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hidden in plain sight

ticks & other potential health risks emerge as warm weather returns

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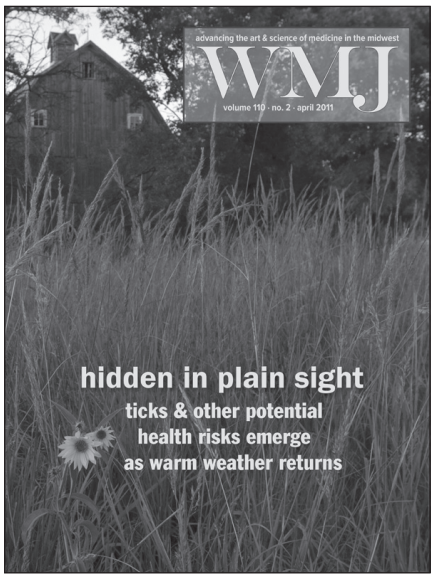

COVER THEME
Hidden in Plain Sight: Ticks & other potential health risks emerge as warm weather returns

Forty years ago, many clinical topics focused on infection and infectious diseases rather than cancer, genomics, and chronic illness—the subjects of much of today's medical literature. While a great deal has changed, much remains the same: infectious diseases are still important health concerns. This issue of *WMJ* highlights tick-borne illnesses and other infectious diseases found in our region, serving as a reminder to readers of some of nature's hidden dangers.

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The Management of *Ixodes scapularis* Bites in the Upper Midwest

Elizabeth L. Maloney, MD

ABSTRACT

Ixodes scapularis, commonly referred to as the deer tick, is the vector of Lyme disease and anaplasmosis; both illnesses are endemic to the upper Midwest. Avoidance of *I scapularis* bites is the primary preventative strategy for both infections. Antibiotic prophylaxis has been demonstrated to prevent Lyme disease, but similar studies have not investigated antibiotic prophylaxis for the prevention of anaplasmosis. Thus, recommendations regarding the management of *I scapularis* bites are focused on the prevention of Lyme disease.

This paper reviews the prevailing antibiotic prophylaxis recommendation for Lyme disease and the evidence supporting it. Given the additional risk of acquiring anaplasmosis from an *I scapularis* bite in the upper Midwest, this paper proposes an alternative regimen for antibiotic prophylaxis in this region.

INTRODUCTION

Lyme disease, the most common vector-borne illness in the northern hemisphere, is endemic to much of Wisconsin and Minnesota.[1] In these areas, more than 20% of the *Ixodes scapularis* populations harbor *Borrelia burgdorferi,* and in many regions *I scapularis* has expanded its range.[2,3] Primary and secondary prevention of Lyme disease assumed greater importance following the withdrawal of the only commercially available vaccine in 2002. *I scapularis* also transmits *Anaplasma phagocytophilum*, the bacterial agent of human granulocytic anaplasmosis (HGA), and species of *Babesia*, red blood cell parasites similar to malaria.[2-6] The presenting symptoms and signs of HGA are generally nonspecific and include fever, headache, myalgia, cough, nausea, and abdominal pain; disease severity can range from an asymptomatic infection to death.[5,6] Diagnosis is usually based on positive polymerase chain reaction (PCR) or serologic results. PCR is most sensitive, 67% to 90%, in the first week of illness;[6] serologic testing looks for a 4-fold rise in IgM or IgG antibody titers between acute and convalescent specimens.[6] HGA is usually treated with 10 days of doxycycline.[5,6] The acute symptoms of babesiosis include fever, chills, sweats, myalgia, arthralgia, anorexia, nausea, and vomiting. The diagnosis is based on positive blood smears, serology, or PCR. Treatment is with either a combination of quinine and clindamycin or atovaquone and azithromycin.[5] Both HGA and babesiosis are endemic to the upper Midwest, and vaccines to prevent either illness are lacking.[5,6] The upper Midwest is also seeing increased cases of human monocytic ehrlichiosis (HME), caused by *Ehrlichia chaffeensis*, and a new Ehrlichia muris-like agent (EML) was recently discovered in Wisconsin and Minnesota.[6,7] HME is transmitted by *Amblyomma americanum* (Lone Star tick);[5,6] the vector for EML is unknown.[7]

Central to the primary prevention of Lyme disease, HGA, and babesiosis is the avoidance of *I scapularis* bites. The risk of these infections may be reduced by avoiding known tick habitat, wearing appropriate clothing (long-sleeved shirts and pants), the judicious use of insecticides (permethrin) and repellents (DEET), and performing body-wide tick checks to find and promptly remove ticks after spending time in tick environs.[5]

When those measures fail and an attached tick is found, antimicrobial prophylaxis assumes a greater role in disease prevention. Recommendations regarding antibiotic prophylaxis for Lyme disease have been formulated;[8] similar recommendations for the prevention of anaplasmosis or babesiosis have not been made. The purpose of this paper is to review the prevailing recommendation for Lyme disease antibiotic prophylaxis following an *I scapularis* bite and the evidence supporting it. This paper will also discuss an alternative prophylaxis strategy that addresses the risk of acquiring *A phagocytophilum* from an *I scapularis* bite in the upper Midwest.

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CME available. See page 85 for more information.

IDSA Recommendation for Lyme Disease Prophylaxis

The Infectious Diseases Society of America's (IDSA) guidelines on Lyme disease contain recommendations regarding the management of *I scapularis* bites.[5] To prevent the development of Lyme disease following a bite, while avoiding the costs and adverse events associated with prophylactic antibiotics, the 2006 IDSA guidelines recommend a single 200-mg dose of oral doxycycline to prevent Lyme disease. This dose should be given only to patients who meet these, and other, criteria:[5] (1) the involved tick was identified as an adult or nymphal *I scapularis* by a reliable source, and the tick attachment time, based on observed engorgement or known time of bite, was greater than 36 hours; and (2) the bite occurred in an area where greater than 20% of the ticks are infected.

The above criteria were drawn from what was known about disease transmission. The risk of acquiring Lyme disease from any given bite is related to the duration of tick attachment and the *B burgdorferi* infection rate among ticks in the area where the bite occurred. Studies in animal models demonstrate that the risk of disease transmission increases with increasing durations of tick attachment times.[9] In general, attachment times under 24 hours have little chance of transmitting *B burgdorferi*; at 60 hours, 50% of infected nymphs will transmit *B burgdorferi*. Feeding to repletion (96 hours or more) results in 94% transmission rates.[9] Lyme-endemic areas of the upper Midwest and Northeast are thought to have tick infection rates consistently higher than 20%, and many areas report infection rates above 40%.[2,3,5] Thus, if a nymphal tick is allowed to feed for 60 hours in an area where the local tick infection rate is 30%, that particular bite has a 15% chance of transmitting *B burgdorferi* to a human host. Ticks transmit *A phagocytophilum* in a matter of hours.[6]

The prophylaxis regimen recommended in the 2006 IDSA guidelines is drawn from a study by Nadelman et al.[5] This randomized, placebo-controlled trial reported that administering a single 200-mg dose of oral doxycycline within 72 hours of an *I scapularis* bite prevented the development of Lyme disease with a treatment efficacy of 87%.[8]

The risk of adverse effects related to antibiotic prophylaxis was also a factor in the recommendation, presumably favoring the single oral dose doxycycline approach. The guidelines cited 2 earlier prophylaxis trials, noting the placebo groups' risk of developing Lyme disease was roughly equal to the risk of an antibiotic-associated rash in the treatment groups.[5]

There are several problems with the IDSA recommendation. The application of the required criteria to primary care practices in Wisconsin and Minnesota may be problematic. Medical professionals are encouraged to acquire the ability to identify ticks and assess engorgement, but physicians lack opportunities to do so. The assessment criteria are based on a study that employed a medical entomologist;[8] community physicians are not likely to have, or develop, this level of expertise. External validity is the ability of the cause-and-effects relationships in an experimental study to be generalized to a clinic setting. External validity is "poor" if the study situation differs from the typical clinical situation in ways likely to affect outcomes,[10] as is the case here. Furthermore, bites from ticks damaged or discarded following identification by non-medical personnel would not receive prophylaxis, yet withholding treatment solely on those grounds exposes patients to the risk of infection. In addition, physicians would need to know the current infection rates for various tick populations, but this data is often unavailable and tick infection rates in the same general locale vary significantly from year to year,[11] potentially leading to inaccurate risk assessments.

The antibiotic regimen recommended by the IDSA is based on the single-dose doxycycline trial, but that trial cannot inform physicians regarding Lyme disease prevention. Lyme disease is a multi-systemic illness having both early and late manifestations;[12-16] patients may be asymptomatic early in the infection only to develop symptoms of late disease after a latent period lasting months to years.[17-19] The single-dose doxycycline trial employed a 6-week follow-up period,[8] too short a timeframe to allow for the development of late Lyme disease. Thus, the ability of a single 200-mg dose of oral doxycycline to prevent Lyme disease following a tick bite was not demonstrated.

Nor did the study investigate the effectiveness of single-dose oral doxycycline on the prevention of early Lyme disease. Data from the Centers for Disease Control and Prevention indicates that 30% of all Lyme disease patients fail to exhibit an erythema migrans rash in the course of their illness, yet the trial's primary endpoint was strictly limited to the development of an erythema migrans rash at the bite site.[8,20] Three study subjects (1 in the doxycycline group and 2 in the placebo group) had clinical and laboratory evidence consistent with early Lyme disease, but because they lacked an erythema migrans, they were not considered "disease positives" when treatment efficacy was calculated.[8]

The trial's short observation period and narrow disease definition limit the scope of its findings. A single 200-mg dose of oral doxycycline successfully prevented the development of erythema migrans at the bite site, but its ability to prevent all stages of Lyme disease remains unknown.

While the risks of adverse events associated with antibiotic prophylaxis need to be considered, they should not be given undue weight. The risks for developing Lyme disease and an antibiotic-induced rash may be equal but the conditions themselves are not; a simple drug eruption and Lyme disease differ significantly in their potential to harm patients. There is substantial evidence detailing both the outstanding clinical safety of doxycycline, amoxicillin, and cefuroxime (other potential prophylactic agents) and the consequences of late Lyme disease,

which can be quite severe and irreversible.[21-26] It is concerning that the guidelines' developers based their prophylaxis recommendation on the single-dose doxycycline study, knowing it was unable to assess the risks of treatment failure.[5]

Single-dose doxycycline carries a risk that was not discussed in the original trial or the IDSA guidelines:[5,8] namely, the risk of developing seronegative Lyme disease. One subject in the doxycycline arm of the trial developed an erythema migrans but remained seronegative by enzyme-linked immunosorbent assay (ELISA) testing. First described by Dattwyler et al and confirmed by others,[27-30] seronegative Lyme disease may be induced by administering insufficient antibiotics early in the course of the infection, thereby altering the immune response and diminishing antibody production such that these patients, though ill, have negative results on serologic testing. This is an important consideration because seronegative patients who remain ill will likely experience treatment delays, which have been associated with poorer outcomes.[31,32]

The IDSA recommendation on antibiotic prophylaxis does not address the realities of the upper Midwest, namely, the possibility that an *I scapularis* bite might transmit *A phagocytophilum* or simultaneously transmit *B burgdorferi* and *A phagocytophilum*.[2,3,33] In a dual-exposure model, single-dose oral doxycycline was only 20% and 30% effective in preventing infection by *B burgdorferi* and *A phagocytophilum*, respectively;[34] its effect on serologic testing for HGA is unknown.

In summary, the IDSA recommendation for antibiotic prophylaxis of *I scapularis* bites using single-dose doxycycline may not be appropriate for use in the upper Midwest because: (1) it mandates clinical criteria that may be difficult to meet; (2) it is based on a poorly designed trial that was unable to demonstrate treatment effectiveness for Lyme disease prevention but did document the development of seronegative Lyme disease when treatment failed; (3) it assessed risk by comparing the number of adverse events from antibiotics to the number of treatment failures instead of discussing the relative significance each risk poses for a patient's health; and (4) the effects and effectiveness of this strategy on the diagnosis and treatment of patients with anaplasmosis alone is unknown, while the ineffectiveness of this approach for dual-exposure has been demonstrated in animal models.

An Alternative Recommendation for the Management of *Ixodes Scapularis* Bites

Given that the rate of *B burgdorferi*-infected ticks in the upper Midwest is high,[2,3] that physicians may be unable to determine attachment times based on tick engorgement, and that the optimum regimens for the prophylaxis of Lyme disease and anaplasmosis are unknown, physicians may offer doxycycline 100-mg twice daily for 10 to 20 days to patients with *I scapularis* bites.

The evidence supporting this recommendation is limited, and the duration of treatment is deductive. The absence of prophylaxis trials for anaplasmosis and the limited understanding of the mechanisms underlying Lyme disease latency and persistence introduce significant uncertainties. Three prospective trials on Lyme disease prophylaxis, using 10 days of antibiotic therapy, were unable to demonstrate treatment efficacy.[35-37] Thus, the shorter end of the duration range simply represents an accepted duration of treatment for HGA and the minimum treatment duration for early Lyme disease.[5,6]

Justification for 20 days of treatment comes from animal studies of prophylaxis. A sustained-release, injectable form of doxycycline, with measurable plasma levels for 19 days, was 100% effective for preventing Lyme disease alone. In a dual-exposure model, this regimen was also 100% effective for preventing *B burgdorferi* and *A phagocytophilum* infections.[34,38]

Doxycycline is the preferred antibiotic in appropriate patient populations because amoxicillin and cefuroxime are not effective for HGA.[6] However, given their effectiveness in early Lyme disease and contraindications for the use of doxycycline in children and pregnant women, amoxicillin and cefuroxime may be appropriate alternatives in some circumstances. However, patients would require continued observation to detect a potential *A phagocytophilum* infection.[29,39,40] Recommending 10 to 20 days of antibiotics for an *I scapularis* bite creates an increased risk for adverse events, especially for those patients who have multiple bites in a single season;[8] the increased risk may make this approach appear excessive to some. Taking doxycycline with food and administering probiotics should reduce or eliminate many of the minor adverse effects (nausea, vomiting, abdominal pain, and diarrhea) encountered in the single-dose doxycycline trial.[41]

CONCLUSION

Lyme disease and anaplasmosis are significant and endemic illnesses in the upper Midwest. Antibiotic prophylaxis is an appropriate response to *I scapularis* bites in this region.[2-6] The differences between the alternative and IDSA recommendations for the management of tick bites reflect the uncertainty of clinical practice when the evidence is scant or absent and the limited usefulness of generalized guidelines in specific clinical situations.[42] While some physicians may prefer to follow the IDSA recommendation on prophylaxis, others may accept the increased risk of adverse events to gain improved efficacy and, therefore, will wish to follow the alternative recommendation. In keeping with the American Medical Association principles of informed consent and patient autonomy,[43,44] physicians should fully explain each prophylaxis strategy and consider the patient's goals and values before making their selection.

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REFERENCES

1. Bacon RM, Kugeler KJ, Mead PS. Surveillance for Lyme disease—United States, 1992 – 2006. *MMWR.* 2008; 57(SS10):1-9.

2. Steiner FE, Pinger RR, Vann CN, et al. Infection and co-infection rates of *Anaplasma phagocytophilum* variants, *Babesia spp., Borrelia burgdorferi*, and the *rickettsial endosymbiont* in *Ixodes scapularis* (Acari: *Ixodidae*) from sites in Indiana, Maine, Pennsylvania, and Wisconsin. *J Med Entomol.* 2008;45(2):289-297.

3. Minnesota Department of Health Disease Control Newsletter. 2006;34(2):15-16.

4. Davis S, Bent SJ. Loop analysis for pathogens: niche partitioning in the transmission graph for pathogens of the North American tick *Ixodes scapularis*. *J Theor Biol.* 2010 Oct 13. [Epub ahead of print]

5. Wormser GP, Dattwyler RJ, Shapiro ED, et al. The clinical assessment, treatment, and prevention of Lyme disease, human Granulocytic anaplasmosis, and babesiosis: clinical practice guidelines by the Infectious Diseases Society of America. *Clin Infect Dis.* 2006;43(9):1089-1134.

6. Thomas RJ, Dumler JS, Carlyon JA. Current management of human granulocytic anaplasmosis, human monocytic ehrlichiosis and *Ehrlichia ewingii ehrlichiosis*. *Expert Rev Anti Infect Ther.* 2009;7(6):709-722.

7. Minnesota Department of Health. MLS: Laboratory Update Human Anaplasmosis & Ehrlichiosis Important Update. May 11, 2010. http://www.saynotyettosex.com/divs/phl/mls/LabAlerts/100511ehrilichiosis.pdf. Accessed February 22, 2011.

8. Nadelman RB, Nowakowski J, Fish D, et al. Prophylaxis with single-dose doxycycline for the prevention of Lyme disease after an *Ixodes scapularis* tick bite. *N Engl J Med.* 2001;345:79-84.

9. des Vignes F, Piesman J, Heffernan R, Schulze T, Stafford K, Fish D. Effect of tick removal on transmission of *Borrelia burgdorferi* and *Ehrlichia phagocytophila* by *Ixodes scapularis* nymphs. *J Infect Dis.* 2001;183:773-778.

10. U.S. Preventive Services Task Force Procedure Manual, *AHRQ Publication No. 08-05118-EF.* July 2008; Appendix VIII, page 90.

11. Frank C, Fix AD, Peña CA, Strickland GT. Mapping Lyme Disease incidence for diagnostic and preventive decisions. *Emerg Infect Dis.* 2002;8(4):427-429.

12. Steere A, Bartenhagen N, Craft J, et al. The early clinical manifestations of Lyme disease. *Ann Inter Med.* 1983;99:76-82.

13. Duray PH. Clinical pathologic correlations of Lyme disease. *Rev Infect Dis.* 1989; 11(Suppl 6):S1487-S1493.

14. Coyle PK, Schutzer SE. Neurologic presentations in Lyme disease. *Hospital Practice.* 1991;26(11):55-66.

15. Lo R, Menzies DJ, Archer H, Cohen TJ. Complete heart block due to Lyme carditis. *J Invasive Cardiol.* 2003;15(6):367-369.

16. Fallon BA. Lyme Borreliosis: neuropsychiatric aspects and neuropathology. *Psychiatr Ann.* 2006;36(2):120-128.

17. Albert S, Schulze J, Riegel H, Brade V. Lyme arthritis in a 12-year-old patient after a latency period of 5 years. *Infection.* 1999;27(4-5):286-288.

18. Logigian EL, Kaplan RF, Steere AC. Chronic neurologic manifestations of Lyme disease. *N Engl J Med.* 1990;323:1438-1444.

19. Pachner AR. Neurologic manifestations of Lyme disease, the new "Great Imitator." *Rev Inf Dis.* 1989;11(Suppl 6):S1482-S1486.

20. Bacon RM, Kugeler KJ, Mead PS. Surveillance for Lyme disease – United States, 1992 - 2006. *MMWR.* 2008;57(SS-10):1-10.

21. Cooper C. Safety of long-term therapy with penicillin and penicillin derivatives. Center for Drug Evaluation and Research. www.fda.gov/cder/drugprepare/penlongsafety.htm. Accessed February 22, 2011.

22. Smith K, Leyden JJ. Safety of doxycycline and minocycline: a systematic review. *Clin Ther.* 2005;27(9):1329-1342.

23. Klempner MS, Hu LT, Evans J, et al. Two controlled trials of antibiotic treatment in patients with persistent symptoms and a history of Lyme disease. *N Engl J Med.* 2001;345:85-92.

24. Waniek C, Prohovnik I, Kaufman MA, Dwork AJ. Rapidly progressive frontal-type dementia associated with Lyme disease. *J Neuropsychiatry Clin Neurosci.* 1995;7(3):345-347.

25. Chehrenama M, Zagardo MT, Koski CL. Subarachnoid hemorrhage in a patient with Lyme disease. *Neurology.* 1997;48(2):520-523.

26. Halperin JJ, Pass HL, Anand AK, Luft BJ, Volkman DJ, Dattwyler RJ. Nervous system abnormalities in Lyme disease. *Ann NY Acad Sci.* 1988;529:24-34.

27. Dattwyler RJ, Volkman DJ, Luft BJ, Halperin JJ, Thomas J, Golightly MG. Seronegative late Lyme borreliosis: dissociation of *Borrelia burgdorferi* specific T and B lymphocyte responses following early antibiotic therapy. *N Engl J Med.* 1988;319:1441-1446.

28. Lawrence C, Lipton RB, Lowy FD, Coyle PK. Seronegative chronic relapsing neuroborreliosis. *Eur Neurol.* 1995;35:113-117.

29. Luft BJ, Dattwyler RJ, Johnson RC, et al. Azithromycin compared with amoxicillin in the treatment of erythema migrans: a double blind, randomized, controlled trial. *Ann Intern Med.* 1996;124:785-791.

30. Keller TL, Halperin JJ, Whitman M. PCR detection of *Borrelia burgdorferi* DNA in cerebrospinal fluid of Lyme neuroborreliosis patients. *Neurology.* 1992;42:32-42.

31. Tager F, Fallon B, Keilp J, Rissenberg M, Jones C, Liebowitz M. A controlled study of cognitive deficits in children with chronic Lyme disease. *J Neuropsychiatry Clin Neurosci.* 2001;13:500-507.

32. Dattwyler RJ, Halperin JJ, Volkman DJ, Luft BJ. Treatment of late Lyme borreliosis-randomized comparison of ceftriaxone and penicillin. *Lancet.* 1988;1:1191-1914.

33. Thompson C, Spielman A, Krause PJ. Coinfecting deer-associated zoonoses: Lyme disease, babesiosis, and ehrlichiosis. *Clin Infect Dis.* 2001;33:676-685.

34. Zeidner N, Massung R, Dolan M, et al. A sustained-release formulation of doxycycline hyclate (Atridox) prevents simultaneous infection of *Anaplasma phagocytophilum* and *Borrelia burgdorferi* transmitted by tick bite. *J Med Microbio.* 2008;57:463-468.

35. Costello C, Steere A, Pinkerton R, Feder H Jr. A prospective study of tick bites in an endemic area for Lyme disease. *J Infect Dis.* 1989;159:136-139.

36. Shapiro E, Gerber M, Holabird N, et al. A controlled trial of antimicrobial prophylaxis for Lyme disease after deer-tick bites. *N Engl J Med.* 1992;327:1769-1773.

37. Agre F, Schwartz R. The value of early treatment of deer tick bites for the prevention of Lyme disease. *Am J Dis Child.* 1993;147:945-947.

38. Zeidner N, Brandt KS, Dadey E, Dolan MC, Happ C, Piesman J. Sustained-release formulation of doxycycline hyclate for prophylaxis of tick bite infection in a murine model of Lyme borreliosis. *Antimicrob Agents Chemother.* 2004;48:2697-2699.

39. Eppes SC, Childs JA. Comparative study of cefuroxime axetil versus amoxicillin in children with early Lyme disease. *Pediatrics.* 2002;109:1173-1177.

40. Nadelman RB, Luger SW, Frank E, et al. Comparison of cefuroxime axetil and doxycycline in the treatment of early Lyme disease. *Ann Intern Med.* 1992;117:273-280.

41. Medical Letter. 2007; 49(1267):66-68.

42. Sniderman AD, Furberg CD. Why guideline-making requires reform. *J Am Med Assoc.* 2009;301(4):429-431.

43. AMA Code of Medical Ethics, Opinion 10.01 - Fundamental Elements of the Patient-Physician Relationship. http://www.ama-assn.org/ama/pub/physician-resources/medical-ethics/code-medical-ethics/opinion1001.shtml. Accessed March 3, 2011.

44. AMA Code of Medical Ethics, Opinion 10.02 - Patient Responsibilities. http://www.ama-assn.org/ama/pub/physician-resources/medical-ethics/code-medical-ethics/opinion1002.shtml. Accessed March 3, 2011.

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Quiz: The Management of *Ixodes scapularis* Bites in the Upper Midwest

EDUCATIONAL OBJECTIVES

1. To understand the range of diseases transmitted by the *Ixodes scapularis* (deer tick).
2. To understand the Infectious Diseases Society of America's current guidelines for the prevention of Lyme Disease and some of the limitations of these recommendations.
3. To understand an alternative treatment for *Ixodes scapularis* (deer tick) bites in the upper Midwest as proposed by the author.

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QUESTIONS

1. The following diseases may be transmitted by the *Ixodes scapularis* (deer tick):
   A. Lyme disease
   B. Human monocytic ehrlichiosis (HME)
   C. Human granulocytic anaplasmosis (HGA)
   D. *Babesiosis*

Answer:

- ❑ A and B
- ❑ A and C
- ❑ A and D
- ❑ A, C, and D
- ❑ All of the above

2. The Infectious Diseases Society of America's (IDSA) current guidelines for the prevention of Lyme disease following a tick bite include the following:
   A. The involved tick should be an adult or nymphal *Ixodes scapularis* (deer tick).
   B. The tick attachment time based on engorgement or known time of bite is greater than 12 hours.
   C. The bite occurred in an area where greater than 10% of the ticks are known to be infected with *Borrelia burgdorferi*, the etiologic agent of Lyme disease.

Answer:

- ❑ A
- ❑ A and B
- ❑ A and C
- ❑ All of the above

3. Problems concerning the IDSA's current guidelines for antibiotic prophylaxis of *Ixodes scapularis* (deer tick) bites using a single dose of doxycycline include the following:
   A. It is based on a clinical trial that was unable to demonstrate treatment effectiveness for Lyme disease prevention but did document the development of seronegative Lyme disease when treatment failed.
   B. The effectiveness of this strategy on the diagnosis and treatment of patients with anaplasmosis is unknown.
   C. The identification of the tick species and the documentation of the attachment time may be difficult to establish in a clinical setting.

Answer:

- ❑ A and B
- ❑ B and C
- ❑ A and C
- ❑ All of the above

4. The author of this article suggests that the clinician who is practicing in the upper Midwest consider treatment for an *Ixodes scapularis* (deer tick) bite with a full course of doxycycline (100 mg twice daily for 10 to 20 days) in those patients in whom there is no contraindication in view of the concern of adequate treatment for *Borrelia burgdorferi* with a single dose of doxycycline and the possible coexistent infection with *Anaplasma phagocytophilum*.

Answer:

- ❑ True
- ❑ False

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