Tick-Borne Disease Testing
Tick-borne diseases occur worldwide, including both temperate and tropical climates. In the United States, major tick-borne diseases include Lyme disease, anaplasmosis, babesiosis, ehrlichiosis, and Rocky Mountain spotted fever.

Historically, only certain pockets of the United States posed a risk for tick-borne disease. However, the geographic range of ticks has expanded and large areas of the population are now at risk. Because of this increased risk, it is important that physicians recognize who to test, when to test, and what test to use.

Mayo Medical Laboratories offers a full menu of tick-borne disease tests and test panels which are organized in a way that makes sense for the physician and the patient. The acute tick-borne disease testing algorithm (located on back page) also helps guide appropriate testing.

**Lyme Disease**

Lyme disease is the most common tick-borne illness in North America and is caused by the bacterium *Borrelia burgdorferi*. Patients treated with appropriate antibiotics in the early stages of the disease are likely to recover completely. In later stages, response to treatment may be slower, but the majority of patients with Lyme disease recover completely with appropriate treatment.

**Infection Acquired from:** Blacklegged or deer tick (*Ixodes scapularis*) and the western blacklegged tick (*Ixodes pacificus*).

**Geographic Prevalence:** Lyme disease is most prevalent in the northeastern, mid-Atlantic, northcentral and Pacific Coast of the United States.

**Symptoms:** Fever, headache, fatigue, and a characteristic bull’s-eye pattern skin rash called erythema migrans. If left untreated, infection can spread to joints, the heart, and the nervous system.

**Babesiosis**

Babesiosis is caused primarily by the protozoan parasite *Babesia microti*. Most cases of babesiosis are probably subclinical or mild, but the infection can be severe and life threatening, especially in older or asplenic patients.

**Infection Acquired From:** Blacklegged or deer tick (*Ixodes scapularis*).

**Geographic Prevalence:** Babesiosis is most prevalent in the northeastern, Upper Midwest, and Pacific Coast of the United States.

**Symptoms:** Most Commonly: Fever, fatigue, malaise, headache, and other flu-like symptoms. Patients may have hepatomegaly and splenomegaly. In severe cases: hemolysis, acute respiratory distress syndrome, and shock.
Anaplasmosis

Human granulocytic anaplasmosis (HA) is caused by the tick-borne bacterium, *Anaplasma phagocytophilum*. Anaplasmosis can be a serious illness that can be fatal if not treated correctly, even in previously healthy people.

**Infection Acquired from:** Blacklegged or deer tick (*Ixodes scapularis*) and the western black-legged tick (*Ixodes pacificus*).

**Geographic Prevalence:** HA is most prevalent in the Upper Midwest and in other areas of the United States that are endemic for Lyme disease.

**Symptoms:** Fever, headache, muscle pain, malaise, chills, nausea and abdominal pain, cough, confusion.

Ehrlichiosis

Ehrlichiosis in the U.S. is caused primarily by *Ehrlichia chaffeensis*, but *E. ewingii* and *Ehrlichia* sp. Wisconsin (*E. muris*-like) are also known to cause infection in humans. Most cases of ehrlichiosis are probably subclinical or mild, but the infection can be severe and life-threatening in some individuals.

**Infection Acquired from:** Lone Star tick (*Amblyomma americanum*) (for *E. chaffeensis* and *E. ewingii*).

**Geographic Prevalence:** Ehrlichiosis is most prevalent in the southeastern, and southcentral regions of the United States.

**Symptoms:** Fever, fatigue, malaise, headache, and other “flu-like” symptoms, including myalgias, arthralgias, and nausea. Central nervous system involvement can result in seizures and coma.

Spotted Fever

In addition to *Rickettsia rickettsii*, the agent of Rocky Mountain spotted fever (RMSF), several other tick-borne species of *Rickettsia*, broadly grouped under the heading “Spotted Fever group Rickettsia (SFGR)” have been shown to cause human infections. Tick-borne SFGR may cause similar signs and symptoms to those observed for RMSF and can potentially be fatal in humans.

**Infection Acquired from:** American dog tick (*Dermacentor variabilis*), Rocky Mountain wood tick (*Dermacentor andersoni*), and brown dog tick (*Rhipicephalus sanguineus*).

**Geographic Prevalence:** RMSF is most prevalent in the southeastern United States.

**Symptoms:** High fever, chills, severe headache, muscle aches, nausea and vomiting, and fatigue.

Acute Tick-Borne Disease Testing Algorithm

Clinical suspicion of tick-borne disease based on patient characteristics:
- Illness during tick season: fever, chills, headache, muscle aches, joint pain, neck pain, skin rash, Bell’s palsy, heart rhythm disturbances, hypotension, jaundice, sepsis.
- Known tick exposure.
- Environmental exposure (outdoor activities, wildlife).

Based on geographic exposure, consider the following tick-borne pathogens. (Choose all that are appropriate.)

At risk for Rocky Mountain Spotted Fever (states with the highest incidence include North Carolina, Oklahoma, Arkansas, Tennessee, Missouri, Arizona, and the tribal Southwest).

SFGP Spotted Fever Group Antibody, IgG and IgM, Serum
*Consider empiric treatment while awaiting test results.

At risk for Lyme disease, ehrlichiosis/anaplasmosis/babesiosis (endemic areas for anaplasmosis and babesiosis include Northeastern and Upper Midwest United States, while ehrlichiosis is most frequently reported from the SE and South-central US).

Classic erythema migrans (target lesion or bull’s-eye rash)

Perform LYME Lyme Disease Serology, Serum (Enzyme-Linked Immunosorbent Assay) and if systemic symptoms are present (e.g., fever, chills, sepsis) also perform PTICK Tick-Borne Panel, Molecular Detection, PCR, Blood
*Consider empiric treatment for ehrlichiosis/anaplasmosis while awaiting test results.
*Consider collecting baseline serology (TICKS Tick-Borne Disease Antibodies Panel, Serum) if patient presents with >7 days of symptoms.

PTICK Results

- NEGATIVE
  - Report as negative.
  - If short disease duration, submit follow-up specimen for repeat testing in 2-3 weeks if clinically indicated.

- POSITIVE
  - Consider treatment.

LYME Results

- NEGATIVE
  - Report as negative.
  - If short disease duration, submit follow-up specimen for repeat testing in 2-3 weeks if clinically indicated.

- POSITIVE
  - Treat.
  - If short disease duration, submit follow-up specimen for repeat testing if clinically indicated.
  - In immunocompromised patient, consider PBORR Lyme Disease (Borrelia burgdorferi), Molecular Detection, PCR (for CSF, synovial fluid, or fresh tissue samples).

- POSITIVE OR EQUIVOCAL
  - Consider treatment.
  - If neurologic or joint symptoms, consider: PBORR Lyme Disease (Borrelia burgdorferi), Molecular Detection, PCR (for CSF, synovial fluid, or fresh tissue samples)
  - OR
  - CLYME Lyme Disease Serology, Spinal Fluid

1 In place of the PCR panel, PCR tests and/or smear for Babesia species can be ordered individually.
2 If Western blot is positive for IgM and negative for IgG, this may reflect 1) acute Lyme disease, or 2) a false-positive IgM result. The IgM test should only be used to diagnose acute Lyme disease in patients with <4 weeks of symptoms. Typically, a follow-up serology is recommended to demonstrate seroconversion of IgG prior to confirming a case of Lyme disease.

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