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Lyme borreliosis in Ontario: determining the risks

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In this issue of *CMAJ* Satyendra Banerjee and colleagues highlight the possibility of exposure to Lyme borreliosis in Ontario.[1] What is the likelihood of encountering the blacklegged tick, *Ixodes scapularis*, the vector of Lyme borreliosis, in eastern Canada? Is this likelihood changing? And what are the implications?

Until recently, the only known Canadian population of *I. scapularis* was found at Long Point, on the north shore of Lake Erie.[2] However, many individual *I. scapularis* ticks have been found, on people and pets with no history of travel, throughout Saskatchewan, southern Manitoba, Ontario, Quebec and the Atlantic provinces.[3,4] Such ticks, found at sites where the species is not endemic, are "adventitious" (coming from without, accidental), having arrived as immature stages on birds migrating from tick-endemic areas to the south.[2,5,6]

Adventitious ticks may transmit *B. burgdorferi* if they have previously fed on an infected host.[6] Given that only 9 (6.5%) of the 139 adult ticks examined by Banerjee and colleagues carried *B. burgdorferi*, many probably originated in areas where few hosts were infected. However, in some localities up to about 20% of nymphs,[7] which seem most important in transmitting *B. burgdorferi* to people,[8] and more than 50% of adults[7] may be infected.

Despite their wide distribution, the density of adventitious ticks in the environment is very low; hence, indigenous Lyme borreliosis is uncommon in Ontario, accounting for 127 of 280 cases of the disease diagnosed in the province between 1981 and 1998 (Charles A. LeBer, Ontario Ministry of Health and Long-Term Care: personal communication, 1999). Passive surveillance underestimates incidence[9] but does permit comparisons of risk. From 1988 to 1998 the highest mean annual incidence of indigenous cases per 100 000 population in Ontario (0.4) was in the northwest, where an outdoor lifestyle may enhance exposure. In the region including Long Point, the annual incidence of indigenous cases for the same period was 0.2 per 100 000 population, whereas in the rest of the province it was 0.1 per 100 000 population. The overall mean annual incidence of Lyme borreliosis in Ontario, including cases acquired out of province, was 0.2 per 100 000 population (Charles A. LeBer: personal communication, 1999). These data are similar to the mean annual incidence per 100 000 over the period 1989 to 1998 in states such as Michigan (0.54 [0.18 in 1998]), Ohio (0.45 [0.42 in 1998]) and Illinois (0.25 [0.12 in 1998]),[10] where there are few established populations of *I. scapularis*. These rates are much lower than the annual incidence where vector populations are widespread and moderately high, such as Minnesota (3.83 [5.66 in 1998]) and Wisconsin (9.29 [12.83 in 1998]), and pale in comparison to data from New York (21.76 [25.51 in 1998]), Connecticut (55.62 [105 in 1998]) and Nantucket County, Massachusetts (more than 1200 in 1996),[11] where infected vectors are commonly encountered.

If enough adventitious immature ticks are introduced to an area, some may survive to find a mate and establish a local population. However, given that *B. burgdorferi* is not transmitted through the tick egg, subsequent generations of ticks will not pose a threat until an infected host, such as a migratory bird, introduces the spirochete into the host–vector cycle in that locality.

The range of *I. scapularis* in the United States is expanding.[12] Range expansion, and a concomitant local increase in the risk of Lyme borreliosis, is also occurring in Ontario. We have detected recently established populations of *I. scapularis* at Point Pelee National Park and Rondeau Provincial Park on the north shore of Lake Erie, as well as evidence for other populations at the eastern end of Lake Ontario, all on landfalls for spring migrant birds (unpublished data). Other such populations may remain undetected, as Banerjee and colleagues imply. Identification and communication of the location and extent of new areas of *I. scapularis* endemicity is required to inform public health education and to assist physicians in evaluating the risk of exposure.

I. scapularis can theoretically become established throughout Ontario south of North Bay, in the Kenora – Rainy River region of northwestern Ontario[3] and possibly in parts of southern Manitoba and Quebec. Climatic constraints on development of the various life stages will likely prevent establishment of populations in most of northern Ontario and possibly in the Maritimes and much of Manitoba and Quebec.

Physicians should recognize that exposure to *B. burgdorferi*, though uncommon, can occur in Canada. The low incidence complicates the diagnosis of an already problematic disease. Canadian primary care physicians can gain little experience with Lyme borreliosis. Unsuspected biting ticks may go unnoticed, and symptoms other than the characteristic erythema migrans rash, which occurs in about 90% of culture-confirmed cases, are nonspecific.[13] Because infection is uncommon, first-step serologic tests (indirect fluorescence assay, enzyme-linked immunosorbent assay and immunodot assay) are more likely to produce a false-positive result than a true-positive result.[14] The more specific second-step test, Western blotting, should be carried out as a sequel to a positive first-step test.[14] Such testing, which is required by the Central Public Health Laboratory in Ontario (Charles A. LeBer: personal communication, 1999), reduces the risk of misdiagnosis on the basis of serologic testing. To detect specific IgG antibodies, Western blotting must be carried out after a month of illness.[14,15] A diagnosis of Lyme borreliosis must be based on critical evaluation of all clinical and laboratory data,[13–15] including any history of exposure to ticks or travel to an area were *I. scapularis* is endemic.

I. scapularis also transmits *Babesia microti*, the agent of human granulocytic ehrlichiosis, and deer tick virus, which is closely related to Powassan virus but of unknown pathogenicity.[16] These agents, which may concurrently infect people with Lyme borreliosis and which do cause disease (although uncommonly) in the Unit ed States, have yet to be recognized in ticks in Canada. However, they may affect travellers.[17]

I. scapularis is not the most common tick on people and pets in Canada. The more common ticks do not transmit *B. burgdorferi*,[7,18] but they do serve as vectors for other zoonoses. *Dermacentor variabilis*, found east of central Saskatchewan, and *Dermacentor andersoni*, found further to the west, transmit Rocky Mountain spotted fever; *D. variabilis* also transmits Q fever and tularemia.[19] *Ixodes cookei* transmits Powassan virus.[20]

Simple measures can mitigate the risk of acquiring any tick-borne zoonoses. These include, at the societal level, publicizing areas where ticks are endemic, so that these areas may be avoided or greater vigilance taken by people who do visit them; and, at the individual level, tucking in pant cuffs and wearing long-sleeved shirts; applying DEET-based repellents to clothing and exposed skin; and carefully examining clothing and body for ticks after a day outdoors. The mouthparts of attached ticks should be grasped with forceps at skin level, and the tick slowly withdrawn. Early removal of ticks may diminish the probability of acquiring Lyme borreliosis and other zoonoses.

Current information on Lyme borreliosis, other than Canadian epidemiology, is readily accessible at the US Centers for Disease Control and Prevention Lyme disease Web site (www.cdc.gov/ncidod/dvbid/lymeinfo.htm).

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