

CONTAGIOUS COMMENTS

Department of Epidemiology

Top Ten Tick Topics!

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1. Tell me about ticks....

Every spring and summer, we receive many calls about children with tick bites. This month's Contagious Comments contains a brief review of tick-borne diseases in Colorado to help clinicians manage patients' tick exposures.

Ticks have been around for more than 200 million years and there are more than 800 species. They are members of the arachnid family and they can transmit bacteria including rickettsiae and spirochetes, viruses, parasites, and toxins. Humans are incidental, dead-end hosts for these infections. Ticks normally feed on small vertebrates and tick "season" is generally April through September. After feeding on a blood meal, an engorged tick can increase its body weight by 100 times. See the photos of ticks below!

2. How can I figure out what kind of tick it is and does it matter?

There is no mechanism for identifying a tick that has bitten a person or testing it for diseases. Instead, we use the patients' travel history and what we know about the geographic distribution of ticks to identify potential tick-borne disease exposures.

There are more than 30 species of ticks in Colorado, but only 3 species comprise the majority of ticks in Colorado. They are: the Rocky Mountain wood tick (*Dermacentor andersoni*); the brown tick (*Rhipicephalus sanguineus*); and the American dog tick (*Dermacentor variabilis*). Most tickborne diseases seen in Colorado are transmitted by the Rocky Mountain wood tick. The deer tick that transmits Lyme disease is not found in Colorado, therefore, we do not have transmission of Lyme disease within Colorado.

3. What are the most common tickborne diseases we see in Colorado and how are they diagnosed and treated?

As with any breach of the skin, a local skin infection can occur at the site of the bite (usually Staph or group A Strep), which may require treatment with

an oral antibiotic just like any other infected cut/scrape. A culture of the area is probably worthwhile to be sure it's not MRSA.

The most common tick-transmitted disease in Colorado is **Colorado Tick Fever (CTF)**. This illness is caused by a virus transmitted by the Rocky Mountain wood tick. The incubation period is usually short (2-3 days) but can be anywhere from 1 to 14 days. Common symptoms include: fever, headache, body aches, and malaise. Some may also have a rash, abdominal pain, nausea or a stiff neck. Leukopenia and thrombocytopenia are commonly seen and rash is seen in 20% of cases. The disease is self-limited and about half of all people have a biphasic illness. Diagnosis is primarily clinical based on symptoms and epidemiological exposure, but testing can be obtained at the CDC through your state health department. Treatment is symptomatic. Because it is a non-specific, self-limited illness, we do not know how many cases there are. It is now reportable in CO, but most patients are not tested.

Tularemia is a bacterial infection caused by *Francisella tularensis*, and it is a serious disease. Similar to CTF, the incubation is typically short (2-5 days) but can range from 1-21 days. The most common presentation of tularemia is ulceroglandular disease, which presents with fever and a small ulcer at the site of the bite/inoculation and with lymphadenitis at the site of the lymph node draining the area of the ulcer. Tularemia has other forms of disease, usually dependent on how the inoculation occurred, including: oroglandular, oculoglandular, pneumonic, and typhoidal. We usually diagnose tularemia with serology or with culture or PCR. Cultures of the ulcer or node will grow the organism, and the State Health Department can use PCR to identify the organism from tissue or blood if you have a biopsy or bacteremia. Let the microbiology lab know if you suspect tularemia so that the lab can use appropriate precautions. Gentamicin, a fluoroquinolone and doxycycline are appropriate antibiotics, and relapses can occur. This disease can also be transmitted by deer fly bites and through environmental exposures such as skinning

rabbits or contact with other animals that have ticks that are carrying tularemia.

4. What are the serious tick-transmitted diseases we wouldn't want to miss? (RMSF, Lyme, tick paralysis, tularemia)

We always worry about **Rocky Mountain Spotted Fever (RMSF)**, although the disease is quite rare in Colorado and is much more common on the East Coast and Southern US. The disease is transmitted by the wood tick or dog tick and presents with fever, headache, malaise and a petechial rash beginning on the wrists and ankles and moving centrally. The disease can be fatal if untreated and early treatment with doxycycline should be started if the disease is suspected. Acute and convalescent serum titers can be sent to confirm the diagnosis.

Our group sees a number of children each year with presumed or proven **Lyme Disease**. All of these children have a history of travel to a Lyme-endemic area (check the CDC website for a map of high-rate areas). Most cases we see are acquired from travel to Northeast, upper Midwest or mid-Atlantic states. The incubation period for early disease is usually 7-14 days with a range of 3-30 days. The early presentation of Lyme disease can include: the classic erythema migrans rash, a large flat, erythematous lesion that develops central clearing and looks like a bull's eye (occurs in 70-80% of people infected); fever; headache; myalgias, arthralgias; and lymphadenopathy. There is also late Lyme disease, which can present with neurologic, musculoskeletal, cardiac and other symptoms. Check the Red Book or the CDC website for treatment information and more details on late Lyme disease, since route and duration of antibiotic depend on the timing of infection and the nature of the symptoms. Amoxicillin is usually the drug of choice in pediatrics.

Tularemia is another serious tick transmitted disease that you do not want to miss. Please see our comments about Tularemia in question #3.

Tick Paralysis is a rare disease caused by a paralyzing toxin secreted by the dog or wood tick while it is attached. It presents with ascending paralysis. Several years ago, 4 cases were seen in CO in June and three of the four had been vacationing in the Estes Park area. The treatment is supportive therapy and finding and removing the tick. The disease can be difficult to diagnose, especially in girls with long hair where the tick may be hidden in the scalp or neck and difficult to see.

5. What should you advise if someone asks you what to do if a child has a tick bite? Is any empiric testing or therapy indicated?

- a. Ticks usually require a blood meal and some time on the host in order to transmit infection to the host, so removing a non-engorged tick usually means the chance that any infection has been transmitted is quite low. Clean the area well and no antibiotics are indicated.
- b. If you remove an engorged tick in Colorado, the usual recommendation is to make sure all the mouth parts are removed, clean the area and ask the family to watch the child carefully for the next week or two, specifically for fever, rash, or infection at the bite site. The incubation periods are as follows:

Colorado Tick Fever	2-3 days (range 1-14)
Tularemia	3-5 days (range 1-21)
Tick paralysis	Tick attached for 3 days before they begin to secrete toxin
- c. No empiric therapy or laboratory testing is indicated at the time of a tick bite in Colorado.

6. Lyme disease: A mom brings her 7-year old boy to you in June with a history that the child has just returned from a week in New Hampshire at a summer camp. No tick bite was recognized while he was there. He now has fever and a large macular erythematous lesion on his thigh with central clearing. How should I manage this case?

This is the classic lesion of early Lyme Disease. The lesion is called erythema migrans (EM) and is usually seen as a solitary lesion at the site of the tick bite. However, many patients may have no history of tick bite, as the tick that transmits Lyme Disease is very small. The EM lesion may begin as a small lesion, but the hallmark is that it continues to grow and can expand to several centimeters with central clearing. Diagnostic testing is not usually sensitive at this stage, as it is usually too soon for the patient to have developed an antibody response to the infecting agent. The diagnosis of Lyme Disease at this stage is made based on the presence of the characteristic skin lesion and epidemiologic exposure. Oral antibiotics are indicated, usually doxycycline or amoxicillin. The AAP Red Book, the CDC website and the IDSA guidelines on Lyme disease are all good resources for further information on diagnosis and treatment of Lyme disease.

7. Can a tick transmit more than one disease?

Occasionally more than one disease can be transmitted by a single tick bite. Babesiosis, Lyme disease, and Anaplasmosis all share the same vector (*Ixodes scapularis*), so in an area where ticks are known to be infected with more than one of these agents, a patient could be co-infected. Co-infection should be suspected if patients are sicker than usual, have manifestations not explained by a single agent, or do not improve with standard therapy.

8. A child's father just removed an engorged tick from the leg of the child. Is any prophylaxis indicated?

For all tick bites, except possibly those in a Lyme hyperendemic area, no prophylaxis is indicated, due to low risk of infection. For tick bites in a Lyme hyperendemic area, the question is controversial. The AAP Red Book states that the benefit or prophylaxis may outweigh the risk if the tick is engorged, has been attached ≥ 36 hours, and prophylaxis can be started within 72 hours of tick removal. The only prophylaxis regimen recommended is doxycycline, 200mg (or 4.4mg/kg if < 45 kg) as a single dose. There is no data on use of amoxicillin for prophylaxis in children < 8 years of age.

9. What is the best way to prevent a tick-transmitted infection?

The best way is to prevent the tick bite in the first place. This is accomplished by use of tick repellent, wearing long pants and long sleeves when hiking, and avoiding areas with tall grass and brush. Adults should check themselves and their children for ticks promptly after being in an area with possible tick exposure, with careful attention to all parts of the body including the hair, behind the ears, and in the axillae and groin. Studies have shown increased risk of transmission of a tick-borne infection with longer tick attachments, particularly if the tick is attached for > 72 hours. If a tick is found, it should be removed immediately.

10. What is the best way to remove an engorged tick?

The best way to remove a tick is with a pair of fine forceps or tweezers. Occasionally infectious agents could be transmitted by contact with tick secretions/body fluids with an area of broken skin, so wear gloves if possible. Grasp the tick as close to the skin surface as possible with the forceps near the mouth parts and pull perpendicular to the plane of the skin with steady even traction until the tick releases its grip. Be careful not to crush or squeeze the body of the tick, and do not use a twisting motion to remove the tick. There are some good videos available on the internet showing how to remove ticks safely. After removal, wash the area with soap and water. The person removing the tick should also wash their hands with soap and water.

References:

1. AAP Red Book 2018, <https://redbook.solutions.aap.org/>
2. Colorado Department of Health and the Environment, "Tick-borne diseases", <https://www.colorado.gov/pacific/cdphe/tick-borne-diseases>
3. Centers for Disease Control and Prevention, <https://www.cdc.gov>

Wood Tick



Deer Tick



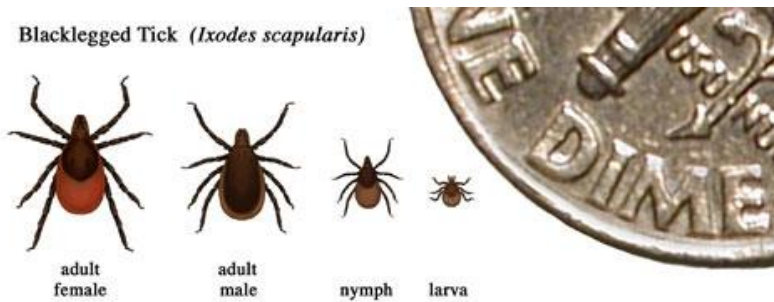
Dog Tick



Soft Tick (Ornithodoros)



Tick Size



Lyme Disease



Photos from the Public health image library database (PHIL) of the US Centers for Disease Control (CDC).

Photo credits are James Gathany and CDC/Andrew Brooks.

Disease	US Cases/Yr	CO Cases/Yr*	Agent	Geographic Area	Therapy**	Comments
Anaplasmosis (Previously known as Human Granulocytic Ehrlichiosis)	Reported cases increasing, ~5,700 in 2017	No endemic disease	<i>Anaplasma phagocytophila</i>	Most reported in upper Midwest and Northeast US; 90% of reported cases from VT, ME, RI, MN, MA, WI, NH, NY	Doxycycline	
Babesiosis	Not a reportable disease until 2011, 900-1,700 cases/yr reported 2011-2014	No endemic disease	<i>Babesia microti</i>	Primarily in Northeast and upper Midwest	Treatment depends on degree of illness; Ill patients treated with atovaquone + azithromycin OR clindamycin + quinine (see Red Book for details)	Diagnose with multiple thick and thin smears (similar to malaria); Parasite seen in RBCs.
Colorado Tick Fever	Unknown, estimated several hundred cases	3 reported in 2017, presumed higher	Colorado tick fever virus, infects RBCs	Western Black Hills through the West Coast	Supportive care	Usually acquired from ticks at elevations of 4,000-10,000 feet; 50% cases with biphasic illness
Ehrlichiosis	reported cases increasing, ~1700 in 2017	No endemic disease	<i>Ehrlichia chafeensis</i> and <i>Ehrlichia ewingii</i>	Highest in southeastern and south central states; reported from East coast as far west as TX	Doxycycline	
Lyme Disease	20-30K confirmed cases, varies by year	No endemic disease	<i>Borrelia burgdorferi</i>	Reported in most states, most prevalent in the Northeast, upper Midwest (Great Lakes area) and mid-Atlantic	Amoxicillin or Doxycycline; Ceftriaxone if parenteral antibiotics indicated (See Red Book for details).	Lyme disease has several clinical stages/ manifestations, which may require different treatment
Powassan virus	Very rare 2-34/yr reported 2008-2017	No endemic disease	Powassan virus (flavivirus)	Northeastern and Great Lakes states	Supportive	Neuroinvasive disease is the most serious manifestation
Q fever	~170 total cases of Q fever in 2014, unknown how many are tick-borne	Rare	<i>Coxiella burnetii</i>		Doxycycline if treatment is indicated; see Red Book for chronic Q fever and immunodeficient hosts	Tick borne infections with Q fever are rare
Relapsing Fever	483 cases reported from 1990-2011	<10 cases	<i>Borrelia hermsii</i> and <i>B. recurrentis</i>	Reported in AZ, CA, CO, ID, KS, MT, NV, NM, OK, OR, TX, UT, WA, and WY	Penicillin and other beta-lactams, doxycycline, macrolides	May see the spirochete on a peripheral blood smear! Associated with sleeping in rustic cabins.
RMSF (Rocky Mountain Spotted Fever)	reported within the group of "spotted fever rickettsiosis" (SFR), 6,248 cases reported in 2017	1-10 cases	<i>R. rickettsia</i>	In all states, but 60% of all SFR cases reported in NC, OK, AK, TN, MO	Doxycycline	Associated with fever, rash starting on wrists and ankles, leukopenia, thrombocytopenia

Disease	US Cases/Yr	CO Cases/Yr*	Agent	Geographic Area	Therapy**	Comments
STARI (Southern Tick Associated Rash Illness)	Unknown, not a notifiable disease	No endemic disease	Unknown	Central OK and TX eastward, in East from FL to ME (geographic distribution of the lone star tick)	Unknown if antibiotics alter course; most patients treated for Lyme	Has "bull's eye-like" lesion similar to that seen in Lyme Disease
Tick Paralysis	Unknown	not reported, estimated 0-5	Neurotoxin released by tick salivary glands	Mostly Western US, but tick vectors all over the US	Remove tick; Supportive care	Presents as ascending paralysis or cerebellar ataxia
Tularemia	estimated at 100	In 2015, 52 reported cases; typically <20	<i>Francisella tularensis</i>	Occurs throughout the US	Ciprofloxacin, Doxycycline, and Gentamicin	Also seen after deer fly bites; Relapses can occur after treatment

*Estimated based on 2013-2017 data

**For treatment, refer to the Red Book, Report of the Committee of Infectious Disease, American Academy of Pediatrics 2018; or to the CDC website.

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