Canine vector-borne diseases – prevalence and prevention

Author : SIMON TAPPIN

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SIMON TAPPIN looks at the tick-borne diseases increasingly seen in the UK dog population and contributing factors to their rise, as well as management methods

Summary

Canine tick-borne diseases are uncommon, but their incidence and, consequently, public awareness is increasing. Many factors are involved, such as changes to tick populations and distribution, pets travelling abroad and being exposed to novel tick vectors and their associated diseases, as well as increased vigilance and more available diagnostic techniques. Warmer climates through northern Europe have allowed tick populations to expand their distribution, and milder winters have led to increased numbers in tick populations.

As a result, the prevalence of endemic diseases such as Lyme disease has increased significantly in man over the past decade, and the incidence of suspected canine cases has also increased. Diseases not usually seen in the United Kingdom, such as Borrelia and Ehrlichia, have been seen as a result of travel to mainland Europe and cases of both diseases have been reported in untravelled animals, prompting concerns these diseases may become endemic in the British tick population.

Key words

tick-borne disease, Pet Travel Scheme (PETS), Babesia, Ehrlichia, Borrelia

TICK-BORNE diseases have received a lot of interest, both in human and veterinary
medicine. Ticks have long life cycles, requiring them to feed on several different hosts at different stages, making them extremely efficient vectors of disease.

Tick-borne diseases are tightly confined to the area of the tick vector, so increasing travel through the Pet Travel Scheme (PETS) leads to increased exposure to unusual tick vectors and disease, with cases of *Ehrlichia* and *Babesia* regularly reported through the Defra reporting scheme Dog and Cat Travel and Risk Information (DACTARI; Table 1), although these figures are likely to poorly reflect the actual disease incidence as reporting is voluntary.

The concern regarding tickborne disease is not limited to exotic disease. In the UK, Lyme disease has been documented with increasing frequency in humans, with cases of suspected disease in dogs also increasing. In part, this is due to increased awareness, better diagnostic tests and statutory reporting of cases in people; however, there is also evidence the tick populations and distributions are changing as a result of climate change.

The warmer climate has led to ticks moving into new areas. For example, *Dermacentor reticulatus* (the European meadow tick) – a tick usually found in southern Europe – is now established in Poland, Belgium and Germany, with increasing numbers being found in the UK.

It is also thought milder winters are reducing tick mortality, leading to increasing tick numbers (Wall, 2012). A study found 15 per cent of dogs were carrying ticks without owners being aware, documenting infestation and therefore the potential opportunity for the transfer of infection (Smith et al, 2011).

**Borrelia**

Lyme disease takes its name from the town in Connecticut, United States, where the symptoms of infectious polyarthritis were first described in people in the mid 1970s. Since then, the spirochete *Borrelia burgdorferi* has been found to be the causal agent of Lyme disease, and it has been documented to cause disease in veterinary species.

Classic signs of canine Lyme disease follow a history of a tick bite and initially, signs of fever and lethargy, followed by a shifting limb lameness. Unfortunately, these classic signs are not always seen and are also found in a wide range of other disease, which makes diagnosis of Lyme disease difficult.

*B burgdorferi* is also associated with glomerulonephritis and neurological signs, which are generally seen later in the course of the disease. Signs are generally seen within a month of the tick bite; however, in experimental studies disease has taken up to six months to develop.

In the UK, the most common vector is *Ixodes ricinus*; however, *B burgdorferi* has also been isolated from other *Ixodes* species, *D reticulatus* and *Rhipicephalus sanguineus*. 
The first documented case of canine Lyme disease in the UK was reported in 1990 (May et al., 1990); however, PCR studies of ticks held at the Natural History Museum document the presence of *B. burgdorferi* in British ticks back to the late 1800s, suggesting the disease has been present longer than it has been recognised (Hubbard et al., 1998).

The exact incidence of canine Lyme disease in the UK is largely unknown; however, studies have documented seropositivity to *B. burgdorferi* in dogs across the country. Seropositivity is higher in dogs living in rural areas compared to those living in urban areas and in animals with a history of tick bites (May et al., 1991).

Despite high seropositivity relatively few dogs develop clinical signs. The exact proportion of seropositive animals that develop disease is unknown, but is believed to be around five to 10 per cent (Greene and Straubinger, 2006). A higher proportion is seen in man, with around 90 per cent of people developing clinical signs (Littman et al., 2006).

The reported incidence of Lyme disease in people is gradually increasing, rising from 0.5 cases per 100,000 of the population of England and Wales in 2001 to 1.73 cases per 100,000 in 2011. In endemic areas such as the Highlands of Scotland, the incidence is significantly higher, with 56 cases per 100,000 of the population reported in 2010 (Slack et al., 2011).

The incidence of Lyme disease in dogs is unknown; however, studies show dogs are regularly exposed to ticks carrying *B. burgdorferi*, with an estimated risk of a dog encountering an infected tick in the UK being around one in 200 over a tick season (Smith et al., 2012).

Initial signs of borreliosis are of acute fever (greater than 40°C), shifting limb lameness and associated lethargy. There may also be joint swelling and enlargement of the local lymph nodes. These signs appear to be most severe in younger dogs and immunocompromised animals. In a proportion of dogs a chronic, non-erosive polyarthritis may develop; this is most likely in patients with chronic infection, which has been incompletely cleared by the immune system (Figure 1).

Serological testing proves exposure to *B. burgdorferi*, but given the high seropositivity in asymptomatic animals, it does not prove the organism is the cause of the clinical disease. A rising titre should be established on repeat sampling two and four weeks later, or a PCR-based test used to establish the presence of the organism. As the spirochetes tend to invade through tissue rather than passive dissemination through the bloodstream, PCR is specific, but has a low sensitivity for diagnosis.

Earlier antibiotic therapy has been shown to be very effective in reducing spirochete numbers, leading to rapid improvement in arthritis signs over a 24 to 48-hour period. Doxycycline is the drug of choice for the treatment of *B. burgdorferi*, although a number of other antimicrobials also have efficacy.
Preventing ticks attaching provides the best method of reducing the risk of Lyme disease, and a number of different products have been shown to have good activity in preventing tick attachment and in killing ticks once they are in place.

As spirochete transmission does not occur until at least 24 hours after tick attachment, prompt removal of the ticks within this period will stop transmission of *Borrelia* (Figure 2). A vaccine has become available in the UK providing protection from Lyme disease, which may be considered in animals at increased risk of tick exposure.

**Anaplasma**

*Anaplasma phagocytophilum*, previously classified as *Ehrlichia platys*, leads to granulocytic ehrlichiosis. *Anaplasma* is transmitted by *Ixodes* species and infection leads to similar signs to *Ehrlichia canis*; however, lameness, joint swelling and neurological signs secondary to meningitis are more commonly seen.

A low prevalence (0.74 per cent) of *A phagocytophilum* has been found in *Ixodes* ticks in the UK (Smith and Wall, 2013); however, clinical cases have been reported (Bexfield et al, 2005). Treatment with doxycycline is usually successful, alongside possible steroidal therapy if immune-mediated disease is present.

**Babesia**

*Babesia* species can cause severe and life-threatening anaemia in dogs (Figure 3). *Babesia canis* is endemic in most of mainland Europe; however, it is particularly prevalent in France, with increasing incidence in the south (particularly south of the Loire Valley). *B canis* is carried by *D reticulatus* (Figure 4) and *R sanguineus* (the brown dog tick).

Although *D reticulatus* is present within the UK, it is not thought to harbour *Babesia*. The brown dog tick (*R sanguineus*) is only rarely found in the UK; however, studies indicate the climate and habitat suggest it is likely to increase in prevalence. This raises concerns *Babesia* could become established in the endogenous tick population and climate changes could favour proliferation of suitable vectors.

Worryingly, there are reported cases of *B canis* infections in untravelled dogs; one fatal case in Kent was postulated to have become infected after possibly encountering an infected tick entering the UK on a goods lorry (Holm et al, 2006).

*Babesia* infection results in an array of clinical signs, which vary between the strains present. Most signs result from haemolytic anaemia or the systemic inflammatory response this generates and multiple organ failure that results.
Diagnosis of canine Babesia is most convincingly made by demonstrating the presence of organisms within infected erythrocytes, with B canis usually forming pairs of pyriform organisms (Figure 5). Collecting blood from peripheral capillary beds (for example, the ear tip or nail bed) can yield a higher number of infected cells. PCR is the most sensitive and specific way of diagnosing infection, and also allows determination of the species present.

Treatment for babesiosis relies on parasite clearance and supportive care. In general, imidocarb (two doses of 5mg/kg/IM given at a 14-day interval) is suggested as the most effective drug for parasite clearance, and improvement is normally seen within 24 hours of treatment.

A PCR study of 742 ticks collected from areas throughout the UK found Babesia gibsoni DNA in 11 I ricinus ticks (Smith and Wall, 2013). This is a surprising finding as B gibsoni is rarely reported in Europe and has not previously been documented in the UK tick population. However, its range is expanding, with two clinical cases of B gibsoni reported in Germany (Hartelt et al, 2007). Further work is required to understand the clinical significance of these findings.

**Ehrlichia**

*Ehrlichia canis* is a tickborne, intracellular, rickettsial parasite that is endemic in southern Europe and the Mediterranean basin. *Ehrlichia* is transmitted by the brown dog tick (*R sanguineus*) and disease mirrors the prevalence of this vector. Although *Ehrlichia* is not endemic in the UK, two cases of *Ehrlichia* have been reported in dogs living in the south-east of England that had not travelled abroad (Wilson et al, 2013).

The route of infection in these dogs is unknown; neither had knowingly mixed with dogs that had travelled abroad or had recent history of tick attachment.

*R sanguineus* is not endemic to the UK as climatic conditions are too cold; however, numbers are increasing due to importation and Defra acknowledges a risk of establishment in houses (Toth and Roberts, 2011; Jameson et al, 2010).

There has also been a suggestion *Ehrlichia* could become established in other tick species – for example, *Argas vespertilionis*, which is a tick associated with bats in Europe (Socolovschi et al, 2012).

Once infected, three phases of ehrlichiosis are seen – acute, subclinical and chronic. The acute phase has an incubation period of eight to 20 days and consists of non-specific signs such as fever, anorexia and lymphadenomegaly. Dogs usually recover spontaneously before entering a period of subclinical infection.

Some dogs clear the organism at this stage; however, in others the organism persists, leading to chronic infection. Chronic infection leads to leukopaenia, thrombocytopenia and platelet
dysfunction, leading to severe bleeding in some cases (submucosal haemorrhage and epistaxis).

Diagnosis can be made on the basis of serology, PCR or finding the *Ehrlichia* morulae in leukocytes; however, this can be difficult and time consuming. Doxycycline is the treatment of choice (5mg/kg twice a day or 10mg once a day for 14 to 21 days); however, imidocarb can be useful in resistant infection.

**Conclusions**

The prevalence of clinical cases of tick-borne disease in the UK is likely to increase over time, as a result of both increased pet travel and changes in tick populations and disease reservoirs.

Although awareness of tick-borne disease is rising, client education as to the risks of tick-borne disease is essential. The risk of exposure to exotic disease can be well predicted, and several web-based resources provide easy access to this information – (for example, www.fleatickrisk.com).

A number of different products have been shown to have good activity in preventing tick attachment and in killing ticks once they are in place. Regular use of a fipronil or permethrin-containing product should be suggested to all owners of dogs walked regularly in areas with high tick numbers – especially at high-risk times of the year (autumn and spring).

Ticks attach to their host rapidly, limiting their exposure to surface drugs such as fipronil. The addition of amitraz increases tick mobility, increasing exposure to – and therefore the effectiveness of – the acaricide. As any acaricide will not be 100 per cent effective in preventing tick attachment, owner vigilance and prompt tick removal using a tick hook will further reduce risks.

Vaccination for Lyme disease may also be considered in high-risk areas.

• Please note some drugs mentioned within this article are not licensed for use in dogs in the UK, or are used under the cascade.

**References**


Figure 1. Joint fluid from a dog with *Borrelia*, revealing neutrophilic inflammation. IMAGE: Butty Villiers.

IMAGE: Butty Villiers.
Figure 2. Prompt tick removal reduces risk of disease transmission.

IMAGE: Butty Villiers.
Figure 3. A dog presented as an emergency, suffering from *Babesia* after a trip to France.
Figure 4. *Dermacentor reticulatus* ticks feeding (male – yellow arrow, female – red arrow).
Figure 5. A blood film revealing *Babesia* merozoites within erythrocytes (green arrows).
Table 1. Reported cases of imported diseases within the United Kingdom since the introduction of the Pet Travel Scheme (PETS) in 2000 (data from Defra’s website, summary report 2011).

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