

Therapeutic Management of Canine Dirofilariasis in Nagaland, India

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Dirofilariasis is one of the most clinically important diseases in dogs. It is also called as heart-worm disease, which is a non-contagious parasitic disease caused by filarial or small thread-like worms, *Dirofilaria immitis*, and *D. repens* of the family *Onchocercidae* (Nelson *et al.*, 2014; Adebayo *et al.*, 2022). It is an arthropod-borne disease. The mosquitoes belonging to the genera *Culex*, *Aedes*, *Anopheles*, and *Mansonia* are principally responsible for the transmission of this disease (Borthakur *et al.*, 2016). Transmission of the parasite occurs when a potential vector bites dogs during a blood meal. It takes about 6-7 months for the third-stage larvae (L3) to become adult parasites after entering the blood vessels of the hosts (Kuotsu *et al.*, 2022). After maturation, the adult worms reproduce and produce microfilariae (pre-L1), which are released in the host blood vessels and taken up by a feeding mosquito (Thilakarathne *et al.*, 2023), and completed the lifecycle of the parasite.

The maturation of the female worms in the pulmonary arteries of the primary host causes inflammatory reactions in the pulmonary microvasculature and larger arteries of the hosts (Adebayo *et al.*, 2020). Canine population living in a heavily populated mosquito area are at potential risk. The clinical manifestation of heartworm disease in dogs is usually chronic. Most infected dogs do not show any sign of the disease for months or years, depending on the worm burden, individual reactivity, and level of exercise (Niwetpathomwat *et al.*, 2006). However, the diagnosis of microfilaria includes multiple approaches.

The diagnostic tests available for the detection of dirofilariasis are based on different techniques, such as parasitological, serological and molecular techniques, which may vary in sensitivity and specificity (Soares *et al.*, 2022). Heartworm treatment is complicated and involves risks, as the dying parasites can cause thromboembolism that may have severe implications to the animal. Due to this reason, a systematic protocol is recommended for the dogs from the day of diagnosis until the end of treatment. In some cases, stabilization of the dog's health condition before treatment is important, although surgical removal of the worms is the best option. The treatment protocol

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as proposed by the American Heartworm Society (AHS) involves at least 5 months of exercise restriction after the last adulticide drug administration. Currently, there are many veterinary products in the market approved for the treatment and prevention of the disease. They contain a single drug class, *i.e.*, the macrocyclic lactones, which, when administered according to label instructions, are proven to be very safe and effective at preventing heartworm disease (Diakou and Prichard, 2021). This communication describes the detailed clinical, investigative, confirmatory and therapeutic management of canine dirofilariasis in a dog in Nagaland.

CLINICAL HISTORY AND OBSERVATIONS

A 3-year-old male crossbred dog was presented at the Veterinary Clinical Complex, College of Veterinary Science

and Animal Husbandry, Jalukie, Nagaland, with a history of anorexia, progressive weight loss, recurrent violent coughing, hemoptysis, and dyspnoea, which was previously treated for canine ehrlichiosis about a month ago. The deworming and vaccination of the dog were done on time and on a regular basis.

On clinical examination, the dog was found to have a slightly elevated rectal temperature (102.7 °F), an increased respiratory rate (42/min) and an increased heart rate (130 bpm). The visible mucus membrane and palpable lymph nodes were normal. The animal appeared to be slightly nervous and anxious, with frequent and violent coughing. Blood-tinged foamy sputum was observed during the clinical examination (Fig. 1 & 2). When the animal was made to walk for a short round, severe panting as well as exercise intolerance was observed. The peripheral blood samples were collected for haematological examinations and a wet mount test was performed. For further biochemical and parasitological examinations, samples were sent to

the respective departments. The SNAP 4Dx Plus test for the detection of antibodies for specific disease was used following the manufacturer's instructions. Parasitological examinations such as the wet mount test and modified Knot's technique were found to be positive for microfilaria (Fig. 3 & 4).

Anticoagulated whole blood was found positive for *Dirofilaria immitis* using the SNAP 4Dx Plus test kit (Fig. 5 & 6). The SNAP 4Dx Plus test IDEXX, an *in-vitro* test for the detection of antibodies to *Ehrlichia canis*, *Ehrlichia ewingii*, *Anaplasma phagocytophilum*, *Borrelia burgdorferi*, *Anaplasma platys*, and *Dirofilaria immitis* in canine serum, plasma, or anticoagulated whole blood was carried out and the result revealed the presence of circulating antibodies against *Dirofilaria* spp.

The haematological examination revealed lymphocytic leukocytosis along with eosinophilia. The blood biochemical profile revealed a significant rise in AST (Table 1).



Fig. 1 & 2: Blood-tinged foamy sputum. (Hemoptysis)

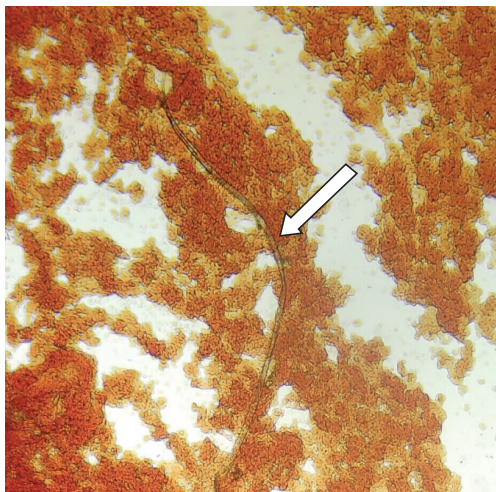


Fig.3: Microfilaria detected by wet mount test

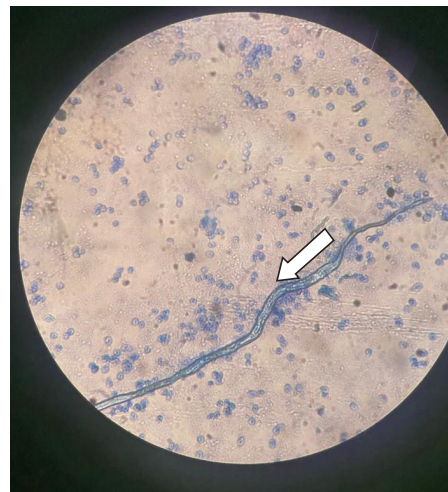


Fig.4: Microfilaria detected by Modified Knot's technique

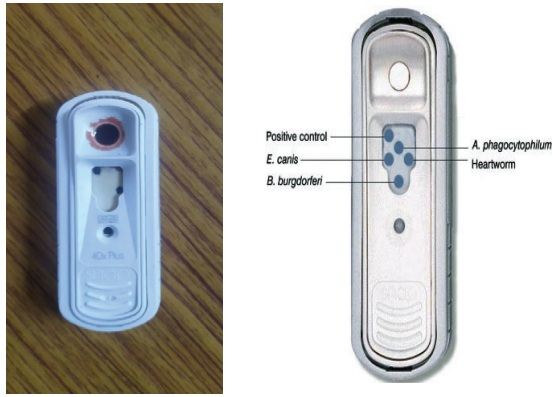


Fig. 5 & 6: SNAP 4DX plus test

Table 1: Haematological and Biochemical parameters

Blood parameters	Values	Reference standard
Hb (g %)	16.6	12-18
TEC ($\times 10^6/\mu\text{L}$)	7.13	5-7.9
TLC ($\times 10^3/\mu\text{L}$)	31.34	5-14.1
Neutrophils (%)	62.9	58-85
Lymphocyte (%)	36.9	8-21
Eosinophil (%)	10	0-9
PCV (%)	44.7	35-57
MCV (fL)	76.23	66-77
MCH (pg)	24.0	21-26.2
MCHC (g/dL)	37.25	32-36.3
Platelet count ($\times 10^5/\mu\text{L}$)	3.59	2.11-6.21
Serum creatinine (mg/dL)	1.11	0.5-1.7
BUN (mg/dL)	31.44	8-28
AST (IU/L)	120.38	10-109

TREATMENT AND DISCUSSION

On confirmation of Dirofilariosis in the dog, immediate treatment with Ivermectin (Neomecb) at 0.2 mg/kg body weight s/c once weekly for 4 weeks and oral Doxycycline (Doxytabc) at 10 mg/kg for 28 days once daily along with supportive therapy such as fluid therapy I/V twice a day and respiratory expectorant (syrup Ascoril LS) was initiated. The dog showed significant recovery with diminished clinical symptoms after 3rd week of treatment. Haematological and biochemical tests showed marked improvement. Parasitological examinations further confirmed the absence of microfilaria in circulation post 3 weeks of treatment. Different literature reported that treatment with Ivermectin combined with oral Doxycycline along with supportive therapy resulted in proper recovery of the animal with the absence of circulating microfilaria (Bazzocchi *et al.*, 2008; Malatesh *et al.*, 2020; Koutsu *et al.*, 2022). However, in tropical conditions melarsomine (2.5 mg/kg) is recommended as the first-line heartworm adulticide (Dantas-Torres *et al.*, 2023).

In conclusion, canine dirofilariosis is a growing concern for pet owners, world over with varying clinical manifestations, and in chronic case it may become severely fatal for the animals. Early detection and vigorous treatment as per the guidelines for lengthy lifecycle of the parasite results in faster recovery without recurrence. The detection of circulating microfilaria shall be correlated with the haematological and blood biochemical profiles.

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