

IN FOCUS

Tick-borne diseases of dogs and cats

This is the second of two articles on ticks, the diseases they carry and treatments. In the UK, ticks on dogs and cats have traditionally been considered to just be a bit of a nuisance or “those things owners mistake for warts on their dog’s head”! There has always been the worry that the site of attachment might become infected, especially if the mouthparts remain in the skin after removal, although I have only rarely seen such problems. Also, they do ingest blood but this is unlikely to result in anaemia (except for heavy infestations of *Rhipicephalus sanguineus*, usually something that only occurs abroad). And many of us are also aware of tick paralysis in Australia when a toxin is released from female *Ixodes holocyclus* ticks leading to paralysis and death in both dogs and cats - and there was a case with an imported dog which, despite tick treatment before travel, developed signs on arrival in this country. However ticks can also transmit viral, bacterial, rickettsial and protozoal diseases. While British sheep, cattle and grouse have long been victims of such infections, tick-borne diseases (TBD) have not been of much concern in small animal practice - until now! With the increasing numbers of travelling pets and changes in climate and land use, infestations by different species of tick and the infections they can carry are becoming more common. And the situation will worsen after January 2012 when mandatory tick treatment prior to arrival in the UK is discontinued.

Below: **A summary of European ticks and their major associated pathogens.**

Tick	Pathogen
<i>Ixodes</i> spp.	<i>Anaplasma phagocytophila</i> , <i>Bartonella</i> spp., <i>Borrelia burgdorferi</i> , <i>Theileria annae</i> , Louping ill virus, Tick-borne encephalitis virus
<i>Rhipicephalus sanguineus</i>	<i>Babesia canis vogeli</i> , (<i>Babesia canis canis</i>) <i>Ehrlichia canis</i> , <i>Hepatozoon canis</i> , <i>Rickettsia conori</i> ¹
<i>Dermacentor</i> spp.	<i>Babesia canis canis</i> , (<i>Babesia canis vogeli</i>)
<i>Haemaphysalis punctata</i>	Tick-borne encephalitis virus <i>Rickettsia conori</i> ¹

¹ Mediterranean Spotted Fever or Boutonneuse Fever of humans - infection is sub-clinical in dogs.

TBD in the UK

Borreliosis (Lyme disease) - caused by the spirochaete *Borrelia burgdorferi*. It occurs in temperate regions, not in the tropics. Luckily only rarely seems to cause canine or feline disease. Signs occur 3 days to one month after infection and include fever, joint swelling, shifting lameness and occasionally renal failure or meningoencephalitis. Lyme disease is a zoonosis characterised by a circular skin rash called erythema migrans and in the UK

is seen as a problem particularly in the New Forest, Exmoor and Dartmoor, and in East Anglia.

Anaplasmosis - caused by *Anaplasma phagocytophila* (formerly *Ehrlichia phagocytophila*, synonym *E. equi* and Human Granulocytic Ehrlichiosis agent and cause of tick-borne fever in sheep) which infects granulocytes. It occurs throughout northern and central Europe and northern and western USA. Infections have occasionally been reported in dogs (including from Scotland, Sweden and Slovenia). Signs are generally mild occurring 8-20 days after tick bite, but can include fever, lethargy, anorexia, stiffness and joint pain, splenomegaly/hepatomegaly, meningitis and seizures.

Louping ill - a viral infection and an important disease of sheep throughout northern Europe. Rare cases resulting in fever, lethargy, anorexia, ataxia, paresis and other CNS signs 6-18 days after infection have been reported in dogs including in the UK. There are other flaviviruses causing tick-borne encephalitis (TBE) either in animals or man, particularly in eastern and central Europe (including Austria, Germany and southern Scandinavia); clinical cases of TBE in dogs are being identified.

TBD abroad

Babesiosis - a protozoal disease of red blood cells. In dogs it is classically caused by *Babesia canis* of which there are two European subspecies:

- i) *B. canis canis* which is transmitted mainly by *Dermacentor reticulatus* but also by *D. marginatus*, and is common in central and southern Europe, particularly in France in areas south of the Loire and around Paris, but including Germany, the Netherlands, Switzerland, Greece and Poland.
- ii) *B. canis vogeli* which is less pathogenic, transmitted mainly by *Rhipicephalus sanguineus* and occurs in many sub-tropical parts of the world including southern Europe.

Signs occur 8-21 days after infection and include fever, lethargy, anorexia, weakness, haemoglobinuria, pallor, lymphadenopathy, splenomegaly, icterus, collapse and death. Disease can be peracute especially in naive dogs such as travelling pets from the UK.

A smaller form of the parasite, *B. gibsoni* has classically been reported from Asia but more recently, cases have been described in the USA, and more rarely Australia and Europe (Italy and Spain). It is thought to be transmitted by *Rhipicephalus* and *Haemaphysalis* spp. but may also be transmitted in blood - in the USA and Australia it is most common in Pit Bull Terriers and other “fighting” breeds. It is more pathogenic than *B. canis* and less responsive to treatment. Recent studies have also demonstrated the presence of other small *B. microti*-like parasites in Europe and the USA; one type infecting a

Spanish dog has been named *Theileria annae* and is believed to be transmitted by ixodid ticks.

The canine babesiae are not zoonotic, although *B. microti* itself does cause serious human disease.

Several *Babesia* species, including *B. cati* and *B. pantherae* infect cats in Africa and Asia, and *B. canis presentii* has recently been found to cause disease in domestic cats in Israel. Clinical disease appears to be rare but this is probably because cats tolerate anaemia well - if disease is severe, sudden death may occur. Treatment of cats using imidocarb (single dose of 2.5mg/kg im) has been reported.

Ehrlichiosis - *Ehrlichia canis* is a rickettsial organism which principally infects canine monocytes. Disease is found worldwide in tropical and sub-tropical areas including southern Europe. *E. canis* is not a zoonosis. Eight to 20 days after infection, most dogs show initial fever, lethargy, depression, lymphadenopathy and sometimes haemorrhages (petechiae); many immunocompetent dogs then eliminate the organism, whilst other dogs remain chronically infected and develop signs such as weight loss, anaemia, lameness, oedema, bleeding tendencies (ecchymoses, epistaxis) and/or neurological signs. Some cases are fatal. Chronic disease is more common in breeds such as German Shepherd Dogs and Dobermans. Other *Ehrlichia* spp. occur in the USA.

Ehrlichia-like bodies (including *Anaplasma phagocytophila*) have been detected in cats in several countries and may cause fever, lymphadenopathy, lameness and dyspnoea. Treatment is with doxycycline.

Hepatozoonosis - the protozoan *Hepatozoon canis* is transmitted by ingestion

of infected *Rhipicephalus sanguineus* ticks (and possibly *Haemaphysalis* spp. in Japan). It spreads via the blood and lymphatic systems and is commonly detected in leucocytes. It is found worldwide in sub-tropical areas including southern Europe and Asia but not in North America. It may be sub-clinical to severe, resulting in fever, lethargy, weight loss and anaemia.

Hepatozoon americanum - occurs in south-eastern USA; it favours myocytes, including cardiac muscle, and is acquired by ingestion of *Amblyomma maculatum* ticks.

Hepatozoon-like organisms have been associated with myositis in cats. Species involved and modes of transmission remain to be characterized but there is often concurrent infection with FIV or FeLV.

Anaplasma platys (formerly *Ehrlichia platys*) - infects thrombocytes and is only mildly pathogenic. Transmission vectors are uncertain.

Tularemia (or rabbit fever) - caused by *Francisella tularensis*, causes an ulcerative/glandular disease or a typhoid-like illness in man in Europe and the USA. It has occasionally been reported in dogs and cats, resulting in lethargy, anorexia and weakness. It can be transmitted by a variety of ticks, but human infections are most commonly the result of contact with an infected animal (typically a rabbit in the USA). Treatment is with doxycycline.

Q fever - caused by *Coxiella burnetii*, it occurs worldwide, resulting in fever, myalgia, headache, cough, endocarditis and other signs in humans, and abortions in sheep and goats. It may be a cause of abortion and perinatal deaths in dogs and cats. It can be transmitted by a variety of ticks but humans are usually infected by inhalation of aerosols

of infective material, typically from placenta and birthing fluids.

Rocky Mountain Spotted Fever - affects both dogs and humans in the USA. It is caused by *Rickettsia rickettsii* and transmission is by *Dermacentor* and *Amblyomma* spp. Signs appear after only 4-5 days and include fever, petechiae, ecchymoses, oedema, cervical pain, depression and stupor. Diagnosis is by PCR or serology (in the USA) and treatment is with tetracyclines or chloramphenicol.

Bartonellosis - many cats have antibodies to *Bartonella* spp. but most infections are sub-clinical, and transmission is via vectors such as fleas as well as ticks. Signs can include lethargy, fever, lymphadenopathy, gingivitis, stomatitis, uveitis, and neurologic dysfunction. Cats act as a reservoir for human infection (e.g. for cat scratch fever). *Bartonella vinsonii (berkhoffii)* is an emerging (in the USA but may have worldwide distribution) bacterial pathogen of dogs that may be associated with endocarditis, lymphadenitis, immune-mediated thrombocytopenia, epistaxis, neurological signs and polyarthritis. The organism is thought to be transmitted by *Rhipicephalus sanguineus* and may be co-transmitted with *Ehrlichia canis* or *Babesia canis*.

Prevention of these diseases is primarily by the avoidance of tick bites and the rapid removal of any ticks which do attach. Transmission of some viruses may occur within hours but most protozoa require ticks to feed for 24-48 hours. Note that cats are very sensitive to the side-effects of permethrin-based products, so tick control products must be chosen with care in cats; fipronil is safe and effective. Vaccines to help protect against babesiosis (*B. canis*) are available in some parts of Europe and for canine Lyme disease in the USA (although the human vaccine there was withdrawn as uneconomic in 2002).

Left: Table of diagnostic tests and treatments.

PCR available at Acarus, Bristol University.

- a More likely to see organisms in capillary blood from ear tip/claw, or smear of buffy coat/just below buffy coat.
- b Doxycycline, (Ronaxan, Merial); 5-10mg/kg BID.
- c Imidocarb dipropionate (Imizol, Intervet/Schering-Plough) 5-7 mg/kg sc/im, not licensed in UK for use in the dog - a consent form should be completed by owner.
- d Not licensed in UK for use in the dog - a consent form should be completed by owner.
- e An Authorised Medicated Premix (Alpharma Animal Health Ltd.); not licensed in UK for use in the dog - a consent form should be completed by owner.

* Parasitological cure is rare - most animals remain sub-clinical carriers.

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Disease	Diagnostic tests	Treatment - drug	Comments
Anaplasmosis (<i>A. phagocytophila</i>)	Protozoa within granulocytes in blood smear ^a or lymph node aspirate PCR (EDTA blood)	Doxycycline ^b	Treat for 14-28 days
Babesiosis (<i>B. canis</i>) [*]	Protozoa in red blood cells in a smear ^a PCR (EDTA blood)	Imidocarb ^c	Repeat in 2-3 weeks
Borreliosis	Serology (ELISA) PCR (EDTA blood +/- synovial fluid)	Doxycycline ^b Amoxicillin Cephalosporins	Give for 3 weeks even if recovery is rapid. Other antibiotics have been used. Vaccine available in the USA for dogs
Ehrlichiosis (<i>E. canis</i>) [*]	Morulae within monocytes ^a Serology (IFAT) PCR (EDTA blood +/- splenic aspirate)	Doxycycline ^b Imidocarb ^c	Treat for 3-8 weeks. Repeat Imidocarb in 2-3 weeks. Chloramphenicol may also be effective. Enrofloxacin is not effective
Hepatozoonosis (<i>H. canis</i>) [*]	Gamonts in neutrophils, (occ monocytes) in blood smears ^a , lymph node, spleen +/- or bone marrow (Serology IFAT - abroad)	Imidocarb ^c +/- Doxycycline ^b	Repeat imidocarb every 2 weeks until blood smears are negative. Give doxycycline for 21 days
Hepatozoonosis (<i>H. americanum</i>) [*]	Cysts and pyogranulomas in muscle biopsies (Serology; ELISA - USA)	Clindamycin 10mg/kg TID Sulphonamide/trimethoprim 15mg/kg BID Pyrimethamine ^d 0.25mg/kg SID plus NSAID	Give in combination for 14 days. Then use decoquinatate ^e 10-20mg/kg BID for a prolonged period
Louping ill, Tick-borne Encephalitis	Serology	Supportive treatment	