



SHORT COMMUNICATION

Physiological and Clinico-Hemato-Biochemical Changes in Canine Babesiosis

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Received: 08 March, 2023

Revised: 27 March, 2023

Accepted: 30 March, 2023

ABSTRACT

A detailed investigation was carried out on the 16 naturally occurring cases of canine babesiosis from Jaipur (Rajasthan). The aim of this study was to determine the Clinico-haemato-biochemical changes in dogs naturally infected with *Babesia*. The present study reports the significant changes in hematology and biochemistry i.g. Hemoglobin (9.37 ± 0.57 g/dl), Total erythrocyte count ($6.24 \pm 0.42 \times 10^6 / \mu\text{L}$), Platelets count ($1.49 \pm 0.17 \times 10^5 / \mu\text{L}$), ALT (84.66 ± 15.15 U/L), BUN (40.12 ± 9.59 mg/dL), and Serum Creatinine (2.74 ± 0.68 mg/dL) in affected dogs when compared to healthy dogs. Clinical and Physiological observations were indicative of severity of babesiosis in dogs. This disease is multisystemic and complex.

HIGHLIGHTS

- Fever, anorexia, weight loss, dehydration, diarrhea, depression, and lethargy are the most prevalent clinical signs seen in dogs with babesiosis.
- BUN, ALT, and creatinine readings being considerably higher than those of the control group.

Keywords: Babesiosis, Biochemical, Canine, Hematology, Rajasthan

Babesiosis is a life-threatening disease that is caused by intra-erythrocytic protozoan parasites of the genus *Babesia*. Several *Babesia* species, including *Babesia canis*, *B. vogeli*, *B. gibsoni*, and *B. rossi* associated with dogs. *Babesia* is a tick-borne hemoprotozoa that was first described by Babes in cattle with hemolytic anemia in 1888. *Babesia* parasite was first identified in 1910 in dogs and jackals from India. Diagnostic approaches, ranging from conventional blood microscopy that can be performed in field conditions to sophisticated and extremely sensitive molecular techniques, are used to diagnose canine babesiosis and identify *Babesia* infection (Lempereur *et al.*, 2017).

Hemolytic effects of canine babesiosis have been associated with changes in serum biochemical values and decreased erythrogram parameters, ranging from hypochromic to normochromic anemia. The finding reveals that the RBC, Hb, PCV and platelets values were below the

reference values, increased level of WBC value, Anemia and thrombocytopenia. There was increase in levels of ALT, AST, ALP, creatinine and bilirubin in the infected dogs (Kumar *et al.*, 2020).

In this research work, we are reporting a thorough study on the clinical observations, including clinical history along with haemato-biochemical alteration, in 16 naturally occurring cases of canine babesiosis from Jaipur region (Rajasthan).

A total of 200 dogs of both sex were suspected for babesiosis were studied at VCC (PGIVER) and Govt. veterinary polyclinic, Jaipur. After a comprehensive

How to cite this article: Gurjar, V.S., Singh, R., Meena, D.S., Jeph, N.K., Choudhary, A. and Sewag, A. (2023). Physiological and Clinico-Hemato-Biochemical Changes in Canine Babesiosis. *J. Anim. Res.*, **13**(02): 303-307.

Source of Support: None; **Conflict of Interest:** None



history, Blood samples were collected from naturally infected dogs which were suspected for babesiosis from the cephalic or lateral saphenous vein in the dry sterile disposable syringe aseptically, from these samples a complete blood count was performed at Veterinary Clinical Complex Lab PGIVER, Jaipur, and biochemical parameters such as serum creatinine, ALT, and BUN were estimated by the spectrophotometric method using an automatic blood biochemistry analyzer (Turbo Chem 100). In order to establish control values, blood was also taken from six healthy dogs.

The mean value of rectal temperature ($^{\circ}\text{F}$) of the affected dogs was $104.27 \pm 0.21^{\circ}\text{F}$ (range 103°F - 106.2°F) with fever ($>102.0^{\circ}\text{F}$) reported in all of the dogs. *Babesia*-infected dogs had significantly higher ($P \leq 0.05$) rectal temperature as compared to the control group $101.55 \pm 0.27^{\circ}\text{F}$. Similarly, Reddy *et al.* (2016) and Gonde (2014) reported elevated rectal temperature.

The mean value of heart rate of *Babesia*-infected dogs was 163.75 ± 5.29 beats/min (range 110-210 bpm), and tachycardia (Normal range 80-100 bpm) was found in all of the babesiosis-positive dogs and had significantly higher ($P \leq 0.05$) heart rate (per minute) as compared to control group 105.67 ± 2.7 beats per minute. Similarly, Wadhwa *et al.* (2011), Vijayalakshmi *et al.* (2014) and Jadhav *et al.* (2015) reported tachycardia ($>120/\text{min}$) in dogs infected with babesiosis. It's possible that the parasite infection is responsible for this elevated heart rate.

The mean respiration rate of the *Babesia*-infected dogs was 64.5 ± 1.63 per min. (range 56-76 per min.), and polypnoea (Normal range 15-25 per min.) was found in all of the babesiosis-positive dogs and had significantly higher ($P \leq 0.05$) Respiration rate (Per Minute) as compared to the control group 29 ± 1.53 per minute. Similarly, Wadhwa *et al.* (2011) and Gonde (2014) also reported polypnoea in dogs infected with babesiosis.

In this study, all the 16 naturally infected dogs out of 200 cases, of both sexes and different breeds, had a variety of clinical symptoms. The most common presenting signs were Pyrexia (93.75%), Anorexia and Depression presented in 75% of cases, Loss of weight (68.75%), Vomiting (26.31%), and changes in the mucous membrane color (56.25%), Diarrhea (50%), Ocular discharge (56.25%), and Dehydration (62.5%). Some of the dogs also exhibited more complicated signs like Lameness

(6.25%), Excessive salivation (18.75%), and Tremors or Convulsion (6.25%). The vomiting could be due to the high serum creatinine concentration observed in these dogs. These results concur with those from Wadhwa *et al.* (2011), Gonde *et al.* (2017), and Brahma *et al.* (2019).

Table 1: Clinical signs observed in dogs with Babesiosis

Clinical Sign	No. of Cases (n = 16)	%
Pyrexia	15	93.75%
Anorexia	12	75%
Vomiting	5	26.31%
Loss of weight	11	68.75%
Pale mucous membrane	3	18.75%
Congested mucous membrane	6	37.5%
Presence of ticks or history of ticks	16	100%
Hind limb weakness (Lameness)	1	6.25%
Diarrhea	8	50%
Depression & lethargy	12	75%
Ocular discharge	9	56.25%
Dehydration	10	62.5%
Excessive salivation	3	18.75%
Nasal discharge	7	43.75%
Tremors or Convulsion	1	6.25%

The most common hematological findings reported in *Babesia*-infected dogs were anemia (81.25%), thrombocytopenia (81.25%), Neutrophilia (68.75%), Leucocytosis (31.25%) and followed by lymphopenia (25%), Lymphocytosis (12.50%), Neutropenia (6.25%), and Eosinophilia (6.25%).

Mean values of hemoglobin were found significantly lower ($P \leq 0.05$) in infected dogs (9.37 ± 0.57 g/dL) as compare to control group (12.25 ± 0.99 g/dL). This reduction in the hemoglobin was due to both intra and extra-vascular hemolysis occurring in canine babesiosis (Maegraith *et al.*, 1957). Anemia can be produced by the parasite's direct mechanical rupture when it exits the red blood cell, as well as intravascular hemolysis and immune-mediated or non-immune-mediated destruction of red blood cells (Mittal *et al.*, 2019; Kumar *et al.*, 2020).

The mean values of TEC were found non-significantly decreased ($P \leq 0.05$) in infected dogs ($6.24 \pm 0.42 \times 10^6 / \mu\text{L}$) as compared to the control group ($7.7 \pm 0.48 \times 10^6 / \mu\text{L}$). It may be due to direct mechanical disruption caused by the parasite as it leaves the red blood cell.

Table 2: Comparison between Hematological and Biochemical parameters in dogs with babesiosis

Parameters	Control	Positive cases		
	Mean $\pm$ SE	Mean $\pm$ SE	Min.	Max.
Hb (g/dL)	12.25 $\pm$ 0.99	9.37 $\pm$ 0.57**	5.5	13.5
TEC (10^6 / μ L)	7.7 $\pm$ 0.48	6.24 $\pm$ 0.42	3.74	10
TLC (10^3 / μ L)	10.68 $\pm$.44	15.94 $\pm$ 2.48	7.5	41.4
Platelet (10^5 / μ L)	4.11 $\pm$ 0.13	1.49 $\pm$ 0.17**	0.35	2.88
Neutrophils (%)	71.16 $\pm$ 2.94	77.44 $\pm$ 2.99	41	92
Lymphocytes (%)	24.33 $\pm$ 3.29	16.25 $\pm$ 2.44	4	43
Monocyte (%)	2.67 $\pm$ 0.33	2.87 $\pm$ 0.27	1	4
Eosinophils (%)	1.83 $\pm$ 0.48	3.12 $\pm$ 0.64	0	10
Serum Alanine Amino transferase (ALT) (U/L)	24.97 $\pm$ 3.7	84.66 $\pm$ 15.15**	19.2	250.7
Blood Urea Nitrogen (mg/dL)	34.75 $\pm$ 5.24	40.12 $\pm$ 9.59	5.42	131.86
Serum Creatinine (mg/dL)	1.17 $\pm$ 0.08	2.74 $\pm$ 0.68**	0.67	11.04

**Significant difference ($P \leq 0.05$) with control group.

The mean values of TLC were found non-significantly increased ($P \leq 0.05$) in infected dogs ($15.94 \pm 2.48 \times 10^3$ / μ L) as compared to the control group ($10.68 \pm .44 \times 10^3$ / μ L). Higher values of TLC in infected dogs indicate acute stage of infection with babesiosis. The mean values of Neutrophils (%), Lymphocytes (%), Monocytes (%), and Eosinophils (%) in dogs infected with Babesiosis were 77.44 ± 2.99 , 16.25 ± 2.44 , 2.87 ± 0.27 , 3.12 ± 0.64 , respectively, whereas the mean values in the control group were 71.16 ± 2.94 , 24.33 ± 3.29 , 2.67 ± 0.33 , and 1.83 ± 0.48 , respectively. These mean values were non-significantly varied in infected dogs as compared to the control group, Statistical analysis revealed no significant difference.

The platelet values were found significantly lower ($P \leq 0.05$) in *Babesia*-infected ($1.49 \pm 0.17 \times 10^5$ / μ L) dogs as compared to the control group ($4.11 \pm 0.13 \times 10^5$ / μ L). Babesiosis-related thrombocytopenia's processes are still poorly understood (Selvaraj *et al.*, 2010). But, systemic DIC, immune mediated platelet destruction and platelet sequestration in the spleen were possible mechanisms of thrombocytopenia in canine babesiosis. Anemia and thrombocytopenia were the most common hematological alterations observed in the present study which concurred with the previous reports (Gonde *et al.*, 2017; Brahma *et al.*, 2019). Persistent anaemia and thrombocytopenia are common in blood parasite infection in dogs (Russell, 2010).

The mean value of ALT were found significantly higher ($P \leq 0.05$) in *Babesia*-infected dogs (84.66 ± 15.15 U/L) as compared to the control group (24.97 ± 3.7 U/L). These findings are in accordance with Kaur (2019), Roopali *et al.* (2018), Kumar (2016), and Reddy *et al.* (2016). This increase in ALT value in dogs with babesiosis suggests liver injury. Elevation of ALT might be attributed to hepatic hypoxia (Aysul *et al.*, 2013). According to Gupta *et al.* (2002), escape of ALT enzyme from the damaged hepatic parenchymal cells with necrosis or altered membrane permeability may cause increased activities of these enzymes indicating hepatic dysfunction.

The mean values of creatinine were found significantly higher ($P \leq 0.05$) in *Babesia*-infected dogs (2.74 ± 0.68 mg/dL) as compared to the control group (1.17 ± 0.08 mg/dL). Similarly, Reddy *et al.* (2016), Kumar (2016), and Kaur (2019) reported a significant increase in creatinine in babesiosis positive dogs. Wadhwa *et al.* (2011) recorded abnormally high concentration of creatinine in *Babesia*-infected dogs. The level of serum creatinine was higher in the infected dogs on day 0th. An increase in creatinine in canine babesiosis might have resulted from acute renal failure.

The mean value of BUN were found non-significantly higher in *Babesia*-infected dogs (40.12 ± 9.59 mg/dL) as compared to the control group (34.75 ± 5.24 mg/dL). These findings are in accordance with Kaur (2019) and Kumar (2016). This high concentration of BUN and

creatinine value due to infiltration of parasites in glomeruli of kidney causing glomerulonephritis (Harikrishnan *et al.*, 2008). Previous studies also demonstrated similar findings (Gonde *et al.*, 2017; Roopali *et al.*, 2018; Brahma *et al.*, 2019; Mittal *et al.*, 2019; and Kumar *et al.*, 2020).

The results of this study indicate that multiple organs, including the liver, spleen, and kidneys, may be involved in the development of haemato-biochemical alterations in canine babesiosis, and that these changes may be useful in determining the severity of babesiosis in dogs.

CONCLUSION

From the present study following conclusions could be drawn: Vital body parameters of dogs with babesiosis like rectal temperature, Heart Rate, and Respiration Rate were found significantly higher than that of control group. Most common clinical observations in dogs with babesiosis include fever, Anorexia, Loss of weight, tick infestation, Dehydration, Diarrhea, Depression and lethargy. Anemia, thrombocytopenia, Neutrophilia, Leucocytosis, and Lymphopenia are the common hematological abnormalities in Babesia-infected dogs. Evident biochemical alterations that the ALT and creatinine values were significantly higher and BUN was non-significantly higher than that of uninfected control group.

ACKNOWLEDGEMENTS

All the authors are thankful to Dean, Post-Graduate Institute of Veterinary Education & Research (PGIVER), Jaipur for providing facilities to carry out this work.

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