

Ticks and Lyme Disease in Scotland

-an overview for practitioners

First published February 2017
Revised July 2018




This presentation has been prepared and approved by the Scottish Health Protection Network's Ticks and Lyme Disease subgroup. It is intended that this slideshow could be presented by a variety of professionals with an interest in health protection, to a range of audiences interested in knowing more about ticks and Lyme disease in Scotland and simple steps that can be taken by people to avoid this illness. There is a great deal of information available over the web on Lyme disease, not all of which is entirely reliable. The intention of this presentation is to offer a measured and authoritative picture of the problem and advise on straightforward ways of dealing with it, summarising the best knowledge and expertise currently available.

The slides themselves should contain all the information that needs to be presented. The notes associated with each slide are meant to assist the presenter understand the background and are not necessarily things that the presenter needs to mention during the presentation, though they may assist with answering questions. How much of this material to bring into the presentation and/or discussion, is very much at the discretion of the presenter and is likely to vary between audiences.

Learning Outcomes

- Understand the nature of Lyme disease and its mode of transmission
- Describe the clinical presentation of early, early disseminated and late Lyme disease
- Identify the risk factors for contracting Lyme disease associated with tick bites and at-risk groups
- Know how to prevent tick borne infections
- Understand how Lyme disease can be diagnosed and treated
- Describe the role of the healthcare practitioner in educating the public about the balance between enjoying the outdoors and concerns about tick borne infection
- Know the existence and role of the Scottish Health Protection Network Lyme disease subgroup



What is Lyme Disease?

- Also known as Lyme borreliosis
- An infection caused by *Borrelia burgdorferi*, a gram negative spirochaete bacterium
- Transmitted through the bite of an infected tick (*Ixodes ricinus* in the UK) – a tick needs to be attached to the skin for around 24 hours to transmit Borrelia to a person.
- Recognised clinical presentations: early localized, early disseminated and late Lyme disease
- There are large gaps in our clinical understanding of Lyme disease, particularly for 'Post-Lyme Syndrome'

Picture credit: James Gathany

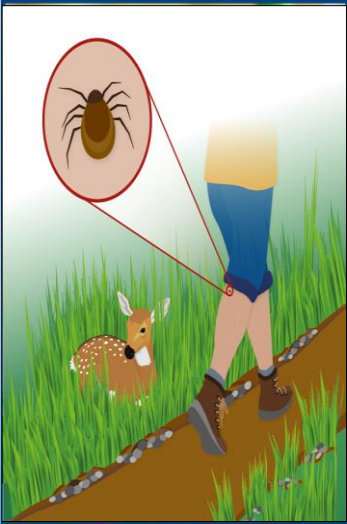
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Lyme borreliosis is a term to describe the full range of syndromes associated with *Borrelia* spp. infection. Importantly, this can include longer term symptoms experienced by a small number of patients who no longer have current active infection with *Borrelia* spp. (in other words, it appears as though the patient's immune system ± antibiotic treatment have cleared these organisms from the body...so, they may be no longer considered to have Lyme disease, though they can continue to suffer consequences of having had Lyme disease for a protracted period after the active infection can be considered to be cured and continue to test positive for antibodies). Ongoing clinical management of 'Post-Lyme Syndrome' patients is very challenging and has proved controversial, especially around the question of extended courses of antimicrobial treatment. (NB some patients refer to 'Post-Lyme Syndrome' as 'Chronic Lyme')

The photograph shows erythema migrans, the classical clinical presentation of Lyme disease described as a 'bull's-eye rash'. Not all cases of Lyme disease present with this lesion, but its occurrence indicates that infection with *Borrelia* spp. is highly likely and should be treated as Lyme disease.

There is a degree of uncertainty about how long it takes an attached tick to transmit *Borrelia* spp. to a person. Experimental studies in animals have shown that this rarely, if ever, occurs before the tick has been attached for at least 24 hrs. Practically then, the best advice to people finding ticks on them is to remove them as quickly as possible (see subsequent slides), and not to be complacent about waiting if they know a tick has only been on for few hours. However, finding attached ticks is also no reason to panic about Lyme disease...what information we have about Scotland suggests that any individual tick is unlikely to be carrying *Borrelia* spp., and if it is removed promptly and correctly (see subsequent slides) it is extremely unlikely that it will have transmitted *Borrelia* spp. even if it is carrying them.



Ticks – vectors of Lyme Disease

- The tick, *Ixodes ricinus*, is known as the sheep or deer tick
- Mammals and birds in affected areas are hosts for the ticks – e.g. vole, deer, rabbit, grouse, blackbird, chaffinch, grey squirrel
- Lyme disease is the most common tick borne disease in Europe
- Found over most of the UK and mainland Europe and the United States

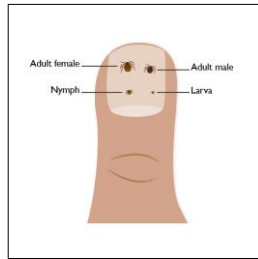
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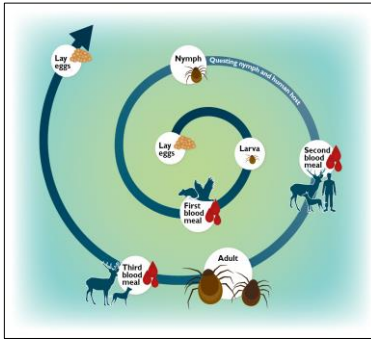
Ticks are very widespread throughout Scotland in the countryside, in rural gardens and in some public parks. These ticks are common throughout UK and Europe. Their life cycle and ecology is complex and there are lots of things we don't know about ticks, especially about modifiable factors that are likely to affect their abundance at the scale of a landscape.

The 3-stage life-cycle of ticks (*Ixodes ricinus*)

Tick scale: size of the various life stages against and adult human thumb nail



In Scotland the life-cycle, typical takes 2-3 years to complete



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The large diagram shows how these ticks progress through a 3-stage life cycle: larvae-nymphs-adults.

These ticks have a 3 stage life cycle:

- Adult female ticks lay eggs (late autumn)
- A LARVA (stage 1) hatches from each egg
- Once it has had a blood meal, a LARVA moults to become a NYMPH (stage 2)
- Once it has had a blood meal, a NYMPH moults to become a ADULT (stage 3)
- Once it has had a blood meal, an ADULT female ticks lay eggs and the cycle begins again

NOTE : Adult females carrying *Borrelia* spp. do not pass these organisms to their eggs, so larvae always hatch uninfected. *Borrelia* spp. are usually acquired by larvae through their first blood meal if they feed on and infected small rodent or bird, though ticks might also be infected for the first time as nymphs if they feed on animal hosts infected with *Borrelia* spp.. Once *Borrelia* spp. is acquired, a tick will carry the organism through all its subsequent life stages.

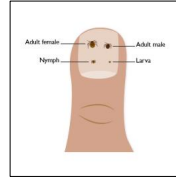
NOTE : deer are not believed to pass on *Borrelia* spp. to any ticks.

The life stage most likely to bite humans is reported to be the nymph as it's small size make it less noticeable than adults. However, all life-stages can and do bite people,

and it is common for people to be bitten by several ticks at the same time (see subsequent slides).

Where and when can ticks be found?

- Long grass, bracken and undergrowth
- Gardens, picnic sites and parks
- Low level vegetation rather than hill tops
- Ticks do not like desiccation
- March and October traditionally are the peak months for tick numbers
- Nymph stage is the size of a full stop with up to 10% 'questing nymphs' carrying *Borrelia*
- Scottish-field studies show seasonal variation in the number of *Borrelia*-infected ticks



Environmental determinants of *Ixodes ricinus* ticks and the incidence of *Borrelia burgdorferi* sensu lato, the agent of Lyme borreliosis, in Scotland
Marianne C. James *et al.*, (2013) *Parasitology*, **140**: 237-246

Only Nymphs and Adults can transmit *Borrelia* spp. to humans; the most common is probably the nymph because it is smaller than an adult and therefore easier to miss when it first attaches to the skin.



Who is at Risk?

- Anyone who is exposed to ticks!
 - Tick habitats may be near people's homes
 - People may travel to tick habitats (e.g. picnicking, rambling, dog walking, jogging, outdoor sports, leisure activities)
 - Children, even babies, can easily get ticks
- Occupational hazard
 - Forestry
 - Scottish Natural Heritage
 - Tourism
 - Outdoor education
 - Gamekeepers
 - Farmers

Image: Tick (larva) by a baby's nappy line

Ticks on people

6 year old child's arm



Nymph (8 legs)

This is the likeliest stage to transmit *Borrelia* spp. to people if not removed promptly.



Larva (6 legs)



Size of larva relative to tick removal device



... compared to size of engorged adult tick (from a dog)

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The images above show one type of removal device only and are included to demonstrate scale. Other tick removal devices are also available. It should be noted that the small size of the larva may make it difficult to remove using tick removal devices, in which case we would advocate the use of fine tipped tweezers to lift the tick off, as the priority is prompt removal of the tick.

How to remove ticks

- There are a range of specially designed tick removal 'devices' or 'tools' available
- In our experience, devices that look like a small claw hammer or a credit card are the most efficient and easy to use
- Available (relatively cheaply) from many outdoor stores, pharmacies and rural shops
- Keep one in first aid kits, back packs and car glove boxes
- DO NOT DELAY REMOVING TICKS FOR LACK OF A TICK REMOVAL DEVICE...fine-tipped tweezers held parallel to the skin can be used to lift ticks off (REMEMBER: a tick needs to be attached to the skin for around 24 hours to transmit Borrelia to a person)

Tick removal

Tick twister

Do a tick check Carry out a thorough tick check at the end of the day.

Tick card

Make sure a friend (or mirror) can check the places you can't see!
Use a mobile phone to photograph ticks and/or rashes as their appearance can change over time

Tick Removal (YouTube video), Dr James Douglas, General Practitioner NHS Highland
<https://www.youtube.com/watch?v=oCuWVqWdWUE>

The infographic is divided into three main sections. The 'Tick twister' section shows two illustrations of a green tick being removed from a skin surface. The 'Do a tick check' section features a front and back view of a person with red circles and lines indicating common tick attachment sites: Hairline and in hair, Behind ears, Back of neck, Armpits, Elbows, Waist, Groin, Back of the knees, and Between toes. The 'Tick card' section shows two illustrations of a tick being placed on a small card for documentation.

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Using a mobile phone to photograph ticks and/or rashes is useful to be able to show to a healthcare practitioner should the need arise for a consultation...should the appearance have changed in the time between the patient noticing and the consultation taking place.

Clinical Diagnosis of Lyme disease

Lyme Disease

- Just because someone has been bitten by a tick doesn't mean to say they will get Lyme disease
- Unfortunately a small number of people bitten by ticks may develop illness
- Lyme can affect all ages including babies sitting in gardens or the fit elderly gardening in tick hot spots.
- Occupational exposure increases risk

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Despite all of the advice presented already, each year a number of people are unlucky enough to be bitten by a tick or ticks carrying *Borrelia* spp. and not realise or notice until after transmission has occurred. In some of these people, symptoms of Lyme disease can begin to develop.

Studies in Scotland in a variety of habitats, seasons and locations reveal a varying picture of the proportion of ticks carrying *Borrelia* spp. from 0% to 10%. So, even in places with the highest carriage rates, it is likely that only 1 in 10 ticks will actually be carrying the agent that causes Lyme disease. However, this is still no basis for complacency, as people can be recurrently exposed to ticks, and it is clear that cases of Lyme disease in Scotland every year.

Clinical Diagnosis of Lyme Disease

Laboratory tests are supportive of clinical diagnosis

- Early localized Lyme disease
 - Erythema migrans is diagnostic of Lyme disease
 - Borrelial lymphocytoma
- Early disseminated Lyme disease (up to 6 months)
 - Flu-like symptoms
 - Lyme meningitis
 - Lyme carditis
 - Neurological symptoms (including Bell's Palsy)
- Late Lyme disease
 - Neurological symptoms
 - Lyme arthritis
 - Acrodermatitis Chronica Atropicans (ACA)
- 'Post-Lyme Syndrome'
 - chronic fatigue, chronic neurological symptoms and arthritis in a smaller number despite appropriate antibiotic treatment



Picture credit: James Gathany



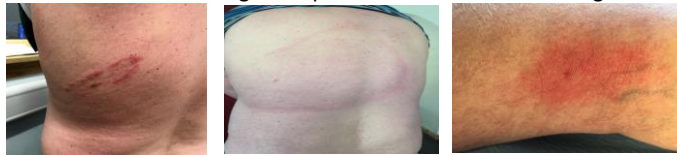
The photos show different presentations of the erythema migrans lesion on the skin of patients around the site of a tick bite that is diagnostic of Lyme disease. The top photograph shows the classical clinical presentation of Lyme disease described as a 'bull's-eye rash' (shown previously in slide 2) and the bottom photograph shows some of the variation that can be seen around that classical presentation.

Erythema Migrans - “migrating rash”

Has several different appearances including classical ‘bullseye’ lesions



However, frequently follows other non classical patterns as shown below including widespread rash on the trunk or leg



Detailed history taking

A detailed history of tick exposure, removal method and onset of symptoms is crucial

Consider:

- What was the exposure, activity and location?
- When did they first notice the rash or general symptoms relative to tick exposure?
- How long was the tick in place?
- Did removal squeeze the tick?
- Could a tick have attached unnoticed?
e.g.groin, behind the knee, umbilicus and hair line

Treatment

- Treat Erythema migrans based on the clinical history
- No blood tests are required in EM and cure is expected with antibiotic compliance
- For EM- In adults Doxycycline 100 mg bd for 21 days taken with food reduces side effects and avoid sun exposure during the course
- Refer to NICE guidelines (2018) for children and alternative antibiotics
- NICE guidelines should also be referred to for other stages of infection
NICE guidelines <https://www.nice.org.uk/guidance/ng95>
- The BNF may state a different dosing schedule, but the recommendations here refer to the most up to date produced by NICE

Early Lyme disease usually responds very well to treatment in this way. Different clinical presentations of Lyme borreliosis present more of a challenge and are beyond the scope of this presentation.

NOTE:

Testing in Scotland

- The National Lyme Borreliosis Testing Laboratory (NLBTL) tests samples from all Health Boards throughout Scotland
- Internationally recognized 2-tiered testing protocol
- Similar protocol to Public Health England, Lyme Reference Unit, Porton Down

NB. There are a range of testing services available through private laboratories for patients and near-patient kits for testing whether a tick is carrying *Borrelia*. It is challenging to interpret the results of these tests with confidence, as many may not be fully validated. All tests give false positive and false negative results in certain circumstances and this is better understood and accounted for in the approved tests used by the NLBTL.

Testing looks for antibodies in the patient's blood that are produced in response to infection with *Borrelia* spp. These antibodies may take up to 6-8 weeks after an infected tick bite to develop, so submitting a sample for testing before this time is unlikely to yield a diagnostic result. A patient who has been treated with antibiotics, perhaps for suspected Lyme disease on the basis of an erythema migrans result, may not produce a detectable antibody response, even if (s)he were infected with *Borrelia* spp. at the time of the tick bite. Patients with erythema migrans should be treated with antibiotics as the strong likelihood is that such a presentation indicates early localized Lyme disease and samples should not be submitted from such individuals. As always, providing as many clinical details to the laboratory as possible in the forms accompanying any submitted sample greatly assists their interpretation of test results.

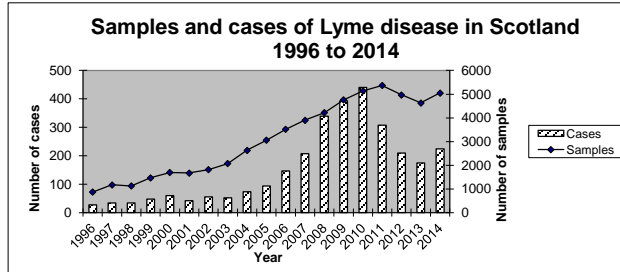
Erythema migrans is diagnostic of Lyme disease – these patients are not normally tested.

Testing protocol

- Erythema migrans is diagnostic of Lyme disease – these patients not normally tested
- Screening Enzyme immunoassay on all serum samples
- Positive, equivocal and negative samples with a significant clinical history of Lyme Borelliosis (tick bite/rash, erythema migrans) tested by Borrelia IgG and IgM Immunoblot
- Interpretation of Borrelia IgG and IgM Immunoblot with clinical information

The laboratory diagnosis of Lyme disease (Webinar)
Dr Roger Evans, Director, National Lyme Borreliosis Testing Laboratory
<http://www.nes.scot.nhs.uk/education-and-training/by-theme-initiative/public-health/health-protection/health-protection-diary-of-events-and-webinars.aspx>

Epidemiology from NLBTL data



The drop in cases from 2010 to 2013 is in part due to encouraging clinicians not to send a serum sample for testing if erythema migrans is diagnosed, changes to the assays used at NLBTL and other factors (e.g. tick ecology etc.). Overall, there is an under-reporting of Lyme disease in Scotland.

National Lyme Borreliosis Testing Laboratory (NLBTL).

The drop in cases from 2010 to 2013 is in part due to encouraging clinicians not to send a serum sample for testing if erythema migrans is diagnosed, changes to the assays used at NLBTL and other factors (e.g. tick ecology etc.). Overall, there is an under-reporting of Lyme disease in Scotland.

The Scottish Health Protection Network (SHPN) Lyme Disease Subgroup

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This and the next 5 slides are to make audiences and their contacts aware of the existence of this group, its composition and its purpose.

Membership

- Consultant Infectious Diseases Physician
- Consultant Microbiologist
- Consultant in Public Health Medicine
- GP with special interest in Lyme borreliosis
- Health Protection Nurse Specialist
- Health Protection Scotland
- Health & Safety Executive
- Forestry Commission
- Local Authority Environmental Health Officer
- National Lyme Borreliosis Testing Laboratory
- NHS Education for Scotland
- NHS24
- Pharmacy
- Public Health England
- Research
- Scottish Government

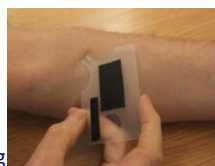
3 Main Priorities

1. Raising awareness of ticks, tick-borne infection and methods of prompt and safe removal of ticks to prevent infection
2. Raising awareness among front line clinical staff to ensure correct recognition and prompt treatment with antibiotics for patients presenting with clinical syndromes suggestive of Lyme Disease
3. Improving surveillance of Lyme Disease to estimate the burden of disease and monitor changes over time

These are the 3 main priorities identified by the Scottish Health Protection Network (SHPN) Lyme Disease Subgroup and approved by Scottish Government.

Action

- Raising awareness:
 - ticks, risks, prompt and safe removal
 - Scotland's Outdoor Bugs and Germs*
- Workforce education
 - Podcast(s), Webinar(s)
 - CPD resources
- Surveillance
 - Support laboratory diagnosis
 - Explore healthcare datasets and coding of disease burden



* <http://www.nhsinform.scot/bugs-and-germs>

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Workforce include: front line clinical staff, local government (including teachers and environmental health) and other agencies.

Scotland's Outdoor Health Code is an initiative has been launched through NHS Inform. It is intended as a deliberate companion to Scotland's Outdoor Access Code and will be a single web-based portal for coherent public-facing advice on avoiding a range of rural infection risks whilst promoting the health benefits of enjoying Scotland's outdoors. The draft core text of the code is included below; this will be downloadable and printable in a 'poster' style; links through the web version will take those interested to more detailed advice (in the form of leaflets etc.) relevant to each bullet point.

How to enjoy Scotland's outdoors without picking up unwanted bugs

Every year Scotland's people, and its visitors, spend many millions of days living, working and enjoying themselves in the outdoors. Spending time responsibly enjoying and connecting with the outdoors is very important for health and wellbeing, and is at the heart of Scotland's identity. However, every year the health of a small number of people is affected by infections acquired in the outdoors, the majority of which could be avoided by observing these simple precautions:

Take responsibility for your actions and follow the Scottish Outdoor Access Code

<http://www.visitscotland.com/see-do/activities/walking/outdoor-access-code>

- Wash your hands thoroughly before eating or drinking
- Wash your hands thoroughly after contact with animals or the places where they're kept
- Don't drink untreated water from lochs, rivers and burns
- Cover up to avoid being bitten by ticks and other insects. Following paths and avoiding dense undergrowth can also reduce the chance of being bitten.
- Always check carefully for ticks after being in the outdoors and remove any from skin quickly.

- Clean up muddy footwear, bikes, pushchairs and pets before taking them into the house – and then wash your hands.
- Clear up after yourself – bag and bin pet and human faeces whenever you can

Information Resources

Ensure that information resources are:

- Not overly prescriptive
- Do not discourage responsible use of the countryside
- Coherent
- Examples of resources:
 - Outdoor Bugs and Germs
<http://www.nhsinform.scot/bugs-and-germs>
 - Lyme disease leaflet
 - Lyme disease infographic
<http://www.hps.scot.nhs.uk/giz/resourcedetail.aspx?id=3253>

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Campaigns all too easily fail because they perceive what has been called an ‘information deficit’ model – i.e. that people will do the right thing if they only have the information to tell them what that is. However, that has been shown not to be the case, specifically for Lyme disease.

Frameworks for risk communication and disease management: the case of Lyme disease and countryside users

Chris P Quine *et al.* (2011) *Philosophical Transactions of the Royal Society B* (DOI: 10.1098/rstb.2010.0397)

What is needed: “...socially and culturally appropriate communication campaigns that manifest knowledge about risk perception, the importance of specific message frames to convey risk, and considerations of attenuation versus amplification of outrage in various scenarios with policy makers and the public.”

Ecology of zoonoses: natural and unnatural histories
William B Karesh *et al.* (2012) *Lancet*; 380 1936-1945

Coherence comes from making sure that everyone is getting the same message for everything....this means NOT having separate, confusing and potentially conflicting campaigns about Lyme disease, *E. coli* O157, *Cryptosporidium* etc., hence the new Scotland’s Outdoor Bugs and Germs <http://www.nhsinform.scot/bugs-and-germs> as a single portal to receive simple and straightforward advice with links to more detailed,

user-friendly information for those that want that much detail.

Summary: Key Messages

- Ticks are very (and increasingly) common in Scotland
- Ticks are unlikely to be infected with *Borrelia* spp.
- Careful checking for, and prompt appropriate removal of, attached ticks is essential to avoid Lyme disease...remember to use mobile phone/digital camera to save pictures of ticks and/or rashes around likely tick bites
- An infected tick has to remain on a person for approximately 24 hrs to transmit *Borrelia* spp.
- We believe this is best done using one of the plastic tick removal devices that look like a small claw hammer or credit card and are sold by many outdoor stores, pharmacies and rural shops.
- People who develop a rash around the site of a tick bite or experience flu-like symptoms or any other health concerns after being bitten should consult their doctor.

Conclusion

- Active and responsible use of outdoor places is very important for health
- Concerns about ticks and Lyme disease should not discourage people from doing that...
...the risks can be managed



This resource may be made available, in full or summary form, in alternative formats and community languages. Please contact us on **0131 656 3200** or email **altformats@nes.scot.nhs.uk** to discuss how we can best meet your requirements.



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