

FEATURE

The Fine Art of Tick Testing

Knowing the infectious agents in your tick increases the likelihood of proper treatment

By Karen Miller

So you've been bitten by a tick. What do you do? After you've removed the little sucker (immediately *and* safely), it's decision time. Should you test it? Save it in case you get sick and *then* test? Throw it away and hope for the best? To know what to do, you need to find out four things: what tick you have, what pathogen(s) to test for, what type of test to request, and what lab to use.

In the U.S. there are nine ticks generally acknowledged to bite humans and transmit disease-causing pathogens. Currently, there are 17 ticks that cause tick-borne diseases nationwide. Though often ignored in CDC discussions, the west coast is a biodiversity hotspot. Nine of those 17 diseases have been found in northern California, transmitted by six species of ticks. Robert Lane, medical epidemiologist from UC Berkeley, has mentioned four new pathogens recently discovered in this region. Other regions, commonly acknowledged as high-risk areas for TBD, may have fewer pathogens but higher rates of infection in ticks. Inform yourself as to what pathogens occur in your area.

Identifying ticks can be difficult. Technicians in many northern California and some Oregon and Washington county

labs often do so for free. I failed to turn up even one county lab in the northeast and midwest that would test ticks, though some would identify them. Some vector control districts and many commercial labs will do so as part of their service (IGeneX does not). Check public health labs, vector control districts, and entomology or veterinary labs at universities for help.

Which test?

If you become sick, testing the tick can tell you what pathogen(s) you were exposed to *by a particular tick*. A negative tick test is not the full story since you may not know if you were bitten another time. Still, knowing which pathogen(s) you were likely exposed to can help you consider a useful treatment approach.

Choosing tests depends on what is available and how much money you are prepared to spend. The chart prepared by Target Lyme of Sonoma County, CA, shows the pathogens *known* to occur in the U.S. These 17 pathogens are correlated with specific ticks known to carry them. Remember, however, that new pathogens are being discovered with some frequency.

Most county public health labs test only for *Borrelia burgdorferi*, strain B31, using an insensitive IFA (immunofluorescence assay) test. A number of commercial labs offer a wider range of tests including the more sensitive polymerase chain reaction (PCR). In the northeast, tick testing is not offered by either state or county labs. A few labs – such as in Dutchess County, NY – can identify the tick and estimate engorgement before referring you to the University of Massachusetts for testing. I found no public health lab in the northeast that offered tick testing although a few universities do. Spot-checking in Oregon and Washington elicited no state or county lab that offered tick testing. Vector control districts generally do not test ticks that have been attached to a human.

In California the situation is a bit different. Most northern California regional public health labs will test ticks for about \$30-40 and will identify the tick (often for free). However, they will only test *Ixodes pacificus* (Western Black-legged tick) and will only test for *B. burgdorferi*. Unfortunately, they test the ticks using an IFA test, which (according to the Sonoma County lab director) will only test positive if there are a minimum of about 100,000 spirochetes. A PCR test, in contrast, will show positive with fewer than 100 spirochetes. According to the U. Mass lab, their PCR test can detect as few as three molecules of DNA.

Sonoma County uses the less sensitive IFA test because it has “better positive predictive value” for human disease. That is, assuming it takes a certain number of organisms to cause disease, they believe that a dose of 100,000 organisms is more likely to cause infection. Unfortunately, this test may be *too* insensitive. The “infectious dose” varies with the genospecies and strain of

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Continued on page 29

Borrelia, so the best cut-off point is unknown.

The Sonoma lab tests roughly 1000 ticks per year and gets 1-2 % positive for *B. burgdorferi*.¹ The infection rate of nymphal ticks is even less, which is contrary to local tick survey results where they are *always* infected at a higher rate than adults. So the numbers match (15-20 positive ticks per year vs. approximately 15-20 human cases per year in five counties served by the lab), but they don't necessarily correlate with *who* gets sick. While this lab finds mostly adult ticks infected with *Bb*, it is most often nymphal ticks causing human infection.

In brief:

Results of tick tests should not be used to predict who gets sick. There are too many variables and no apparent correlation.

Don't wait for test results before treating prophylactically. Preventive treatment is most effective when begun in the first 24 hours after a bite and (according to a recent mouse model study² less effective if begun more than three days later. Tick testing is unnecessary in deciding to get preventive treatment – that should be based on where you picked up the tick and how much risk you are willing to take.

Which lab?

Check first! If you decide to use a publicly-accessible com-

1 sonoma-county.org/health/publications/index.asp#factsheets,

2 Piesman, *et al*, "Efficacy of an Experimental Azithromycin Cream for Prophylaxis of Tick-Transmitted Lyme Disease Spirochete Infection in a Murine Model," *Antimicrob. Agents Chemother.* January 2014 vol. 58 no. 1 348-351

Tick Testing Laboratories

Lab	Cost	Available tests
N. Arizona U	Free in U.S.	<i>Borrelia burgdorferi</i> & <i>miyamotoi</i> , <i>Anaplasma</i> , <i>Babesia microti</i> , <i>Ehrlichia</i>
IGeneX	\$68 ea	<i>Borrelia burgdorferi</i> & <i>miyamotoi</i> , <i>Babesia microti</i> & <i>duncani</i> , <i>Bartonella</i> , RMSF
U Mass LMZ	\$50/set <i>determined by tick species</i>	<i>Ixodes Tick</i> : <i>Borrelia burgdorferi</i> & <i>miyamotoi</i> , <i>Anaplasma</i> , <i>Babesia microti</i> <i>Dog Tick</i> : <i>Borrelia burgdorferi</i> , RMSF, <i>Tularemia</i> <i>Lone Star Tick</i> : <i>Borrelia burgdorferi</i> , <i>Ehrlichia</i> , STARI
Tickchek	\$50 ea	<i>Borrelia burgdorferi</i> , <i>Anaplasma</i> , <i>Babesia microti</i> , <i>Ehrlichia</i> , <i>Bartonella</i> , RMSF, <i>Tularemia</i> , STARI
Clongen	\$75 for one or \$65 ea	<i>Borrelia burgdorferi</i> & <i>miyamotoi</i> , <i>Anaplasma</i> , <i>Babesia microti</i> & <i>duncani</i> , <i>Ehrlichia</i> , <i>Bartonella</i> , RMSF, <i>Tularemia</i> , STARI
Imugen	\$75 or \$98 for both	<i>Borrelia burgdorferi</i> , <i>Babesia microti</i> <i>Ixodes scapularis</i> only
Analytical Services	\$65	<i>Borrelia burgdorferi</i>
U Michigan	Free: for residents only	<i>Borrelia burgdorferi</i> , <i>Anaplasma</i> , <i>Babesia microti</i> , RMSF
U Connecticut	\$50, 2/\$80, 3/\$100	<i>Borrelia burgdorferi</i> , <i>Anaplasma</i> , <i>Babesia microti</i>
Cornell U	\$100	<i>Borrelia burgdorferi</i> , <i>Anaplasma</i>
Tic-Kit	\$41 for all	<i>Borrelia burgdorferi</i> , <i>Anaplasma</i> , <i>Babesia microti</i> , <i>Ehrlichia</i> , <i>Bartonella</i>

All tests are PCR. RMSF is Rocky Mountain Spotted Fever.

- 1) **NAU/Bay Area Lyme Foundation.** www.bayarealyrme.org/lyme-disease-prevention/tick-testing.
- 2) **IGeneX.** www.igenex.com/Website/#. Will test up to 20 ticks per test if requested. Contact a Vector Control District for tick ID.
- 3) **Tickchek.** www.tickchek.com/landing/lyme-disease?gclid=COGC58OJOsYCFUxqfgodV4sGFw. *Bb*, *Anaplasma* and *Babesia* recommended. Free tick ID.
- 4) **University of Massachusetts Lab of Medical Zoology Tick-Borne Disease Network.** www.tickreport.com. For tick ID information, refers you to www.tickencounter.org/tick_identification/guide.
- 5) **Clongen Laboratories.** www.clongen.com/clinical-diagnostics-services/tick-testing. Also offers \$175 for Colorado Tick fever, Heartland or Powassan virus; \$500 for all three viruses. Will pool up to four ticks from one individual, if requested. Links to ALDF, an organization associated with the IDSA; proceed with caution.
- 6) **Imugen.** Norwood, Massachusetts.
- 7) **Analytical Services.** www.analyticalservices.com/tick-testing.html#what_limit.
- 8) **University of Michigan:** www.michigan.gov/mdard/0,4610,7-125-1566-44271--,00.html.
- 9) **University of Connecticut.** cvm.dl.uconn.edu/service/tick.php.
- 10) **Cornell University.** ahdc.vet.cornell.edu/Sects/paras/tickID.cfm. Tick ID included.
- 11) **TIC-KIT.** www.tic-kit.com. Also tests for *Borrelia afzelii*, *B. garinii*, *Babesia divergens* and *Babesia*. EU1, *Ehrlichia ewingii* and may soon add *Babesia duncani* and *Borrelia miyamotoi*.

mercial lab, you need one that does relevant tests for the region in which your tick was acquired. The directions for mailing the tick varies, so choose a lab *before* you do anything with your specimen. Some labs require a live tick; some ask for the tick to be in alcohol; some will test frozen ticks (important if you want to test the tick *only* if you develop symptoms). Generally, live ticks should be sent within two weeks of removal.

Be aware that doctors may or may not recommend tick testing. Any information that may help untangle the wide array of ensuing symptoms can be useful, however. Of course, preventing tick bites in the first place will spare you having to use the information in this article.

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