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Tick bite prophylaxis: Results from a 2012 survey of healthcare providers

Anna E. Perea, MS, **Alison F. Hinckley, PhD**, and **Paul S. Mead, MD, MPH**

Division of Vector-Borne Diseases, Centers for Disease Control and Prevention, Fort Collins, CO, USA

Summary

Objective—In a recent national survey, over 30% of healthcare providers (HCPs) reported prescribing tick bite prophylaxis in the previous year. To clarify provider practices, we surveyed HCPs to determine how frequently and for what reasons they prescribed tick bite prophylaxis.

Methods—We included four questions regarding tick bite prophylaxis in the DocStyles 2012 survey, a computer-administered questionnaire of 2205 U.S. primary care physicians, pediatricians, and nurse practitioners. Responses in 14 states with high Lyme disease incidence (high-LDI) were compared with responses from other states (low-LDI).

Results—Overall, 56.4% of 1485 providers reported prescribing tick bite prophylaxis at least once in the previous year, including 73.9% of HCPs in high-LDI and 48.2% in low-LDI states. The reasons given were “to prevent Lyme disease” (76.9%); “patients request it” (40.4%); and “to prevent other tickborne diseases” (29.4%). Among HCPs who provided prophylaxis, 45.2% did so despite feeling that it was not indicated. Given a hypothetical scenario involving a patient with an attached tick, 38.1% of HCPs from high-LDI states and 15.1% from low-LDI states would prescribe a single dose of doxycycline; 19.0% from high-LDI states and 27.5% from low-LDI states would prescribe a full course of doxycycline.

Conclusions—HCPs prescribe tick bite prophylaxis frequently in areas where Lyme disease is rare and for tickborne diseases for which it has not been shown effective. HCPs may be unaware of current tick bite prophylaxis guidelines or find them difficult to implement. More information is needed regarding the efficacy of tick bite prophylaxis for diseases other than Lyme disease.

Keywords

Lyme disease; tickborne disease; tick bite; antibiotic prophylaxis; DocStyles

Introduction

Ticks are globally distributed arthropods that transmit a diverse array of pathogens, including viral, bacterial, rickettsial, and parasitic agents. Although risk of tick bite is often

Address for Correspondence: Anna Perea, Centers for Disease Control and Prevention, 3156 Rampart Rd, Fort Collins, CO 80521, USA. Telephone: 970.494.6545. Fax: 970. 494.6631. aperea@cdc.gov.

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focal and varies across urban and suburban settings, exposure to ticks is nevertheless a common and underappreciated health problem.

Antibiotic prophylaxis for tick bites has been shown to reduce the risk of Lyme disease (Warshafsky et al. 2010). In a randomized, placebo-controlled trial, 0.4% of patients treated with a single 200-mg dose of doxycycline after the removal of an attached Ixodes scapularis tick developed erythema migrans, as compared to 3.2% of controls ($p<0.04$) (Nadelman et al. 2001). The specific circumstances under which such prophylaxis is considered beneficial are limited (Wormser et al. 2006) and the utility of prophylaxis for preventing other tickborne diseases has not been established. Nevertheless, a 2009 survey found that 31% of participating U.S. health care providers (general practice/pediatricians, dermatologists, nurse practitioners, obstetrician/gynecologists) had prescribed tick bite prophylaxis in the previous year (Brett et al. 2014).

To better define the practice of tick bite prophylaxis in the U.S., we surveyed health care providers (HCPs) to determine how frequently and for what reasons they prescribed antibiotic prophylaxis following a tick bite. Additionally, we asked how often HCPs prescribed prophylaxis when they believed it was not indicated. A hypothetical clinical question sought to determine what actions a provider would take when faced with a teenage patient with an attached tick.

Materials and Methods

Study Design and Population

DocStyles 2012 is a web-based survey of 2205 U.S. HCPs conducted by Porter Novelli, a public relations firm with a specialty practice in health and social marketing. CDC licensed the results of the DocStyles 2012 survey post-collection from Porter Novelli, and analysis of these data was exempt from institutional review board approval because personal identifiers were not included in the data file.

Physicians are drawn from the Epocrates Honors Panel, an opt-in panel of over 275,000 medical practitioners who are verified against the American Medical Association's (AMA) master file by name, birthdate, medical school, and graduation date. Physicians are randomly sampled from the Panel to match the proportions for age, gender, and region within AMA's master file. Nurse practitioners were drawn from the Epocrates Allied Health Panel of over 78,000 nurse practitioners. All respondents were pre-screened to include HCPs in the U.S. who actively see patients and have been in practice for at least three years.

Questions regarding tick bite prophylaxis were limited to family practitioners, internists, pediatricians, and nurse practitioners for a total of 1503 HCPs surveyed on this topic. Survey quotas were set to reach 1,000 primary care physicians (internists and family/general practitioners), 250 pediatricians, and 250 nurse practitioners. Invitations to participate are sent electronically in numbers estimated to yield the desired quotas of completed questionnaires. Once a sampling quota for a provider specialty is met, the survey blocks additional respondents in that specialty. Porter Novelli paid participants an honorarium of $20 to $85, depending on their specialty, for completing the survey.

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Variables Measured

The anonymized DocStyles 2012 survey contained 139 questions covering a wide range of topics, including provider and practice characteristics. Four questions regarding tickborne diseases included:

Q1 In the past year, for how many patients did you prescribe prophylactic antibiotics for tick bites? (*Select one: None, 1-5 patients, 6-10 patients, 11-25 patients, 25-100 patients, more than 100 patients*)

Q2 What are the reasons that you prescribe tick bite prophylaxis? (*Select all that apply: Patients request it, to prevent Lyme disease, to prevent other tickborne diseases, other reasons, I do not prescribe tick bite prophylaxis*)

Q3 Patients often express their desire for antibiotic treatment. In the past year, for how many patients did you prescribe prophylactic antibiotics for tick bites when you felt it was not indicated? (*Select one: None, 1-5 patients, 6-10 patients, 11-25 patients, 25-100 patients, more than 100 patients*)

Q4 A 15-year-old male comes to your office with an attached, partially engorged tick. His mother requests antibiotics. Which of the following would you do? (*Select all that apply: Remove the tick, prescribe one dose of doxycycline, prescribe a full course of doxycycline, prescribe one dose of a different antibiotic, prescribe a full course of a different antibiotic, order a test for Lyme disease, send the patient home and tell him to be alert for fever and rash, none of these*)

HCPs who answered “none” to question 1 were not asked questions 2 and 3.

Statistical Methods

Frequencies and p values were calculated using SAS JMP v. 10.0.1. Data were excluded if there was no zip code associated with the response or if the respondent answered that they prescribed antibiotics in Q1 but denied prescribing antibiotics in Q2. For Q1 and Q3, the total number of patients given prophylaxis was estimated by multiplying the number of responses by the midpoint value for each response category (e.g., 3 for 1-5 patients) or by 25 for responses in the ≥ 25 category. For purposes of this analysis, 14 states were defined as high Lyme disease incidence (high-LDI) states based on having a reported incidence greater than the 2010 national incidence of 7.3 per 100,000 population: CT, DE, ME, MD, MA, MN, NH, NJ, NY, PA, RI, VT, VA, and WI (*Summary of notifiable diseases--United States, 2010. Morbidity and Mortality Weekly Report (MMWR)* 2012). These states account for approximately 97% of all Lyme disease cases reported to CDC each year. All other states were classified as low Lyme disease incidence, or “low-LDI” states.

Results

Invitations were sent to 2175 primary care physicians, 518 pediatricians, and 456 nurse practitioners. This yielded a total of 1503 completed surveys, which was reduced to 1485 after excluding aberrant data as described above. Porter Novelli's calculated response rates are 49.9%, 53.5%, and 65.4%, respectively, for each practice type. Demographic features

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and distribution by provider type are presented in Table 1. Median age was 46 years (range: 27–78 years); median time in practice was 14 years (range: 3–50 years).

Overall, 838 (56.4%) of the 1485 participating HCPs reported prescribing tick bite prophylaxis in the past year; 170 (11.4%) prescribed it more than 10 times (Table 2). The total number of patients given prophylaxis is estimated at 6,242 patients, for an overall average of 4.2 patients for every HCP surveyed. Tick bite prophylaxis was prescribed more frequently by HCPs in high-LDI states (351/475; 73.9%) than in low-LDI states (487/1010; 48.3%; $p < 0.0001$). Among the 170 HCPs who prescribed tick bite prophylaxis >10 times, twice as many were from were from high-LDI states than were from low-LDI states.

The most commonly reported reason for prescribing tick bite prophylaxis was “to prevent Lyme disease” (644/838; 76.9%), followed by “patients request it” (339/838; 40.4%), and “to prevent other tickborne diseases” (246/838; 29.4%). Even in low-LDI states, prevention of Lyme disease was also the most commonly cited reason for prescribing prophylaxis (337/487, 69.2%). The number of HCPs who prescribed tick bite prophylaxis when they felt it was not indicated was 45.2% (379/838), with no significant differences between providers in high-LDI and low-LDI states. Nearly 10% of HCPs prescribed tick bite prophylaxis more than 5 times, despite feeling it was not indicated. The total number of patients given prophylaxis when not indicated is estimated at 1,757, or approximately 28% of all patients given prophylaxis.

In the hypothetical scenario in which the mother of a 15-year-old male with an attached, partially engorged tick requests antibiotics for her son, the type of prophylaxis prescribed varied by region (Table 3). HCPs from high-LDI states were more than twice as likely as HCPs from low-LDI states to prescribe one dose of doxycycline ($p < 0.0001$). HCPs from low-LDI states were more likely to prescribe a full course of doxycycline (27.5%) than HCPs from high-LDI states (19.0%; $p < 0.001$). Less than 3% of HCPs choose prophylaxis with an antibiotic other than doxycycline. Nearly half of HCPs (48.0%) would instruct the patient to be alert for fever or rash. Nearly 20% of HCPs from both groups indicated that they would order a Lyme disease test for this patient.

Discussion

Optimal management of tick bite is complicated by the diversity of diseases ticks transmit, geographic differences in disease risk, and limited information regarding prophylaxis efficacy. Even within “high-LDI” states, there is likely large variation in risk of tick bite. For Lyme disease, available evidence indicates that antimicrobial prophylaxis is effective in reducing the risk of infection following tick bite (Warshafsky et al. 2010). Nevertheless, the magnitude of benefit is limited by the low risk of infection following a single bite. In a recent meta-analysis of four placebo-controlled trials conducted in high LDI states, investigators concluded that antibiotic prophylaxis would prevent one case of Lyme disease for every 50 patients given tick bite prophylaxis, or in cases where patients had a visibly engorged tick, one case for every 11 patients given prophylaxis (Warshafsky et al. 2010). At the same time, prophylaxis is associated with side effects, some of which can be serious. Accordingly, the Infectious Diseases Society of America (IDSA) recommends that

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prophylaxis be limited to the minimum dose shown effective (a single 200 mg dose of doxycycline for adults) and be given only when the attached tick can be reliably identified as I. scapularis; the estimated time of attachment is ≥36 h; prophylaxis can be started within 72 h of tick removal; and the local rate of infection of I. scapularis ticks with Borrelia burgdorferi is ≥20%. Similarly detailed assessments are not available of other tickborne diseases, but given an even lower likelihood of infection following a single tick bite, the proportion of patients who must be given prophylaxis to prevent a case would be even greater.

Against this backdrop, the results of this survey present a mixed picture. The absolute frequency of tick bite prophylaxis is remarkable, with 56.4% of participating HCPs prescribing it in the past year, and 11.4% prescribing it more than 10 times in the last year. This frequency is higher than the 31% reported by Brett et al. (2014), possibly due to differences in wording of questions, response rate, and inclusion in the previous study of obstetricians and gynecologists. In the current survey's tick-bite scenario, 38% of providers in high-LDI states opted to give a single dose of doxycycline, which is generally consistent with IDSA guidelines even though the tick species was not indicated. An additional 20% of providers opted to prescribe a full course of doxycycline, which is arguably the worse choice because it increases the costs and likelihood of side effects without additional demonstrated benefit. Among respondents from low-LDI states, 15% opted to prescribe single dose doxycycline and 27% a full course as prophylaxis. It is unlikely that the infectivity criteria set forth by IDSA can be met in low-LDI states, (Wormser et al. 2006) suggesting that prophylaxis to prevent Lyme disease is not justified in this setting. Some low-LDI states have relatively high rates of Rocky Mountain spotted fever (RMSF) and ehrlichiosis; however there is no evidence supporting prophylaxis to prevent these diseases (Chapman et al. 2006). In a guinea pig model, prophylaxis with a single dose of oxytetracycline can prevent RMSF, but only under certain circumstances of dose and timing (Kenyon et al. 1978). Pre-exposure prophylaxis with doxycycline has been shown to prevent scrub typhus (Rickettsia tsutsugamushi); however, the efficacy of post-exposure prophylaxis has not been demonstrated (Twartz et al. 1982). Overall, prophylaxis practices do not align well with current recommendations.

While it is difficult to determine all the factors that drive prescribing practices, there is evidence that patient expectation plays an important role. Among HCPs prescribing prophylaxis, 40% reported doing so at least once in the past year because of a patient request, and 45% of providers prescribed tick bite prophylaxis at least once in the past year despite the provider feeling that it was not indicated. These findings align with data from studies of provider antibiotic prescribing practices in the cases of acute respiratory tract infections (Scott et al. 2001), ear aches (Mangione-Smith et al. 1999), and sore throats (Mangione-Smith et al. 1999). Educating patients about the risks and benefits of antibiotics is central to optimal management (‘Get Smart: Know When Antibiotics Work’ 2013).

A final concern is that nearly 20% of HCPs chose to order Lyme disease serology in response to the tick bite scenario. While it may be that the providers were simply obtaining a “baseline” sample, this practice is unnecessarily costly and not recommended (Wormser et al. 2006). Furthermore, it may generate false positive results that could complicate case

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management. Providers and patients should understand that serologic testing is not generally effective at identifying infection before the patient has developed symptoms.

Limitations of this research include the lack of inclusion of physician assistants and emergency department physicians, coupled with a relatively low response rate. It may be that providers' responses to the hypothetical tick bite scenario are different than what their actual practices would be. Although related to the same topic, wording of the survey questions differs from that used in a previous study (Brett et al. 2014) and therefore results are not directly comparable.

Tick bite prophylaxis guidelines, though quite specific, may raise more questions among HCPs than they answer. Clinicians may not be prepared to identify a tick at a specific life stage or estimate the local rate of I. scapularis infection with B. burgdorferi. Additionally, patients bring their anxieties and expectations to the examination table. They may not want to adopt a “wait and see” approach, particularly when their children are involved; they may expect that antibiotics— either a single dose or an entire course—will be prescribed; they may consider antibiotics “safe” and may not be familiar with the risks; and they may lack health adequate health insurance and don't want to make a return visit.

HCPs must use their professional judgment when balancing clinical uncertainties and patient demands. Additional research into tick bite prophylaxis for other tickborne diseases could provide additional insight into prophylaxis recommendations.

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Impacts

- Overall, tick bite prophylaxis practices do not align well with current recommendations.
- Patient expectation plays an important role in prescribing practices. Among providers prescribing prophylaxis, 40% reported doing so because of a patient request at least once in the past year; 45% of providers prescribed tick bite prophylaxis at least once in the past year despite feeling that it was not indicated.
- Additional research into tick bite prophylaxis for other tickborne diseases could provide guidance for prophylaxis recommendations.

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Table 1

Characteristics of 1485 participating practitioners surveyed for DocStyles 2012.

Characteristics	n	(%)
Sex		
Male	874	(58.9)
Female	611	(41.1)
Age		
≤40 years	443	(29.8)
>40 years	1042	(70.2)
Race		
White	1133	(76.3)
Asian	196	(13.2)
Other	102	(6.9)
Black or African American	54	(3.6)
Ethnicity		
Non-Hispanic	1418	(95.5)
Hispanic	67	(4.5)
LD endemicity		
High Lyme disease incidence states (high-LDI)	475	32.0
Low Lyme disease incidence states (low-LDI)	1010	68.0
Practitioner type		
Family/General Practitioner	533	(35.9)
Internist	457	(30.8)
Pediatrician	247	(16.6)
Nurse Practitioner	248	(16.7)
Practice Setting		
Group	1098	(73.9)
Hospital	141	(9.5)
Individual	246	(16.6)
Years of practice		
≤10	501	(33.7)
>10	984	(66.3)
Patients per week		
≤100	995	(67.0)
>100	490	(33.0)

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Table 2

The frequency with which all participating health care providers prescribed tick bite prophylaxis in the past year in high-LDI and low-LDI states.*

	Low-LDI states		High-LDI states		Total	
Range	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
None	523	51.8	124	26.1	647	43.6
1-5	342	33.9	159	33.5	501	33.7
6-10	91	9.0	76	16.0	167	11.2
11-25	44	4.4	77	16.2	121	8.1
> 25	10	1.0	39	8.2	49	3.3
Total	1010	100.1	475	100	1485	100.1

*$p<.0001$ for comparison between high-LDI and low-LDI states for any prophylaxis versus no prophylaxis.

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Table 3

Frequency of actions taken in hypothetical case by participating health care providers in high-LDI and low-LDI states.

	Low-LDI states		High-LDI states		Total	
Actions taken	**Freq. (Yes)**	**% (Yes)***	**Freq. (Yes)**	**% (Yes)***	**Freq. (Yes)**	**% (Yes)***
Prescribe one dose of doxycycline**	152	15.1	181	38.1	333	22.4
Prescribe a full course of doxycycline**	278	27.5	90	19.0	368	24.8
Prescribe one dose of different antibiotic	8	0.8	7	1.5	15	1.0
Prescribe a full course of a different antibiotic	15	1.5	7	1.5	22	1.5
Order a test for Lyme disease	188	18.6	108	22.7	296	19.9
Send the patient home and tell him to be alert for fever/rash	500	49.5	212	44.6	712	48.0
None of these	41	4.1	8	1.7	49	3.3

*Multiple answers were allowed. Totals may exceed 100%.

**p>.001 for comparison between high-LDI and low-LDI states.