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Prognostic Indicator for Clinical Babesiosis in Cattle

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Abstract

Present Study has been carried out on the animals suffering from clinical bovine babesiosis in the Patna districts of Bihar, India. A total number of 36 lactating cows of different breeds and ages were included in the study to develop a prognostic indicator card for better and economic management of disease. There are two types of prognostic indicator systems that has been evolved viz numerical and categorical on the basis of oxidant marker, antioxidant status, trace mineral status, hematological changes and vital parameter changes between dead and survived suffering animals. Erythrocytic LPO in succumbed cases were significantly (P<0.01) higher than recovered ones. GPx, SOD and catalase in succumbed cases were significantly (P<0.01) lower than recovered ones. Trace elements Zn, Cu & Se in succumbed cases were significantly (P<0.01) lower than recovered ones. The body temperature, respiration and heart rate in dead cases were significantly (P<0.01) higher than recovered ones. In conclusion, Prognostic indicator card developed in the present study may be helpful in the management of clinical babesiosis in field condition .

Keywords: Oxidative marker, *Babesia bigemina*, prognosis,Ixodidae, icterus .

Introduction

Babesiosis is a hemoprotozoal disease caused by haemotropic protozoa of the genus *Babesia spp.* within the phylum Apicomplexa (Bock *et al*., 2004). It is a well recognized disease of veterinary importance in cattle, horses and dogs and has gained attention as an emerging zoonotic disease causing malaria-like syndrome including fever, haemolysis and hemoglobinuria. Ticks of the Ixodidae family especially *Boophilus microplus* are the main vectors and their geographical distribution influences the epidemiology of the disease. *Babesia bigemina* and *Babesia bovis* are particularly economically important in Asia, Africa, Central and South America, Southern Europe and Australia (Spickler and Roth, 2008). Hemoparasites of the genus Babesia are protozoans which predominantly infect ruminants in tropical and subtropical regions (Hashemi-Fesharki, 1997) and impose heavy losses due to high rates of mortality and decreased productivity in affected animals. India suffers losses of about 57.2 million US dollars annually due to babesiosis in livestock (Sharma *et.al.,* 2013 and McLeod *et.al.,* 1999). The diagnosis of *B. bigemina* is routinely done by conventional parasitological techniques like Giemsa stained thin blood smear (GSTBS). The recovered animals from *B. bigemina* infection may reamian subclinically infected or become carrier for other susceptible

healthy animals in the herd and a source to infect the tick vectors. The acute form of the disease is characterized by fever, anemia, hemoglobinuria, jaundice and a variable mortality rate. Despite substantial recent advances in knowledge regarding biology of *Babesia*, immunopathogenesis, diagnostic testing and chemotherapy, we are still unable to attain, definitive diagnosis and effective treatment of *Babesia* infections (Birkenheuer, 2004). Until now, there is no well defined prognostic indicator system exist for the clinical babesiosis to definitely say that whether infected animals will survive or not. The present study was undertaken to establish a valid comprehensive prognostic indicator.

Materials and Methods

A comprehensive prognostic indicator system was determined on the basis of level of various parameters in clinically affected animals. The parameters taken into consideration were body temperature, mucus membrane status, degree of anemia, presence or absence of icterus, hemoglobinuria, hemoglobin concentration, PCV, significant oxidative stress determinant and trace mineral status. Total 36 clinically affected animals were included in this study. For the determination of prognostic indicator all the parameters mentioned earlier were measured pretreatment and post treatment and compared with the healthy group. A standard cut off value of each parameter was determined in the clinically affected animals on the basis of survival/ death of animals even after best treatment. Two types of prognostic indicator systems had come up on the basis of quantification of parameters viz numerical and categorical. Numerical parameters can be quantified whereas, categorical cannot. Numerical parameters include hemoglobin concentration, PCV, significant oxidative stress determinant, trace minerals status, body temperature, respiration rate, heart rate and categorical consists of mucus membrane status, degree of anemia, presence or absence of icterus, hemoglobinuria etc.

Results and discussion

Numerical prognostic indicator:

The Mean± SE of various parameters of numerical prognostic indicator for clinical babesiosis is shown in the table-I. The Mean ±SE of rectal temperature (106.41±0.26^{0}F) and respiration rate (42.28±0.80/min) of succumbed cases was significantly (P<0.01) higher than the recovered cases (104.95±0.16^{0}F) and (46.52±1.20) respectively. The observed high fever could be attributed due to the effect of unspecific toxic substances produced during the metabolism of *Babesia* on thermoregulation and increased respiration and heart rate occurred as a result of anemia (Radostits *et al*. 2000). The present findings of *B. bigemina* infection in cattle are in agreement with what was previously described by Brown and Torres (2008), Georgi *et al*. (1990) and Kaufmann (1996). The heart rate was also higher in succumbed cases (90.64±2.70/ min) than the recovered cases (87.60±2.09/ min) but it was statistically nonsignificant. The mean±SE of hemoglobin (2.29±0.09 gm/dl), PCV (13.13±0.35%) and TEC (2.29±0.09 x10^6 /µl) of succumbed cases was significantly (P<0.01) lower than the recovered cases in relation to Hb (5.54±0.161 gm/dl), PCV (21.41±0.59%) and TEC (3.85±0.08x10^6 /µl). These observations were similar to what were reported by Col and Uslu (2007); Durrani *et al*. (2006) and Mahmmod (2014).

The Mean±SE of selenium (0.256±0.010 µg/ml), copper (0.281±0.022 µg/ml) and Zinc (0.263±0.023 µg/ml) of dead cases was significantly (P<0.01) lower than the recovered cases 0.891±0.002 µg/ml, 0.452±0.010 µg/ml and 0.548±0.012 µg/ml respectively. The Cu and Zn are essential component of SOD which is located in the cell cytosol (McCord and Fridovich, 1969) and contribute to the first line of antioxidant pathway by catalyzing the conversion of O_2^- (superoxide) into H_2O_2. Se-containing GPX catalyzes the conversion of H_2O_2 to H_2O through the oxidation of R-GSH (Chance *et al*., 1979). In the present study it has been observed that the decrease in trace minerals further reduces the antioxidant activity of enzymes which leads to increased oxidative damage to the erythrocytes and subsequent hemolysis and anemia (McCord and Fridovich, 1969). Esmaeilnejad *et al.* (2014) also reported the same pattern of variation in trace minerals in sheep infected with *Theileria*. The

Table 1: Numerical comprehensive prognostic score, of clinically affected cattle in terms of survival/death

Parameters	Mean ± SE of recovered cases (n=25)	Mean ± SE of dead cases (n=11)
Rectal temperature (^{0}F)	104.95±0.16^b	106.41±0.26^a
Heart rate/min	87.60±2.09	90.64±2.70
Respiration rate/min	42.28±0.80^b	46.52±1.20^a
Hb (gm/dl)	5.54±0.161^b	2.29±0.09^a
PCV (%)	21.41±0.59^b	13.13±0.35^a
TEC (x10^6/µl)	3.85±0.08^b	2.29±0.09^a
LPO (nmol/ml)	313.16±3.82^b	514.38±8.34^a
SOD (unit/mgHb)	21.63±0.22^b	18.89±0.16^a
GSH (mM/mgHb)	26.79±0.14^b	13.71±0.14^a
Zn (µg/ml)	0.55±0.01^b	0.26±0.02^a
Cu (µg/ml)	0.45±0.01^b	0.28±0.02^a
Se (µg/ml)	0.89±0.00^b	0.26±0.01^a

Mean ±SE with different superscript differ significantly at P<0.05

Table 2: Categorical comprehensive prognostic score of clinically affected cattle in terms of survival/ death

Parameters	Recovered cases (n=11)	Dead cases (n=25)
Hemoglobinuria	< +++	> ++++
Dyspnea	Mild	Severe
Lymphadenitits	Absent	Present
Icterus	Mild	Severe
Appetite	Inappetence	Anorexia
Nervous signs	Absent	Present (mild)
Frothy salivation	Absent	Present
Posture	Normal	Normal
Occulonasal discharge	Mild	Severe
Mucus membrane	Pale	Icteric

mean±SE of LPO (514.38±8.34 nmol/ml) of dead cases was significantly (P<0.01) higher than the recovered cases (313.16±3.824 nmol/ml). Lipid peroxidation of erythrocytes also decreases RBC membrane pliability, resulting in slow passage and further damage to the RBC as it traverse through capillary beds (Taboada and Lobetti, 2006). The mean±SE of SOD (18.89±0.161 unit/mgHb) and GSH (13.71±0.138 mM/mgHb) of dead cases was significantly (P<0.01) lower than the recovered cases 21.63±0.22 unit/mgHb and 26.79±0.141 mM/mgHb respectively. The present findings are in

agreement with Esmaeilnejad *et al*., (2012) who reported similar changes in SOD, GSH and catalase in Babesia infected cattle.

Categorical prognostic indicator:

The categorical prognostic indicator was evaluated on the basis of severity of clinical manifestations in survived and dead cases of clinically affected animals as shown in table 2. Severity of condition was denoted by+/present/ severe. Out of 36 cases, 11(30.55%) cases have died due to babesiosis. In succumbed cases there were severe hemoglobinuria (++++) as compared to recovered animals (< +++). Similarly severe dyspnea, icterus, occulonasal discharge was found in dead animals as compared to survivors. Anorexia, lymphadenitis and frothy salivation were also found in succumbed cases but not in survivors.

Finally it can be concluded that cut off values of various vital parameters can be used as prognostic indicator for the prediction of success of treatment of the clinical babesiosis. Prognostic indicator card developed in the present study may be helpful in the management of clinical babesiosis in field condition and will reduce the unnecessary expenditure on treatment of animals whose prognosis is grave.

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Conflict of Interest: All authors express no conflict of interest.

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