

Clinical scoring as a prognostic indicator in canine babesiosis

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ABSTRACT

Babesiosis, a tick borne disease of canine has varying severity and several forms involving nervous, cardiovascular, respiratory and other body systems. The *babesia gibsoni* remained the dominant species in canine population of south Gujarat without manifestation of haemoglobinuria in infected animals. Based on severity of the disease and involvement of various body systems, a clinical score that helps in early prognosis in babesia infection was worked out. Mortality remained significantly higher in dogs with higher clinical score at the time of first presentation in the present study.

Key words : Canine babesiosis, clinical scoring, prognosis

Babesiosis is one of the important diseases of domestic and wild Canidae caused by intraerythrocytic piroplasms of the genus *Babesia*. It is a tick borne disease, has a world-wide distribution and is a well established clinical entity in the tropical and subtropical countries (Soulsby, 1982) including India. The disease is emerging as an important clinical disease in the cosmopolitan cities of the country (Varshney *et al.*, 2008).

MATERIALS AND METHODS

Of the 1986 dogs brought at the Nandini hospital, Surat, Gujarat for treatment of illness, 518 ailing dogs with various systemic signs were examined clinically and were subjected to peripheral blood cytology for confirming babesia infection. Of the ailing 518 dogs, 314 dogs found cytologically positive to *B. gibsoni* infection were included in the study. These dogs were subjected to detailed clinical and specific examinations like electrocardiography and ultrasonography to know the involvement of specific body system. Based on severity of symptoms, Babesiosis was classified as per-acute, acute, chronic or subclinical (Schoeman, 2009; Irwin, 2010) or as

complicated and uncomplicated form. Uncomplicated form was further subdivided into severe, moderate and mild depending upon the degree of anaemia (Jacobson and Clark, 1994).

A clinical score recording proforma was worked out on the basis of severity and involvement of various systems. A clinical score of each dog was calculated on a 20 point scale as per the proforma. The score was primarily based on presence (score-1) or absence (score-0) of 20 clinical signs and investigations carried out at initial presentation. These signs were then clubbed as of general state, gastrointestinal, nervous, cardiac and respiratory forms. (Table 1). Thirty two cases which died during the course of the disease were given an additional score. Clinical score of each individual animal was worked out based on the systematic examination of the animal using signs as given in Table 2.

RESULTS AND DISCUSSION

The clinical picture

The clinical picture in naturally occurring cases of canine babesiosis remained very diverse and a wide variability in clinical signs was recorded. The different clinical symptoms recorded are given in Table 1 with their frequency of occurrence.

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Table 1 Frequency distribution of clinical signs among 314 canine babesiosis positive cases.

Sr. No.	Clinical Signs	Total	Percentage
General signs		249	92.22
Temperature			
A	Hyperthermia (> 102.40F)	174	64.44
B	Hypothermia (< 98.0F)	21	7.77
C	Normothermia	75	27.77
Weakness/emaciation		145	53.7
Presence of ticks on body		140	51.85
Dehydration (STT >3 sec)		115	42.59
Gastrointestinal signs		229	84.81
Anorexia		204	75.55
Vomition/nausea/salivation		120	44.44
Constipation/diarrhoea		94	34.81
Ascites/oedema		4	1.48
Splenomegaly		36	13.33
Hepatomegaly		9	3.33
Nervous signs		88	32.59
Ataxia		29	10.74
Tremors/convulsions		20	7.40
Dull/depressed/coma		64	23.70
Cardiac signs		162	60.00
Arrhythmia/cardiomyopathy		147	54.44
Weak thready pulse		48	17.77
Pulse deficit		46	17.03
Anaemia		70	25.92
Respiratory signs		58	21.48
Nasal discharge/ coughing/ epistaxis		35	12.96
Tachypnoea/dyspnoea		48	17.77
Collapse		32	11.85
Mean Clinical Score in cases presented		5.87 ± 0.20 (1-15)	-

Table 2 Relationship of Clinical score and mortality in canine babesiosis

Clinical score	Total cases	No of dogs died	Percentage
1-5	138	2	1.45
6-10	102	12	11.76
11-15	30	18	60.00
Total	270	32	11.85

The cases of babesiosis were further classified as acute, chronic and subclinical. The dogs with subclinical babesiosis showed no overt clinical signs but were cytologically positive. Acute form of the disease was seen in 27.78%, chronic form in 48.52% and subclinical form in 23.70% of the cases.

The signs were categorised as general state, gastrointestinal, nervous, cardiac and respiratory. Majority (92.22%) of the dogs had clinical signs attributable to the general state. Rectal temperature was elevated in 64.44% dogs, hypothermia in 7.77%, (21) while remaining 27.77% of the dogs had normal body temperature. Thus it is apparent that pyrexia is not a concordant sign in canine babesiosis due to *B. gibsoni*, contrary to the common belief. It was interesting to note that severely septicemic dogs had subnormal temperature. The fact that normal rectal temperature was also recorded in 27.77 % cases which indicated that pyrexia should not be taken as a thumb rule in canine babesiosis and the disease can be suspected even when there is no elevation of temperature if other clinical indicators are present.

Weakness, emaciation, dehydration were other general non-specific clinical signs observed, agreeing with earlier workers (Abdullahi *et al.*, 1990; Gupta *et al.*, 2002; Irwin, 2010). The main agent responsible for transmission of the disease is tick. However ticks were found only in 51.85% of the cases at the time of referral. Godara *et al.* (2010) in their study noted that there was a positive correlation between presence of ticks on the body surface of the host and haemoprotozoan infections. The general signs were manifested singly or in various combinations.

Gastrointestinal symptoms were observed in 84.81% of the dogs in the present study. Earlier workers have also recorded gastrointestinal symptoms as the major manifestation (Botros *et al.*, 1975; Irwin and Hutchinson, 1991). However, Malherbe and Parkin (1951) reported that the enterohagic form was a comparatively rare finding in *B. canis* infection.

In the present study 75.55% of the dogs suffered from anorexia. Indeed many dogs were presented with the only complaint of complete or partial anorexia for past few days. Vomiting or excessive salivation observed in 44.44% dogs may be a result of gastritis.

Diarrhoea (34.81%) in the present study was manifested in different forms ranging from merely increased frequency or semi-solid stools to haemorrhagic diarrhoea. Many dogs showed classical signs of haemorrhagic gastroenteritis (HGE). It seems probable that in many cases HGE might have accentuated babesia infection. Many of the dogs suffering from babesiosis subsequently or concurrently also suffered from severe HGE. Babesiosis by lowering the immune defence of the host could possibly make the dog more susceptible to other pathogens resulting in HGE. The reverse could also be true. Such complications were common in young pups (< 4 months) and dogs with no history of vaccination. The mortality in such cases was also higher.

Splenomegaly a relatively common sign in canine babesiosis (Conrad *et al.*, 1991; Varshney *et al.*, 2003; Vial and Gorenflot, 2006) was seen in 13.33% of the cases in the present study. Varshney *et al.* (2008) reported 20% incidence of splenomegaly. Seneviratna (1965) found on post-mortem examination that spleens of dogs infected with *B. gibsoni* were 3-6 times the normal size. Splenomegaly in babesiosis could be a result of chronic inflammation (Varshney *et al.*, 2008). The lower incidence in the present study might be due to increased awareness of the owners about the disease and their overwhelming concern for their pets. As such most dogs were usually brought to the Hospital immediately when they showed the slightest abnormal activity. Therefore chronic symptoms were not seen in such cases.

Hepatomegaly was seen in very few cases (3.33%). Ultrasonography also revealed hepatomegaly and hypoechoic texture of liver in one case which was suggestive of inflammation. (Sakuma *et al.*, 1987; Varshney *et al.*, 2003). Two dogs showed hyperechoic texture which could be due to hepatic fibrosis/ cirrhosis. Varshney *et al.* (2003) also documented hepatomegaly in clinical cases of babesiosis. Mathe *et al.* (2006) reported hepatomegaly and increased echogenicity of the liver in dogs with babesiosis. In canine babesiosis, hepatomegaly has been observed at necropsy (Irwin and Hutchinson, 1991).

Biurate crystals in urine were observed on microscopic examination in one dog with babesiosis which had protracted illness for more than a month and revealed splenomegaly and hepatomegaly with hyperechoic liver on ultrasonography. Biurate crystals are indicative

of chronic liver disease (Rothuizen, 2009) which in this case was probably secondary to babesiosis. Hypoxia can cause diffuse hepatocellular swelling (LeMasters, 2001) and therefore the hypoxia in babesiosis may be sufficient to cause transient hepatopathy. Thus the present findings indicate that the hepatic insult does occur in cases of babesiosis and the severity will increase if proper treatment is not instituted at an early juncture.

Ascites was seen in a small percentage of the cases (1.48%). Limb oedema was also seen in three dogs. Two dogs showed bilateral limb oedema (one also had ascites) while one showed oedema of all four limbs. Wadhwa *et al.* (2011) reported bilateral limb oedema in canine babesiosis. However oedema of all four limbs has not yet been reported. The oedema could be due to disturbances in peripheral circulation due to vascular stasis resulting from sludging of parasitized erythrocytes in the capillary beds (Birkenheuer, 2012). This may lead to escape of fluid into interstitial spaces resulting in oedema.

Symptoms of nervous system involvement were seen in 32.59% dogs with babesiosis. The main nervous signs were dullness and depression (23.70%) with coma in severe cases, ataxia (10.74%) and tremors or convulsions (7.4%). Cerebral babesiosis has been reported in *B. canis* infections (Jacobson, 1994; Collett, 2000; Sriram and Gomathinayagan, 2004). Recent publications have also described similar nervous signs in *B. gibsoni* infection (Varshney *et al.*, 2008; Chaudhari *et al.*, 2009). Cerebral babesiosis though less common, is characterised by nervous symptoms such as limb weakness, rheumatoid muscular pain, paresis and sudden death (Soulsby, 1982). Sludging of parasitized erythrocytes in small capillaries of CNS may lead to the development of CNS signs (Birkenheuer, 2012). Moore and Williams (1979) observed that microvascular damage secondary to hypoxia due to haemolysis contributed to the development of disseminated intravascular coagulation (DIC) which may be responsible for the atypical manifestations of babesiosis such as the nervous form. In the present study, 29 dogs showed ataxia and hind limb weakness. Epileptic convulsions with foaming at the mouth commensures were seen in five dogs. Myoclonus was seen in four dogs, one dog with myoclonus also had concurrent canine distemper (distemper inclusion in blood film) and head tilt was seen in one dog. The nervous signs in the present

cases were similar to those reported in cerebral malaria in humans. The nervous form had greater severity and was potentially more fatal.

Cardiac signs were observed in 60% cases in the present study. Arrhythmias were seen in 54.44% cases. Pulse deficit observed in 17.03% cases could be due to tachycardia. Pale mucous membranes (25.92%) could be due to the profound anaemia seen in babesiosis. However congested mucous membranes may also be seen in babesiosis (Varshney *et al.*, 2008). This may be due to the paradoxical phenomenon of severe intravascular haemolysis and haemoconcentration (Jacobson and Clark, 1994).

Respiratory manifestations were noticed in 21.48% dogs. Of respiratory signs, nasal discharge, epistaxis and coughing were seen in 12.96% and dyspnoea or tachypnoea in 17.77 % of the dogs with babesiosis. Deshmukh *et al.* (2008) also reported respiratory syndrome in a Great Dane pup with a mixed infection of *B. gibsoni*, *B. canis* and *E. canis* which was manifested by coughing, dyspnoea, tachypnoea and tachycardia. Increased vesicular tone auscultated in these cases was probably due to pneumonic changes or concurrent cardio-pulmonary involvement.

Higher frequency of tachypnoea in babesiosis (Chou, 1995) seems to be due to marked anaemia and stress (Varshney *et al.*, 2008). Hyperventilation which results in respiratory alkalosis is probably due to the body's attempt to compensate metabolic acidosis owing to hypoxemia (Birkenheuer, 2012). Epistaxis though not common in babesiosis can be due to marked thrombocytopaenia.

Clinical scoring

The individual dogs' total clinical score varied from 1 to 15 with a mean of 5.87 ± 0.20 in the present study. The present investigation showed a wide variability in clinical signs ranging from fever, anorexia, lethargy, weight loss, dehydration, diarrhoea/ constipation, vomition, pale mucous membranes to splenomegaly, hepatomegaly, ascites, arrhythmia, dyspnoea, ataxia and convulsions which is in accordance with the observations of earlier workers (Botros *et al.*, 1975; Irwin and Hutchinson, 1991; Gupta *et al.*, 2002; Varshney *et al.*, 2003; Varshney *et al.*, 2008; Selvaraj *et al.*, 2010; Wadhwa *et al.*, (2011). Haemoglobinuria which has been reported in *B. canis* infection was not seen in any case of *B. gibsoni* infection in the

present study and concurred with Groves and Dennis (1972) and Chou (1995). The large variation in clinical signs could be due to differences between breeds, age of the dogs, concurrent infections, nutritional and immune status of the dog.

Canine babesiosis is manifested in a myriad of forms. However clinical symptoms such as fever, anorexia, anaemia, presence of ticks, vomiting and diarrhoea, splenomegaly either singly or in combination should raise the suspicion of babesiosis.

Role of age and sex

Conrad *et al.* (1991) reported that the acute form is more common in *B. gibsoni* infection. There was no difference in the proportion of the disease severity between sexes and between breeds of dogs. However significantly ($P < 0.05$) higher number (50.00%) of dogs in > 72 months age group suffered from the acute form of the disease in the present study. This could probably be due to lowering of defence mechanisms in older dogs (Kearns *et al.*, 1999) thus making them more susceptible. Irwin (2005) stated that the age and immune status of the host play an important role in determining the pathogenesis of the disease.

Mortality

Death in 32 (11.85%) of the cases was attributed to respiratory failure. Fatality was significantly higher ($P < 0.01$) in dogs with hypothermia than in dogs with hyperthermia. Thus it is clear that dogs with subnormal temperature require more critical care. Mortality was also significantly related ($P < 0.01$) to the clinical score (Table 2). Increasing mortality with increase in clinical score observed in the study could be due to multisystemic complications in such cases. Therefore computation of clinical score at the time of admission could lead to a correct prognosis and better management of critical cases keeping all aspects in mind. Collapse was also significantly correlated with nervous signs, cardiac signs and respiratory signs. Chaudhari (2006) and Jacobson (1994) reported that the nervous form of babesiosis is potentially more fatal.

CONCLUSION

Babesiosis shows wide variability in clinical signs in canines. Working out clinical score of the case at the time of first presentation, help early prognosis and thereby better management of case.

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