

TICK-BORNE BORRELIOSIS - USA: (CALIFORNIA) **BORRELIA MIYAMOTOI**

A ProMED-mail post

<<http://www.promedmail.org>>

ProMED-mail is a program of the

International Society for Infectious Diseases <<http://www.isid.org>>

Date: Wed 19 Feb 2014

Source: Emerging Infectious Diseases Journal [edited]

<http://wwwnc.cdc.gov/eid/article/20/3/13-0668_article.htm>

DJ, Cinkovich S, Nieto NC: Tick-borne pathogens in northwestern California, USA [letter].
Emerg Infect Dis [Internet].

2014 Mar [date cited]. <<http://dx.doi.org/10.3201/eid2003.130668>>

In northwestern California, USA, the western black-legged tick, *Ixodes pacificus*, is a known vector of *Borrelia burgdorferi*, the spirochete that causes Lyme disease. *Borrelia miyamotoi*, which is more closely related to spirochetes that cause relapsing fever, has also been detected in 2 locations in California (1,2) and has recently been implicated as a human pathogen in the northeastern United States (3,4). Other studies may have unintentionally included *B. miyamotoi* infections among measures of *B. burgdorferi* if the diagnostics were for spirochetes (such as, direct fluorescent antibody tests or dark-field microscopy) or genetically targeted for *Borrelia* spp. (5).

To investigate *Borrelia* spp. ecology in California, we collected adult *I. pacificus* ticks by dragging a 1-sq m white flannel blanket along vegetation and/or leaf litter in 12 recreational areas in the San Francisco Bay area during January-May 2012 (Table). Habitat varied from chaparral and grassland to coastal live oak woodland. Ticks were pooled for examination by quantitative PCR (qPCR) for the presence of *Borrelia* spp. We interpreted the prevalence of *Borrelia* spp. from positive pools as the minimum infection prevalence (that is, assuming 1 positive tick/positive pool). DNA was extracted from ticks by using the DNeasy Blood and Tissue Kit (QIAGEN, Valencia, CA, USA) according to the manufacturer's protocols and then stored at -20 deg C [-4 deg F] until use. DNA was analyzed by qPCR, with use of primer and fluorescent hybridization probes previously developed to differentiate *Borrelia* spp. spirochetes (5).

To identify the *Borrelia* spp. genotype, we attempted to sequence the 16S-23S (rrs-rrlA) intergenic spacer of each sample positive by qPCR (8). The nested PCR product was further purified by using the QIAquick Kit (QIAGEN) and then sequenced (Environmental Genetics and Genomics Laboratory, Northern Arizona University, Flagstaff, AZ, USA; <<http://www.enggen.nau.edu/dna.html>>) by using capillary Sanger sequencing on an ABI 3730 sequencer (Life Technologies, Grand Island, NY, USA). BLAST (<<http://blast.ncbi.nlm.nih.gov/Blast.cgi>>) was used to compare each sequence to other *Borrelia* spp. sequences available from GenBank.

>From a total of 1180 adult ticks, we found 43 samples positive for *Borrelia* spp., resulting in a minimum infection prevalence of 3.6 percent (Table). We obtained intergenic spacer sequence data for 27 of the positive samples; 6 samples were *B. burgdorferi* sensu stricto, 7 were *B. burgdorferi* sensu lato (both on the basis of alignments of 816 bp), and 14 were *B. miyamotoi* (on the basis of alignments of 503 bp). The *B. miyamotoi* sequences for our samples from California and those for isolates from the eastern United States (9) and Japan (8) formed a monophyletic clade that was oriented as a sister clade to the 3 *Borrelia* spp. that cause tick-borne relapsing fever in the United States (*B. hermsii*, *B. turicatae*, and *B. parkeri*).

We found borreliae-infected adult *I. pacificus* ticks at all 12 sites from which tick sample sizes exceeded 30. When the presence of *B. burgdorferi* sensu stricto or *B. burgdorferi* sensu lato was detected (4/12 sites each), prevalence was 0.6-2.2 percent and 0.7-2.5 percent, respectively.

B. miyamotoi was detected at 7/12 sites, and prevalence ranged from 0.7 percent to 7.5 percent. A previous survey of *B. burgdorferi* in nearby Santa Cruz County recreational areas reported an infection prevalence of approximately 6 percent among adult *I. pacificus* ticks (6); the study did not, however, differentiate between *Borrelia* spp. and therefore may have included *B. miyamotoi* among its prevalence measures (5).

In our study, *B. burgdorferi* was found more frequently in woodland habitats, but it was also detected in a grassland-chaparral habitat several hundred meters from the nearest woodland. We did not detect *Borrelia bissettii*, a species recently implicated as a human pathogen in Mendocino County, California (10). The high level of habitat variation in northwestern California presents a varied risk for *Borrelia*-associated tick-borne disease in humans because of diverse variations in vertebrate reservoir ecology, tick abundance, and human exposure to ticks. This variation emphasizes the need to understand the local epidemiology and ecology of a disease.

In adult *I. pacificus* ticks in the San Francisco Bay area, *B. miyamotoi* is as abundant as its congener *B. burgdorferi*. Human disease caused by *B. miyamotoi* infection has not been reported in California, and transmission efficiency of *B. miyamotoi* by *I. pacificus* ticks is unknown. However, it is possible that *B. miyamotoi* infections in ticks and humans have not been accurately diagnosed. We advocate for increased scrutiny of the eco-epidemiology of *B. miyamotoi* in human, tick, and possible vertebrate host populations in northwestern California.

[The tables and references are available at the source URL above.]

--

Communicated by:
ProMED-mail from HealthMap Alerts

<promed@promedmail.org>

[For a detailed discussion of *Borrelia miyamotoi*, the clinical presentations of illness produced by this organism and its epidemiology, please see moderator ML's comments in ProMED-mail posts Tick-borne borreliosis - USA: (South. New Engl., NY) *B. miyamotoi* 20130118.1504740 and Tick-borne borreliosis - USA (02): (MA,NJ) *B. miyamotoi* 20130703.1805219; and moderator LL's comments in posts Tick-borne relapsing fever - Russia: (SV) *Borrelia miyamotoi* 20110920.2858 and Tick-borne relapsing fever - USA (02): discussion 20110824.2580.

It is apparent that human infection with *B. miyamotoi* can present as a non-specific acute febrile illness with fever as high as 39.5 deg C (103.1 deg F), headache, and myalgias or as a relapsing fever-like illness. It also has the potential to be misdiagnosed as Lyme disease, although *B. miyamotoi* usually does not cause the bull's eye shaped rash that characterizes Lyme disease, or be misdiagnosed as human granulocytic anaplasmosis, two other tick-borne diseases. The infection has also presented in an elderly, immunocompromised woman with confusion and an unsteady gait.

B. miyamotoi can be detected by PCR in the blood of infected patients, or the diagnosis could be made with a specific serologic test, for example, one that uses *Borrelia miyamotoi* GIpQ protein (an antigen that is nonreactive to *Borrelia burgdorferi* antibody), but these tests may not be widely available. The 2 step serology for Lyme disease is usually negative in *B. miyamotoi* infections. Because of its non-specific clinical presentation and lack of readily available diagnostic laboratory tests, the true extent of *B. miyamotoi* infection may be underappreciated.

Maps of California can be seen at <<http://healthmap.org/r/ahFb>> and <<http://www.digital-topo-maps.com/county-map/california.shtml>>. - Mod.ML]