## BABESIOSIS

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<th>Animal Group(s) Affected</th>
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<td>Ubiquitous in wildlife wherever tick infestations are present. Variety of mammal species, including humans, and birds can be affected.</td>
<td>Numerous species of ixodid ticks</td>
<td>Severe hemolytic anemia, hemoglobinemia, hemoglobinuria, fever, possible neurologic signs, anorexia, slight jaundice, or subclinical. Majority of infections in wildlife are subclinical.</td>
<td>May be severe, with acute clinical presentation and death. Clinical disease often less severe in free-ranging animals than domestic animals.</td>
<td>Imidicarb, tick control</td>
<td>Tick control is primary means of preventing Babesia infection; host immunity through exposure.</td>
<td>Babesia microti, carried by wild rodents, has caused human infection</td>
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**Susceptible animal groups:** Most mammal orders, including humans, can be susceptible although not marine mammals (Cetacea, Pinniped), and several avian species.

**Causative organism:** Babesia bovis, B. bigemina, and B. odocoilei (ungulates); B. caballi and B. equi (horses); B. canis, B. gibsoni, and B. anae (canids); B. latori (raccoons); B. mephitis (striped skunk); B. microti (rodents); currently, 14 distinct avian Babesia species have been identified. Babesia sp. found outside of North America may be encountered in the zoological setting in animals that are imported directly from other countries. Additionally, Entopolyploides macaci, which is closely related to B. microti, is often identified in colonies of research primates, such as rhesus macaques, African monkeys, and baboons, and will infect other species of primates.

**Zoonotic potential:** B. microti is the cause of a mild, typically self-limiting human infection. Other species such as B. divergens–like MO-1 and B. duncanii are known to cause disease mainly in immunocompromised people. More severe, and often fatal, babesiosis occurs in splenectomized people.

**Distribution:** Typically, the organism follows that of the tick vector: B. bovis and B. bigemina are transmitted by Rhipicephalus microplus and R. annulatus respectively and found in Mexico and occasionally southern Texas and California. B. odocoilei is transmitted by Ixodes scapularis and I. pacificus which are found in eastern half of U.S. and Canada (I. scapularis) and Pacific coast of U.S. and Canada (I. pacificus). B. caballi and B. equi were eradicated from the US and are absent in Canada. B. canis and B. gibsoni are transmitted by R. sanguineus and found throughout most of the US and southeastern Canada. B. latori’s tick vector is unknown, but it is found in eastern US, Texas and California. B. anae has been reported from raccoons and foxes in Massachusetts. B. mephitis has been reported in skunks in Maryland. B. microti is transmitted by I. scapularis and found in northeastern and upper Midwest US. The geographic distribution of avian Babesia species is not fully understood.

**Incubation period:** B. bovis and B. bigemina – incubation is generally 2–3 weeks post-tick infestation, and from 5 days to 3 weeks post-blood inoculation, depending on dose of inoculum. Ticks must feed for 2–3 days for successful transmission of B. canis. Incubation period for humans is reported as 1–6 week from beginning of tick feeding. Chronic infections may recrudesce if an animal is stressed or becomes immunocompromised for any reason.

**Clinical signs:** Nonspecific clinical signs include fever, anorexia, depression and lethargy,
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Lymphadenopathy. Erythrocyte destruction by the parasite and host immune response results in mild to severe hemolytic anemia, icterus, hemoglobinemia, hemoglobinuria, splenomegaly. In rare cases where Babesia-infected erythrocytes obstruct brain capillaries, neurologic signs may be noted.

Post mortem, gross, or histologic findings: Pathologic findings may include icterus, generalized lymph node enlargement, hepatomegaly and splenomegaly (due to red pulp hyperplasia), abomasal mucosal ulcerations, hemorrhage into the intestinal tract, and dark red kidneys (hemoglobinuric nephrosis). Edema and hemorrhage of tissues such as the cardiac muscle, intestinal serosa, and lymph nodes may be observed, as well as fluid in the body cavities and pericardial sac. The urinary bladder frequently is distended with dark red urine. For fulminating ruminant infections, Giemsa-stained brain crush smears are helpful to detect parasitized erythrocytes in brain capillaries. Also, the spleen often contains large numbers of parasitized cells, which may be appreciated on impression smears taken from cross sections of the spleen.

Diagnosis: Microscopic visualization of piroplasms within erythrocytes in Giemsa-stained thin or thick whole blood smears. Piroplasms become more difficult to find on blood smears after the acute phase of infection passes. Serologic tests (cELISA, IFA, CF), nucleic acid probes and PCR are also available. Gross splenomegaly is a common finding, particularly in naïve or unnatural hosts. Impression smears of spleen may be made for the identification of parasitized cells.

Material required for laboratory analysis: Whole blood (EDTA) for smears and PCR, serum for serological testing.

Relevant diagnostic laboratories: Several veterinary diagnostic laboratories offer serologic and PCR testing for *B. bovis*, *B. bigemina*, *B. caballi*, *B. equi*, *B. canis*, and *B. gibsoni*. Research labs with Babesia expertise are good options to work up samples.

Treatment: Treatment is most successful in the early phase of the disease. Chemotherapy may not completely eliminate infection and may be unsuccessful in the later stages of the disease. Imidocarb dipropionate (1mg/kg IM), diminazene acutrate (3mg/kg IM), phenamidine diisethionate (8-13 mg/kg), and amicarbalide diisethionate (10 mg/kg IM), have been used to treat babesiosis in artiodactylids. Similarly, imidocarb, diminazene, and phenamidine have also been utilized to treat *B. canis* and *B. gibsoni*. Primaquine phosphate is preferred treatment in felids and birds. Quinine and clindamycin, or atovaquone and azithromycin are used to treat zoonotic babesiosis and might be tried for nonhuman primate infections. In addition to specific therapy, supportive care with fluids, blood transfusions, iron, and antibiotics may be important as well. Supportive therapy may be contraindicated in severely anemic animals that are easily stressed with handling.

Prevention and control: Free-ranging animals sharing zoo habitats are often already infected with Babesia as well as vector ticks. The primary means of controlling outbreaks is through control of the tick vector. Elimination or reduction of tick infestation may be accomplished via application of acaricides, prophylactic use of chemotherapeutics, range burning, prolonged pasture rest, and repellents. Additionally, care should be taken to prevent accidental transmission through the transfer of infected blood between animals via routine surgical or vaccination procedures. Vaccines of noninfectious material have been developed, and although they do not prevent infection, they do ameliorate the severity of disease. Additionally, differences in strain antigenicity limit cross-protection by the vaccine.

Suggested disinfectant for housing facilities: Disinfectants are generally not effective in preventing the spread of babesiosis. However, standard measures should be taken to prevent the transfer of infected blood between animals. *R. sanguineus*, the vector for canine babesiosis, is typically found indoors in kennels and other housing situations; such facilities should be treated with appropriate acaricides.

Notification: Babesiosis caused by *B. bovis*, *B. bigemina*, *B. equi* and *B. caballi* are reportable diseases and state and federal authorities must be notified immediately of infection. Public health officials may need to be notified if zoonotic infection has occurred or is suspected.
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**Measures required under the Animal Disease Surveillance Plan:** Equine piroplasmosis is considered a foreign animal disease in the U.S., therefore any equids imported must be serologically screened by the National Veterinary Services Laboratory using the competitive enzyme-linked immunosorbent assay (cELISA) prior to importation. Current information regarding the USDA’s requirements for disease surveillance can be found at [http://www.aphis.usda.gov/vs/nahss/index.htm](http://www.aphis.usda.gov/vs/nahss/index.htm).

**Measures required for introducing animals to infected animal:** Animals that have been treated for and survive infection should be considered chronic carriers. The most important means of preventing transmission is through vector control. A premunition approach may be an alternative strategy for introducing naïve animals into endemic areas for conservation purposes.

**Conditions for restoring disease-free status after an outbreak:** Disease-free status may not be realistic, particularly where wildlife is involved in the maintenance of endemnicity.

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**References:**
2. Animal Disease Fact Sheets: Bovine babesiosis. The Center for Food Security and Public Health, College of Veterinary Medicine, Iowa State University.
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