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Clinical management of an outbreak of Babesiosis in a herd of cattle: A Case Report

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Abstract: *Eight Friesian-Sahiwal cattle aged between 8 months and 1 ½ years old of both sexes weighing between 100 and 170 kg were infected. The cattle were managed semi intensively. Two weeks before presentation to the University Veterinary Hospital, Universiti Putra Malaysia, two calves died out of 10. The 8 remaining cattle were presented with chief clinical signs of pale mucous membrane, jaundice, and increased respiratory rate, and were diagnosed with Babesiosis. Diagnostic work up was carried out by taking venipuncture blood sample from the cattle and sent to the Clinical Pathology Laboratory for complete blood count (CBC) and biochemistry. Blood sample was also sent to Parasitology Laboratory for blood protozoa evaluation. Ticks were also collected and sent to Parasitology Laboratory for the identification of parasites. Berenil® 5% (Diminazene Aceturate) injection was administered intramuscularly and Ivermectin pour on was applied topically against the blood parasites and for both endo and ecto parasites. The most significant features of the disease are the persistent and consistent lymphocytosis and monocytosis that proves suggestive of the disease from the blood picture and the disease is also associated with muscle degenerations and severe pains and these are additional signs to be observed during the diagnosis of Babesiosis.*

Keyword: *Cattle, Babesiosis, Jaundice, 5 % Diminazene Aceturate, Ivermectin*

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I. Introduction

The Malaysian cattle industries are at risk of infection and disease particularly the cattle population affected by Babesia parasites that could caused local or large-scale financial encumber, predominantly since information concerning the cost of losses due to diminished productivity of cattle as a result of tick infestation is frequently not up to date or readily obtainable. The disease will cost the agricultural sector some colossal amount of money in countries afflicted by this disease (Sackett et al., 2006) as a result of the infection causing retarded growth in calves, death, increased abortion rate and sterility, reduced milk and meat production and escalate the cost of prevention and treatments (Bock et al., 2004). Babesiosis is a disease caused by intraerythrocytic apicomplexan parasites of the genus Babesia, and transmitted by blood-sucking ticks of the Ixodidae family (hard ticks). It is a one-host tick; all stages are spent on one animal. The transmission occur transovarially through several generations. While the parasites can be readily transmitted experimentally by blood inoculation, mechanical transmission by insects or during surgical procedures has no practical significance. Intrauterine infection has also been reported but is rare. By means of the universal distribution of the ixodid tick, Babesiosis is the second most widespread blood-borne disease of animals (Homer et al., 2000; Hunfeld et al., 2008, Gohil et al., 2013) and, prominently, is gaining increasing interest as an emerging zoonosis of humans (Homer et al., 2000; Kjemtrup and Conrad, 2000; Zintl et al., 2003; Hunfeld et al., 2008; Leiby, 2011; Gohil et al., 2013). Clinically, they are all characterized by fever and intravascular hemolysis manifested by a syndrome of anemia, hemoglobinuria and jaundice. It is also named as tick fever, Texas fever, red water fever (Bock et al., 2004; Cooke et al., 2005; Gohil et al., 2010; Gohil et al., 2013). Cattle tick fever is now known to have widespread distribution, being found throughout the tropics and subtropics, as well as in many temperate areas (Zintl et al., 2003; Bock et al., 2004; Chauvin et al., 2009; Rahman et al., 2010; Gohil et al., 2013). Animals susceptible to natural infection include cattle of all breeds, buffaloes, and the Zebu (Homer et al., 2000; Hunfeld et al., 2008, Gohil et al., 2013). Recovered animals become resistant carriers and serve as reservoirs of infection for susceptible animals (Zintl et al., 2003; Bock et al., 2004; Chauvin et al., 2009; Gohil et al., 2013). Babesia is transmitted by ticks in which the protozoan passes transovarially, via the egg, from one tick generation to the next (Gohil et al., 2013). Babesiosis is particularly severe in naive animals introduced into endemic areas and is a considerable constraint on livestock development in many parts of the world. The major economic impact of Babesiosis is on the cattle industry and the two most important species in cattle, *Babesia bovis* (small) and *B. bigemina* (big). From examination of stained blood films show the organisms to be within

red cells, almost always singly or as pairs, often arranged at a characteristic angle with their narrow ends opposed. Typically they are pyriform, but may be round, elongated or cigar shaped. The main vectors of Babesia are Boophilus ticks. Babesia spp is transmitted by blood sucking ticks, which become infected when they ingest parasites in the blood of infected cattle.

II. Life cycle of Babesia spp

The life cycle has two phases, in the first one they multiply asexually by binary fission in the erythrocytes of the vertebrate host; the second phase is in the female ticks which occur by the process of sporogeny. Each sporozoite (merozoite) penetrates the cell membrane of an erythrocyte with the aid of a specialized apical complex. Once inside, it transforms into a trophozoite from which two merozoites develop by a process of merogony (binary fission). When Babesia-infected erythrocytes are ingested by ticks, most of the parasites degenerate and are destroyed. However, some specific stages of the parasite ("pre-gametocytes") survive and undergo further development to evolve into gametocyte. Gamogony (gamete differentiation and zygote formation) occurs in tick intestinal cells. Ookinetes and kinete formed by asexual division of ookinete (sporogonies) occur in various tick organs. Final differentiation of sporozoites occur in salivary glands

The clinical signs vary with the age of the animal and the species and strain of the parasite. The acute disease generally runs a course of 3 to 7 days and fever (>40°C) is usually present for several days before other signs become obvious. This is followed by inappetance, depression, increased respiratory and heart rate, weakness and reluctant to move. There is hemoglobinemia and hemoglobinuria, the conjunctiva and mucous membranes are first congested and reddened, but as erythrocytic lysis occur, the color changes to the pale and develop into anemia. In the terminal stages, there is severe jaundice, the urine is dark red to brown in color and produces a very stable froth. Either constipation or diarrhea may be present.

III. Case Report

Patient signalment

Eight Friesian-Sahiwal cattle aged between 8 months and 1 ½ year old of both sexes weighing between 100 and 170 kg were infected with Babesiosis (Fig. 1). They were managed semi-intensively.

History

Eight Friesian-Sahiwal cattle aged between 8 months and 1 ½ years old of both sexes weighing between 100 and 170 kg were infected. The cattle were managed semi intensively. Two weeks before presentation to the Ambulatory Unit of University Veterinary Hospital, Universiti Putra Malaysia, two calves died out of 10. The 8 remaining cattle were physically examined and found with chief clinical signs of pale mucous membrane, jaundice, and increased respiratory rate, and were diagnosed with Babesiosis.

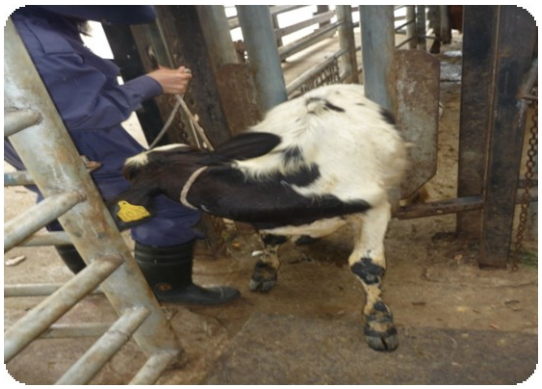

Fig 1: Pictures of a calf presented for examination.

Physical examination

On physical examination 2 calves out of 8 animals had high temperature of 39.4°C. 7 out of 8 cattle had pale mucus membrane and the capillary refill time (CRT) was more than 2 sec (Fig. 2). The ticks were also found on the inguinal and the neck region.

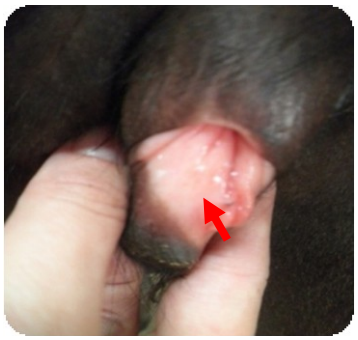

Fig. 2: Pale mucus membrane at vulva region

Fig. 3: Hard ticks of the family Ixodidae, Boophilus microplus

Diagnostic work up

Diagnostic work up was carried out by collecting the blood sample via jugular vein and sent to Clinical Pathology Laboratory for complete blood count (CBC) and biochemistry. Blood sample was also sent to Parasitology laboratory for the investigation of blood protozoa. The ticks were also collected and sent to parasitology laboratory for identification.

IV. Results

The blood results reveal that all animals consistently showed lymphocytosis and monocytosis were suggestive of the infection. The ticks were Boophilus microplus sp. As shown in (Fig. 3). Besides that, from the Geimsa stained blood were positive for Babesia spp (Fig. 4).

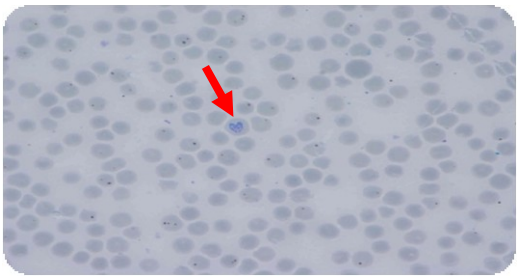

Fig. 4: Stained blood smear showing Babesia sp.

Final diagnosis

Therefore, the final diagnosis of the case was Babesiosis based on the history, clinical signs, presented by the calves particularly the pale mucous membrane; the blood results of all the calves revealed consistent lymphocytosis and monocytosis due to the infection and the parasitology results indicated positive for Babesia spp.

Table 1: Hemogram Laboratory Result

Parameters		Results	Reference values
Erythrocytes (RBC)	X 10^{12}/L	6.14	5-10
Hemoglobin	g/L	83	80-100
PCV	L/L	0.27	0.24-0.46
MCV	fL	36	40-60
MCHC	g/L	329	300-360
Leucocytes (WBC)	X 10^9/L	15.8*	4.2-12.0
Band Neutrophil	X 10^9/L	0.32*	< 0.2
Seg. Neutrophil	X 10^9/L	2.84*	0.6-4.0
Lymphocytes	X 10^9/L	10.90*	2.5-7.5
Monocytes	X 10^9/L	0.95*	0.05-0.8
Eosinophils	X 10^9/L	0.63	0.05-2.4
Basophils	X 10^9/L	0.16	< 0.2
Thrombocytes	X 10^9/L	397	100-800
Plasma Protein	g/L	70	60-80
Icterus Index	(Unit)	5(Lysed)	< 15

Comment: * Lymphocytosis; monocytosis, left shift- infection/inflammation

Table 2: Biochemistry Laboratory Result

Parameters		Results	Reference values
Sodium	mmol/L	149.8*	132-145
Potassium	mmol/L	5.0	4.1-5.1
Chloride	mmol/L	101.5	85-105
Calcium	mmol/L	2.28	2.2-2.7
Inor.Phos.	mmol/L	2.66	1.6-2.9
Urea	mmol/L	5.4	1.8-7.11
Creatine	µmol/L	173*	< 176
Bilirubin, Total	µmol/L	0.8	1.7-27.2
y-GT	U/L	8	< 25
AST	U/L	79.1	50-100
CK(CPK)	U/L	1892*	50-200
Total Protein	g/L	61.1	55-75
Albumin	g/L	18.0*	27-45
A:G	(Unit)	0.8	08-1.2

Comment: * Hypernatremia; Hypoalbunaemia; Potassium and creatinine at high normal. Elevated muscle enzyme- muscle disease.

Treatments

All the calves were treated with Berenil® 5 % (Diminazene Aceturate) injection, 1 ml/20 kg, intramuscularly and Ivermectin 1ml/20kg, pour on was applied topically on the skin at the dorsal aspect from the head down to the tail region. Berenil is an antiparasitic drug for treatment and control of protozoa infection in cattle, sheep, horses and dogs. It also protects cattle against Babesiosis and Trypanosomiasis for 2-4 weeks. Ivermectin was instituted for the control of endo and ectoparasites. The cattle were also administered with Fercobsang, 5 ml, intramuscularly as a supplement for iron and vitamin to increase RBC formation.

Progression

Follow up of the case after 1 week of treatment revealed an improvement in the condition of cattle, the cattle responded well to the treatments showing a pink mucous membrane and become more active. The blood result divulged absence of the Babesia sp and also there were no more ticks on the body of the cattle.

V. Discussion

The cattle with the history and clinical signs of fever, anemia, jaundice and hemoglobinuria should be suspected for Babesiosis. Hence, the differential diagnosis comprises of Babesiosis, Trypanosomiasis, Anaplasmosis, Leptospirosis and Theileriosis.

The disease can be diagnosed by the examination of blood and organ smears with Giemsa. From the live animal, thick and thin blood smears should be prepared, preferably from capillaries in the ear or tail tip.

Thick films can be helpful in detecting small numbers of parasites, but species identification is best in thin films. At necropsy, smears of heart muscle, kidney, liver, lung, and brain and from a blood vessel in the extremities (lower legs) should be taken. Diagnosis is unreliable in cattle that were dead for more than 24 hours.

PCR can detect and differentiate Babesia spp, and are particularly useful in carriers. Serology is not valuable in the clinical stage of the disease but is used for the purpose of research, epidemiological studies, export certification or where vaccine breakdown are suspected. Antibodies to Babesia spp. are usually detected with an indirect fluorescent antibody (IFA) test or enzyme-linked immunosorbent assay (ELISA). To confirm the diagnosis, post mortem can be conducted and is unreliable in animals that were dead for more than 24 hours (Fincher et al., 2001; Cynthia, 2005).

Post mortem lesions are mainly related to intravascular hemolysis, anemia and jaundice. The mucous membrane is usually pale and may be icteric. The subcutaneous tissue may also be icteric. The spleen is markedly enlarged with a dark, pulpy and friable consistency. The liver may be enlarged and darkened or icteric with a distended gallbladder containing thick, granular bile. The kidneys are usually dark red or black, and the urinary bladder often contains reddish-brown urine. However, in some cases, the urine may be normal. Other organs may show congestion or petechial haemorrhages and occasionally there will be pulmonary edema (Fincher et al., 2001; Cynthia, 2005).

The morbidity and mortality rates are highly variable. Cattle can develop lifelong resistance to a species after infection. Animals that recover from natural infection remain immune with persistence of the parasite in the peripheral blood for a number of years with B. bovis and for a few months in the case of *B. bigemina.* This phenomenon was termed premunity. No signs are apparent during this carrier state but protection

can be broken down by stress factors such as parturition, starvation, or concurrent diseases and clinical signs may reappear. Repeated infections results in permanent immunity. If the illness is treated urgently and efficiently, and the protozoa are killed before antibodies are produced, no immunity occurs (Urquhart et al., 1996).

The immune response of cattle to infection with *B. bovis* or *B. bigemina* involves both innate and acquired immune mechanisms. Innate immunity is no specific and includes factors such as host-parasite specificity, genetic factors, age of the host and the response of host cells. According to Trueman and Blight, 1978; Goff et al. 2001, young calves exhibit a strong innate immunity compared to adult cattle. Infected animals with most Babesia spp. develop the immunity against reinfection with the same species.

Treatment should be tried early (before the animal becomes anemic) even if parasitemia is eliminated. Currently, Diminazene Aceturate and imidocarb dipropionate (Imidocarb®) are the most widely used. Imidocarb dipropionate salt (Imizol®) is effective at a dose 1-2mg/ kg subcutaneously and used as a chemoprophylactic at a high dose, 3mg/ kg subcutaneously. It provides protection from B. bovis for 4 weeks and *B. bigemina* for at least 2 months (Taylor and Mc Hardy.1979). Diminazene Aceturate (Berenil®) is widely used and given in a 7 % aqueous solution by deep intramuscular injection at a dose 3.5 mg/kg. It is well tolerated and will protect cattle from this disease for 2-4 weeks.

Besides that, Quinuronium sulfate, (Acaprin®) 5 % solution also can be given at a dose of 1 mg/kg subcutaneously. Supportive therapy is important in chronic cases and convalescent animals such as vitamin, fluid therapy and hematinic drug (Iron dextran 7 ml /kg by intramuscularly). In the severely affected animals, where anemia occurs, blood transfusion must be done. A blood transfusion partially restores the PCV and greatly improves the survival rate of more severely affected cattle.

Control measures that are currently applied are control of ticks by use of acaricides, vaccination and chemoprophylaxis. The most effective procedure for the control of babesiosis is to control and eradicate its vector, the Boophilus tick. It can be by dipping or regular spraying every 2-3 weeks. The common acaricides used for combating ticks are the chlorinated hydrocarbons, carbamates, natural and synthetic pyrethrins, and avermectins. Live, attenuated strains of *B. bovis*, *B. bigemina* or *B. divergens* are used to vaccinate cattle.

Malaysia is not practicing the use of vaccine and no vaccine is available in the country (Rahman et al., 2010). Single 2 ml dose injected either subcutaneously or intramuscularly. Animals can be vaccinated at any age, but it is best to vaccinate animals at 3-9 months of age, it gives immunity after 8 weeks, which usually lifelong. Chemoprophylaxis with Imidocarb can protect animals from clinical infection for as long as 2 months while allowing development of immunity. To minimize losses treat sick cattle as soon as possible and identify those treated. Sick animals may not recover if treated too late (Cynthia, 2005).

VI. Conclusion

In conclusion, watchfulness and education is crucial predominantly for the government, farmers and Veterinarians in endemic areas. Babesiosis is caused by intraerythrocytic protozoan parasites of the genus Babesia that infect a wide range of domestic animals. This disease is a tick transmitted and is distributed worldwide. Two most important species in cattle are *B. bovis* and *B. bigemina*. It can be controlled by vector control, vaccination and chemoprophylaxis. In the present case report the most significant features of the disease are the persistent and consistent lymphocytosis and monocytosis that proves suggestive of the disease from the blood picture and the disease is also associated with muscle degenerations and severe pains and these are additional signs to be observed during the diagnosis of Babesiosis.

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