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BABESIOSIS IN CATS

ABCD guidelines on prevention and management

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Agent properties

Several *Babesia* species have been detected in domestic cats in different regions of the world, including South Africa, Sudan, Zimbabwe, Israel, India, Thailand, Brazil, France, Poland and Germany. However, only few of these *Babesia* organisms have been characterised.

Most reports about babesiosis in cats come from South Africa, where it is mainly found in coastal areas. There (as well as in other parts of Africa, such as the Sudan) infection is caused principally by *B felis*, a small *Babesia* species that causes severe anaemia and icterus.^{1,2}

Most other small *Babesia* species in domestic cats, like *B cati* found primarily in India, are less pathogenic.

B leo, another small species, is genetically similar to *B felis* and common in lions of the Kruger National Park, South Africa, and in Swaziland,³ but also prevalent in domestic cats in these areas. A small *Babesia* species was also seen in blood smears of cats in Rio de Janeiro, Brazil, but the species was not identified.

Sporadic cases of canine *Babesia* species infections in domestic cats have been reported in Europe, such as *B canis canis* in Spain and Portugal, a *B microti*-like species in Portugal, and a *B canis*-like species in Poland.² *B canis presentii* has been detected in Israel, and *B canis vogeli* is common in stray cats in Thailand.^{4–6}

In addition to the small *B leo*, several large *Babesia* species, including *B herpailuri* and *B pantherae*, have been discovered in wild felids, such as lions, cheetahs and the Florida panther. They can be transmitted experimentally to domestic cats, but their infectivity and pathogenicity under natural circumstances is unknown.²

Overview: Babesiosis is a tick-borne protozoan disease caused by parasites of the genus *Babesia* that belong to the *Piroplasmida*.

The disease is named after the Romanian bacteriologist Victor Babeş. Babesiosis is also known as piroplasmosis (from Latin *pirum*, meaning 'pear', and *plasma*, 'image, formation').

Infection: Babesiosis affects domestic and wild animals and humans worldwide. While the disease is recognised in dogs around the world, it is found only rarely in cats.

Human disease: *Babesia* species are common blood parasites of mammals. Human babesiosis is uncommon, but more cases in people have been reported recently, most likely because of rising awareness.

The level of genetic diversity within *Babesia* species suggests that new subspecies can develop easily.



European Advisory Board on Cat Diseases

The European Advisory Board on Cat Diseases (ABCD) is a body of experts in immunology, vaccinology and clinical feline medicine that issues guidelines on prevention and management of feline infectious diseases in Europe, for the benefit of the health and welfare of cats. The guidelines are based on current scientific knowledge of the diseases and available vaccines concerned.

The latest version of the babesiosis in cats guidelines is available at www.abcd-vets.org

The vector(s) for *Babesia* species in cats has/have not yet been identified.



Several new species (eg, *B venatorum*) have been discovered in recent years. A new species, named *B hongkongensis*, was discovered in kidney sections of a free-roaming cat in Hong Kong.⁷ The level of genetic diversity within *Babesia* species suggests that new subspecies can develop easily.⁸

Life cycle

Babesiosis are vector-borne diseases usually transmitted by ticks. The vector(s) for *Babesia* species in cats has/have not yet been identified.

Babesia organisms replicate in erythrocytes, where they produce merozoites. These structures appear as inclusions attached to each other at their ends, thereby forming tetrads. These so-called Maltese cross formations are pathognomonic of *Babesia* species. Ticks are infected by ingesting merozoites during feeding, and replication of the parasite within their salivary cells results in sporozoite formation. When infected ticks feed, the sporozoites are regurgitated and fed back into the bloodstream of the host.

Epidemiology

B felis is the most important pathogenic species in cats. It is mainly found in the coastal areas of South Africa.^{1,2} It usually occurs in cats less than 3 years of age, without any predilection for sex or breed.^{9,10}

Apart from the usual transmission by ticks, *Babesia* species have been transmitted iatrogenically (eg, through blood transfusions). Virulence is determined primarily by the parasite species involved.

Clinical signs

Severe disease has been described in cats infected with *B felis* in South Africa, where feline babesiosis is diagnosed regularly.¹ This species has not been reported in Europe to date. In contrast, feline babesiosis caused by other *Babesia* species presents as a chronic, mild disease.⁴

Common clinical signs are anorexia, lethargy, weakness and a rough haircoat.^{9,11} Unlike in dogs, fever and icterus are uncommon. In most cases with fever, a concurrent illness is diagnosed.¹¹ Most clinical signs are secondary to haemolytic anaemia that results from the infection of erythrocytes by the piroplasm.

Cats usually cope with the anaemia and may show only mild clinical signs.

Complications of babesiosis include renal failure, pulmonary oedema, hepatopathy and central nervous system signs.¹¹ Concurrent infection with *Mycoplasma hemofelis*, feline leukaemia virus (FeLV) or feline immunodeficiency virus (FIV) can contribute to the clinical presentation and severity of disease.

The typical laboratory findings in cats with babesiosis are a consequence of haemolytic anaemia, which is usually regenerative, macrocytic and hypochromic. Haemolysis can be caused by both extravascular and intravascular erythrolysis.¹⁰ Anaemia is most pronounced approximately 3 weeks after an experimental infection.¹² Blood smears can show increased polychromatophils, Howell-Jolly bodies, nucleated erythrocytes and anisocytosis.¹¹ Erythrophagocytosis by monocytes is also observed,¹¹ and intra-erythrocytic parasites can sometimes be detected.¹⁰ Secondary, immune-mediated haemolytic anaemia with anti-erythrocyte antibodies can occasionally be seen, leading to a positive Coombs' test and autoagglutination.¹⁰

Infected cats usually show no changes in their white blood cells. Thrombocytopenia is common in other species but is an inconsistent finding in cats.^{10,12}

On serum biochemistry, alanine transaminase (ALT) activity is elevated in most cases, whereas alkaline phosphatase (ALP) activity is generally within the reference range.^{1,10} Total bilirubin concentration is commonly increased,¹⁰ most likely as a result of haemolysis, but secondary hepatocellular injury can be a contributing factor.¹ Feline babesiosis usually does not alter urea, creatinine and cholesterol concentrations, or blood pH.¹³ Polyclonal gammopathy has been observed in cats with hypergammaglobulinaemia, leading also to increased total protein concentrations.¹⁰

Immunity

The host generates a specific immune response against most *Babesia* species, but this does not eliminate the parasite. Cats that recover from the clinical signs usually remain chronic carriers.



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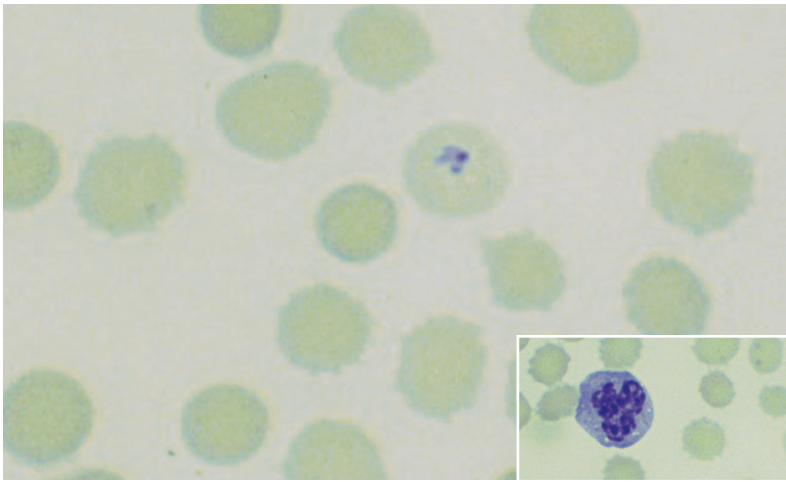


Figure 1 Blood smear from a cat with *Babesia* species in its erythrocytes (inset shows a smear at higher magnification). Courtesy of Katrin Hartmann, Ludwig Maximilians University, Munich, Germany

When the level of parasitaemia is low, which is often the case, detection of the organism in blood smears can be difficult.



Diagnosis

Babesiosis is suspected when merozoites are detected in blood smears. Parasites are best identified in thin smears examined at maximum magnification under oil, using Romanowsky (methylene blue and eosin) or Giemsa stains (Figure 1). The different *Babesia* species and some other blood parasites, including *Cytauxzoon felis*, are more morphologically indistinguishable.² When the level of parasitaemia is low, which is often the case, detection of the organism in blood smears can be difficult.

Testing for anti-*Babesia* antibodies is widely used in dogs, but not in cats so far.

Currently, the best method for definitive diagnosis of *Babesia* species infection in cats is detecting the organism's nucleic acid in blood samples by polymerase chain reaction [EBM grade III].⁸ Techniques have been developed for simultaneous detection of several *Babesia* species, but differentiation between species (eg, through nucleotide sequence differences within the 18S ribosomal subunit) is also possible.^{2,4,8}

Treatment and prognosis

The prognosis depends on the severity of disease, which in turn depends on both organism and host factors. Mortality rates of 15–20% have been reported [EBM grade IV].¹⁴ Concurrent infection with *M hemofelis*, FeLV or FIV has a negative impact on the response to treatment and outcome of disease [EBM grade III].¹⁰

Antiprotozoal drugs and supportive care are the mainstays of therapy. Cats infected with *B felis* should always be treated, as the infection is commonly fatal if left untreated. In a review of 20 cats with experimentally induced babesiosis and 70 natural cases, all untreated animals eventually died [EBM

Cats infected with *B felis* should always be treated, as the infection is commonly fatal if left untreated.

EBM grades
The ranking system for grading the level of evidence of various statements within this article is described on page 533 of this Special Issue.

grade III].¹¹ The response to treatment is generally good, but recurrence of clinical signs and chronic persistent infections are possible,¹³ and repeated or extended treatment may be necessary.¹

Most antibabesial drugs are not effective in cats and, when used in experimental studies to treat *B felis* infection, have shown variable or questionable results [EBM grade III].^{15,16} Currently, the drug of choice is primaquine phosphate, an antimalarial compound. The following dosages were found to be effective: administration of 0.5 mg/kg PO q24h for 1–3 days, or 1 mg/cat IM q36h for four doses, then 1 mg/cat every 7 days for four doses [EBM grade III].¹⁷ However, although primaquine phosphate is capable of reducing parasitaemia, it does not eliminate *B felis* from the host. Also, it frequently causes vomiting when administered orally. Due to its narrow therapeutic window in cats it has to be administered carefully, as dosages exceeding 1 mg/kg can be lethal.¹⁵ Rifampicin and sulfadiazine–trimethoprim were shown to have some antiparasitic effect in one study, but were less active than primaquine phosphate, while buparavaquone, enrofloxacin and danofloxacin did not show any antibabesial effect [EBM grade III].¹⁶

Prevention

As *Babesia* species are transmitted by different tick species, tick control is the best way to prevent infection [EBM grade IV]. Since cats do not tolerate permethrin, other drugs (eg, fipronil) need to be used.

The soluble parasite antigen of several *Babesia* species has been used experimentally as a vaccine against the clinical manifestations of babesiosis, with variable success against bovine and canine species. No feline vaccines exist.

KEY POINTS

- ❖ Babesiosis is a common tick-borne protozoan disease affecting animals and humans worldwide; it is rare in cats.
- ❖ Babesiosis is caused by intracellular parasites of the genus *Babesia* that belong to the *Piroplasmida*.
- ❖ Small and large *Babesia* species have been detected in domestic cats in different regions of the world, but only a few of them have been characterised.
- ❖ Most reports about feline babesiosis are from South Africa, where infection is mainly caused by the small, pathogenic *B felis*.
- ❖ *B felis* can cause severe anaemia and icterus in cats; other *Babesia* species are less pathogenic and rarely cause clinical signs.
- ❖ *Babesia* species infection in cats is usually diagnosed when the parasite is detected in blood smears; the best diagnostic method is PCR.
- ❖ Treatment consists of antiprotozoal drugs and supportive therapy; repeated or prolonged treatment might be necessary.
- ❖ The drug of choice is primaquine phosphate.
- ❖ Tick control is the best way to prevent infection.



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Conflict of interest

The authors do not have any potential conflicts of interest to declare.

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