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To Stop Lyme, Vaccinate...the Mice?
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February 14, 2014

Field trials of a new oral vaccine against Borrelia burgdorferi in mice significantly reduced the level of infected ticks in the treated areas and might help lower the risk for human infection, researchers report in an article published online February 11 in the Journal of Infectious Diseases.

The oral bait vaccine elicits antibody responses against the outer surface protein A (OspA) of B burgdorferi. According to the authors, injectable vaccines based on OspA have been shown to protect humans, dogs, and mice against infection. This study provides proof of concept that an oral anti-OspA can provide similar protection.

Maria Gomes-Solecki, DVM, and colleagues tested a new oral anti-OspA formulation that is being commercialized by US Biologic. Dr. Gomes-Solecki is assistant professor at the University of Tennessee Health Sciences Center, Memphis, and owner of Biopeptides, Inc.

The field trial targeted white-footed mice (Peromyscus leucopus) because they are the major reservoir for B burgdorferi, which is then transmitted to the Ixodes scapularis tick, the vector for transmission to humans. "A high prevalence of infection with Borrelia burgdorferi in ixodid ticks is correlated with a high incidence of Lyme disease," the authors write.

Gary M. Green, MD, infectious disease specialist at Kaiser Permanente, Santa Rose, California, told Medscape Medical News, "This is a novel approach aimed at environmental control of Lyme disease by breaking the cycle of transmission between the tick vector and the reservoir host, which is the white-footed mouse. It seems clear now that [for] Lyme disease, which occurs in complex peridomestic areas where forest regrowth has increased contact between humans and Lyme vectors, a multipronged strategy for disease control is needed. This type of vaccine aimed at the reservoir host might be one of those prongs." Dr. Green was not involved in the study.

The researchers conducted a prospective 5-year field trial in Lyme-endemic Dutchess County, New York, which involved seven 1.1-hectare plots of similar oak-dominated forest and understory vegetation, as well as soil type, slope, and drainage. Four of the plots were treated with an oatmeal-based OspA/RTV bait including 200 mg Escherichia coli expressing OspA; 3 control plots were treated with oatmeal only. Each plot had an 8 by 8 array of live traps and was baited in the late afternoon for 5 consecutive nights per week from mid-May until mid-September. Vaccine consumption was recorded the next morning, and captured mice were tagged with numbered ear tags.

During the peak time for ticks, 10 mice per grid were brought into the lab, and their blood was tested for anti-OspA antibody levels. Host-seeking nymphal ticks were collected in

May and June from each plot, B burgdorferi DNA was extracted from 16 to 150 ticks per site per year, and real-time polymerase chain reaction was used to assess tick infection rate and vaccine efficacy.

The authors report that oral vaccination of the mice resulted in OspA-specific seropositivity followed by reductions in the number of infected ticks by 23% at year 2 and 76% at year 5 in the treated areas.

"Although eliminating B. burgdorferi from its natural enzootic cycle seems unrealistic, diminishing its threat to humans via reduction of the tick infection prevalence is an achievable goal with remarkable public health ramifications.... Our results suggest that prevention of Lyme disease can be shifted from the current standard of direct vaccination of humans to an indirect strategy of containment of transmission, as the pathogen moves through its natural enzootic cycle, before it spins out into a zoonotic human disease," the authors write.

The study was supported by the Centers for Disease Control and Prevention, the National Institute of Allergy and Infectious Diseases, and the National Science Foundation. Dr. Gomes-Solecki has relevant patents that might pose a conflict of interest and is chair of the scientific advisory of and a shareholder in US Biologic. The other authors and Dr. Green have disclosed no relevant financial relationships.

J Infect Dis. Published online February 11, 2014. Abstract

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Cite this article: To Stop Lyme, Vaccinate...the Mice? Medscape. Feb 14, 2014.