International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST218467

A Case Study of Assessment of Haemato-Biochemical Profile, Clinical Diagnosis and Therapeutic Management of Canine Monocytic Ehrlichiosis (Tropical Canine Pancytopenia) In A Male Doberman DOG

Deepak Chandran[1*], Georgen G Edana[1], Salini Varghese[2], Ajin S Kumar[3]

[1*]Assistant Professor, Department of Veterinary Sciences & Animal Husbandry, School of Agricultural Sciences, Amrita Vishwa Vidyapeetham University, Tamil Nadu, India
*Corresponding author, Email-ID : c_deepak@cb.amrita.edu
[1, 2]BVSc & AH Scholar, Kerala Veterinary and Animal Sciences University, Kerala, India
[3]Veterinary Doctor (BVSc & AH), Kerala, India

Article Info
Volume 8, Issue 4
Page Number : 426-434

Publication Issue
July-August-2021

Article History
Accepted : 20 July 2021
Published : 27 July 2021

ABSTRACT

Ehrlichia canis is an obligate intracellular rickettsial agent that is transmitted by a brown dog tick called as Rhipicephalus sanguineus which is considered as the principal vector of this disease. A 3-year-old male Doberman dog weighing 25 kg is presented with the history of inappetence, fever, weakness, anemia, scanty feces, hemoglobinuria, shrunken eye ball with mild corneal opacity and reluctant to walk due to pain in the joints. Clinical examination revealed elevated rectal temperature of 104.30F, tachycardia, increased respiratory rate and pale mucous membrane. Blood and serum samples were collected for hematology and serum biochemistry respectively. On blood smear examination with Giemsa staining, Ehrlichia morulae were noticed in monocytes suggestive of Canine Monocytic Ehrlichiosis / Tropical Canine Pancytopenia.

Keywords - Ehrlichiosis, Doberman, Monocytosis, Pancytopenia, Morula

I. INTRODUCTION

Canine ehrlichiosis is a tick borne, febrile, debilitating disease of dogs and wild canidae caused by *Ehrlichia canis* transmitted by the brown dog tick *Rhipicephalus sanguineus.* The infections are known to occur worldwide. The disease is also known as canine typhus, canine haemorrhagic fever, tracker dog disease, idiopathic haemorrhagic syndrome and tropical canine pancytopaenia (Ristic and Holland, 1993). Ehrlichia are obligate intracellular organism which differ from rickettsiae because they replicate in the phagosome of host cell whereas all Rickettsia, with one exception (*C. burnetti*) grow free within the cytoplasm (Mudaliar, 1944). *Ehrlichia canis* and other members of the genus Ehrlichia are minute organisms that stain dark blue to purple with Romanowsky stain and with Machiavello method they stain light red and brown-black with silver stain. Studies conclusively proved trans-stadial transmission where in larvae, nymphs and adults are able to transmit the disease.

Pathogenesis depends on the strain of organism, breed of dog affected, concomitant diseases and the host defense mechanism (Neer, 1998; Parmar *et al*., 2013). The disease is characterized by a wide variety of clinical signs of which depression, lethargy, weight loss, anorexia, pyrexia, lymphadenomegaly, splenomegaly, and bleeding tendencies are the most common. Major hematologic abnormalities comprise of thrombocytopenia, mild anemia, and mild leukopenia during the acute stage, mild thrombocytopenia in the subclinical stage, and pancytopenia in the severe chronic stage. The main biochemical abnormalities include hypoalbuminemia, hyperglobulinemia, and hypergammaglobulinemia (Harrus *et al*., 1997). The most common and consistent haematological abnormality of dogs infected with E. Canis naturally or experimentally is thought to be thrombocytopenia (Waner *et al*., 1995; Waner *et al*., 1999). Mechanisms assumed to be involved in the pathogenesis of thrombocytopenia in the acute phase of the disease include increased platelet consumption due to inflammatory changes in blood vessel endothelium, increased splenic sequestration of platelets, and immunologic destruction or injury resulting in a significantly decreased platelet life span (Kakoma *et al*., 1978; Troy and Forrester, 1990). The only consistent finding among cases of ehrlichiosis was inconsistency and hence diagnosis of ehrlichiosis was difficult since there were no pathognomonic signs. Diagnosis of ehrlichiosis is by microscopic detection of organism in Giemsa-stained blood smears or buffy coat preparations. The morular rosettes take a light blue or lilac tint within the cytoplasm of the monocytes. Tetracyclines are the most effective for the treatment of *E. canis* and other ehrlichial infections of dogs. E. canis causes a potentially fatal disease in dogs that requires rapid and accurate diagnosis to initiate appropriate therapy leading to a favorable prognosis (Pyle, 1980; McBride *et al*., 2001).

II. REVIEW OF LITERATURE

Donatien and Lestoquard (1935) described the disease for the first time in Algeria and recorded the causative agent from dogs exposed to tick infestation and named it as *Rickettsia canis*. The incidence of canine ehrlichiosis in India was reported for the first time by Mudaliar (1944) in a Spaniel dog of eight months old. Bool and Sutmoller (1957) identified *Ehrlichia canis* in the monocytes of severely ill dogs in the island of Aruba (Netherlands Antilles). The role of Brown dog tick, *Rhipicephalus sanguineus* as a vector was first documented by Donatien and Lestoquard (Eing, 1969). According to Pyle (1980), the only consistent finding among cases of ehrlichiosis was inconsistency and hence diagnosis of ehrlichiosis was difficult since there were no pathognomonic signs. Cases of Canine monocytic ehrlichiosis were confirmed by microscopic examination of stained blood smear which revealed morulae in monocytes (Buoro *et al*., 1990). Meneses (1995) observed anaemia, leukopaenia and thromboctopaenia as the most common haematological alterations in a study on twelve dogs suffering from ehrlichiosis. In an epidemiological study on Canine monocytic ehrlichiosis conducted by Harrus *et al*. (1997), German shepherd dogs were severely over represented. In *Rhipicephalus sanguineus*, strict trans-stadial transmission was noticed and adult ticks were capable of transmitting infection to susceptible population for at least 155 days. Blood transfusion from infected donors could transmit the ehrlichial organism (Neer, 1998). Though tetracycline and oxytetracycline have been considered to be the initial drug of choice, doxycycline and minocycline were also used as drug of choice. Short term therapy with glucocorticoids may be beneficial in the early treatment period, when severe life threatening thrombocytopaenia was present.

III. METHODS AND MATERIAL

A 3-year-old male Doberman dog (Figure 1) weighing 25kg is presented with the history of

inappetence, fever, weakness, anemia, scanty feces, hemoglobinuria, shrunken eye ball with mild corneal opacity and reluctant to walk due to pain in the joints. Clinical examination revealed elevated rectal temperature 104.3^0F, tachycardia and increased respiratory rate. On detailed examination, superficial lymph nodes especially the popliteal lymph node was found to be enlarged in size. Though the animal was well groomed, the inside margin of the ear of the animal was infested with ticks. On physical inspection capillary refill time increased to 3 seconds, penile mucous membrane was pale, second degree of dehydration and on palpation splenomegaly and partial hepatomegaly can be observed (Parmar et al., 2013). Sonographic investigation of the abdomen revealed rounding of the borders of liver and expanded spleen. Due to this enlargement, there was a pressure build on diaphragm towards cranial aspect leading to partial dyspnoea. Blood and serum samples were collected for hematology and serum biochemistry, respectively. The peripheral blood smear was prepared and stained with Giemsa stain after methanol fixation (Sathpathi *et al*., 2014). The stained blood smear was screened for haemoprotozoa under the light microscope. Haematological analysis was carried out as per the standard method (Jain, 1986). Biochemical analysis was done with a semi-autoanalyzer. The haemato-biochemical values were compared with normal reference values and interpreted.

Figure 1: 3-year-old male Doberman dog presented with above mentioned history and clinical symptoms

IV. DIAGNOSTIC PROCEDURES AND TREATMENT STRATEGY

Haematological analysis revealed anaemia (decreased level of hemoglobulin, and red blood cell count), thrombocytopenia, normal leucocyte count with neutrophilia and lymphocytosis. The serum biochemistry showed elevated total protein value and elevated Alanine Aminotransferase (ALT), while all other parameters were normal. The detailed haematological and serum biochemical parameters before treatment and after treatment are mentioned in Table 1. Wet film examination of the peripheral blood taken from the ear tip was found negative for any moving parasites. Upon Giemsa staining and microscopic examination of Buffy coat smear, light blue stained morula was observed in the monocytes (Figure 2). Based on history, clinical and laboratory findings it was diagnosed as a case of Canine Monocytic Ehrlichiosis.

Table 1 : Haemato-biochemical changes in the dog before and after treatment

Haematological Parameters			
Parameters	**Apparently healthy dog values**	**Pre-treatment values**	**Post-treatment values**
Hemoglobin (g/dL)	12 – 19	6.7	13.3
RBC count (millions/mm^3)	5 - 8	2.82	4.6
Total WBC count (10^3 cells/mm^3)	5 – 14	4.25	10.3
Platelets (lakhs/mm^3)	2.1– 6.2	1.57	1.92
Neutrophils (%)	58 - 85	90	62
Lymphocytes (%)	8 - 21	28	18
Monocytes (%)	2 – 10	2	3
Eosinophils (%)	2 – 9	7	3
Basophils (%)	0 – 1	-	-
Serum Biochemical Parameters			
ALT (U/L)	10-109	136	34
TP (g/dl)	5.5 – 7.2	8.3	6.2
BUN (mg/dl)	8-30	29	24
Total Bilirubin (mg/dl)	0.1 - 0.6	0.9	0.56
Glucose (mg/dl)	60 - 111	110	95
Creatinine (mg/dl)	0.5 – 1.5	1.7	0.9

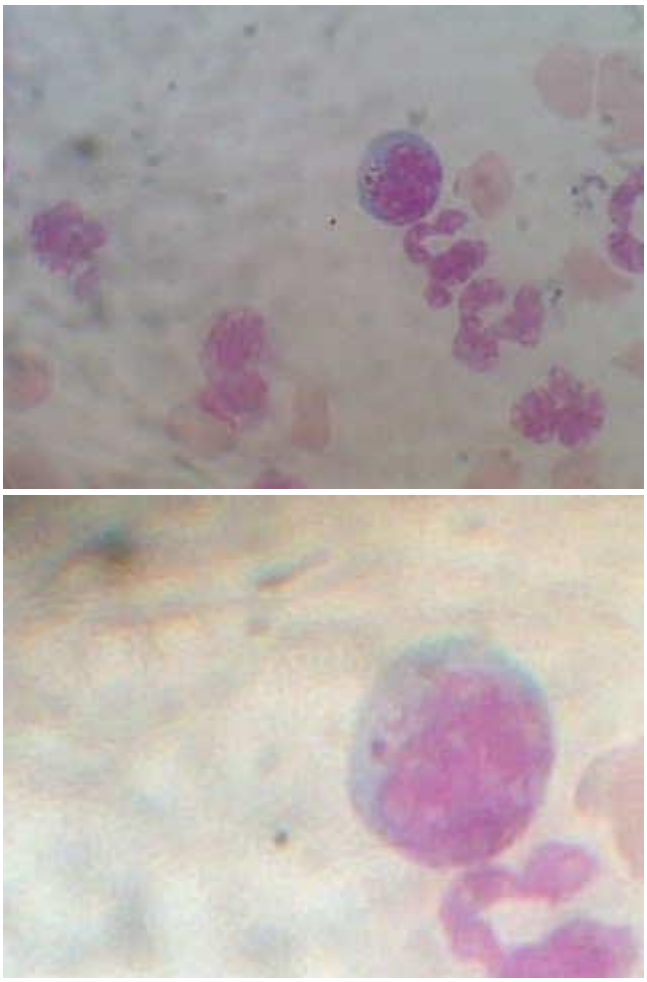

Figure 2: Presence of Ehrlichia morulae inside monocytes

The treatment was started with Doxycycline tablet @ 5mg/kg body weight orally twice daily for 28 days. For the management of ticks, Fiprofort spot on was advised. Supportive treatment was done with Normal Saline injection @ 200 ml very slow IV, Oxytetracyclin injection @ 22mg/kg body weight IV, Meloxicam injection @ 0.5mg/kg body weight, IM BID and Ranitidine injection @1 mg/kg body weight via sub-cutaneous route thrice daily for 3 days. Along with this, Prednisolone tablet was advised @1mg/kg

bodyweight for 5 days followed by 0.5mg/kg for next 5 days (tapering dose). Hematinic (Syrup aRBC pet @ 10 ml orally twice daily) and liver protectant (SyrupLiv-52@ 10 ml orally twice daily) was given for 4 weeks. After 4 weeks of treatment, the dog showed marked improvement in clinical condition. Haemato-biochemical values were found to be within a normal range and peripheral blood smear was negative for *E. canis* on the 28th day of post-treatment.

V. DISCUSSION

Canine ehrlichiosis is a tick borne, febrile, debilitating disease of dogs and wild canidae caused by *Ehrlichia canis* and transmitted by the brown dog tick *Rhipicephalus sanguineus.* The infections are known to occur world-wide. The disease is also known as canine typhus, canine haemorrhagic fever, tracker dog disease, idiopathic haemorrhagic syndrome and tropical canine pancytopaenia. In Kenya the disease is locally known as Nairobi bleeding disease. The disease was first discovered by Donatien and Lestoquardin 1935 at the Pasteur Institute in Algeria. They noted that experimental dogs infected with brown dog ticks developed severe febrile illness characterized by anaemia. Blood smears of infected dogs stained by Giemsa stain showed small Rickettsia-like organism inside canine monocytes. They called the newly discovered organism *Rickettsia canis*. In 1945, Moshkovski renamed the organism as *Ehrlichia canis* in honour of Paul Ehrlich the famous German Bacteriologist (Buhles, 1975; Pyle, 1987). Ehrlichia are obligate intracellular bacteria which differ from rickettsiae because they replicate in the phagosome of host cell whereas all Rickettsia, with one exception (*C. burnetti*) grow free within the cytoplasm. Other distinguishing characters include their ultrastructure, tropism for circulating leukocytes and antigenic composition. All ehrlichiae are presumed to be tick borne and only one species, *Ehrlichia sennetsu* is thought to be pathogenic to humans (Neer, 1998). Since its discovery, reports indicate that the disease has been increasing in frequency and importance. The disease was characterized by general debilitation, epistaxis, anaemia and leukopaenia. Later Huxsoll in 1970 detected ehrlichial inclusions in the blood and tissues of dogs with TCP and realized that TCP was a severe form of canine ehrlichiosis.

Morphology

Ehrlichia canis and other members of the genus Ehrlichia are minute gram negative cocci that stain dark blue to purple with Romanowsky stain and with Machiavello method they stain light red and brown-black with silver stain. Like Chlamydia, Ehrlichia go through three developmental stages namely elementary bodies (individual Ehrlichia organisms), initial bodies (immature organismal inclusions) and morula (mature organismal inclusions). Elementary bodies are small gram-negative organisms about 0.2-0.5 µm in diameter and difficult to detect by light microscopy. Elementary bodies are usually coccoid or ellipsoidal. Elementary bodies enter canine monocytes by phagocytosis. Phagolysosomal fusion does not occur in infected cells and elementary bodies begin to grow and divide within the confines of the phagosome. Replication of organism occurs by binary fission. At 3 -5 days after infection, small members of tightly packed elementary bodies 1.0-2.5 µm in diameter are observable as pleomorphic inclusions, called as initial bodies. During next 7-12 days, additional growth and replication occurs and initial bodies develop to mature inclusions called mulberry or morula (4-6 µm in diameter). Infected monocytes usually contain several morula each containing several dozen elementary bodies. Morula breaks up into elementary bodies when infected cell ruptures and infectious cycle is repeated. All the three growth stages occur within a membrane-lined vacuole of host origin that separates individual organisms or a group of these from the host cell cytoplasm (Waner *et al.*, 1999; Das and Konar, 2003; Taylor, 2007).

Epidemiology

As early as 1935 the brown dog tick *Rhipicephalus sanguineus* was considered to be the vector of *E canis.* Studies conclusively proved trans-stadial transmission where in larvae, nymphs and adults are able to transmit the disease. In infected ticks *E canis* multiplies within haemocytes and cells of the salivary gland. Then organism enters digestive tract and infects midgut epithelium. Ticks could transmit *E.canis* for 155 days. Attraction of mononuclear cells to the inflamed site of tick bite may facilitate the infection of blood monocytes. *Amblyomma americanum* and *Otobius megnini* were most recently described as potential vectors (Ettinger and Fieldman, 2010). Wild and domestic canids are currently considered the naturally susceptible to infection. Usually, the infection is sporadic and is of worldwide occurrence. Even though disease occurs in all breeds of dogs. German shepherds are most susceptible. All ages are affected, but males are found to be more affected (Pyle, 1987; Troy and Forrester, 1990).

Pathogenesis

Pathogenesis depends on the strain of organism, breed of dog affected, concomitant diseases and the host defense mechanism. The most common finding in an acute *E canis* infection is the extensive invasion of parenchymal organs and perivascular cuffing by plasma cells particularly lungs, meninges, kidneys and spleen suggesting an immunopathologic etiology. Lymphocytes of infected dogs exert a cytotoxic effect upon autologous monocytes. Leukopaenia along with a highly prominent thrombocytopenia is a pathognomonic haematologic manifestation for canine ehrlichiosis (Hildebrandt *et al.*, 1970; Harrus *et al.*, 1998). The clinical findings such as pale mucous membranes, hepatomegaly, lymphadenopathy, splenomegaly, emaciation, increased hair loss and hematological alterations observed in these infected animals have been previously reported in cases of canine ehrlichiosis (Hoskins, 1991; Troy and Forrester, 1990). Thrombocytopenia, leucopenia, and anemia are most frequently observed in CME (Hoskins, 1991; Davoust *et al.*, 1991). Infected dogs presented mild to moderate hematological changes in acute experimental infection for just a few weeks. The tendency for the hematological parameters to return to normal was evident at the end of the experiment.

This result may be a consequence of transient suppression of bone marrow activity due to E. canis infection (Buhles *et al*., 1975). The pathogenesis of thrombocytopenia is due to Anti-platelet antibodies produced in CME (Harrus *et al*., 1996). Anemia may explain the observed paleness of mucous membranes and most organs. Lymphadenopathy, splenomegaly, ascites, paleness of mucous membrane, kidney and liver, and discrete pulmonary congestion were observed at the necropsy of inoculated dogs as has been previously reported in cases of canine ehrlichiosis (Hildebrandt *et al*., 1970; Hildebrandt *et al*., 1973). observed the same in German Shepherd dogs and posited breed susceptibility (Nyindo *et al*., 1980).

Clinical disease

After an incubation period of 10-15 days canine ehrlichiosis begins as an acute febrile disease. The first stage is characterized by fever 40-41.4ºC, depression, anorexia, weight loss, oculonasal discharge, conjunctivitis, occasional vomiting and lymphadenopathy. Oedema of limbs and ataxia may also be present. The acute phase typically last for 2 or 3 weeks. Most dogs survive acute phase followed by a subclinical phase lasting several months. Animals remain infected but are generally asymptomatic and blood values remain subnormal. Characteristic features of TCP are occasional fever, corneal opacity, regenerative or non-regenerative anaemia with severe leukopaenia and thrombocytopenia (Ettinger and Fieldman, 2010). Initially there may be bone marrow hyperplasia followed by hypoplasia due to the exhaustion of cellular elements in the bone marrow. The outcome of the third and the terminal phase depends on the breed of the dog. Beagles, for example, may become chronic carriers. German shepherds usually succumb. Clinical manifestations include fever, anorexia, severe weight loss, marked pancytopaenia, anaemia and peripheral oedema. Ecchymosis and petichiae commonly occur at multiple sites. Unilateral or bilateral epistaxis is common. Death occurs due to extensive mucosal or serosal haemorrhage or due to secondary bacterial infection prompted by the dog's debilitated condition. Increased ESR and prolonged bleeding time is very characteristic. Dogs are also susceptible to infection with *E.equi* and *E.risticii* which is mild and inapparent (Troy and Forrester, 1990; Ristic and Holland, 1993; Waner *et al*., 1999).

Diagnosis

The most commonly followed methodology for diagnosis of acute ehrlichiosis is by microscopic detection of organism in Giemsa-stained blood smears or buffy coat preparations (Hoskins, 1991). The morular rosettes take a light blue or lilac tint within the cytoplasm of the monocytes. The first drop of blood from a prick incision on the ear of dog is considered ideal. Percentage of infected monocytes within the peripheral blood is extremely low and hence best results are obtained by searching the feather edge of the stained whole blood smear. An iFAT is currently the only available specific means for detection and titration of antibodies to *E canis* (McBride *et al*., 2001). The organism generated by the *in vitro* culture techniques serves as the antigen for the test. This test can also be used for assessing the efficacy of treatment (Meneses, 1997).

Treatment

Among all therapeutics tested, tetracyclines are the most effective for the treatment of *E canis* and other ehrlichial infections of dogs.

First line antibiotics:

Tetracycline 22mg/kg BW IV for 14 days.

Oxytetracycline 25mg/kg BW PO TID for 21 days.

Doxycycline 5mg/kg BW PO BID for 14 days.

Minocycline 20mg/kg BW PO BID for 14 days.

Second line antibiotics:

Chloramphenicol 50mg/kg BW PO TID for 21 days.

Imidocarb dipropionate 5mg/kg BW IM or SC single injection and repeated in 2-3 weeks.

Following treatment with tetracycline dogs in early stages of disease show spontaneous clinical and

haematological improvement. Chronically infected dogs may respond more slowly to treatment. Some dogs may require prolonged treatment. Efficacy of treatment can be judged from the IFA titres. Various supportive therapies like blood transfusion using whole blood or platelet rich plasma and polyionic fluids are recommended. Short term administration of anti-inflammatory and immunosuppressive compounds may be useful for secondary immune mediated complications (Ristic and Holland, 1993; Ettinger and Fieldman, 2010).

Prevention and Control

The only preventive therapeutic measure for canine ehrlichiosis is administration on a continuous basis tetracycline at a low dosage of 6.6mg/kg/day. This can be tried in dogs travelling in enzootic area. Routine use of acaricides and control of ticks is recommended. All new dogs should be free of tick infestation and serological status screened before introducing them to *E canis* free groups (Ettinger and Fieldman, 2010).

VI. CONCLUSION

Based on history, clinical and laboratory findings the reported case report was diagnosed as a case of Canine Monocytic Ehrlichiosis. Canine ehrlichiosis is a tick borne, febrile, debilitating disease of dogs and wild canidae caused by *Ehrlichia canis* transmitted by the brown dog tick *Rhipicephalus sanguineus.* The infections are known to occur worldwide. Ehrlichiosis occurrence in canine usually remains preclinical. The disease was characterized by general debilitation, fever, anorexia, marked pancytopaenia, anaemia and peripheral oedema. Ecchymosis and petichiae commonly occur at multiple sites. Unilateral or bilateral epistaxis is common. The most commonly followed methodology for diagnosis of acute ehrlichiosis is by microscopic detection of organism in Giemsa-stained blood smears or buffy coat preparations. The morular rosettes take a light blue or lilac tint within the cytoplasm of the monocytes. Among all therapeutics tested, tetracyclines are the most effective for the treatment of *E canis* and other ehrlichial infections of dogs.

VII. REFERENCES

[1]. Buhles, W. C., Huxsoll, D. L. and Hildebrandt, P. K. 1975. Tropical Canine Pancitopenia: role of aplastic anemia in the pathogenesis of severe disease. J. Comp. Pathol. 85: 511-521.

[2]. Das, M. and Konar, S. 2003. Clinical and hematological study of canine Ehrlichiosis with other hemoprotozoan parasites in Kolkata, West Bengal, India. Asian Pacific J. Trop. Biomed. 3(11): 913-915.

[3]. Donatien, A. and Lestoquard, F. 1935. Existence en Algerie dune Rickettsia duchien. Bulletin de la societie de pathologie exotique. 28: 418-419.

[4]. Ettinger, S.J. and Fieldman, E.C. 2010. In. Text book of Veterinary Internal Medicine. 7th edn, Volume I, Saunders Elsevier, p. 901-906.

[5]. Harrus, S., Waner, T., Keysary, I., Aroch, I., Voet, H. and Bark, H. 1998. Investigation of splenic functions in canine monocytic ehrlichiosis. Vet. Immunol. Immunopathol. 62: 15–27.

[6]. Harrus, S., Waner, T. and Bark. H. 1997. Canine monocytic ehrlichiosis - an update. Comp. Cont. Ed. Prac. Vet. 19: 431- 444.

[7]. Harrus, S., Waner, T., Weiss, D. J., Keysary, A. and Bark, H. 1996. Kinetics of serum antiplatelet antibodies in experimental acute canine ehrlichiosis. Vet. Immunol. Immunopathol. 51: 13-20.

[8]. Hildebrandt, P. K., Huxsoll, D. L. and Nims, R. M. 1970. Experimental ehrlichiosis in young Beagle dogs. Fed. Proc. 29: 754.

[9]. Hildebrandt, P. K., Huxsoll, D. L., Walker, J. S., Nims, R. M., Taylor, R. and Andrews, M. 1973. Pathology of canine ehrlichiosis (Tropical

canine pancytopenia). Am. J. Vet. Res. 34: 1309-1320.

[10]. Hoskins, J. D. 1991. Ehrlichial diseases of dogs: diagnosis and treatment. Canine Pract. 16: 13-21.

[11]. Huxsoll, D. L., Amyx, H. L., Helmet, I. E., Hildebrandt, P. K., Nims, R. M. and Gochenour. W. S. 1972. Laboratory studies of Tropical Canine Pancytopenia. Exp. Parasitol. 31: 53-59.

[12]. Jain. N. C. 1986. Schalm's Veterinary Hematology. Fourth ed., Lea and Febiger, Philadelphia.

[13]. McBride, J., Corstvet, R., Breitschwerdt, E. and Walker, D. 2001. Immunodiagnosis of Ehrlichia canis Infection with Recombinant Proteins. J. Clin. Microbiol. 39: 315-322.

[14]. Meneses, A. 1997.Diagnosis of Canine ehrlichiosis by detecting inclusion bodies and morulae in blood smears. Ciencias – Veterinarias – Heredia. 20: 57-63.

[15]. Mudaliar, S.V. 1944. Canine Rickettsiosis in South India – a preliminary note. Indian Vet. J. 20(4): 163-164.

[16]. Neer, T.M.1998. Canine monocytic and granulocytic ehrlichiosis. Infectious diseases of dog and cat. (ed. Greene, C.E.). Second edition. W.B. Saunders Company, Philadelphia, pp.139-149.

[17]. Parmar, C., Pednekar, R., Jayraw, A. and Gatne, M. 2013. Comparative diagnostic methods for canine ehrlichiosis. Turkish J. Vet. Ani. Sci. 37: 282-290.

[18]. Pyle, R.L. 1980. Canine ehrlichiosis. J. Am. Vet. Med. Assoc. 177: 1197-1199.

[19]. Ristic, M. and Holland, C.J. 1993. Canine ehrlichiosis In Z. Woldehiwet and M. Ristic (ed.), Rickettsial and chlamydial diseases of domestic animals. Pergamon Press, Oxford, United Kingdom. 169- 186.

[20]. Sarma, K., Mondal, D.B., Saravanan, M., Kumar, M. and Mahendran, K. 2012. Haemato-biochemical changes in Hepatozoon canis infected dog before and after therapeutic management. J. Vet. Parasitol. 26(1): 35-38.

[21]. Taylor, M.A., Coop, R.L. and Wall, R.L. 2007. In. Veterinary Parasitology. 3 rd edn, Blackwell Publishing, p. 420-424.

[22]. Troy, G. C. and Forrester, S. D., 1990. Canine Ehrlichiosis. In: Greene, C.E., Infectious Diseases of the Dog and Cat. W.B. Saunders, Philadelphia, 48-59.

[23]. Waner, T., Harrus, S., Weiss, D. J., Bark, H. and Keysary, A. 1995. Demonstration of serum antiplatelet antibodies in experimental acute canine ehrlichiosis. Vet. Immunol. Immunopathol. 48: 177- 182.

[24]. Waner, T., Keysary, A., Bark, H., Sharabani, E. and Harrus, S. 1999. Canine monocytic ehrlichiosis – an overview. Israel J. Vet. Med. 54: 103–107.

Cite this article as :

Deepak Chandran, Georgen G Edana, Salini Varghese, Ajin S Kumar, "A Case Study of Assessment of Haemato-Biochemical Profile, Clinical Diagnosis and Therapeutic Management of Canine Monocytic Ehrlichiosis (Tropical Canine Pancytopenia) In A Male Doberman DOG ", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 8 Issue 4, pp. 426-434, July-August 2021. Available at

doi: https://doi.org/10.32628/IJSRST218467

Journal URL : https://ijsrst.com/IJSRST218467