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## Clinical and haematological study in ehrlichia infected dogs

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#### Abstract

*Ehrlichia canis* is a potentially fatal tick born disease in dogs characterised by high body temperature, drop in peripheral blood count due to bone marrow suppression, ophthalmic lesions, splenomegaly, epistaxis, and lymphadenopathy. Diagnosis of ehrlichiosis is mainly based on haematological signs, demonstration of morulae in peripheral blood smear or tissue aspirates, indirect immunofluorescence antibody test, enzyme-linked immunosorbent assay (ELISA) etc. In the present study, total 120 adult dogs irrespective of age, sex, body weight and breed with the history of tick infestation and showing clinical signs suggestive of ehrlichiosis were screened for detection of ehrlichia by blood smear examination and Snap 4Dx test. Out of 120 dogs screened 16 dogs were found positive for ehrlichia based on Snap 4Dx test. Of which 12 were selected for the study. The ehrlichia infected dogs showed pyrexia, depression, lymphadenopathy, splenomegaly, anorexia, inappetence, corneal opacity, epistaxis, lameness and pulmonary signs. Clinico-physiological parameters showed rise in rectal temperature and respiratory rate in ehrlichia infected dogs than normal physiological reference range. Pale mucus membrane was predominantly found in ehrlichia infected dogs. The haematological study revealed anaemia, thrombocytopenia, neutropenia, lymphocytosis in ehrlichia infected dogs.

**Keywords:** *Ehrlichia canis*, dogs, haematology, clinico-physiology, diagnosis

#### Introduction

*Ehrlichia canis*, is a Gram-negative intracellular organism causes potentially fatal canine monocytic ehrlichiosis (CME). It is mainly transmitted by brown tick *Rhipicephalus sanguineus*<sup>[1]</sup>. The disease can also be transmitted through blood transfusion from an infected dog<sup>[2]</sup>.

The acute phase of infection occurred after several weeks of tick's infestation and can be last up to a month. The clinical signs are mainly characterized by high body temperature, drop in peripheral blood count due to bone marrow suppression, ophthalmic lesions, splenomegaly, epistaxis, and lymphadenopathy<sup>[3, 4]</sup>. After inadequate treatment for one to four weeks or no medicinal treatment, dogs may recover from the acute disease and may enter in subclinical form of disease where the animal may appear normal or show slight anaemia. There are no outward clinical manifestations of subacute or subclinical phase. Dogs in this stage may remain the carriers of the rickettsia for months or years<sup>[5]</sup>. In the chronic stage, the common clinical signs exhibited by dogs such as weakness, depression, anorexia, bleeding, neurological signs, inflammation of the eye, chronic weight loss, oedema in hind legs and emaciation<sup>[6]</sup>. In addition to that pale gums, non-regenerative anaemia, leucopenia, thrombocytopenia can also be observed<sup>[7, 8]</sup>.

Diagnosis of ehrlichiosis is mainly based on haematological signs, demonstration of morulae in peripheral blood smear or tissue aspirates such as spleen, lung and lymph node<sup>[9, 10]</sup>. The indirect immunofluorescence antibody test is considered as the gold standard for diagnosis of canine monocytic ehrlichiosis. However, this test performed in selected laboratories in India and it required expensive instruments and expertise. The enzyme-linked immunosorbent assay (ELISA) is a semi-quantitative test. ELISA used small quantities of antigen to detect specific antibodies. The commercially available dot- ELISA kit is also used to detect *Ehrlichia canis* immunoglobulin. Among them, Snap 4 Dx is a sensitive kit to detect the IgG antibodies<sup>[11, 12]</sup>. In the present investigation detection of ehrlichia was carried out by blood smear examination and Snap 4Dx test and clinical and haematological alterations associated with ehrlichia infected dogs were studied.

## Materials and methods

The present study was undertaken in the Department of Veterinary Clinical Medicine, Ethics and Jurisprudence and Teaching Veterinary Clinical Complex, Post Graduate Institute of Veterinary and Animal Sciences, Akola (MS).

### Selection of animals

Total 120 adult dogs irrespective of age, sex, body weight and breed with the history of tick infestation and showing clinical signs suggestive of ehrlichiosis were screened for detection of ehrlichia by blood smear examination and Snap 4Dx test. Out of 120 dogs screened 16 dogs were found positive for ehrlichia based on Snap 4Dx test. Of which 12 positive dogs were selected for the present study.

### Diagnosis of ehrlichiosis

#### a) Blood smear examination

Blood smear was prepared from each case on clean glass slide and stained with Giemsa stain as per standard methods described by Brar *et al.*, (2014). The stained blood smears were examined under 100X oil immersion fields (OIFs). The results were interpreted as ehrlichiosis positive when morulae of canine ehrlichiosis or initial bodies were found in at least one cell of monocytes or lymphocytes [13].

#### b) Detection by using diagnostic test kit

Snap 4Dx Canine ehrlichia Antibody Test Kit, manufactured by IDEXX, USA was used to determine canine serum IgG antibody to canine ehrlichiosis.

### Clinico-physiological parameters

The clinico-physiological parameters such as Rectal temperature ( $^{\circ}$ F), Respiration rate (per/ min), Heart rate (per/ min) and colour of the visible mucous membrane were recorded in all selected dogs with ehrlichiosis.

### Haematological parameters

The blood sample were collected from a cephalic vein in a sterile vial containing EDTA for determination of haematological parameters such as Haemoglobin (Hb) (gm/dl), Packed cell volume (PCV) (%), Total leukocyte count (TLC) ( $\times 10^3$ /cu.mm), Total erythrocyte count (TEC) ( $\times 10^6$ /cu.mm), Differential leukocyte count. (DLC) (%) and Platelets count ( $\times 10^3$ /cu.mm). all these haematological parameters were estimated by using ABX VETPACK automatic haematological analyser.

### Results and discussions

In the present study, the ehrlichia infected dogs were diagnosed by using blood smear examination in which, morulae were detected in the monocyte and neutrophils and later on, it was confirmed by using Snap 4Dx test. It is an ELISA based test. It based on the principal of antigen-antibody where it determines IgG antibodies to Canine ehrlichiosis. Out of 16 ehrlichia positive dogs only 1 dog showed morula in monocyte (6.25%) on blood smear examination, whereas all 16 (100%) dogs were positive by Snap 4Dx test.

### Clinical signs

In the present investigation, the dogs positive for ehrlichiosis exhibited various clinical signs are presented in Table 1. Among the 12 positive cases of dogs with ehrlichiosis, the presence of tick infestation was recorded in all dogs (100%).

Out of 12 infected dogs with ehrlichia, 91.66% (11) dogs had pyrexia, 83.33% (10) dogs showed depression. Lymphadenopathy was observed in 9 dogs (75%). These findings are in agreement with the reports of several workers who also reported enlarged lymph node in ehrlichiosis infected dogs [14, 15, 16, 12, 1]. The reticuloendothelial system is the site for the replication of canine ehrlichiosis, where they cause the proliferation of the lymphocytes which leads to aggregation of reactive histocyte in lymph node resulted into the development of lymphadenopathy [10, 17, 12].

In ehrlichia infected dogs, the splenomegaly was recorded in 9 dogs (75%). Similar findings are also recorded by many researchers in dogs infected with ehrlichiosis [4, 18, 16]. The splenomegaly in ehrlichiosis might be attributed to the involvement of inflammatory mediators and other splenic substances in the development of the diseases [19]. In addition to that some authors attributed the hyperplastic activity of both B and T lymphocyte [20], may cause enlargement of lymph node due to stimulation response by ehrlichial antigen. However, other scientific studies reported that the splenomegaly in the acute phase of ehrlichiosis could be due to the diffused proliferation of lymphocytes and plasma cells in the white and red blood pulp [21].

In the present study, the clinical signs of bleeding tendency such as epistaxis was recorded in 2 dogs (16.66%). These findings are in accordance with the earlier reports [14, 22, 16, 12]. The epistaxis in dogs infected with ehrlichiosis is associated with thrombocytopenia, mild vasculitis and thrombocytopeny [23, 15, 21]. The anorexia and inappetence were observed in 58.33% cases (7 dogs) and 41.66% cases (5 dogs), respectively in ehrlichiosis during the present study.

Lameness was observed in 8.33% cases (1 dog), which might be attributed to oedema of hind limb and arthritis. These findings are in accordance with the earlier findings reported by several workers [7, 14, 22, 12]. The dogs infected with ehrlichiosis showed the ocular signs such as corneal discharge in 33.33% cases (4 dogs) and corneal opacity in 25% cases (3 dogs). Similar findings were also recorded by many researchers in ehrlichia infected dogs [4, 24, 8].

The ophthalmic abnormalities such as ocular discharge and corneal opacity in canine ehrlichiosis might be attributed due to cuffing of blood vessels in sclera and association with plasma cell cuffing with the veins of ganglion cell [21]. In this study, the pulmonary signs like sneezing, nasal discharge and respiratory distress were observed in 8.33% (1 dog) cases of canine ehrlichiosis [8].

### Clinico-physiological parameters

The mean rectal temperature ( $^{\circ}$ F), heart rate (per minute) and respiratory rate (per minute) in ehrlichia infected dogs are presented in Table 2.

In ehrlichia infected dogs the mean rectal temperature was  $104.33 \pm 0.47$ , indicated rise in rectal temperature as compared to normal reference range (99.5–101.5 $^{\circ}$ F) [25]. Similar findings of increase in rectal temperature in dogs with ehrlichiosis were also recorded by many workers [4, 26, 14, 12, 1]. In the dogs infected with ehrlichiosis, the mean heart rate was  $113.25 \pm 4.24$ , which was within normal reference range (70–120 per minute) as documented by the author [25]. Some workers recorded increase in heart rate in ehrlichiosis [22]. The dogs infected with ehrlichiosis, the mean respiratory rate was slightly higher ( $30.67 \pm 1.80$ ). The similar clinical finding of an increase in the respiratory rate in dogs with ehrlichiosis was also recorded by some workers [22].

In the present study, total 8 dogs (66.66%) showed pale mucous membrane, indicated severe anaemia, whereas 3 dogs (25%) had congested mucous membrane and 1 dog (8.33%) had slightly congested mucous membrane [4, 12].

### Haematological parameters

The mean Hb (gm/dl), PCV (%), TEC ( $\times 10^6/\text{cu. mm}$ ), TLC ( $\times 10^3/\text{cu. mm}$ ) and DLC (%) in ehrlichia infected dogs are presented in Table 3.

The mean Hb concentration (gm/dl) was  $8.78 \pm 0.50$  in ehrlichiosis infected dogs, indicated low Hb concentration in dogs with ehrlichiosis as compared to normal reference range (10-16 gm/dl) [27]. These observation of the present study are in accordance with the observations of several researchers who also recorded low haemoglobin in canine ehrlichiosis [3, 4, 26, 7, 18, 16].

In the ehrlichia infected dogs, mean PCV (%) was  $26.17 \pm 1.82$ . These findings indicated that the PCV (%) was lower in dogs with ehrlichiosis than the normal (30-50%) reference range [27]. Similar observations were also reported by many workers [4, 26, 7, 14, 16].

In the present study the mean TEC in ehrlichia infected dogs was  $4.10 \pm 0.35$ , demonstrated decline in TEC in dogs with ehrlichiosis as compared to normal reference range (5 to  $8 \times 10^6/\text{ul}$ ) as documented by author [27]. The decreased TEC was also reported by several researchers [7, 14, 22, 12].

In the present investigation Hb, PCV and TEC were found low in dogs with ehrlichiosis resulted in anaemia. The alteration in hemogram in canine ehrlichiosis could be attributed to the loss of blood due to epistaxis, petechial, ecchymotic haemorrhages and hematemesis etc. as seen in dogs with ehrlichiosis. These haemorrhages seen in ehrlichiosis might be as a result of thrombocytopenia and disturbance in the haematopoietic system and bone marrow hypoplasia as a result of progressive replication of canine ehrlichiosis in the bone marrow, which leads to suppression in erythroid, myeloid and megakaryocytic cells resulted in decreased RBC production [28, 16, 12]. It is also opined that the low hemogram in ehrlichiosis might be probably due to immune mediated destruction of red blood cells [6, 29]. Anaemia is a common clinical sign seen in canine ehrlichiosis. Many previous studies reported normocytic, normochromic and non-regenerative anaemia in canine

ehrlichiosis [30].

The mean TLC was  $6.87 \pm 0.98$ , indicated a slight decrease in TLC in dogs with ehrlichiosis. The decreased TLC in dog with ehrlichiosis in present study are in accordance with the reports of the previous studies [21, 4, 7, 15]. The leukopenia observed in the present study might be due to decrease in lymphocytes as a result of myelosuppression in ehrlichiosis [2]. However, some researchers reported leucocytosis in dogs with ehrlichiosis [22].

In the present study, the mean platelet count was low ( $115.58 \pm 18.62$ ) in the dog with ehrlichiosis as compared to normal reference range documented by author [27], indicated thrombocytopenia. These findings are in accordance with the findings of earlier research works who also recorded low platelet count in ehrlichiosis [4, 26, 22, 16]. The thrombocytopenia in ehrlichiosis might be due to increased splenic sequestration of platelets, decreased half-life of circulatory platelets, suppressed production, platelets dysfunction and increased platelets destruction by anti-platelets antibodies [31, 28, 32, 19].

The mean neutrophils (%), lymphocytes (%), monocytes (%) and eosinophils (%) were  $55.75 \pm 2.15$ ,  $36.25 \pm 2.09$ ,  $5.00 \pm 1.16$  and  $2.50 \pm 0.77$ , respectively. In the present study, neutrophils per cent were decreased in a dog with ehrlichiosis. These findings are in agreement with the findings of earlier researchers [18, 22, 15, 33]. However these findings are in contradiction with the findings of the other workers [23, 14], who reported an increase in neutrophils per cent in ehrlichiosis. In the present investigation, the lymphocytes per cent were increased in dogs with ehrlichiosis before initiation of treatment. Similar findings were also reported by many workers [8, 22, 33]. However, some workers reported significantly decreased in lymphocytes per cent in dogs with ehrlichiosis [23, 14, 22].

In the present study, monocytes (%) and eosinophils (%) were within the normal range throughout the experimental period. Many researchers reported decreased in eosinophils (%) and increased in monocytes (%) in dogs suffering from ehrlichiosis [23]. The increase in lymphocyte (%) and monocytes (%) per cent might be due to alteration in haemostasis as well as parasite involvement which elucidate immune responses and thus increased lymphocytes and monocytes in the circulation [33].

**Table 1:** Clinical manifestations in dogs with ehrlichiosis

Symptoms	No of animal affected	Percentage of the affected animal
Tick infestation	12	100%
Pyrexia	11	91.66%
Depression	10	83.33%
Lymphadenopathy	9	75%
Splenomegaly	9	75%
Anorexia	7	58.33%
Inappetence	5	41.66%
Ocular discharge	4	33.33%
Corneal opacity	3	25%
Epistaxis	2	16.66%
lameness	1	8.33%
Pulmonary sign	1	8.33%

**Table 2:** Clinico-physiological parameters in dogs with ehrlichiosis

S. No.	Parameters	Ehrlichia Infected dogs	Normal Reference Range
1.	Rectal temperature ( $^{\circ}\text{F}$ )	$104.33 \pm 0.47$	99.5–101.5
2.	Heart rate (per/ min)	$113.25 \pm 4.24$	70-120
3.	Respiration rate (per/ min)	$30.67 \pm 1.80$	14-30

**Table 3:** Haematological parameter's in dogs with ehrlichiosis

S. No.	Parameters	Ehrlichia Infected dogs	Normal Reference Range
1.	Haemoglobin (gm/dl)	8.78±0.50	10-16
2.	PCV (%)	26.17±1.82	30-50
3.	TEC (x10 <sup>6</sup> /cu.mm)	4.10±0.35	5-8
4.	TLC (x 10 <sup>3</sup> /cu.mm)	6.87±0.98	7-16
5.	Platelet count (x 10 <sup>3</sup> /cu. mm)	115.58±18.62	200-850
6.	Neutrophils (%)	55.75±2.15	60-70
7.	Lymphocytes (%)	36.25±2.09	15-30
8.	Monocytes (%)	5.00±1.16	3-8
9.	Eosinophil (%)	2.50±0.77	2-10

### Conclusion

From the findings of the present study, it is concluded that the rise in rectal temperature and respiratory rate were the common clinico-physiological alterations observed in ehrlichia infected dogs. Haematological study revealed Anaemia, thrombocytopenia, neutropenia and lymphocytosis in ehrlichia infected dogs.

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