RECOMMENDED PROCEDURES FOR TICK BITES IN A LYME BORRELIOSIS ENDEMIC AREA

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ABSTRACT

Ticks transmit causative agents of several diseases; however, the most common disease in many parts of the northern hemisphere is Lyme Borreliosis. An active search for possibly attached ticks (after potential exposure to an appropriate environment) is quite important for preventing the disease because it enables early detachment.

Recommended procedures after a tick bite in a Lyme Borreliosis endemic region include early removal of the attached tick, disinfection of the site of the tick bite, the policy of wait and watch for the possible appearance of Lyme Borreliosis manifestation(s) and advice on early treatment of the possible signs or symptoms of Lyme Borreliosis.

The effectiveness of antibiotics for preventing Lyme Borreliosis has not been unequivocally proven. Even if it was determined, several questions concerning the rationality of such preventive usage of antibiotics remain to be answered.

KEY WORDS

Lyme Borreliosis, prevention, procedures after tick bites, removal of an attached tick, preventive usage of antibiotics

INTRODUCTION

Ticks transmit causative agents of several diseases; however, the most common human illness in many parts of the northern hemisphere is Lyme Borreliosis (LB) (1,2).

Its clinical course is difficult to predict and when the illness assumes a chronic form, it can notably deteriorate the patient's quality of life. The risk of late sequelae is reduced, though not completely eliminated, by initiating proper therapy in early stages of the disease (3). At present, most efforts are directed to the prevention of infection by effective immunization and to non-specific protective measures.

In the recent years, people have been increasingly afraid of being exposed to a tick and the associated risk of *Borrelia burgdorferi* (*Bb*) infection and some individuals even panic when bitten by a tick. Thus, it is important to have simple and precise advice on what can be done and what should be done following a tick bite.

RECOMMENDED PROCEDURES AFTER TICK BITES

ACTIVE SEARCH FOR POSSIBLY ATTACHED TICKS

There is not doubt that active search for a tick which may be attached to a person is important because it enables early removal. People should be encouraged to actively check themselves and their clothing after any potential exposure to ticks.

REMOVAL OF ATTACHED TICKS

Important questions about removal are: when and how to do it.

The answer to the question „when?" is as soon as possible. It is well known that even if a tick is infected, transmission does not invariably occur after each bite. One of the reasons is that the tick has not been attached long enough for bacteria to be successfully transmitted to the feeding site (4,5). In questing ticks borreliae are usually limited to their midgut (6-8); for transmission the spirochetes should disseminate and arrive in salivary glands (8-10). Experiments on animals have stressed the importance of early removal of ticks: transmission occurred only exceptionally when the tick was removed within 48 hours of the bite, while longer attachment times were associated with a much higher probability of transmission (4,5).

However, the results of animal experiments cannot be automatically applied to man. Furthermore, data from patients with erythema migrans (EM) suggests that some of them developed skin lesions even after a very short tick attachment time. Similar data was also found at Lyme Borreliosis Outpatient Clinic in Ljubljana where 892 adult patients with typical EM were diagnosed and registered by four physicians in 1993 (11). All the patients were asked to estimate the duration of the tick attachment. One third (212/654) of the patients with a tick bite at the site of later EM stated that they were able to accurately assess the maximum possible duration of the tick attachment. These patients were predominantly indoor persons who remembered the day and hour when they went out (usually for a walk in the forest) and the time when they returned and discovered an attached tick. Nearly one third of these 212 patients reported the duration of attachment to be up to 12 hours and more than two thirds assessed this time to be 24 hours or less (11).

These results seem to conflict with the findings of experiments on animals conducted in the USA in which transmission did not take place during the first 24 hours of attachment (4). When interpreting this contradiction it should be stressed that the time required for transmission from a tick vector to a host may be different for humans than for laboratory hosts (hamsters) and natural animal hosts (white-footed mice). Moreover, animal experiments were carried out with *Ixodes scapularis* (4,5,12) and not with *I. ricinus* ticks which are present in Europe (8). The epidemiological data presented here concerning *I. ricinus* complies with the observations of Lebet and Gern, who described the presence of *Bb* in salivary glands of a relatively high percentage (11%) of *I. ricinus* nymphs before the blood meal (13). This suggests that the transmission of spirochetes by these ticks may occur earlier than what was described for *I. scapularis*.

A plausible explanation for the disseminated infection in ticks and the accelerated transmission of spirochetes to a host is antecedent partial feeding of ticks (14). The results that were obtained in patients with EM do not negate the possibility that the proportion of exposed population who develop an EM lesion is lower or even much lower in persons who carry the infested tick for shorter durations (i.e. 24 hours or less); however, according to this data, there is no „safe" first 24-hour period of tick attachment. It still remains to be elucidated as to why and how often this kind of early transmission occurs.

Despite all the above-mentioned reservations, prompt removal of the tick remains a simple and, probably in most cases, an effective way of preventing *Bb* infection and LB in humans.

Daily inspections for attached ticks should be a regular routine in endemic regions and prompt removal of attached ticks cannot be emphasized enough (15).

The next question is „how?".

Attached ticks must be removed immediately with fine forceps.

A variety of tick removal products are now available for this purpose, but actually nothing more complicated than forceps with sharp tips is necessary (15,16).

The tick should be grasped as close to the point of attachment as possible and pulled with a steady motion directly away from the skin until removed (15).

Some people put a drop of oil on the attached tick - after a few minutes it will fall away by itself without any traction. However, this method is only effective in cases when it was attached for a short

Table. Controlled trials of antibiotic therapy to prevent Lyme Borreliosis after a tick bite (17,19,20).

Lyme cases				
Author	**Year**	**Therapy**	**Placebo**	
Costello	1989	0/27	1/29	(3.4%)
Shapiro	1992	0/192	2/173	(1.2%)
Agre	1993	0/89	1/90	(1.1%)
		0/308	4/292	(1.4%)

Fisher exact test (2-tailed): p = 0.0593730

period of time, that is, when it was attached only superficially; when it is embedded in the skin for a longer period of time a drop of oil will not be of any help. There is a fear that manipulating an attached infected tick might increase the chances for transmission of the causative agent to the host. If this were true, it would be logical to expect that it would be more effective when it occurs through vomiting or defecation and not through transmission via salivary glands.

Often, especially with adult ticks, some of the mouthparts (hypostome) remain in the skin. Complete removal is not necessary to prevent *Bb* infection (15). However, the embedded parts need to be treated as foreign body.

LOCAL DISINFECTION OF SKIN AT THE BITE SITE

As with any wound, it is necessary to disinfect the area. However, it would be beneficial to have a disinfecting agent, which used topically at the site of a tick bite, would have borrelicidal effects on borreliae already present in skin. Unfortunately, I am not aware of any such agent.

Wait and watch for the eventual appearance of Lb manifestation(s)

In addition to early tick removal, some authors recommend the use of antibiotic prophylaxis. Several reports on this issue appeared in literature mostly published after 1992 (17-20). Some authors tend to use preventive antibiotic treatment for patients with a history of a recent tick bite (21-23), other authors have many reservations against empirical antibiotic prophylaxis (17,19,20,24-26), while others maintain that antibiotics should only be given to patients with a high chance of infection, i.e. when chances to develop LB after a tick bite are greater than 3.6% (18,27), in the event that examination for borreliae in tick is positive (28) or after sufficiently long period of attachment of the tick (29).

All these views, however, are based on the presumption that antibiotics administered after a tick bite can effectively prevent *Bb* infection.

It would be reasonable to suppose that antibiotics, which are successfully used for treatment of LB, can be equally effective for preventing *Bb* infection. However, generalizing about the efficacy of a treatment modality may be misleading, as illustrated by the example of *Rickettsia rickettsii* infection: therapy with tetracycline for Rocky Mountain spotted fever may be potentially life-saving, yet in asymptomatic individuals with a history of tick bite, tetracycline can at the very best delay rather than prevent the onset of the disease (30).

In controlled trials of antibiotic therapy to prevent LB after a tick bite (data from the USA) (17,19,20), none of the 308 patients that were given phenoxymethylpenicillin, doxycycline or amoxicillin developed LB while in the control groups in 4/292 manifestations of LB appeared (see Table). These numbers are not high enough to prove a significant statistical difference. In addition, if the preventive antibiotic usage really is effective, we neither know which antibiotic is the best choice for prophylaxis nor the dosage and duration of treatment.

In studies presented on the Table phenoxymethylpenicillin (17,20), tetracycline (20) and amoxicillin (19) were used for 10 days in a dosage that is usually applied for the treatment of EM. However, as shown in the study by Shapiro and coworkers, compliance to the prescribed regimen may be a substantial problem (19).

Even if we presume that antibiotics can successfully prevent the disease, it is highly debatable whether

this prophylaxis is rational. The observed discrepancy in recommendations provided in the literature is mainly due to inadequate information about the factors involved in the transmission and development of the disease.

Accurate data is needed regarding the proportion of infected ticks in individual geographic areas as well as regarding the incidence of infection following a (infected) tick bite and the rate of asymptomatic infections. The latter is estimated at 80% in Europe (31,32) and approximately 50% in the USA (33,34).

It should be emphasized that it is nearly impossible to know the tick infection rate for all individual geographic regions and that data on the chances of infection after a bite by a borrelia-infested tick is sparse (17,19) and may theoretically range from 0 (as in a tick with small number of spirochetes in the midgut which was attached for a short time) to 100%.

Thus, we cannot accurately determine the chances of developing LB after a single tick bite. Additional studies will be needed to answer this question more precisely. Yet, it seems that on average chances of developing LB after a single tick bite are low and may only rarely surmount 3.6%, i.e. the percentage found in a mathematical model to be a limit above which preventive treatment with doxycycline (100 mg b.i.d. for 10 days) in all persons with a tick bite is cost effective (18). Even lower chances (1%-3.6%) are probably achieved only rarely.

When weighing the pros and cons of the use of antibiotic prophylaxis in patients bitten by a tick, it should be kept in mind that, in addition to being potentially harmful to the patient, overuse of antibiotics also has general untoward effects, such as selection of resistant bacteria.

EARLY TREATMENT

A prerequisite for early treatment is early recognition, that is, a timely diagnosis.

It is relatively easy to diagnose a typical EM lesion, but often not so simple to recognize other manifestation(s) of LB without previous EM.

There may be some difficulties in interpreting the small redness at the site of a tick bite: this may be an early EM lesion or unspecific (allergic or toxic) reaction at the site of the tick bite. The latter usually develops at the time when a tick is still in the skin or in the first 24 hours after removal of the tick, while in EM a free interval from the tick bite to the appearance of skin redness of at least several days is typical.

It is not necessary to administer an antibiotic to a person with small redness on the skin in the vicinity of a tick bite which was removed one day ago, but serious thought should be given to EM and antibiotic treatment in a patient with a skin redness of the same diameter if the skin lesion appears one week after the bite.

CONCLUSIONS

Attached ticks should be removed promptly.

The efficacy of antibiotics in preventing *Bb* infection and the onset of LB has not yet been unequivocally confirmed. Even if antibiotic prophylaxis proved efficacious, it remains to be assessed whether it is rational or not. Although the available data does not allow us to draw any definitive conclusions, it seems to speak against, rather than in favour of, general antibiotic prophylaxis following a tick bite.

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