Clinical, haematological and therapeutic studies on babesiosis in Arabian horses in the Qassim region, central of Saudi Arabia

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ABSTRACT
This study was carried out in the Qassim region, central of Saudi Arabia to determine the clinical, haematological and therapeutic impact of babesiosis caused by Babesia caballi in Arabian horses. The clinical signs in infected horses were pyrexia (40.5–41.5°C), depression, pale or icteric mucous membranes and emaciation. Haematological examination revealed significant decrease in erythrocyte, thrombocyte counts and haemoglobin concentration in infected horses compared with controls. Treatment with imidocarb dipropionate was 100% effective in eliminating the parasites from the blood and led to an improvement in the clinical state. In conclusion, babesiosis should be suspected in any horses showing signs of anaemia or jaundice and severe body weight loss in addition to the presence of ticks. Bloody urine which is a characteristic feature of babesiosis in other animals is not common in Arabian horses. Moreover, treatment using imidocarb dipropionate in conjunction with hematinics and fluid therapy should be applied for treatment of equine babesiosis.

1. Introduction
Equine babesiosis is an infectious disease of horses, donkeys, zebra and mules caused by intra-erythrocytic, protozoa of the genus babesia; Babesia caballi (large babesia) and transmitted by ticks (Russell et al. 2005; Sakha 2007; Knowles 2010). These parasites are widely distributed in the world, including Asian continent, Europe, Africa, and South America, and the prevalence corresponds to the presence of the tick-vectors (Kumar & Kumar 2007; Motloang et al. 2008).

The clinical picture of the disease in horses is variable and may be manifested by fever, oedema of the ventral abdomen, icterus and haemoglobinuria (Radostits et al. 2007). However, it has been thought that carriers are generally responsible for the propagation and maintenance of the infection (Radostits et al. 2007).

The disease and its severity not only depend on the virulence of the causative agent, but also to a large extent on the degree of host susceptibility where the disease is more severe in those horses moved from tick-free areas to tick infested areas or in animals suffering from stress (Mehlhorn & Schein 1998).

The diagnosis of babesiosis in acute cases is mainly based on clinical findings and microscopic examination of 10% Giemsa-stained thin blood smears. However, expertise in piroplasm microscopy is required in unapparent carrier horses or chronic infections because parasitaemias are often extremely low and may otherwise be missed (Friedhoff & Soule 1996; Bashiruddin et al. 1999; Hodgson 2002).

Economic losses associated with equine babesiosis include cost of treatment, abortion, loss of performance, restrictions in meeting international requirements related to exportation or participation in equestrian sporting events and death in some cases (Kerber et al. 1999; Rothschild 2013). The disease is endemic in Saudi Arabia. So, this study was delineated to study the clinical, haematological and therapeutic impact concerning babesiosis in Arabian horses.

2. Materials and methods
2.1. Animals
At the Qassim region, central of Saudi Arabia, 20 (13 females and 7 males) B. caballi naturally infected Arabian horses (Figures 1 and 2) and 10 (5 females and 5 males) parasitologically free controls were used in this study. All horses under study were over 5 years old.

2.2. Clinical examination
All horses were subjected to careful clinical examination before treatment.

2.3. Parasitological examination
Thin blood films from the ear vein, air-dried, fixed in methanol for 5 min, stained in 10% Giemsa stain and rinsed with distilled water. The smears were examined at 1000 magnification (oil immersion) where at least 50 fields were searched per slide.
2.4. Haematological examination

Anticoagulated blood samples were collected via jugular venepuncture from the infected horses \((n = 20)\) as well as from the controls \((n = 10)\). The samples were taken before administration of any medications. Erythrocyte and total and differential leucocyte counts and thrombocytes as well as haemoglobin concentration were measured (Coles 1986).

2.5. Treatment trials

To study the efficacy of imidocarb dipropionate in the treatment of equine babesiosis in naturally infected horses at different stages of the disease was carried out. Twenty \(B. \text{caballi}\) infected horses were treated using imidocarb dipropionate \((\text{Imizol, Schering-Plough Animal Health})\) for two treatments 24 h apart delivered intramuscularly to the neck at a dosage rate of 2.2 mg/kg body weight. Additional supportive treatments as phosphorous; 10 mg/kg body weight and vitamin B12; 500 mg/ kg bodyweight \((\text{Cobozal 10\%, Arab Company For Medical Product})\) and two liters of 10\% dextrose saline were administered for five days. Tick control by spraying the surrounding environment with diazinon \((\text{Nucedol Ultra 60 EC, Bioagripharm, Germany})\) was performed twice, one week apart. The clinical and parasitological status of each treated horses was evaluated for 4 weeks post-treatment.

2.6. Statistical analysis

Student \(t\) test was carried out on the obtained data. \(P\)-values less than 0.05 were considered significant.

3. Results

Microscopic examination of blood smears of infected horses revealed pyriform-shaped merozoites of \(B. \text{caballi}\) within erythrocytes that often form pairs joined at their posterior (Figures 1 and 2).

The clinical signs observed in infected horses are recorded in Table 1. In the early stage of infection, pyrexia \((40.0–41.0°C)\), anorexia, pale of conjunctiva, weakness and depression were the most common signs. Death occurred in one late-treated horse.

After recovery from the acute phase of babesiosis, the infection may assume a subclinical, chronic course and these animals could become carriers of the protozoans. Chronically infected horses showed signs of inappetence, pale or icteric mucous membranes \((\text{Figures 3 and 4})\) and severe loss of body weight.

| Signs                    | Acute (no. 11) | Chronic (no. 9) | Total (no. 20) |
|--------------------------|----------------|-----------------|----------------|
|                          | No.  | %   | No.  | %   | No.  | %   |
| Temperature              | 11   | 100 | 0    | 0    | 11   | 55  |
| Depression               | 11   | 100 | 4    | 44.44| 15   | 75  |
| Weakness                 | 6    | 54.54| 9    | 100  | 15   | 75  |
| Haemoglobinuria          | 0    | 0   | 2    | 22.22| 2    | 10  |
| Pale mucous membrane     | 2    | 18.18| 3    | 33.33| 5    | 25  |
| Icteric mucous membrane  | 2    | 18.18| 6    | 66.66| 8    | 40  |
| Oedema                   | 0    | 0   | 2    | 22.22| 2    | 10  |
| Abortion                 | 0    | 0   | 2    | 22.22| 2    | 10  |

Table 1. Clinical signs in \(B. \text{caballi}\) infected horses.
Oedema was observed in the limbs and at the thoracic inlet in two cases (Figure 5). Temperature of animals was not affected. Pregnant mares sometimes abort at 8 months pregnancy (2 cases out of 4 pregnant mares). Haemoglobinurea was only observed in two acute infected cases and not observed in chronically infected ones.

Hematological examination revealed decrease in the erythrocyte counts, haemoglobin concentration and thrombocytes in addition to a decrease in packed cell volume in infected horses compared with the controls (Table 2).

Treatment results revealed that early intervention using imidocarb dipropionate in conjunction with supportive treatments as phosphorous and vitamin B12 and two liters of 10% dextrose saline were highly efficient in the elimination of the protozoan parasites from blood with a clinical improvement and an eventual 100% cure rate especially in acutely affected horses. Clinical improvement takes more time in chronic cases (four weeks) compared with acute ones (within week). Forty percent of treated horses (8 horses out of 20) showed salivation, colic and sometimes recumbence that disappeared after short time.

4. Discussion

Equine piroplasmosis (EP) is a tick-borne protozoal disease of horses, mules, donkeys and zebras that is characterized by acute haemolytic anaemia (Rothschild 2013).

The paired merozoites joined at their posterior ends are considered to be a diagnostic feature of *B. caballi* infection. Similar findings were recorded previously by de Waal (1992) and OIE Terrestrial Manual (2014).

Considerable variation was noticed in the clinical signs of the infected horses according to the stage of infection. Death may be due to the haemolytic anaemia which results from intra-erythrocytic piroplasms (Preston et al. 1992). Similar signs were recorded previously by Sakha (2007), Uilenberg (2006) and Zobba et al. (2008).

Chronically infected horses showed signs of inappetence, pale or icteric mucous membranes and severe loss of body weight. Similar findings were reported previously by Potgieter et al. (1992) who recorded that intrauterine infections may result in abortion and neonatal death and Teglas et al. (2005) who found that diseases related to the tick-borne infections (chronic) can frequently result in abortion and decrease in weight gain. Often clinical signs of piroplasmosis are too general to allow specific diagnosis and may be confused with other diseases especially in endemic areas. In carrier horses that may act as reservoirs of infection, parasites were present in very low numbers in the blood (Böse et al. 1995). In addition, de Waal and van Heerden (1994) noticed that the clinical signs of EP were not pathognomonic for the disease, especially in endemic areas and horses infected with *B. caballi* may remain carriers for up to 4 years and carrier horses maintained the life cycle of the parasites by serving as a source of transmission for ticks.

Pale or icteric mucous membranes that represent a constant feature of the disease are largely due to hyperbilirubinemia from severe intravascular haemolysis as a result of multiplication of the piroplasms inside red blood cells (Radosits et al. 2007). Jaundice occurred as a result of the increase in the indirect (un-conjugated) bilirubin, which is deposited in mucosal surfaces and elsewhere, imparting a yellow color to those tissues (Rothschild 2013). Haemoglobinurea was not a prominent feature of the disease. Similar observations were previously recorded by de Waal (1992) and Friedhoff and Soule (1996).
Camacho et al. (2005) explained the weight losses in infected horses by the energy uptake by piroplasms in forms of adenosine tri-phosphate (ATP) and adenosine mono-phosphate (AMP) deprive the host (horse) of essential energy for normal anabolic processes thus contributing to the loss of weight. Comparisons between infected and healthy horses (mean ± SD) showed a significant decrease in erythrocyte counts, hemoglobin concentration and thrombocytes in infected horses compared with the controls. Moreover, a significant decrease in packed cell volume was also seen (Table 1). Similar result was recorded previously by Alsaad (2014). Ambawat et al. (1999) mentioned that the alterations in erythrocyte membrane protein and lipid content and increases in plasma malondialdehyde during severe parasitemia suggested that accumulation of oxidative ions resulting from lipid peroxidation alters the erythrocytes' biochemical composition, leading to haemolysis. Moreover, they added that thrombocytopenia may be a result of low-grade DIC, as proposed in dogs with Babesia canis infections.

There is no safe and efficacious vaccine against equine babesiosis in Saudi Arabia and control of the disease is mainly based on the chemotherapy and tick control. Treatment results revealed that early intervention using imidocarb dipropionate in conjunction with supportive treatments as phosphorous and vitamin B12 and two liters of 10% dextrose saline was highly efficient. Similar results were obtained previously by Bruning (1996), de Wall (1990), Friedhoff and Soule (1996) and Schwint et al. (2009). Forty percent of the treated horses showed side effects in the form of salivation, colic and sometimes recumbence. These signs which were observed in those treated horses could be attributed to the anticholinesterase activity of imidocarb dipropionate that can result in adverse cholinergic effects. Similar observation was recorded previously by Frenichs and Holbrook (1974). Tick control by spraying the surrounding environment with diazinon (Nucedol Ultra 60 EC, Bioagripharm, Germany) was performed twice, one week apart.

5. Conclusion

It can be concluded that anemia or jaundice and severe body weight loss are characteristic for equine babesiosis. Also, bloody urine which is a characteristic feature of babesiosis in other animals is not common in Arabian horses. In addition, the early intervention using imidocarb dipropionate is the key of treatment success.

Disclosure statement

No potential conflict of interest was reported by the author.

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