



Spots and Lumps: Treacherous Tick-Borne Problems

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During this current week of summer, you are seeing your fifth patient with a history of tick bite, your second patient with a “spider bite,” and now your third patient with a bite or sting of unknown etiology. Not to mention another child you examined today who has developed a strange purpuric rash on the entire left side of his leg that has persisted for the past 3 weeks (Figure 1).

Nontoxic children with a history of tick bite have a unique and worrisome set of possible problems to which you must alert the family. Nearly all serious tick-borne illnesses (if they occur as a consequence of an arachnid bite) will start manifesting their specific signs between 2 and 14 days after the bite.

TICK-RELATED SPOTS

First, you may want to discuss the size of the tick, such as deer ticks, which are tiny, pinpoint-sized ticks that can transmit Lyme disease (spots),



Figure 1. An otherwise healthy, afebrile 8-year-old white male with a very unusual unilateral leg purpura and petechiae for 3 weeks.

especially in certain areas of the country north of the North Carolina latitude (Figure 2). If the history is consistent with a deer tick, then I suggest that you consider discussing with the family the physical findings and appropriate workup and management of Lyme disease caused by *Borrelia burgdorferi* (as explained in my column “Making Lemonade out of Lyme”¹ in the February 2013 issue of *Pediatric Annals*). The first manifestation of Lyme disease in children is usually an expanding, slightly raised red ring enlarging centripetally from the site of the original tick bite (Photo I in Table 1).

If the tick is of average size or larger or engorged, then there are two possible, and sometimes very serious, “dog tick”-related diseases: Rocky

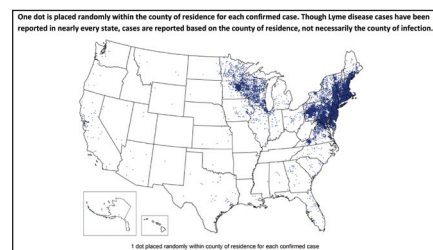


Figure 2. Reported cases of Lyme disease in the United States in 2012. (From the Centers for Disease Control and Prevention.⁷)

Mountain spotted fever (RMSF group; spots) (Figure 3), lumped together with ehrlichiosis and anaplasmosis (very rare) (Figure 4).

TICK-RELATED LUMPS

The other problem related to tick bites is lymphadenitis from *Francisella tularensis* (tularemia; lumps) (very rare) (Photo V in Table 1). Occasionally, the

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TABLE 1.

Serious Skin Signs to Watch for If Your Child Has Had a Tick Bite

If your child has been bitten by a tick:

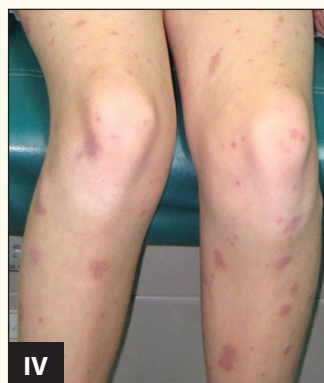
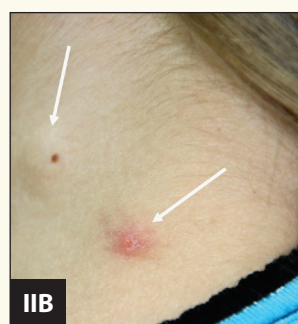
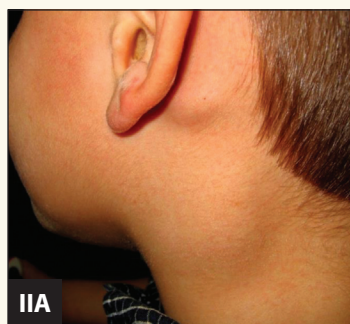
1. Promptly remove the tick with firm and steady traction—preferably using tweezers if possible.
If the tick has never been attached to the skin, or attached for less than 24 hours, your child is *usually at no risk* from this particular tick-related incident.
2. Clean the area with soapy water.
3. Assess whether the tick was a deer tick (tiny), a dog tick (larger, average size), or a fully fed and bloated tick.
4. Most serious tick-related infections show signs within 2 to 14 days of the tick attachment.
5. Deer tick attachments:
These bites carry a slight risk for Lyme disease, depending on the region of the country in which you live. At the tick bite area, you should watch for any red, ring-like rash (Photo I) that is expanding around the bite. Any rash at the tick-bite location requires prompt evaluation by your doctor.

6. Dog tick attachments :

You should watch for three possible problems:

- Staphylococcal or methicillin-resistant *Staphylococcus aureus* (MRSA) infections, which often start with a reddened tender area of skin, or a small boil, or a red streak going toward the chest. Sometimes near the tick bite you will find a small, tender kernel or lymph node, which often requires medical evaluation (Photos IIA and B).
- Rocky Mountain spotted fever (and ehrlichiosis) nearly always begin with many of the following signs: fever, aches, headaches; and usually (but not always) a rash initially on the hands/arms or feet/legs. The rash may be red, spotty, and raised; or with small, flat purplish dots that do not blanch when you press on them (Photos IIIA and B); or with larger, bruise-like splotches (Photo IV); or any combination of these.
- Tularemia (very rare) mostly shows signs of a swollen tender, red lymph gland (Photo V) near the tick bite, and is sometimes associated with a small ulcer within a few inches of the tick bite as well.

If your child develops any of the above findings in relationship to a recent tick bite, please contact your doctor promptly.



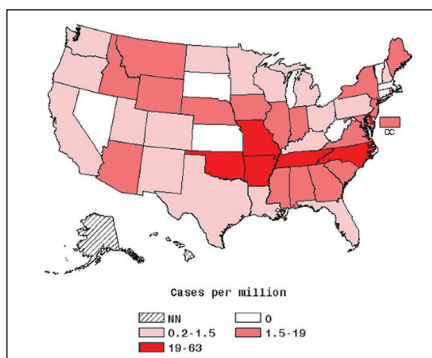


Figure 3. Distribution of Rocky Mountain spotted fever cases in the United States. (From the Centers for Disease Control and Prevention.⁸⁾)

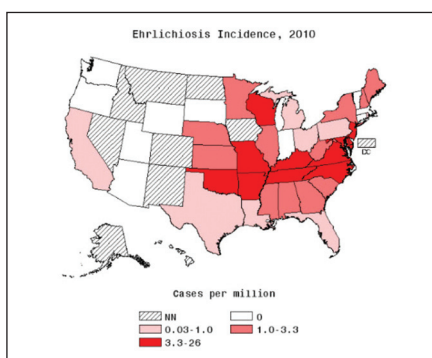


Figure 4. Distribution of ehrlichiosis cases in the United States. (From the Centers for Disease Control and Prevention.⁹⁾)



Figure 5. Tick bite appearance on the biceps area at 72 hours in a 14-year-old male.

child may develop a commonly seen secondary infection leading to cellulitis and lymphadenitis by *Staphylococcus aureus* (lump) (often methicillin resistant [MRSA]) (common), which can be related to any type of insect bite as well. Like Lyme disease, the likelihood of RMSF group and tularemia illnesses is highly dependent upon the geographic region in which the bite occurred. They both tend to cluster mostly in the mid-Southeastern United States and/or



Figure 6. 48 hours. Initial appearance of the scarlet fever-like rash located primarily on the trunk and arms 48 hours after a tick bite on the upper right arm of a 14-year-old boy.

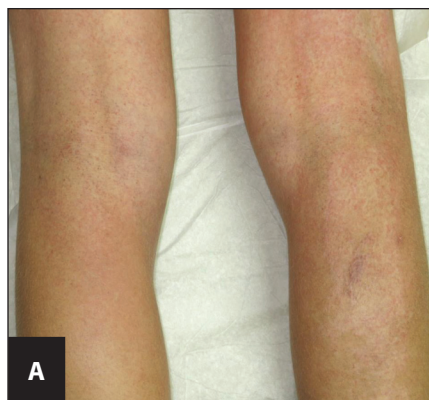


Figure 7. 72 hours. Appearance of the combined scarlet fever-like rash and petechiae, which has spread to the posterior knees (A) and ankles but not on the soles of the feet (B) at 72 hours after a tick bite in a 14-year-old boy. He has been taking oral clindamycin for 1 day. Note the intermingled petechiae in the maculo-papular rash.

the mid-South (Arkansas and Texas) (Figures 3 and 4).

For this group of four serious tick-borne or tick bite-caused diseases, I have

developed a one-page brief synopsis and photographs that can be handed out to families (**Table 1**) whose child has incurred a seemingly innocuous tick bite. This shows them the terms, their meaning, and possible physical findings for which they should be on alert.

LABORATORY ASSESSMENTS FOR PETECHIAE/PURPURA: FOUR CRITICAL POINTS FOR THE PRACTITIONER

1. You must be keenly aware that the earliest finding and sometimes only good hint for invasive meningococcal disease (IMD) in nearly one-third of infected patients is an elevated band count on the manual differential of the complete blood count (CBC).²

2. The “RMSF triad.” Nearly all patients with RMSF will have at least one or more of the three following laboratory findings manifested over several days: a high band count but with a normal or low leukocyte count, thrombocytopenia, and/or hyponatremia.³ If your patient manifests any number of these three laboratory findings, then an empiric course of doxycycline to treat RMSF may be prudent and may save a life.³ Rarely ever do other serious infections will routinely present with this RMSF laboratory triad constellation, and no other available antibiotic has been demonstrated to be as curative.

3. Any child who presents with elevated liver function tests, plus any one or more of the “RMSF triad”—whether or not a tick bite history is given or a petechiae/purpuric rash is observed—deserves serious consideration for a diagnosis of ehrlichiosis (and rarely RMSF). I have seen two cases of progressively worsening and eventually comatose patients who had ehrlichiosis diagnosis (2 weeks later by serology) without rash, and who were eventually saved by the initiation of doxycycline therapy.

4. Any significant rise in acute serologic titers for RMSF and ehrlichiosis typically requires 4 to 6 days of illness.

More importantly, acute titers will often be negative for perhaps more than one-half of cases; and this will often be too late. Just like doing the spinal tap for suspected meningitis, if either of these two infections is suspected, doxycycline therapy should be initiated empirically, no matter the age or condition of the patient. Many patients have died while still receiving ceftriaxone or ampicillin/gentamicin antibiotics, when the causative pathogen is RMSF or ehrlichiosis.

If the child is febrile or ill-appearing at all, a blood culture should be performed. You will then have to make a calculated guess as to whether to initiate empiric antibiotics (orally or parenterally), whether to use doxycycline to cover for the RMSF group and/or ceftriaxone to cover for meningococemia, and finally whether to hospitalize your patient. These medical decisions are still one of the most difficult for medical newcomers.

Remember that although some newer, expensive hematology machines may perform a band count, almost no current in-office hematology machine and leukocyte counter can perform a band count. It certainly cannot examine a peripheral blood smear for “blasts” or hemolysis of leukemia or hemolytic-uremic syndrome, respectively.

CASE

A 14-year-old white male with a history of a tick bite 3 days prior to this office visit (**Figure 5**), presents to your partner with the fine maculo-papular rash seen in **Figure 6**. Because the rash has some unusual characteristics, and your partner will be out of the office the next day, he asks you to take a look at it. The rash distribution is typical for a scarlet fever-like rash on the trunk, and it is heavily distributed in the groin, axilla, and elbow creases, with almost no rash on the lower extremities. However, you are suspicious that his truncal rash has a few scattered petechiae in the midst

of it. He is not ill-appearing at all, and he has no fever or other constitutional symptoms. His throat appears mildly reddened.

Because of some peculiarities of this rash, you decide to obtain a streptococcal antigen detection test, CBC, comprehensive metabolic panel (CMP, for sodium and transaminases), urine analysis, and protime—all of which are normal. Because you are still wary of this atypical scarlet fever-like rash (which may possibly be a surgical scarlet fever rash from the initial tick bite related to MRSA), you elect to treat the boy with clindamycin to obtain coverage for both MRSA and Group A *Streptococcus*.

He returns to your office the next day, and his rash has distinctly worsened. It is now very petechial all over the posterior knees (**Figure 7A**) and ankles (**Figure 7B**), but not on the soles of the feet. He is still happy, talkative, afebrile, and with a normal appetite and no headache. You repeat his blood work, and he still has a normal CBC, CMP, and protime. You considered doing a blood culture, but you do not perceive that this happy-go-lucky young man needs ceftriaxone to cover for IMD. But the uncertain etiology of the rash now really bothers you. You decide oral doxycycline should be started empirically while you await serologic titers for RMSF and ehrlichiosis. But you also realize the high likelihood of negative acute titers early in the illness, which could mislead you.

On his return to the office the next day, he was still afebrile, talkative, and smiling but he was now limping on his left leg. An atypical expression, you could see that his petechial rash was now denser and heavily distributed on his thighs, lower legs and ankles, and palms and soles (**Figure 8**). On close inspection of the left ankle, you easily observe an ankle effusion and some peculiar pearly white papules distributed over his entire left ankle (**Figure 8F**). You had never seen anything like this before today.

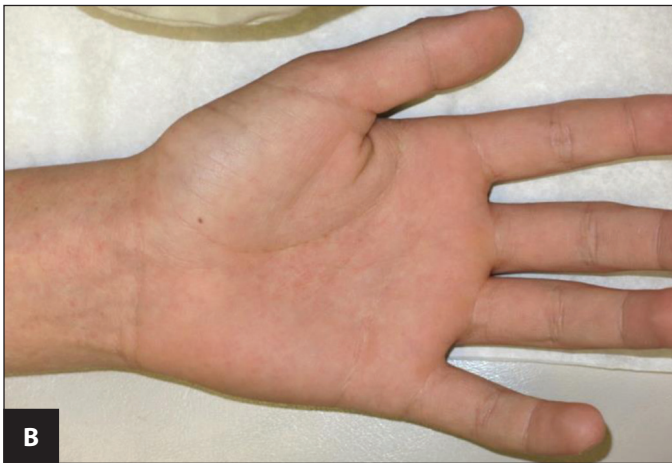


Figure 8. After 24 hours of oral doxycycline therapy, the patient is still afebrile, but has now developed a left ankle arthritis with swelling, pain, and a small effusion (A). The rash is redder and more confluent, and more petechial on the palms of his hands (B) and soles of his feet (C), which is much more typical of Rocky Mountain spotted fever. The rash is distinctly and heavily petechial without purpura on the back of his knees (D) and anterior thighs (E). He has also developed unusual pearly white papules on his left ankle (F).

You were seriously considering to hospitalize him despite his being afebrile and happy. Should you now start parenteral ceftriaxone for IMD? Should you consider gonococcal arthritis and rash? You repeat all of his previous labs, and they are all still normal. When you call the laboratory during this visit, you also learn that his ehrlichiosis acute serology titer is negative, but his acute RMSF titer by immunofluorescence assay is positive at 1:64. You obtain radiographs of his left ankle, and they are normal. You further consider an orthopedics consultation, possibly for aspiration of the ankle effusion, but this would require finding an orthopedics physician available for an immediate situation. You discuss with the family all of the aforementioned options.

With much trepidation, you and the reliable family decide to wait 1 more day in order to give the doxycycline a full 2 days to work, which has been the reported amount of time for defervescence to occur in most patients.⁴ You have personally seen enough cases of RMSF during your residency in North Carolina to know that it may take up to 48 hours to respond well. You warn his mother to call or return if he worsens in any manner.

To your relief, on his return visit the next day his rash has almost disappeared and his ankle pain and swelling has resolved. The doxycycline has done its job. You ask them to continue the medication for an additional week.

WHY NO FEVER IN YOUR CASE?

You are puzzled as to why a child with RMSF (note the word “fever” in the name) looked so well and remained basically asymptomatic for so long, except for the rash. You remember reading that Marshall and colleagues⁵ reported that nearly 12% of children in several Southeastern endemic states who had no history of previous RMSF infection were seropositive ($\geq 1:64$) for RMSF. So apparently, asymptomatic

or even low-grade RMSF may be much more common than suspected in this region. However, only 1.2 cases of RMSF per million people aged 10 to 19 years are reported annually.⁶ Welcome to rural Kentucky—the land of “zebras” in the midst of herds of cows.

ROCKY MOUNTAIN SPOTTED FEVER

In a report of 92 hospitalized children with RMSF from its endemic areas, symptoms were present for a mean of 6 days, and included fever (98%), rash (97%, but rash did not appear until day 6 on average), nausea and vomiting (73%), and headache (61%). Platelet counts were $<100,000/\text{mm}^3$ in 41%, leukocyte counts ranged from 5500 to $14,700/\text{mm}^3$ (thus not much help), and serum sodium $<135\text{ mEq/dL}$ in 52%. Note the following huge challenges also observed in these 92 reported cases of RMSF: Rash may not appear in 10% of children, nearly half of children may not get a rash until day 5 of illness; one-third of cases do not have petechial rashes; and perhaps only one half of patients can recall a tick bite (remember, these are children).⁴ In addition, 3% of children died and 15% had neurologic defects; 90% of cases occurred between the months of April and October.

Thus, your high index of suspicion is the key—almost regardless of where you reside.

EHRlichiosis/ANAPLASMOSIS

In contrast to RMSF, the CBC findings in ehrlichiosis/anaplasmosis include leukopenia between 1000 and 4000 cells/ mm^3 in most patients, thrombocytopenia in $>70\%$ (a bit higher rate), and anemia in 38%. Another marked distinction between the two infections is an elevated serum transaminase noted in 90% of the ehrlichiosis group of patients. Clinically significant hyponatremia, such as in RMSF, also occurs frequently, but the vasculitis of RMSF is uncommon and

rash is also less common (66%).

When there is no rash, the entire RMSF/ehrlichiosis/anaplasmosis group of diseases becomes an extremely treacherous and deadly guessing game. Thus, you must carefully evaluate the characteristics of the serial daily CBC, band count, platelet count, sodium, and transaminases for any key clues to their diagnosis. Sometimes the empiric initiation of doxycycline becomes a life-saving option in febrile infected patients of all ages, particularly in those with a history of tick exposure.

WHAT'S YOUR DIAGNOSIS?

The patient in **Figure 1** had an atypical presentation of Henoch-Schönlein purpura presenting as unilateral but characteristically palpable purpura.

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