

Therapeutic management of hepatozoonosis in a domestic dog in Nagaland, India- A case report

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Abstract

An adult 3-year-old male non-descriptive dog, weighing 35.8 kg was presented at the Veterinary Clinical Complex, College of Veterinary Sciences and Animal Husbandry, Jalukie, Nagaland, with a history of weight loss and decreased appetite. The detailed clinical examination revealed tick infestation, elevated body temperature, swollen mandibular and popliteal nodes, ocular discharge and excessive salivation with a slightly pale mucous membrane. The dog was having the history of regular vaccination and deworming. Haematological findings indicated a slight reduction in the count of red blood cells with lymphocytosis. Microscopically, a blood smear examination revealed the presence of *Hepatozoon* gamonts in neutrophils. The dog was treated with a combination of imidocarb dipropionate and oral doxycycline, along with other supportive supplements and fluid therapy. From this study, it can be concluded that combination therapy including imidocarb dipropionate and doxycycline along with supportive treatment like fluids, haematinic and liver tonics may be considered effective in relieving the clinical symptoms and clearing the blood of *H. canis* gametocytes.

Keywords: Doxycycline, Gamonts, Hepatozoon, Imidocarb dipropionate

Highlights

- The presence of the vector population in the study area correlates to the prevalence of canine hepatozoonosis.
- Reduction in the count of red blood cells with lymphocytosis is the major haematological change in canine hepatozoonosis.
- Imidocarb dipropionate and oral doxycycline combination could be recommended for the treatment of canine hepatozoonosis.

Hepatozoon canis, also known as old world hepatozoonosis, is a hemoprotozoan parasite belonging to the phylum *Apicomplexa*, family *Hepatozoidae* (*Hemogregarinidae*) of suborder *Adeleorina*. It is a tick-borne disease of domestic canids, transmitted by the brown dog tick, *Rhipicephalus sanguineus*, which is considered as the main vector and the route of infection is by ingestion of an infected tick (Dantas-Torres and Otranto, 2015). It was first detected in India and named as *Leukocytozoon canis* (James, 1905). The dog becomes infected with *Hepatozoon canis* by ingestion of ticks or parts of the tick body containing oocysts (Gevrey, 1993). Further, after the encystment of sporozoites from the disruption of the oocyst wall, the sporozoite spreads in internal organs probably by two routes: haematogenous, via the gut wall and transported

by blood or by ingestion route from phagocytising cells and transported by the lymph or the blood (Ivanov and Tsachev, 2008). The sporozoites then penetrates the endothelial cells and cells of the phagocytic system of these organs and transforms into the schizonts stage, later two types of schizonts are formed: macroschizonts, with 2-4 macromerozoites and microschizonts with 20-30 micromerozoites. The micromerozoites infiltrate into the neutrophils and differentiate into an oval shape and large granulated nucleus known as gamonts. The infection in dogs may vary with the load of parasites in blood circulation, in low levels of parasitemia; it could be asymptomatic in dogs, and in subclinical infection cases, it may remain unnoticed unless other concurrent infection is present (Otranto *et al.*, 2011). Whereas, in high parasitemia, it is manifested as a severe life-

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threatening disease with fever, lethargy, anaemia and cachexia in dogs (Baneth *et al.*, 1995; Karagenc *et al.*, 2006). For the diagnosis of *H. canis* infection in dogs, history of tick infestation, vector density during monsoon season and in conjunction with clinical examination along with laboratory testing should be considered. The most common finding on haematological examination in dogs infected with *H. canis* is anaemia. *Hepatozoon canis* gamonts are usually observed in neutrophils and macrophages (Rubini *et al.*, 2008).

A 3-year-old male non-descriptive dog, weighing 35.8 kg, was presented at the Veterinary Clinical Complex, College of Veterinary Sciences and Animal Husbandry, Jalukie, Nagaland, with a complaint of weight reduction of 5 kgs in a week time, decreased appetite and a history of tick infestation. The dog was having the history of regular vaccination and deworming.

The dog showed pyrexia (105°F), with normal respiratory and heart rate. The visible mucus membrane was slightly pale, swollen mandibular and popliteal lymph nodes with profuse ocular discharge and excessive salivation. The peripheral blood samples were collected for parasitological examination, and whole blood (2 mL) was collected in an EDTA vial from the cephalic vein for haematological examination. Peripheral blood smears were prepared, fixed with methanol and stained with Giemsa stain, then the blood smears were screened for the presence of haemoprotozoa under microscope examination.

Parasitological examinations using peripheral blood smears revealed the presence of *Hepatozoon* gamonts (Fig. 1 and Fig. 2). Tick morphology study was carried out under the 45x of the stereo zoom microscope and showed typical characteristics of *Rhipicephalus sanguineus* which were similar to the characteristic features described by Wu *et al.* (2024) as the presence of sub hexagonal basis capitulum, scutum, bifid coxa in the 1st pair, presence of genital pore, posteriorly presence of festoons, adanal shield, anus and comma-shaped spiracular plate (Fig. 3 and Fig. 4). Haematological examination on day 1 revealed a slight reduction in total erythrocyte count with an increased number of lymphocyte count, the other parameters falling under the normal range (Table 1), however on day 21 there was a slight increase in total erythrocyte count, haemoglobin count, and most of the other parameters falling in normal ranges (Table 1).

On confirmation of the presence of the *hepatozoon* infection, the treatment was initiated with imidocarb dipropionate injection @ 6.6 mg/kg, subcutaneously, along with a combination of oral doxycycline @ 10 mg/kg, PO, OD for 21 days. Imidocarb dipropionate and doxycycline were reported to be the most effective

Table 1. Haematological changes on day 1 and day 21 (pre and post therapy)

Blood parameters	Values		Reference standard
	Day 1	Day 21	
Hb (g %)	14.6	16	12-18
TEC (million/cmm)	5.49	6.35	5.5-8.5
TLC (thousand/cmm)	12.56	16	6-17
Neutrophils (%)	57.8	53.9	50-80
Lymphocyte (%)	41	45	8-38
PCV (%)	40.4	46	35-55

medications for treating *H. canis* infection (Kwon *et al.*, 2017). For the management of ticks, spot-on (fipronil 9.8% W/V + (S)-methoprene 8.8% W/V) was applied topically. Supportive treatment was done with meloxicam @ 0.5 mg/kg, fluid therapy with Haemaccel, supplemented by Iroshine™ syrup @ 10 mL PO, bid for 14 days. After 14 days, imidocarb dipropionate inj. @ 6.6 mg/kg, subcutaneously was to be repeated. For the treatment of canine hepatozoonosis, the first line of treatment is doxycycline (Kumar *et al.*, 2012). Baneth (2011), however, reported that the use of imidocarb dipropionate alone failed to eliminate *H. canis* infection. For evaluating the haematology study, haematological parameters viz. Hb, TEC, TLC, neutrophils, lymphocytes, and PCV count were taken into consideration, and a slight decrease in red blood cells was observed, with normal leukocyte count and an increase in lymphocyte count. Anaemia (normocytic normochromic) is the most common primary haematological sign observed in most cases (Baneth, 2006). Anaemia in hepatozoonosis may be due to massive tick infestation or bone marrow suppression (Wenyon, 1911). Baneth (2011) found out that the leukocyte count is usually normal when parasitemia is low and is elevated in dogs with high parasitemia. After 3 weeks of therapy, a peripheral blood smear examination revealed a negative result for *H. canis*, and the haematological pictures also projected an increase in the red blood cell count as well as the haemoglobin count, with most of the other parameters within the normal range. The dog showed marked improvement in condition with normal appetite and an increase in body weight, indicating that the dog health status had improved. To treat the possible co-infections transmitted by the tick vector, often imidocarb dipropionate is combined with doxycycline at daily oral doses of 10 mg/kg (Thakur *et al.*, 2018; Mondal *et al.*, 2021). The percentage of healed dogs with low *Hepatozoon canis* parasitemia is high and mostly depends on other accompanying diseases. The prognosis in animals with high parasitemia rates is guarded (Ivanov and Tsachev, 2008). In this study, parenteral administration of imidocarb dipropionate in combination with oral

Therapeutic management of *Hepatozoon canis* infection

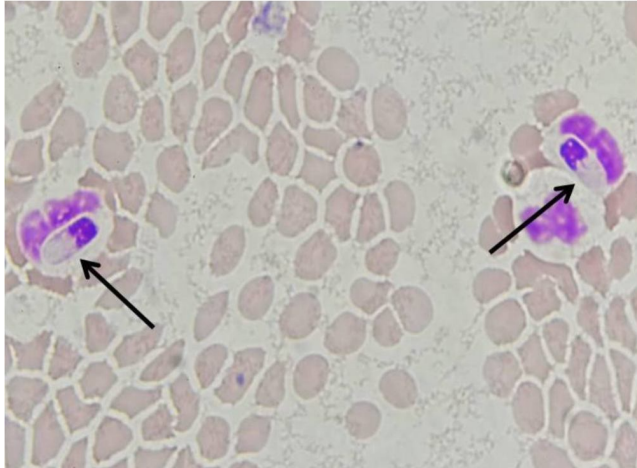


Fig. 1. *Hepatozoon canis* gamont in neutrophils (Giemsa stain)

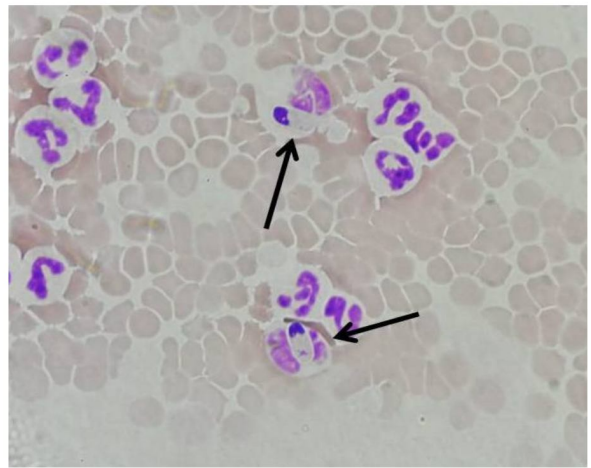
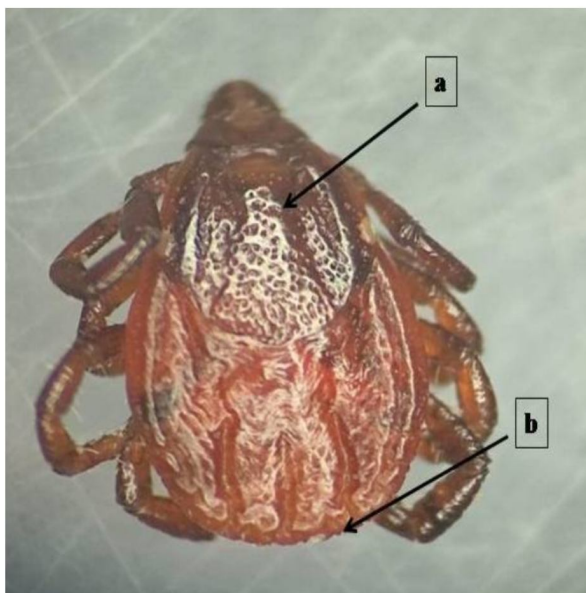
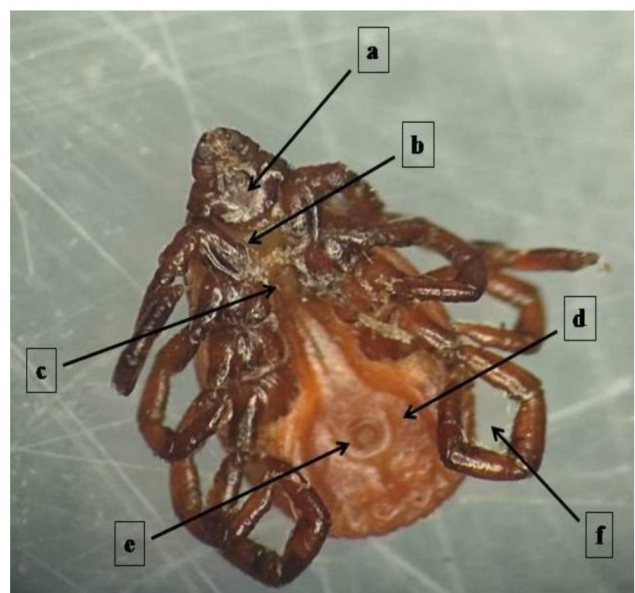


Fig. 2. *Hepatozoon canis* gamont in neutrophils (Giemsa stain)



[a: Scutum, b: Festoon]
Fig. 3. *Rhipicephalus sanguineus* (dorsal)



[a: Hexagonal basis capitulum, b: Bifid coxa 1, c: Genital pore, d: Adanal shield, e: Anus, f: Comma shaped spiracular plate]
Fig. 4. *Rhipicephalus sanguineus* (ventral)

doxycycline therapy resulted in the successful therapeutic management of *H. canis* infection.

Hepatozoonosis is a growing concern for domestic dogs. The increase in hepatozoonosis cases is due to an increase in the prevalence rate of the vector tick population, i.e., *Rhipicephalus sanguineus* in the study area. The warmer climatic condition of Jalukie is favourable for the fecundity of *R. sanguineus* and the increase in population density of domestic dogs, co-infection with other tick-borne hemoparasitic diseases, viz., canine babesiosis and ehrlichiosis. Improper grooming of the dogs results in more ingestion of ticks by domestic dogs, and urbanization is one of the factors contributing to the increase in hepatozoonosis cases amongst domestic dogs in our study area. Understanding the external signs of the disease, like fever, progressive emaciation, and anaemia, may result in the earlier detection and control of the disease, but in chronic conditions, it may become fatal for the animals. But early detection of the hemoprotozoan parasite, with combination therapy including imidocarb dipropionate and doxycycline along with supportive treatment like

fluids and liver tonics, may be considered effective in relieving the clinical symptoms and clearing the blood of *H. canis* gametocytes.

Conflict of interest: The authors declare that they have no competing interests.

Author's contribution: KK, NK, SO, GYJ: Carried out all the clinical examinations, observations and treatment aspects; TC, NBD: Supervised the case study; LT, LS, RB: Carried out all the diagnosis work for the case study; KK, GD, GYJ: Writing work of this manuscript.

Data availability statement: The data mentioned in the article will be available with the corresponding author.

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