



8945 Ridge Avenue
 Suite 3 - 4 - 5
 Philadelphia, PA 19128
 215-483-8558
 andorrapediatrics.com

Tick Removal

The discovery of an attached tick on a child can provoke great anxiety in parents. Here are concise instructions for completely removing those tiny, stubborn subjects of worrisome scrutiny in your office. Includes a Guide for Parents.

May 1, 2006

By: John Howard, DO, John Loiselle, MD
 Contemporary Pediatrics

DR. HOWARD is a pediatric emergency medicine fellow at Alfred I. duPont Hospital for Children, Wilmington, Del.

DR. LOISELLE is assistant director of the division of emergency medicine at Alfred I. duPont Hospital for Children and associate professor of pediatrics at Jefferson Medical College, Philadelphia, Pa.

The authors have nothing to disclose in regard to affiliations with, or financial interests in, any organization that may have an interest in any part of this article.

The tick takes its blood meal through the hypostome (circled). Use a large-gauge needle or forceps to remove a hypostome that is left behind as you remove the tick.



Through its bite, a tick can transmit the spirochete, virus, rickettsiae, bacteria, and protozoa that cause a wide array of infectious diseases in children, including Lyme disease, Q-fever, ehrlichiosis, babesiosis, Rocky Mountain spotted fever, and tularemia.¹ Some ticks secrete a neurotoxin that produces tick paralysis, with neurologic manifestations and ascending paralysis.²

Not all species of tick attach to humans and, of those that do, the likelihood that one will transmit a pathogen depends on its developmental stage and prevalence of infectious pathogens in a particular geographic area. Estimates are that the prevalence of the spirochete responsible for Lyme disease, *Borrelia burgdorferi*, in the nymphal stage of *Ixodes scapularis*, the deer tick, in endemic areas of the Northeast and Midwest, is 15% to 30%. (The responsible vector in the western states is *I. pacificus*, a deer and cattle tick.) The likelihood of disease transmission from the bite of an infected tick is only 1% to 3%.¹ A patient who develops a tick-borne disease is unlikely to recall a tick bite-generally because a tick drops off its host after feeding.

Whether any pathogen is transmitted by the bite of a tick is determined by the location of that organism in the tick's gut and the duration of the tick's attachment to its host. A pathogen residing in the salivary glands of the tick will pass to its host more quickly and efficiently than one in the tick's lower gastrointestinal tract. The principal determinant of disease transmission, however, is the duration of the tick's attachment: The longer a tick is attached, the greater the likelihood that the pathogen will transmit to host.

Each pathogen requires a different duration of attachment.³ Transmission of *B burgdorferi* from an infected deer tick is unlikely with less than 24 hours of attachment, more likely after 48 hours than after 24, and highly likely after 72. Shorter periods of attachment may suffice for an infected tick to transmit *Ehrlichia chaffeensis* and *E ewingii*, the pathogens responsible for ehrlichiosis.¹ This research confirming the relationship between duration of attachment and the spread of infectious agents underscores the importance of timely tick removal.¹ The table provides a snapshot of common tick-borne diseases in the US.

The tick employs several appendages to achieve its tenacious grip on your patient host.^{4,5} On each side of the hypostome—a rod-shaped structure through which the tick sucks blood from the host—are cheliceral digits that painlessly penetrate the host epithelium (see figure). Hundreds of barbs on the outer surface of the hypostome grip the skin like fishhooks as it enters the break in the epithelium. To strengthen its hold, the tick secretes a ring of cement around the cavity, fixing itself in place for a feast. It is while the tick feeds—a meal that can last several days or a week—that pathogens may be transferred to the host. Meal complete, the tick detaches from the patient's epidermis, leaving the cement behind. (Depth of attachment varies by tick; dog ticks, for example, attach superficially, whereas lone star ticks and *Ixodes* species attach more deeply within the epidermis.³)

Petroleum jelly? Gasoline? How about angled forceps?

The definitive treatise of tick removal has yet to be published, despite the abundance of anecdotal suggestions in the medical literature.⁶⁻¹⁰ The few randomized trials that have compared removal techniques have significant limitations; most studies used animal models, and others were underpowered.

The primary goal of tick removal is to remove the tick's body, head, mouth and mouth parts, and the cement—anything left in the skin can cause infection and local irritation or lead to a granuloma.^{4,5,10} The best technique is one that allows you to:

- remove the tick as soon as possible to minimize or interrupt the transfer of infectious material
- prevent the tick from regurgitating infectious material into the patient
- minimize damage or pain to the patient undergoing the procedure.

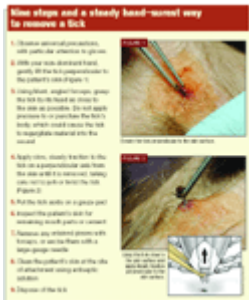
Click on the image below to see a larger version.



Techniques to remove an embedded tick employ either mechanical force to pull it out or application of agents such as viscous lidocaine, petroleum jelly, nail polish, isopropyl alcohol, or gasoline that irritate or suffocate the tick and cause it to spontaneously detach. Because a tick breathes at a rate of three to 15 breaths an hour, suffocation methods are rarely effective.^{4,11,12} Animal studies have demonstrated that irritating the tick with a lighted match, heated nail, or pocketknife—which may burn the child or cause the tick to regurgitate its contents into the host—do not stimulate the tick to detach.⁴ Researchers who injected lidocaine and lidocaine with epinephrine below the site of attachment also failed to induce the tick to detach.⁵

Click on the Although no technique will remove completely every tick, one that employs slow,

image below to see a larger version.



steady traction applied at the point of attachment is more likely to remove the tick intact with the cement.^{3-5,10-13} One such method is described in "Nine steps and a steady hand-surest way to remove a tick." Success depends on the type of tick, its developmental stage, and depth of attachment. Note that nymphs that penetrate deeply are less likely to be removed intact by any method.

Experts recommend a blunt, medium-tipped, angled mosquito or splinter forceps. (Using your fingers to grasp the tick will force its contents into the host and is less likely to remove the mouth parts and cement.) Any retained mouthparts or cement should be removed promptly with forceps; alternatively, the area can be excised with an 18-gauge needle, as would be done for a splinter.¹⁴

Commercial devices for tick removal demonstrate varying degrees of utility.^{3,12,13}

One such tool has jaws that allow the operator to grasp the tick at its mouth and then pull it away from the skin. A second tool incorporates a V-shaped notch so that, as the operator slides the tool along the patient's skin, the tick is trapped at the apex and then pulled from the skin. Although these instruments may be as useful as tweezers or forceps for tick removal, they are not commonly found in most offices or hospital emergency departments.

Post-procedure considerations

It is unnecessary to preserve the tick's remains in alcohol because the predictive value of tick analysis has not been defined.¹⁵ Post-exposure prophylaxis with antibiotics also is not recommended, because of, first, the low risk of disease transmission after a tick bite and, second, the risk of adverse effects from doxycycline and the unproven efficacy of amoxicillin for prophylaxis.^{16,17} Consider prophylaxis, however, in a patient who has multiple tick bites or if a tick's attachment is known to have lasted at least 72 hours. Counsel parents to monitor the child for signs and symptoms of infection.

Parents and child may need to be reminded that avoiding tick bites is key to avoiding Lyme and other tick-borne diseases, and that avoidance can be achieved by simple measures:

Wear long pants in areas where tick exposure is likely, and tuck pant legs into socks to ward off the immature ticks on the ground and on low growth.

Inspect the skin, especially the armpit and groin areas, immediately after outdoor activities to detect and remove ticks before transmission can occur.

If skin exposure is unavoidable, apply an appropriate insect repellent to skin or clothing to protect against tick bites.

REFERENCES

1. Des Vignes F, Piesman J, Heffernan R, et al: Effect of tick removal on transmission of *Borrelia burgdorferi* and *Ehrlichia phagocytophila* by *Ixodes scapularis* nymphs. *J Inf Dis* 2001;183:773
2. Daugherty RJ, Posner J, Henretig FM, et al: Tick paralysis: Atypical presentation, unusual location. *Pediatr Emerg Care* 2005;21:677-80
3. Piesman J, Mather TN, Sinsky RJ, et al: Duration of tick attachment and *Borrelia burgdorferi* transmission. *J Clin Microbiol* 1987;25:557
4. Needham GR: Evaluation of five popular methods for tick removal. *Pediatrics* 1985;75:997

Click on the image below to see a larger version.



5. Lee MD, Sonenshine DE, Counselman FL: Evaluation of subcutaneous injection of local anesthetic agents as a method of tick removal. *Am J Emerg Med* 1995;13:14
6. Benforado JM: Removal of ticks [letter]. *JAMA* 1984;252:3368
7. Karras DJ: Tick removal [letter]. *Ann Emerg Med* 1998;32:519
8. Kammholz LP: Variation on tick removal [letter]. *Pediatrics* 1986;78:378
9. Shakman RA: Tick removal [letter]. *West J Med* 1984;140:99
10. Gammons M, Salam G: Tick removal. *Am Fam Physician* 2002;66:643
11. Teece S, Crawford I: How to remove a tick. *Emerg Med J* 2002;19:323-324.
12. De Boer R, van den Bogaard AE: Removal of attached nymphs and adults of *Ixodes ricinus* (Acari: Ixodidae). *J Med Entomol* 1993;30:748
13. Bowles DE, McHugh CP, Spradling SL: Evaluation of devices for removing attached *Rhipicephalus sanguineus* (Acar: Ixodidae). *J Med Entomol* 1992;29:901
14. Henretig FM, King C, Joffe MD, et al: Tick removal. In: Wiley JM, ed. *Textbook of Emergency Pediatric Procedures*. Baltimore: Williams & Wilkins; 1997;1328
15. Lyme Disease. In: Pickering LK, ed. *Red Book: 2003 Report of the Committee on Infectious Diseases*, 26th ed. Elk Grove Village, Ill, American Academy of Pediatrics, 2003;407
16. Shapiro ED, Gerber MA, Holabird MB, et al: A controlled trial of antimicrobial prophylaxis for Lyme disease after deer-tick bites. *N Engl J Med* 1992;327:1769
17. Bratton RL: Tick-borne disease. *Am Fam Physician* 2005;71: 2323

This information should not be used as substitute for the medical care and advice of your child's physician. Health related topics found on the Andorra Pediatrics web site should not be used for diagnosing purposes or be substituted for medical advice. As with any new or ongoing treatment, always consult your professional healthcare provider before making any changes in treatment or beginning any new treatment. If you have any questions or concerns, please call our office.