

## Ticks and Humans

PAUL-ERIK UGGELDAHL

Suvikatu 8, FIN-80200 Joensuu, Finland. E-mail: [pe.uggeldahl@gmail.com](mailto:pe.uggeldahl@gmail.com)



Hard ticks, especially *Ixodes ricinus* in Europe, carry different microbes, which can cause the diseases described in my babesiosis article (1). However, most bites by blood-sucking ticks do not result in infection. The body has a self-curing tendency, but if signs and symptoms of borreliosis, ehrlichiosis or babesiosis develop, patients should be treated according to current recommendations. The conditions termed chronic Lyme borreliosis or post-Lyme syndrome, requiring several months or even years of antibiotic therapy, have not been proven. The question of subclinical infection has been discussed, especially in borreliosis, where seroconversion can develop with no clinical symptoms of the disease.

Few doctors are sufficiently familiar with the symptoms of tick-borne diseases (2). Thus collaboration and consultation with experts, especially regarding Lyme borreliosis (Lyme disease) (3), are important. Hopefully such contact could be established also with vets, who are, or should be, familiar with borrelia, ehrlichia and babesia.

### Taxonomy

Ticks (*Metastigmata*) are giant mites, all of which are blood-sucking parasites, in contrast to the abundant microscopic mites (*Acari*), most of which are harmless to humans. Hard ticks are in the majority (family *Ixodidae*). If these vectors were mosquitos there would be less fear concerning the infectors themselves and the diseases they can pass on.

### Mosquito and tick bites

As a consequence of mosquito bites half a million people die each year from malaria. However, deaths following hard tick bites are rare. Not a single person has died from Lyme borreliosis in the Nordic countries, but the recommendation of treatment with massive doses of antibiotics is a threat for life. A mosquito bite is painful, but a tick bite is not, due to substances with anaesthetic and antihistamine effect in the saliva of the ticks.

### Near neighbours

We have to accept the existence of ticks, as well as mosquitos, often close to us (4, 5). Living in a city is no guarantee of not

being bitten, since the green spaces in cities are good habitats for a multitude of hosts for ticks, such as mice, rats, rabbits and hares. The conditions may be perfect for the lifecycle of ticks, e.g. as in Central Park in Manhattan in the middle of New York.

### Stages of *Ixodes ricinus*

The stages of *Ixodes ricinus* are: the egg, larva, nymph and adult ticks; male and female. Of the adult ticks only the female sucks blood. The male couples with the female during her meal or shortly afterwards. In borreliosis approximately 10% of nymphs are infected with *B. burgdorferii*, and for adult females at least double this proportion are infected. However, because nymphs are 40 times more frequent than adult ticks, they are the most important vectors of disease in borreliosis and other tick-borne diseases (6).

Before they have had a meal of blood, all stages of the tick are very small; the larvae are roughly the size of a full stop on this page. You could find the size in Ref 7, on page 1152. At this page, the framed picture is of importance. The text is in Finnish but reads from left: The adult female, the male, nymph and the minuscule larvae. The text under the ticks: "Ticks in natural size".

### Reservoir- and reproduction hosts

Reservoir hosts are vertebrates from which the larvae, nymphs and adult female ticks suck blood containing live microbes. As a result the ticks become infected. In borreliosis the reservoir hosts are mainly small rodents. Migrating birds can also act as reservoir hosts.

Reproduction hosts have no microbes in their bloodstream. They are often large mammals, such as the deer family. However, there are many other reproduction hosts, such as domestic animals, cattle, horses, dogs and cats. Humans are also reproduction hosts, but they are not essential for the lifecycle of ticks, and are poor hosts as, in general, people spend most of the day indoors. This means that most ticks that attach to people drop off indoors and not in the soil. Reproduction hosts may develop symptoms of the diseases mentioned in this article: borreliosis, ehrlichiosis and babesiosis. As in ehrlichiosis

and babesiosis, in borreliosis only the tick, *Ixodes ricinus*, is the vector (of *Borrelia burgdorferi*), not mosquitos or horseflies (8).

### Removing ticks

Having a tick embedded deep in the skin is disgusting, so we try to remove them. Often our fingernails are sufficient for this. Forceps are ideal, but usually these surgical instruments are usually only available to doctors. Pharmacies in Finland have suitable tweezers. If the tick does not come off whole, but parts remain in the skin, it is not a problem; our body's rejection mechanisms will eliminate the rest. Disinfection of the bite site is not necessary. The smallest of the blood sucking stages, the larva, can be difficult to remove, even with forceps. However, the larvae do not carry any microbes, with one exception: babesiosis caused by *B. divergens* (1).

### Diagnosis of tick-borne diseases

Diagnosis of tick-borne diseases is first and foremost based on the patient's symptoms. Symptoms of ehrlichiosis and babesiosis (9, 1) are not as specific as for borreliosis. The patient may have borrelia-antibodies in his/her serum, but there must be borreliotic symptoms also, before the diagnosis (Lyme) borreliosis can be made. Seropositivity merely is not a "case".

Cases, humans with borreliotic symptoms, but being seronegative (no B.b. antibodies) do exist. Especially this is true for erythema migrans, the most prevalent symptom of borrelia and also Borrelial lymphocytoma. In erythema migrans not even half of the patients produce antibodies. In borrelial lymphocytoma more than half of the patients are seropositive. So, what we see (and hear) is crucial, as in dermatology in general. In Ref 7 is a description of a boy, 15 years old, who come to my practice with an enlarged right mamilla. Seronegative, no skin symptoms (erythema), no ticks observed. With doxycyclin, this "miracle" antibioticum (9) a rapid response. Two weeks treatment, 150 mg doxycyclin daily. Diagnosis: Borrelial lymphocytoma (of the right mamilla).

The patients may not have seen any ticks on their skin, despite having a tick-borne infection. On the other hand, a patient may report many tick bites, but remain symptomless or have symptoms that cannot be, for example, Lyme borreliosis.

A patient being investigated because of gastrointestinal symptoms is not suffering from borreliosis, even though he would have borrelia-antibodies in his serum, and perhaps having observed ticks on his skin. Because the gastrointestinal tract is not affected in borreliosis! Seropositivity as such is an immunologic reminder of the infection; an infection now or sometimes earlier.

A rare possibility is that the patient with gastrointestinal symptoms has simultaneously some symptoms of Lyme borreliosis explaining the seropositivity. But an infection sometimes earlier is more probable.

### Role of the media

Medicine is a popular topic, and much is written in the media about diseases in general. In Finland especially, tick-borne encephalitis (TBE) and borreliosis (called Lyme disease in the USA) are in focus. This has resulted in a groundless fear of ticks and the diseases they may cause. It is unnecessary for people go to health centres or emergency rooms to have ticks removed.

### About recommendations

Light-coloured clothing and rubber boots are recommended for walking in tick-prone areas in summertime. This allows ticks to be detected more easily. Especially children are recommended to wear rubber boots.

It is also recommended that people check their skin for ticks in the evening. However, this may be of limited use in adults, as the genitals and intergluteal skin are seldom checked. Even on areas of skin that are easy to inspect, the most prevalent form of tick, the nymph, can escape observation. A bite reaction will reveal the presence of a tick, if such a reaction develops during blood sucking. Small children, who are often naked in the evening before going to bed, should be inspected. However, if a larva is detected on a small child it may be difficult to remove as the child may not co-operate. The only microbe this minuscule tick could harbour, is *Babesia divergens*; and this is an extremely small possibility (1). Skin symptoms of borreliosis may be detected by inspecting another person's skin, especially erythema migrans and multiple erythema migrans.

### Iceland in this context

The issue of whether *Ixodes ricinus* can survive and complete its lifecycle in Iceland is a topic of discussion. Ticks are certainly found on migrating birds in Iceland, as in Finnish Lapland, but that is a rather different matter.

In my review of babesiosis (1), I discuss the issue of when and where ticks wait for their prey. Ecology, meteorology and geography are important aspects, as written in detail in a dissertation by the Swedish entomologist Hans Mejlon from Uppsala (6).

The Finnish entomologist Camilla Öhman and co-workers undertook a geographical and topographical study of the

distribution of *Ixodes ricinus* in Finland mainly during the summer period in 1958, which was published 1961 (10). Since that date, no other extensive field study has been carried out in this country. In her paper the author mentions the huge number of people (400,000) and cattle evacuated, mostly from Karelia, southeastern Finland, before the end of the USSR–Finnish war (1941–44). Many ticks were introduced with these mammals. Humans and animals certainly also displayed symptoms, especially of borreliosis.

At this time, Finland lost nearly 10% of its territory to the Soviet Union. This national and human tragedy was beneficial for mosquitos, horseflies and ticks. The population of *Ixodes ricinus* increased, perhaps permanently, in our country. The population of Finland also diminished, because approximately 100,000 Finnish soldiers died in the two wars, 1939–40 (the Winter War) and 1941–44. In addition, there were lots of more or less seriously wounded soldiers.

### Case reports

Patient cases are often the most interesting in articles, so here are 3 of them – from the smallest tick to the largest (larva, nymph, adult female):

*First case:* It happened in July 2008, when our granddaughter was 1½ year old. One evening we noticed what seemed to be a “dot of a typewriter” in her left axilla. The only larva I have seen. After much struggling of the patient, I succeeded to remove it with a forceps. Evidently unnecessary. I refer to my text about larvae.

*Second case:* To my practice came a young mother with her son, exactly one year old. On one of the boy’s buttocks was a typical homogenous erythema migrans. More than 5 cm in diameter. No sign of tick-bite could be seen. And the mother had not seen the tick, which sucks blood at least 24 hours! I assume that it was a nymph, because an adult tick is so much bigger. Astonishing anyhow. Looking at a tick but not seeing (observing) it! And she was taking good care of her son.

*Third case:* One August morning 2010 after waking up I saw in the mirror on my chest an adult bloodsucking female tick surrounded by a red area 2–3 cm in diameter – bite reaction, not infection. With the usual method, my own fingers, I took it away. It seemed to be bloodless, having recently started its bloodsucking. So, what was the explanation?

All these 3 cases are from Joensuu.

### Conclusion

Ticks are not harmless, although they are far from as dangerous as the media would have us believe, at least here in Finland. If symptoms of tick-borne disease develop one should visit a doctor. It may be necessary for the clinician to contact a colleague who is familiar with tick-borne diseases; *consultation is the key*. Much work is needed to understand the life of ticks, and the symptoms, diagnostics and treatment of tick-borne diseases. If you have the will and endurance to seriously penetrate this topic, then begin from the beginning (2, 3)!

If the readers regard what I have written as a speech for the defense of the ticks they are wright. Microbes have huge importance for the evolution and probably also those that ticks can transmit from one living organism to another. Ticks have existed far longer (100 million years) than we humans (depending on criteria: 100,000–200,000 years), and these bloodsucking giant mites may still have a significant role in the ecosystem of the world.

Having been involved in this “Tick business” for over 30 years, a Russian proverb has become my favourite: “Paper will accept any writing” – Even this one!

I express my gratitude to MD Eva Åsbrink for her remarks and suggestions for the better of this article. The kindness and help of the Managing Editor Agneta Andersson has been crucial.

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