, N.W.T. (69°32'N, 93°32'W); 1984	14	1 human (clinical case)	<i>B. suis</i> biotype 4 isolated	Animal Diseases Research Institute, Nepean, Ontario (unpublished data)
Repulse Bay, N.W.T. (66°32'N, 86°15'W); 1984	15	1 caribou with suppurative bursitis	<i>B. suis</i> biotype 4 isolated	Animal Pathology Laboratory (unpublished data)
Pelly Bay, N.W.T. (68°32'N, 89°50'W); 1985	16	1 caribou with tenosynovitis	<i>B. suis</i> biotype 4 isolated	G. Wobeser (unpublished data)

<sup>a</sup>Site number indicated on Figure 2.<sup>b</sup>N.W.T. = Northwest Territories.<sup>c</sup>It is likely that these *Brucella* isolates were *B. suis* biotype 4.

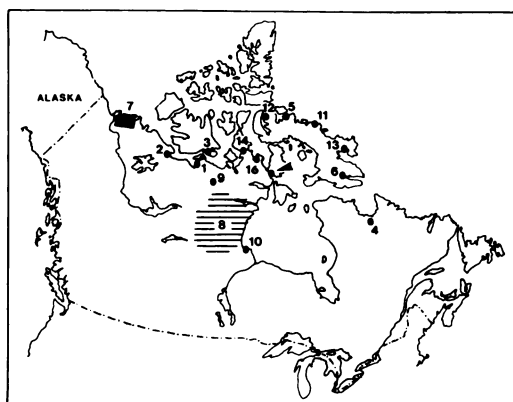


FIGURE 2. Location of reported instances of brucellosis in northern Canada. Numbers correspond to the cases listed in Table 1. The arrow indicates Repulse Bay, the location of the case of granulomatous nephritis in a barren ground caribou and of case number 15 in Table 1.

of lesions caused by *B. suis* biotype 4 in caribou is important from a food-hygiene standpoint because of the zoonotic significance of the disease.

In Table 1 information on brucellosis in the Canadian arctic is summarized. *Brucella suis* biotype 4 infections were confirmed in an additional nine Inuit people from arctic Canada between 1971 and 1984, but the precise locations of these cases were not documented (Laboratory Center for Disease Control, Health and Welfare Canada, Ottawa, Ontario, unpubl.). The broad geographical distribution of human and animal cases (Fig. 2) suggests that rangiferine brucellosis is enzootic in most Canadian caribou herds.

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bacteriology results for the human case from Spence Bay, Northwest Territories. Microscope slides and the photograph were prepared by the staff of the Department of Veterinary Pathology, Western College of Veterinary Medicine, Saskatoon, Saskatchewan. Also we thank Dr. G. Wobeser, Western College of Veterinary Medicine, and Dr. W. D. G. Yates for their valuable comments on the manuscript.

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