What is the risk of tick-borne diseases to UK pets?

John S.P. Tulloch BVetMed, MSc, DipRN, MRCVS

NIHR Health Protection Research Unit in Emerging and Zoonotic Infections, University of Liverpool, L69 3GL, UK.

At this time of year many animal owners will be finding ticks on their pets and themselves, and it is therefore appropriate to discuss the One Health risk that tick-borne diseases (TBD) pose (1).The study by Wright and others (1), summarized on p 514 of this week’s issue of *Vet Record*, which uses data collected by Public Health England’s (PHE) Tick Surveillance Scheme (TSS) (<https://www.gov.uk/guidance/tick-surveillance-scheme>), stands out as a fantastic example of what can be achieved with a One Health surveillance approach is adopted (1).

The TSS is well supported by the veterinary profession, who submitted 46.8% of all ticks received by the scheme (2). Their work provides a solid evidence base that enables the veterinary profession to offer sound advice to clients and the general public. It is important that such coordinated surveillance schemes continue to be supported and funded. However, there is a large hole in our knowledge of TBDs in companion animals and the actual incidence of clinical disease.

Wright and others (1) describe where clinical examinations for ticks should be focused, the range of tick species found, and the seasonality of exposure (1). By combining their findings with other work displaying the geographic distribution of ticks, the study findings contribute to our understanding of the expanding tick distribution in the UK (2–4). Together these studies describe the native tick species being the most prevalent in the UK (predominately *Ixodes ricinus* and *Ixodes hexagonus).* With such information available on geographical and seasonal spread, vets should no longer say, ‘This is the wrong time of year for ticks’ or ‘This isn’t a tick area’.

Pet owners are one and a half times more likely to be bitten by a tick than non-pet owners (5). This risk extends beyond rural areas as it is now well established that exposure can occur in urban parks (6,7). Current estimates suggest that a tick needs to feed for more than 24 to 48 hours before pathogen transmission occurs (8). As Wright and others discuss, regular tick checks should be encouraged and seen as an everyday part of pet care, regardless of whether you live in a rural or urban area (1). This should equally be extended to checking yourself for ticks. Therefore, prompt recognition and correct removal is important (TSS offer useful advice on their website). In short, client education is fundamental and no pet owning household should be without a tick removal tool.

**Exotic ticks and TBDs**

A major concern is the increasing number of exotic ticks that are entering the UK (2,9), which has been attributed to both the changing climate (10), and the removal of compulsory tick treatments as part of the pet passport scheme (11,12). The TSS have confirmed 399 ticks being imported on animals from 15 different countries since 2005(9). However, this is an underestimate as not all imported animals would have ticks submitted to the TSS. Most worryingly six non-endemic species were found, the most prevalent of these was *Rhipicephalus sanguineus,* which could increase the risk ofcanine babesiosis, ehrlichiosis and Mediterranean spotted fever (a human infectious disease) being introduced to the UK. There has already been a house infestation of *R.sanguineus,* whose source was an imported Spanish dog (13). There has been much coverage of the 2016 *Babesia canis* cases in Essex, showing how a once exotic TBD can gain a foothold into the UK tick population (14–17).

Exotic TBDs of human concern include Crimean-Congo Haemorrhagic Fever (CCHF) virus, a zoonotic pathogen carried by *Hyalomma* ticks (18), and Tick-borne encephalitis (TBE) virus, a flavivirus carried by *I.ricinus* (19)*.* Both of these viruses pose a serious and fatal threat to human health. The likely route of CCHF to the UK is via migratory birds, though a tick found on a dog originating from Portugal had the potential to carry CCHF (9). TBE is spreading from Eastern to Western Europe, with Belgium and the Netherlands confirming cases in the last couple of years (20,21). As the host tick species is resident in the UK, the potential of TBE arriving and establishing in the UK tick population is clear. The risk of these viruses entering the UK is currently deemed low; however vigilance is needed to detect the first arrival of ticks carrying these pathogens.

**TBDs in the UK**

There are two useful reference works from 2001 describing TBDs in dogs and cats (22,23). They interestingly describe *B. canis* as having a ‘tropical/semitropical’ geographical distribution, showing how the TBD landscape is rapidly changing. Recent research describes the tick infection rate of ticks found on pets (24,25). Ticks found on dogs showed a prevalence of 2% for *Borrelia burgdorferi* sensu lato (the spirochaetal genuspecies complex responsible for Lyme disease) and 1.5% for *Babesia spp.* In ticks found on cats this was 1.8% and 1.1% respectively.

Lyme disease is probably the TBD with the highest awareness amongst the general public, but it’s influence on clinical disease in companion animals remain uncertain. The American College of Veterinary Internal Medicine in their recent consensus state that ‘*It is not proven that European LB* (Lyme borreliosis) *causes clinical signs in dogs*’ and that ‘*although cats may be seropositive, it’s unknown if infection causes illness in cats*’ (26). In the majority of cases dogs show no clinical manifestations, otherwise the two most common presentations are arthritis and nephritis. The current recommendation for diagnosis is serology, however this only shows pathogen exposure, and is ‘*not the proof of cause of clinical signs, nor can it be used as a predictor for development of future clinical signs*’ (26). To my knowledge, there are no studies describing the epidemiology of Lyme disease in UK companion animals; without this how can the profession provide advice to worried owners about the possible risk it poses to their pets?

In people, the UK reports around 1200 laboratory confirmed cases a year (27). This is likely an underestimate, as patients presenting with the pathognomonic bull’s eye rash (erythema migrans)*,* something not seen in companion animals, are recommended to be treated without performing diagnostics. Interestingly, the NICE guidelines similarly state that, ‘*there is a lack of robust epidemiological data on Lyme disease in the UK*’ (28). For further advice about Lyme disease see PHE’s (<https://www.gov.uk/government/collections/lyme-disease-guidance-data-and-analysis>) and NHS Choices (<https://www.nhs.uk/conditions/lyme-disease/>) webpages. It is likely that the risk of Lyme disease is greater to owners rather than their pets.

**Risk Outcomes**

The profession must remain vigilant to TBDs, but risks need to be placed into perspective. For the overwhelming majority of companion animals the main clinical consequence of a tick bite is a reaction or infection (although incidence studies are lacking). Therefore, by examining pets, removing ticks appropriately, educating owners and using appropriate tick treatments, unnecessary antibiotic treatment and minor procedures can be avoided. To aid surveillance, ticks from recently travelled dogs, and especially re-homed continental dogs, should be examined. To help in-practice identification of ticks the Bristol University Tick ID website (<http://www.bristoluniversitytickid.uk/>), supported by European Scientific Counsel for Companion Animal Parasites (ESCCAP), offers a great first point of call. It must be stressed that tick identification is challenging, and sending suspicious ticks onwards to the TSS is still recommended. Without surveillance schemes, such as the TSS, and the active reporting of suspicious clinical cases by the veterinary profession, we won’t know when TBDs are entering the country.

**Where do we go from here?**

To summarise; the understanding of ticks and TBDs in the UK is rapidly improving, but we are missing the critical piece of the puzzle – that is the clinical incidence of disease. Without this we will remain in the dark of how badly/well policy changes (i.e. the pet passport scheme) have performed. The research and laboratory community need to perform, at the bare minimum, a cross-sectional seroprevalence study of TBDs in companion animals, ideally stratified by travelled and resident pets. This is likely to overestimate disease, as it only describes exposure not clinical disease, and therefore a study identifying the clinical incidence of TBDs is also warranted. Without these data we cannot fully explain the risk of ticks and TBDs to our clients in an evidenced based manner.

The findings of the Tick Surveillance Scheme highlight why vector surveillance is critical to the UK, and the benefit it can provide to the health status of the nation and their pets. Vets and vet nurses form an integral part of this surveillance. They, over many other professions, come in to contact with a high number of ticks on a weekly if not daily basis. As such they should see themselves as sentinels to the introduction of exotic TBDs to the UK, and educators to the general public. If you see an unusual tick, don’t ponder and put it in the clinical waste, send it to the TSS.

**What you need to know:**

* Check for ticks during routine physical examinations of companion animals. Focus the search on the head, legs and neck. Remove appropriately and ensure animals are covered with appropriate tick treatment. Ensure owners know how to remove ticks, and highlight the need for them to check themselves too.
* Ticks are found over large parts of the UK, all year round, and so they should never be ruled out in a consult if an owner describes one.
* Increasingly, exotic tick species are found in the UK and potentially carry exotic tick-borne diseases.
* Submit any ticks of unknown identity, or from animals that have a history of foreign travel, to **The Tick Surveillance Scheme**.
* Little is known about the clinical incidence of tick-borne diseases in companion animals in the UK. Research is greatly needed.

**Disclaimer**

John Tulloch is funded by the National Institute for Health Research Health Protection Research Unit (NIHR HPRU) in Emerging and Zoonotic Infections at University of Liverpool in partnership with Public Health England (PHE), in collaboration with Liverpool School of Tropical Medicine. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR, the Department of Health or Public Health England.

**References**

1. Wright I, Cull B, Gillingham EL, Hansford KM, Medlock J. Be tick aware: when and where to check cats and dogs for ticks. Vet Rec. 2018;pii:vetrec-2017-104649. doi: 10.1136/vr.104649

2. Cull B, Pietzsch ME, Hansford KM, Gillingham EL, Medlock JM. Surveillance of British ticks: An overview of species records, host associations, and new records of Ixodes ricinus distribution. Ticks Tick Borne Dis. 2018;9(3):605–14. doi: 10.1016/j.ttbdis.2018.01.011

3. Tulloch JSP, McGinley L, Sanchez-Vizcaino F, Medlock JM, Radford AD. The passive surveillance of ticks using companion animal electronic health records. Epidemiol Infect. 2017;145(10):2020-2029. doi:  10.1017/S0950268817000826

4. Abdullah S, Helps C, Tasker S, Newbury H, Wall R. Ticks infesting domestic dogs in the UK: a large-scale surveillance programme. Parasit Vectors. 2016;9(1):391. doi: 10.1186/s13071-016-1673-4

5. Jones EH, Hinckley AF, Hook SA, Meek JI, Backenson B, Kugeler KJ,Feldman KA. Pet ownership increases human risk of encountering ticks. Zoonoses Public Health. 2018;65(1):74–9. doi: 10.1111/zph.12369

6. Hansford KM, Fonville M, Gillingham EL, Coipan EC, Pietzsch ME, Krawczyk AI, Vaux AGC, Cull B, Sprong H, Medlock JM. Ticks and Borrelia in urban and peri-urban green space habitats in a city in southern England. Ticks Tick Borne Dis. 2017;8(3):353–61. doi: 10.1016/j.ttbdis.2016.12.009

7. Jennett AL, Smith FD, Wall R. Tick infestation risk for dogs in a peri-urban park. Parasit Vectors. 2013;6:358. doi: 10.1186/1756-3305-6-358

8. Eisen L. Pathogen transmission in relation to duration of attachment by Ixodes scapularis ticks. Ticks Tick Borne Dis. 2018;9(3):535–42. doi: 10.1016/j.ttbdis.2018.01.002

9. Hansford KM, Pietzsch ME, Cull B, Gillingham EL, Medlock JM. Potential risk posed by the importation of ticks into the UK on animals: records from the Tick Surveillance Scheme. Vet Rec. 2018;182(4):107. doi: 10.1136/vr.104263

10. Medlock JM, Leach SA. Effect of climate change on vector-borne disease risk in the UK. Lancet Infect Dis. 2015;15(6):721–30. doi: 10.1016/S1473-3099(15)70091-5

11. BVA calls for compulsory tick treatment for travelling pets. Vet Rec. 2016;179(20):501. doi: 10.1136/vr.i6142

12. Trees AJ, Ridge A. Threat of imported diseases to UK dogs. Vet Rec. 2016;178(14):347–8. doi: 10.1136/vr.i1799

13. Hansford KM, Pietzsch M, Cull B, Medlock JM. Brown dog tick infestation of a home in England. Vet Rec. 2015;176(5):129–30. doi: 10.1136/vr.h496

14. Hansford KM, Medlock JM, Swainsbury C, Phipps LP, de Marco MDMF, Hernández-Triana LM, Johnson N, Fooks AR. Babesia canis infection in ticks in Essex. Vet Rec. 2016;178(13):323. doi: 10.1136/vr.i1690

15. Swainsbury C, Bengtson G, Hill P. Babesiosis in dogs. Vet Rec. 2016;178(7):172. doi: 10.1136/vr.i803

16. Phipps LP, de Marco MDMF, Hernández-Triana LM, Johnson N, Swainsbury C, Medlock JM, Hansford K, Mitchell S. Babesia canis detected in dogs and associated ticks from Essex. Vet Rec. 2016;178(10):243-244. doi: 10.1136/vr.i1265

17. de Marco MDMF, Hernández-Triana LM, Phipps LP, Hansford K, Mitchell ES, Cull B, Swainsbury CS, Fooks AR, Medlock JM, Johnson N. Emergence of Babesia canis in southern England. Parasites and Vectors. 2017;10(1):241.  10.1186/s13071-017-2178-5

18. England ME, Phipps P, Medlock JM, Atkinson PM, Atkinson B, Hewson R, Gale P. Hyalomma ticks on northward migrating birds in southern Spain: Implications for the risk of entry of Crimean-Congo haemorrhagic fever virus to Great Britain. J Vector Ecol. 2016;41(1):128–34. doi: 10.1111/jvec.12204

19. Mansfield KL, Johnson N, Phipps LP, Stephenson JR, Fooks AR, Solomon T. Tick-borne encephalitis virus - A review of an emerging zoonosis. J Gen Virol. 2009;90(8):1781–94. doi: 10.1099/vir.0.011437-0

20. Weststrate AC, Knapen D, Lavermann GD, Schot B, Prick JJ, Spit SA, Reimerink J, Rockx B, Geeraedts F. Increasing evidence of tick-borne encephalitis (TBE) virus transmission, the Netherlands, June 2016. Euro Surveill. 2017;22(11);pii: 30482. doi: 10.2807/1560-7917.ES.2017.22.11.30482

21. European Centre for Disease Prevention and Control. Tick-borne encephalitis. In: ECDC. Annual epidemiological report for 2015 . Stockholm: ECDC;2018.

22. Shaw SE, Day MJ, Birtles RJ, Breitschwerdt EB. Tick-borne infectious diseases of dogs. Trends Parasitol. 2001;17(2):74–80.

23. Shaw SE, Birtles RJ, Day MJ. Arthropod-transmitted infectious diseases of cats. J Feline Med Surg. 2001;3(4):193–209. doi: 10.1053/jfms.2001.0149

24. Davies S, Abdullah S, Helps C, Tasker S, Newbury H, Wall R. Prevalence of ticks and tick-borne pathogens: Babesia and Borrelia species in ticks infesting cats of Great Britain. Vet Parasitol. 2017;244:129–35. doi: 10.1016/j.vetpar.2017.07.033

25. Abdullah S, Helps C, Tasker S, Newbury H, Wall R. Prevalence and distribution of *Borrelia* and *Babesia* species in ticks feeding on dogs in the U.K. Med Vet Entomol. 2018;32(1):14-22. doi: 10.1111/mve.12257

26. Littman MP, Gerber B, Goldstein RE, Anna Labato M, Lappin MR, Moore GE. ACVIM consensus update on Lyme borreliosis in dogs and cats. J Vet Intern Med. 2018;[Epub ahead of print]. doi:  10.1111/jvim.15085

27. Public Health England (2017) Zoonoses Overview Report UK 2016. www.gov.uk/government/uploads/system/uploads/attachment\_data/file/664448/UK\_Zoonoses\_report\_2016.pdf. Accessed April 3, 2018

28. National Institute for Health and Care Excellence. Lyme disease: NICE Guideline [NG95] [Internet]. 2018 [cited 2018 Apr 11]. Available from: https://www.nice.org.uk/guidance/ng95