

Tick-borne Diseases Affecting Humans in the Southeastern United States

Ticks are external parasites that attach themselves to an animal host to take a blood meal at each of their active life stages. Blood feeding by ticks may lead to the spread of disease. Several common species of ticks may vector (transmit) disease. Many tick-borne diseases are successfully treated if symptoms are recognized early. When the disease is not diagnosed during the early stages of infection, treatment can be difficult and chronic symptoms may develop. The most commonly encountered ticks in the southeastern U.S. are the American dog tick, lone star tick, blacklegged or “deer” tick and brown dog tick. While the brown dog tick is notable because of large numbers that may be found indoors when dogs are present, it only rarely feeds on humans.

Borne Diseases and Conditions

The major tick-borne diseases in the southeastern U.S. include Lyme disease, Rocky Mountain spotted fever, STARI, ehrlichiosis and tularemia. Several other tick-borne diseases also occur in the U.S., but are not common in the Southeast. In addition to tick-borne diseases, a toxin can be transmitted through the saliva of a tick bite that causes progressive paralysis, a condition known as “tick paralysis.” Tick feeding also may result in mild to severe allergic reactions in some individuals.

Primary tick-borne diseases in the southeastern U.S.

Disease (<i>causal organism</i>)	Tick vector (<i>Scientific name</i>)
Lyme disease (<i>Borrelia burgdorferi</i> species complex)	Black-legged or “deer” tick (<i>Ixodes scapularis</i>)
Rocky Mountain spotted fever (<i>Rickettsia rickettsii</i>)	American dog tick (<i>Dermacentor variabilis</i>)
Southern Tick-Associated Rash Illness or STARI (<i>Borrelia lonestari</i> (suspected, not confirmed))	Lone star tick (<i>Amblyomma americanum</i>)
Tick-borne Ehrlichiosis HGA-Human granulocytic anaplasmosis (<i>Anaplasma</i> formerly <i>Ehrlichia phagocytophilum</i>)	Black-legged or “deer” tick (<i>Ixodes scapularis</i>)
HME-Human monocytic Ehrlichiosis (<i>Ehrlichia chafeensis</i>)	Lone star tick (<i>Amblyomma americanum</i>) American dog tick (<i>Dermacentor variabilis</i>)
<i>Ehrlichia ewingii</i> ehrlichiosis (<i>Ehrlichia ewingii</i>)	Lone star tick (<i>Amblyomma americanum</i>)
Tularemia (<i>Francisella tularensis</i>)	Lone star tick (<i>Amblyomma americanum</i>) American dog tick (<i>Dermacentor variabilis</i>) Black-legged or “deer” tick (<i>Ixodes scapularis</i>) Brown dog tick (<i>Rhipicephalus sanguineus</i>)
Tick paralysis (A condition caused by neurotoxins, not a disease)	Several species, but in southeast, usually American dog tick (<i>Dermacentor variabilis</i>)



Tick- Active stages of the blacklegged tick (female-left, male-middle, nymph-right) compared to a sesame seed. Photo: Harrison County Health Dept.

Lyme disease

Lyme disease is caused by a bacterium. It is transmitted to humans and other animals by the blacklegged or “deer” tick in the eastern, southern, central and mid-western U.S. Other closely-related tick species transmit the disease in others parts of the country. Transmission usually occurs after the tick has been attached and feeding for 24-72 hours. Typical symptoms appear within days or weeks, and may include fever, headache, chill, stiff neck, fatigue, muscle aches and joint pain. Characteristic of Lyme disease is an expanding red skin rash called an erythema migrans (EM), which grows at a rate of ½ to ¾-inches per day at the site of the tick bite in 70-90% of patients. The EM rash should not be mistaken for a local allergic reaction to the tick bite which typically lasts for 2-4 days; redness caused by an allergic reaction will have shorter duration and expands at a slower rate than an EM rash. However, people who are hypersensitive to tick bites may have an immediate, intense reaction that is not an EM. The rash associated with Lyme disease is typically around 6-inches in diameter, but can reach 8-16 inches. A red rash with a central clearing, known as a bull’s eye rash is characteristic of older rashes and is present in less than half of all cases.



“Bulls-Eye” rash seen in 50% of Lyme disease patients. Photo: www.usda.gov

When treated early with antibiotics, people usually recover quickly and completely. When the symptoms are overlooked and the disease is untreated, infection can spread to the joints, heart, and nervous system causing serious chronic medical problems. Inflammation in the joints may be misdiagnosed as arthritis, so it is important to watch for other symptoms. Lyme disease also can occur in horses and dogs.

Rocky Mountain spotted fever

Rocky Mountain spotted fever (RMSF) is caused by a bacterium that is spread to humans by the American dog tick, which occurs east of the Rocky Mountains. The Rocky Mountain wood tick also transmits RMSF, but is found primarily through the Rocky Mountain States and into Canada.



Male and female American dog tick Photo: NC Dept. Environment and Natural Resources



Rocky Mountain spotted fever rash. Photo: www.cdc.gov

Early signs and symptoms of the disease include sudden onset of fever, headache and muscle pain, and sometimes nausea, vomiting, abdominal pain and appetite loss followed by the development of a spotty rash in 90% of patients. When it appears, the rash usually is noticed first on the wrists and ankles and then spreads to the entire body. Symptoms typically appear from 5 to 7 days (range 2-14 days) after the initial tick bite. The flu-like symptoms make the disease difficult to diagnose in the early stages especially in the absence of a rash or no knowledge of a tick bite. The disease can be fatal if not treated quickly and appropriately. Even with treatment some patients may die. Dogs also may be affected by RMSF. Early removal of attached ticks can prevent RMSF because 12-24 hours is required to reactivate the bacterium in the tick's tissue before transmission can occur.

Southern Tick-Associated Rash Illness or STARI

STARI is an emerging tick-borne disease that results in a rash similar to that seen with Lyme disease. It begins as a red, expanding "bull's eye" open sore that develops around the site of the bite of a lone star tick. The rash usually appears within 7 days of the tick bite and expands to a diameter of 3 inches or more. The rash may occur with fatigue, fever, headache, muscle and joint pains.

STARI has not been linked with chronic problems such as those associated with Lyme disease. The bacterium *Borrelia lonestari*, which has been isolated from lone star ticks, is the suspected agent of STARI.



Lone star tick - male (left) and female (right). Photo: Oklahoma State University

Tick-borne Ehrlichiosis

Tick-borne bacteria that are collectively termed human ehrlichiosis cause severe to life-threatening infections in humans and other animals. The diseases are named for the type of white blood cell that the bacteria invade, including granulocytes and monocytes. Human granulocytic anaplasmosis (HGA), human monocytic ehrlichiosis (HME), and *Ehrlichia ewingii* ehrlichiosis are three variations of the disease caused by different bacteria. HME and *Ehrlichia ewingii* ehrlichiosis are found more commonly in the southeastern and south central U.S. and are transmitted by the lone star tick, with the American dog tick sometimes transmitting HME. HGA is less common, being more prominent in the northeast and upper Midwestern states, and it is caused by the bite of the blacklegged tick. Symptoms for these diseases caused by human ehrlichiosis usually occur 5 to 10 days after the tick bite and may include fever, headache, joint pain, muscle ache, nausea and vomiting. Two to 40% of patients develop a body rash that typically does not involve the hands and feet. Simultaneous infections of HGA/HME and

Lyme disease can result in a more severe disease. Another species of *Ehrlichia* can cause ehrlichia in dogs.

Tularemia

Tularemia is a rare infectious disease caused by a bacterium transmitted through the bite of infected

ticks and deer flies or through handling an infected animal carcass such as when skinning a rabbit. The ticks that transmit the bacterium in the East are the American dog tick and lone star tick and the Rocky Mountain wood tick in the West. Symptoms usually begin to appear three to five days after being bitten.



Ulcer on thumb caused by Tularemia infection. Photo: www.ucsf.edu

They may include chills, headache, coughing, muscle aches, vomiting, repeated spikes of severe fever and swollen lymph nodes that develop into skin ulcers in 80% of cases, conjunctivitis (pink eye) and pneumonia. If the patient was infected through an insect or tick bite, a scab may develop at the bite site before flu-like symptoms occur. Symptoms may go into remission for 1-3 days, followed by return of the illness for 2-3 weeks.

Tick paralysis

Tick paralysis is the only tick-borne condition not caused by a bacterium or other infectious organism. The American dog tick and Rocky Mountain wood tick cause tick paralysis. The illness is caused by a neurotoxin produced in the tick's salivary glands. After prolonged attachment, the engorged tick transmits the toxin to its host. The toxin usually causes symptoms within two to seven days. Symptoms may include headache, vomiting, general malaise and loss of motor function and reflexes. Weakness begins in both legs which progresses to paralysis and spreads to the rest of the body. If the tick is not removed, the paralysis can move upward to the trunk, arms, and head within hours and may lead to respiratory failure and death. Most North American cases of tick paralysis occur from April to June, when adult *Dermacentor* ticks emerge from hibernation and actively seek hosts. Symptoms of paralysis and the discovery of the tick, usually on

the scalp, are indicative of tick paralysis. Removal of the tick usually relieves symptoms within hours to several days without any lingering aftereffects. Tick paralysis also may affect other vertebrate animals including birds.

How to Remove a Tick Safely

Using tweezers, grasp the tick as close to skin as possible and gently pull upward. Do not twist or jerk, as you want to keep the tick mouthparts and body intact. Do not grasp the tick around the body with tweezers or fingers. You do not want to risk squeezing the blood and other fluids from the engorged tick into the site of the bite. After removing the tick, disinfect the site of the bite. To test ticks for disease, they must be kept alive. At a minimum, save the tick in a container with rubbing alcohol. Record the date and location where you picked up the tick whenever you find one attached.



Firmly grasp the tick as close to the skin as possible and gently pull upward Photo: *L.A. County West Control District*

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