JUST AGRICULTURE
multidisciplinary e-Newsletter

An Overview of Babesiosis in Canines

Namrata, Ajeet Kumar, Sonam Bhatt and Pallav Shekhar
Department of Veterinary Medicine, Bihar Veterinary College
Bihar Animal Sciences University, Patna

ARTICLE ID: 07

Canine Babesiosis

It is a tick-borne disease caused by hemoparasites of the genus *Babesia*. It is considered the most common of all canine vector-borne diseases. Many species of *Babesia* with diverse pathogenicity are found in canines worldwide. Disease is characterized by fever, hemolytic anemia of varying degrees, thrombocytopenia, and splenomegaly. Roman Physician Victor Babes first time observed the microorganism in the ruminants' erythrocytes. The one found in cattle was named *Babesia bovis* and the other discovered in sheep was called *Babesia ovis*, the genus being named after its discoverer.

What Causes the Disease?

Canine babesiosis is caused by intraerythrocytic protozoa of the genus *Babesia*, order Piroplasmida, and phylum Apicomplexa. Morphologically, they are classified into small forms (1-3 µm) and large forms (3-5 µm). Small forms include *Babesia gibsoni*, *Babesia conradae*, and *Babesia Vulpes* while the large forms include *Babesia canis*, *Babesia vogeli*, and *Babesia rossi*. In India *B. canis* and *B. gibsoni* have been reported from almost all states of the country.

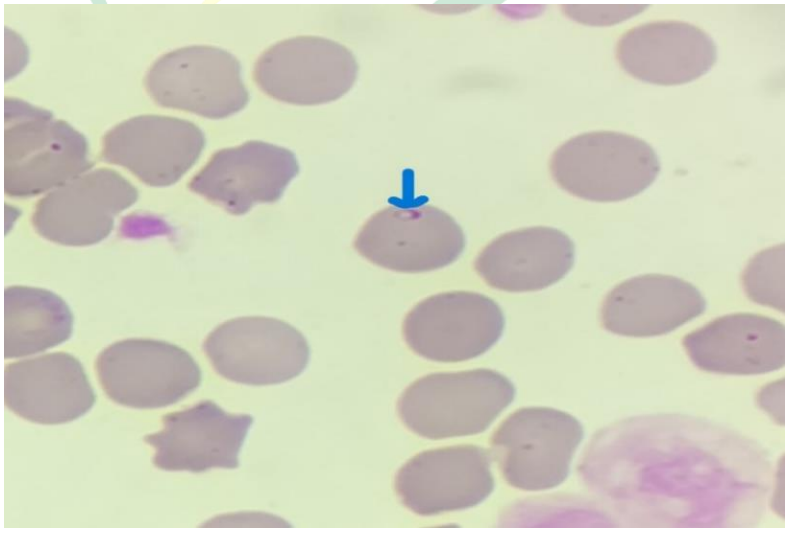

Fig.1. Microscopic view of small form of *Babesia* organism in RBC (Blue arrow)

JUST AGRICULTURE
multidisciplinary e-Newsletter

Fig. 2: Babesiosis-affected puppy showing severe icterus (yellowish discoloration)

How Does Transmission Take Place?

This disease is primarily spread by tick bite and the hard ticks are the main vectors. *Rhipicephalus sanguineus, Dermacentor spp*., and *Haemophysalis ellipticum* transmit large forms of *Babesia* of dogs whereas *B. gibsoni* is transmitted by *Haemaphysalis longicornis.*

More about the Role of Vector

Completion of the life cycle of *Babesia* spp. requires both vertebrate and invertebrate hosts (tick). They go through the sexual union and the sporogony part of their life cycle inside the tick. These stages take place within the intestinal lumen and the hemocoel of the tick. Transmission of sporozoites from the tick's salivary gland to the vertebrate host occurs through blood meal. In vertebrate hosts, the asexual replication called merogony takes place within the red blood cells, and merozoites are formed. These merozoites further leave the host RBCs and enter new RBCs, thus continuing the cycle.The ticks are involved in both transovarial and transtadial transmissions and are supposed to stay infective for several generations. For successful transmission of sporozoites into the host, the tick must bite and feed on the dog's blood for two to three days. So, the ticks being primarily responsible for the babesia organism transmission the disease occurrence is related to their seasonal activity. Thus, the clinical cases are seen usually in spring and autumn.

What does the disease look like?

Common clinical signs seen in canine babesiosis are lethargy, weakness, anorexia, pale mucous membranes, dull appearance, fever, enlarged lymph nodes and spleen, anemia, thrombocytopenia, jaundice (Fig.2), and hemoglobinuria or bilirubinuria.

JUST AGRICULTURE
multidisciplinary e-Newsletter

How Does the Disease Progress?

Dogs of all ages are affected with Babesia spp., especially young puppies. The incubation peiod i.e. time period between inoculation of sporozoites to manifestation of symptoms varies from 10-21 days and 14-28 days for B. canis and B. gibsoni respectively. The factors such as species and strain of Babesia organisms, and the age and immunity of the animal determine the severity of the disease.

The course of canine babesiosis can be uncomplicated or complicated. An uncomplicated includes hemolytic anemia and its concomitant clinical signs. On the other hand, cardiovascular, respiratory, hepatic, renal, gastrointestinal, neurologic, and coagulopathic dysfunctions are the clinical manifestations not directly related to hemolytic anemia and are referred to as complicated babesiosis.

Hemolytic anemia and thrombocytopenia are the major complications of babesiosis. Factors like the reduced life span of RBCs, RBC breakdown due to increased osmotic fragility, parasitic antigen on RBCs causing their immune-mediated destruction, erythrocytic damage due to oxidative stress followed by their phagocytosis, parasite-induced membrane impairment, etc. combine to cause both extra and intravascular hemolysis.

Elevated hepatic enzymes and icterus are commonly seen in babesiosis. Associated hemolytic anemia contributes to hyperbilirubinemia along with the Centrilobular hepatitis which is most likely the effect of hypoxic liver damage.Renal hypoxia and hemoglobinuria have a role in the development of renal tubular damage leading to acute renal failure. Pancreatitis is associated with lowered blood flow and oxygen supply due to hypotensive shock, anemia, and hemoconcentration.

Postulated pathogenesis behind Cerebral or cerebellar signs are endothelial cell damage and microvascular necrosis with perivascular hemorrhage and edema.

Acute Respiratory Distress Syndrome in the form of dyspnoea, tachypnea, moist cough, serosanguinous frothy respiratory secretions, and hypoxemia occurs as a result of the production of inflammatory cytokines and reactive oxygen species.

The accompanying Hemato-Biochemical changes

Anemia and thrombocytopenia are the primary hematological changes. Initially, after the first few days of infection a mild, normocytic, normochromic anemia is generally noted which then becomes macrocytic, hypochromic, and regenerative with the progression of the

JUST AGRICULTURE
multidisciplinary e-Newsletter

disease. Leukocyte abnormalities are inconsistent and may include leukocytosis, neutropenia, neutrophilia, lymphocytosis, and eosinophilia. An increase in the level of liver enzymes namely alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase, and serum bilirubin is proportional to the degree and speed of the anemia and associated hepatopathy. Total serum protein and albumin levels are lowered. Blood urea level elevates disproportionately to creatinine due to gastrointestinal hemorrhage and protein catabolism resulting from febrile inflammation. A proportionate increase in serum urea and creatinine levels occurs in the condition of decreased renal blood supply resulting from hypovolemia.

What are the recommended treatment protocols for the ill dogs?

Drug name	**Recommended dose**	**Susceptible Babesia Species**
Imidocarb Dipropionate	5-7mg/kg SC or IM once and repeat in 14 days	*Babesia canis* *Babesia vogeli* *Babesia rossi*
Diminazine aceturate	3.5mg/kg IM once	*Babesia gibsoni* *Babesia rossi*
Atovaquone and Azithromycin combination	13.3mg/kg PO q8h (atovaquone) and 10mg/kg PO q24h (azithromycin), together for 10 days	*Babesia gibsoni* *Babesia vulpes* *Babesia conradae*
Clindamycin, Doxycycline and Metronidazole combination	Clindamycin @ 25mg/kg PO q 12h, Metronidazole @ 15mg/kg PO q 12h and Doxycycline @ 5mg/kg PO q 12h for 10 days	*Babesia gibsoni*

In what ways can the disease be diagnosed?

Microscopic evaluation of blood smears is suitable for acute infections with high to moderate parasitemia. *Babesia canis* are large (3-5 µm) in size and are found as singular or paired piroplasms and may appear oval or pear-shaped i.e., pointed at one end and round at the other. The small form (1-3 µm) of *Babesia* organisms may be found singly or multiply in the form of signet rings within infected RBCs (Fig.1).

Molecular diagnostic method, PCR targets parasitic DNA and has proven to be the most sensitive and specific test available for diagnosis of peracute, acute, and chronic babesial

JUST AGRICULTURE
multidisciplinary e-Newsletter

infections. It has the advantage of detecting infection in very young and immunocompromised dogs.

The Possible Preventive Strategies

Avoiding tick infestation is a key to prevent babesiosis in dogs. Additionally, prevention of infected blood contact by any means e.g. during dog fights or blood donation must be taken care of.

Tick Control

It is a must for pet parents to keep an eye on any tick infestation on their pet's body, especially in long-coat breeds. Acaricidal drugs are available in the form of collars or oral tablets or, topical spot-on, shampoo and powder or injectable form. The most commonly used acaricides are Fipronil, sarolaner, imidacloprid, pyrethroids, methoprene, furalaner, selamectin, ivermectin, doramectin etc.

Vaccine availability

Two anti-babesial vaccines, one containing culture-derived soluble parasite antigens from European homologous *B. canis* and the other containing culture-derived soluble parasite antigens of heterologous European *B. canis* and South African *B. canis subsp. Rossi* are licensed for use in Europe. The suitable age for vaccinating with these vaccines is five months onwards and requires annual revaccination. It is important to mention here that these vaccines do not provide cross-protection against other *Babesia* species.

Conclusion

The risk of canine babesiosis is increasing with many causative *Babesia* species and several tick vectors spreading the disease worldwide. The disease usually synchronizes with the seasonal tick's activity with clinical cases seen in spring and autumn. The type of Babesia species or subspecies determines the severity of canine babesiosis i.e., peracute, acute or chronic. Making an accurate diagnosis of the infecting *Babesia* sp. and then providing a specific treatment increases the chances of disease elimination. Ticks are a serious stakeholder in canine babesiosis, so avoiding tick infestation is crucial to the prevention of disease