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List of Diseases Spread by Deer Tick Grows, Along with Their Range

From malaria-like problems to potentially fatal encephalitis, newly emerging tick-borne afflictions challenge scientists to improve diagnosis and surveillance

ATLANTA (November 12, 2012)—An emerging tick-borne disease that causes symptoms similar to malaria is expanding its range in areas of the northeast where it has become well-established, according to new research presented today at the annual meeting of the American Society of Tropical Medicine and Hygiene (ASTMH).

Researchers from the Yale School of Public Health reported that from 2000 to 2008, cases of babesiosis—which invades red blood cells and is carried by the same tick that causes Lyme disease—expanded from 30 to 85 towns in Connecticut. Cases of the disease in Connecticut, where it was first reported in 1991, also have risen from 3 to about 100 cases per year.

The findings on babesiosis presented at the ASTMH annual meeting were accompanied by discussions of a range of other investigations into newly emerging tick-borne diseases, which include afflictions that can cause fatal encephalitis, an inflammation of the brain.

“Today’s findings underscore the shifting landscape of tick-borne diseases, whose rapid emergence can challenge the best efforts of science and medicine to diagnose, treat, and prevent their occurrence,” said Peter Krause, MD, a researcher at the Yale School of Public Health in New Haven, Connecticut.

ASTMH President James W. Kazura, MD, FASTMH, said: “This is a real-time illustration of the interconnectedness of human and animal health that many people don’t often think about. Ticks are a major carrier for many human diseases and efforts like this offer timely information that is of regional and clinical importance.”

Lyme disease—with 20,000-30,000 cases reported each year in the United States—is still the best known example of a recently emerged tick-borne disease. But research points to a growing number of pathogens carried by the deer tick, all of which are expanding their range.

Malaria look-alike in United States

A prime example is babesiosis, which is caused by the parasite *Babesia microti*. It has similarities to malaria in that it invades and destroys red blood cells. In the United States, this parasite is the most common pathogen transmitted through blood transfusions.

Acute cases are commonly associated with fever, fatigue, chills, headache, sweats and muscle pain. Infection can be asymptomatic or severe, causing death in about 6 to 9 percent of patients hospitalized with the illness. If transmitted through a blood transfusion, the mortality rate is about 20 percent. However, if properly diagnosed, babesiosis generally is promptly cured with antibiotics.

Its range is expanding:

- Krause's colleague at Yale, Maria Diuk-Wasser, PhD, said that as *Babesia* has expanded its range. In some northern Connecticut towns the current rate of deer tick infection is now similar or even higher than in coastal Connecticut or the highly-endemic Nantucket Island, where about 10 percent of deer ticks are carrying the *B. microti* parasite.
- The expansion of *Babesia*'s range in Connecticut follows a similar explosion of the parasite in New York's Lower Hudson Valley, where the number of cases diagnosed in residents increased 20-fold from 2001 to 2008, from 6 cases to 119 cases per year during 2001 to 2008.
- Babesiosis is now considered endemic in Connecticut, Massachusetts, Minnesota, New Jersey, New York, Rhode Island, and Wisconsin. And cases have turned up in at least 8 other states, from Washington to northern California in the West and from Maine to Maryland in the East.

In a separate study, Krause, Diuk-Wasser, Durland Fish, MD, and colleagues found evidence that Lyme disease and babesiosis parasite co-infection in mice appears to increase the transmission of *Babesia microti* and enhance its ability to become established in new areas.

They studied mice that had been deliberately infected with either one of the parasites that cause the diseases—*B. microti* in the case of babesiosis and *B. burgdorferi* for Lyme—or both at the same time. They allowed ticks to feed on the mice, and then each week over a six-week period they measured the percentage of ticks infected with each pathogen. They found ticks that fed on the mice infected with *both* the Lyme and babesiosis parasites were more likely to be carrying *Babesia*—and at higher concentrations—than ticks that fed on the mice infected only with the babesiosis parasite.

“This suggests that Lyme disease is somehow intensifying transmission of babesiosis,” Krause said.

Encephalitis-causing Ticks Emerging in Northeast

Marc El Khoury, MD, with New York Medical College in Valhalla, New York, reported on two related diseases: deer tick virus, which, as its name suggests, is carried by the hard-bodied deer tick, and Powassan virus (POWV), which is carried by a soft-bodied tick that feeds on groundhogs and woodchucks. But the two diseases share a common ancestor and are difficult to tell apart in standard antibody tests.

Until recently, however, deer tick virus was not considered a threat to human health. The first clue that deer tick virus could cause human disease came in 2001 when deer tick virus RNA, taken from the brain of a man who died in 1997 shortly after a presumed Powassan encephalitis infection, was sequenced.

Now, El Khoury reports that, in Lyme-endemic areas, many, if not all, cases previously diagnosed as POWV are likely deer tick virus. Furthermore, the number of cases appears to be rising rapidly. Between 1958 and 2003—a span of 45 years—only about 40 cases of POWV were reported in the United States and Canada. Then, in four years, from 2008 to 2012, 21 cases were reported from Wisconsin and Minnesota, and 12 cases from New York State.

“Almost all of these cases are in Lyme country, where humans are much more likely to be preyed upon by deer ticks carrying deer tick virus than ticks carrying Powassan virus,” El Khoury said. “Now it appears that in Lyme-endemic areas, people can not only get Lyme disease or babesiosis, but also a deer tick virus-related meningoencephalitis.”

Many infections are probably mild or asymptomatic. But more severe infections can progress to encephalitis, which can have a case fatality rate of up to 15 percent and cause permanent nerve or brain damage in about 50 percent of diagnosed cases. Powassan virus infections (that may in fact be deer tick virus) have been reported in Pennsylvania, New Jersey, Massachusetts, New York, Connecticut, Maine, Vermont, Minnesota, and Wisconsin.

There’s Nothing Like Family

And that’s not all. Deer ticks also are known to transmit a bacterial disease known as HGA (human granulocytic anaplasmosis) Also known as ehrlichiosis, HGA has become the third most frequent vector-borne disease in North America and Europe, and is now emerging in Asia, according to J. Stephen Dumler, MD, at Johns Hopkins University School of Medicine in Baltimore, Maryland.

HGA attacks white blood cells, and while milder forms cause fever and muscle pain, it can also cause serious disease and immune system malfunction that can lead to opportunistic infections. It is related to Rocky Mountain spotted fever (transmitted by another tick species) and typhus (transmitted by lice.)

HGA’s rapid spread has been abetted by an expanded family of deer tick relatives, with different, closely related tick species carrying the disease in the Western United States, Europe and Asia, Dumler said. But as in the case of POWV and deer tick virus, limited information can sometimes lead to incorrect conclusions when it comes to the growing menagerie of tick-borne pathogens.

Dumler reported on an unusual outbreak of life-threatening HGA in China between 2007 and 2010 that affected hundreds of patients. But when scientists looked more closely, scrutinizing patients’ blood for foreign DNA and sequencing whatever they found, the culprit was identified not as HGA but as a novel tick-borne virus—one that had a 30 percent case fatality rate. And just this summer, a novel, closely-related and dangerous tick-borne virus infected two Missouri men.

Sam Telford, MD, of Tufts University in Massachusetts noted that one of the biggest challenges posed by the emergence of new tick-borne diseases is the ability to match surveillance capabilities with the discovery of new diseases.

“We increasingly need to apply the most sophisticated genetic tools to identify the numerous new tick-borne microbes that have the theoretical capacity to infect humans,” Telford said. “Only by raising awareness among health professionals of what to look for, publishing case reports with good laboratory

details, and doing good epidemiology will we be able to truly understand and appropriately respond to emerging disease threats.”

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About the American Society of Tropical Medicine and Hygiene

[ASTMH](#), founded in 1903, is a worldwide organization of scientists, clinicians and program professionals whose mission is to promote global health through the prevention and control of infectious and other diseases that disproportionately afflict the global poor.

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