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Hemomycoplasmosis (Eperythrozoonosis) in domestic animals (A review)

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Abstract
Among the blood parasites in mammals are Eperythrozoon, Haemobartonella and Trypanosoma species. Which are extracellular of RBCs. Their effects on the susceptible hosts vary from mild effect to death. Haemobartonella and Eperythrozoon species are currently classified as Rikettsiae (order: Rickettsiales) because of their small size and staining properties, their uncultivated status, their transmission by arthropod vecrots and their haemotrophic character. Haemobartonella and Eperythrozoon differ from Anaplasma in that they are wall less attach to the surface of red cells and do not invade the erthtocytes. Haemobartonella and Eperythrozoon species in different animals have been shown to be transmitted by various blood – feeding arthropods, including tick, lice, fleas, flies and mosquitoes.
Recently, Eperythrozoon and Haemobartonella have been reported in cattle, sheep, goat, pigs, dogs and cats as well as humans in several parts of the world. The difference between Haemobartonella and Eperythrozoon that Haemobartonella does not occur free in the plasma. In electron micrographs Haemobartonella appears more closely associated with the erythrocyte. Eperythrozoon adheres to the surface of erythrocytes and may occur as free.

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I. Introduction

Hemomycoplasmosis caused by Hemotrophic mycoplasmas (formerly classified as *Eperythrozoon*) are uncultivable organism, parasitize erythrocytes of different mammalians, such as cattle, sheep, goats, horses, camels, pigs, cats and dogs, However latent infection might also occurs in mules, deer and elk since the organisms mostly appear species specific(1,2).

Hemomycoplasma spp. causes haemotropic mycoplasmosis in animals, it's an important infectious disease characterized by anemia, weakness and emaciation, and mostly death of infected animals, (3). The disease is extremely common in different places of the world. As It was present in Africa, America, southern Europe, and central Asia, and transmitted mechanically by different species of ticks (3,4), Furthermore, the disease was circulated in different rejoins of Iraq (5,6,7,8).

History of the disease

According to (9,10,11,12), It has been mentioned that , Hemomycoplasma have been identified for a number of years as disease causing organisms in a variety of animals species In

- the 1928 *coccoides* in mice
- *Mycoplasma canis* in do *Mycoplasma*gs were observed in Germany to cause the disease
- In the early 1930, Eperythrozoon infection in pigs, characterized by icterus and anemia
- Jensen ,1943 record that Eperythrozoon ovis as one of the common blood parasite of native Louisiana sheep.
- *Mycoplasma wenyonii* infection had been recorded by Adler and Ellenbogen ,1934
- At 1934,1035, 1939 and 1941 the disease were reported from USA, England ,South Africa France and so on .

Blood-borne mycoplasmas, known collectively as hemotropic mycoplasmas or hemoplasmas, are small, pleomorphic, epicellular bacteria that adhere to the host's red blood cells. They cannot be cultured. They can be detected microscopically in blood smears and, more reliably, through use of PCR assays on whole blood(2,3). The hemoplasmas vary in severity of disease caused to the host and most infected animals appear healthy. Concurrent infections, stress, and immunosuppression may induce signs of disease that include fever, lethargy, anorexia, and mild to severe anemia. Severe forms of disease are characterized by hemolytic anemia, which can be treated with antibiotics and blood transfusions. Although often effective at eliminating signs of

disease, treatment is not likely to completely clear hemoplasmas from the body and the infected animal remains a carrier(9,10). Transmission of hemoplasma is by arthropod vectors, blood transfusions, common use needles and surgical instruments, and, possibly, by animals fighting with each other. Vertical transmission from mother to offspring occurs with several of the hemoplasmas(3,4).

The causative agent

Mycoplasmas are one of the smallest microorganism dividing into two groups, Haemotropic mycoplasmas and Non haemotropic mycoplasmas

Hemotrophic mycoplasmas :Are obligate erythrocyte organism infect a wide range of mammalian species and induce anemia in infected host(12).

Characteristics of the organism (9,10)

- It range from 0.3 to 1 μm in diameter
- Absence of cell wall (Wall less organism)
- Have precise or diminutive genome that gives strict dependence to the host cell
- Resistance to some antibiotics because of wall less structure
- Infect the outside on the surface of the red blood cells
- pleomorphic coccoid, rod, and ring-shaped structures might found individually or in chains on the red cell and have gram-negative staining

Classification :According to(13)

Firstly It were classified to

Genera :*Rikettsials*

Order : *Eperythrozoon and Haemobartonella*

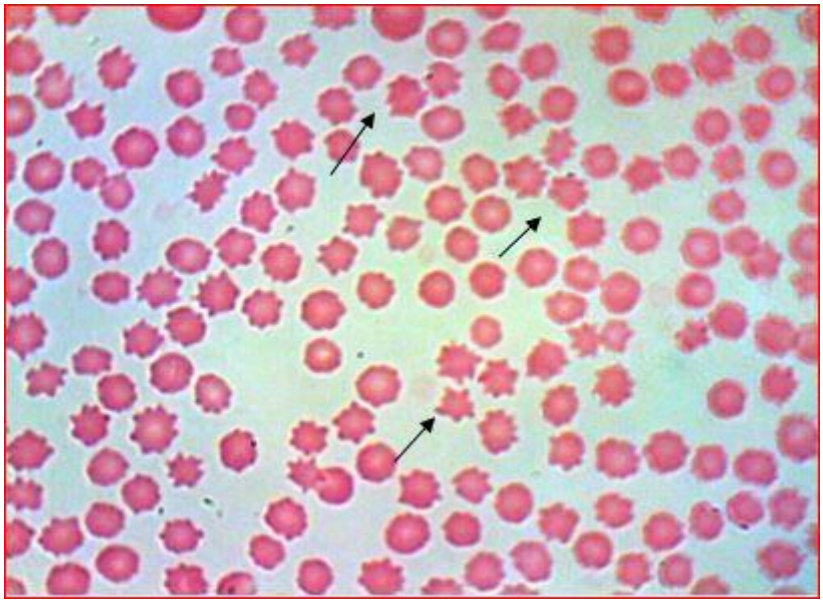
Then, based on strong phylogenetic evidence and 16 s ribosomal RNA gene sequences it were re-classified to

- *Order: Mycoplasmatales*
- *Family: Mycoplasmataceae*
- *Genus: Mycoplasma*
- *Mycoplasma wenyoni & Mycoplasma. hemobos In cattle and buffaloes*
- *Mycoplasma ovis &i Mycoplasma haemovis n sheep and goats*
- *Mycoplasma canis and Mycoplasma haematoparvum* in dogs
- *Mycoplasma haemofelis* in cats
- *Mycoplasma suis* in pigs
- *Mycoplasma haemolamae in camels and* Llamas
- *Mycoplasma haemofelis* and *Mycoplasma haemobos in horses*

Hemoplasmas of Cattle & Buffaloes

The hemoplasmas of cattle are thought to induce latent infections that seldom manifest as overt clinical disease. There are two recognized hemoplasmas of cattle, *Mycoplasma wenyonii* and *Mycoplasma hemobos*. The former has been known for decades, has worldwide distribution, and is common while the latter, *M. hemobos*, is newly recognized and information on its distribution is limited. *M. hemobos* has been locally reported in Asia, Europe, and South America(2,3,4). In areas where both organisms are found, dual infections occur and there is some thought that this may increase the risk for clinical disease developing. When clinical signs associated with hemoplasmas occur in cattle they are often mild and include mild depression, mild anemia, and transient low grade fever. Other clinical signs may include anorexia, lymphadenopathy with enlarged and palpable pre femoral lymph nodes, edematous hind legs, scrotal edema, udder and teat edema, weight loss, drop in milk production, and reproductive inefficiency(7,9). Signs of reproductive inefficiency associated the hemoplasmas in cattle are abortion and delayed estrus in cows, and lowered fertility in bulls. Reports indicate that young calves are most susceptible to severe anemia. With the exception of cases of severe disease, most cattle recover without treatment in 7 to 10 days.(3).

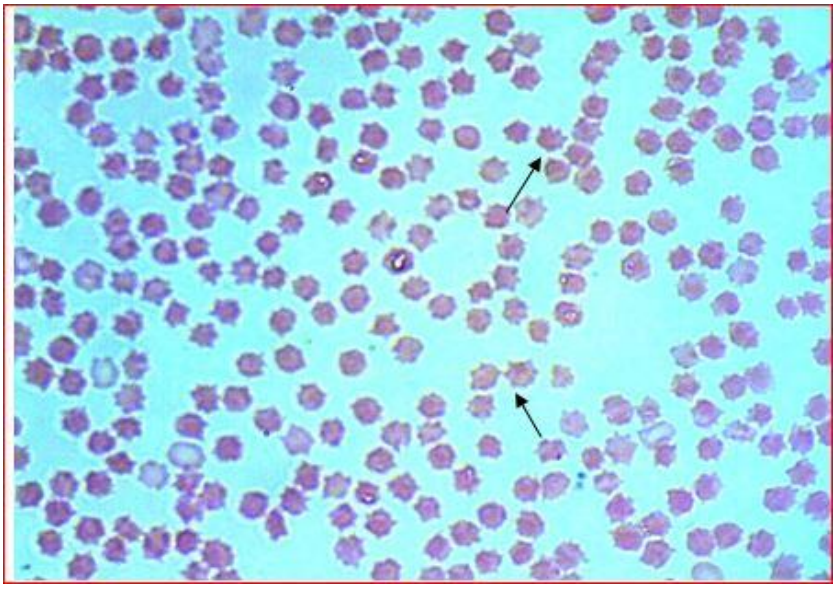
Clinical disease caused by the bovine hemoplasmas may be seen in cattle of all ages. However, disease has been reported most often in adult animals. In dairy cattle, disease is often seen in periparturient animals and likely is stress associated. Recent reports suggest transplacental transmission of the bovine hemoplasmas can occur(14). A small study of pregnant cattle infected with *M. wenyonii* or *M. hemobos* found 10% of calves born to the infected dams were infected with either *M. wenyonii* or *M. hemobos.*



Mycoplasma wenyonii In cattle and buffaloes

Hemoplasmas of Sheep

The hemoplasmas of sheep, *Mycoplasma ovis* and *Mycoplasma haemovis*, are still being sorted out, as at this time is not clear if there are multiple hemoplasmas or multiple variants of the known hemoplasmas(3,4). *Mycoplasma ovis* (formally Eperythrozoon ovis) is widespread and common, while *M. haemovis* is newly described and its distribution is not yet known(5). *M. ovis* may induce poor weight gain, severe anemia, hypoglycemia, and mortality in infected lambs and infected young adults. The severe signs of disease are most common during an acute infection and often associated with recent stress such as weaning and yarding. Double digit mortality rates have been reported. More frequently, infection of sheep with the hemoplasmas results in subclinical to mild disease that my manifest as mild anemia and marginal hematologic changes associated with red blood cells. As with the hemoplasmas of other species, chronic infection occurs. Indicators of chronic infection include reduced weight gain, ill thrift, and reduced wool production. Seasonality of clinical disease has been noted and, like the hemoplasmas of cattle, there is a correlation with seasonal presence of arthropods in some outbreaks (6,7,8).



Mycoplasma ovis

Hemoplasmas of Horses

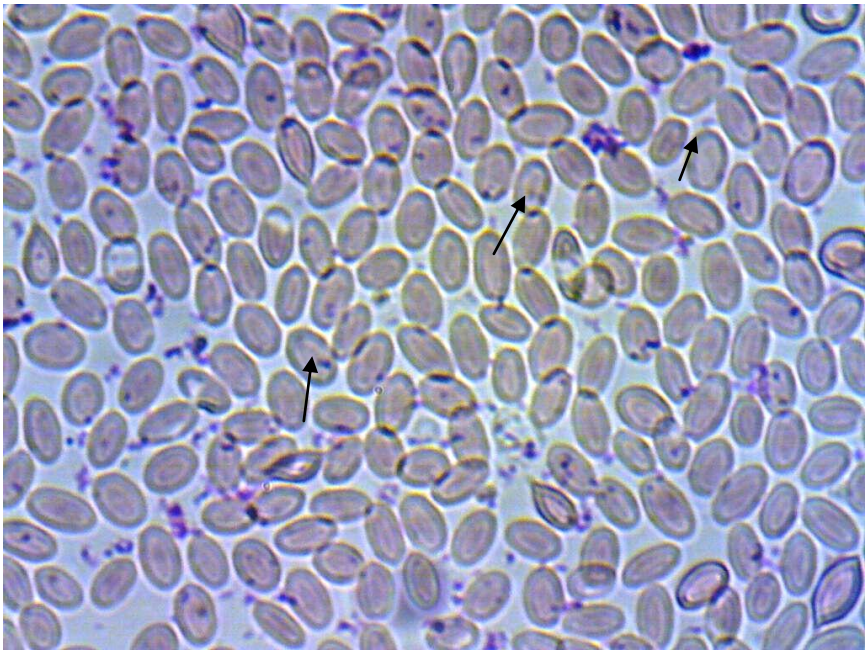
The first report of hemoplasma infection in horses appeared in 1978 and described an outbreak of ‘‘haemobartonellosis’’ in horses in Nigeria (3,4). The clinical signs exhibited by the horses included fever,

apathy, lymphadenitis, circulatory disorders, and pale mucosa. At that time, the diagnosis was made by detection of the organism in blood smears and a definitive classification of hemoplasmas was not possible. In 2010, a hemoplasma infection of horses was verified and preliminary characterization of the agent was done using nucleic acid sequencing. The report involved two horses that were presented to a veterinary clinic showing rough hair coat, unthriftiness, loss of weight and condition(15). Hematologic evaluations showed that both horses had a mild anemia. A hemoplasma was suspected and a PCR assay used to detect hemoplasmas of dogs and cats was used to amplify DNA from the organism. Nucleic acid sequencing of 900 bases or the 16S rDNA gene indicated that the equine hemoplasma was most closely related to *M. hemobos* of cattle. The newly derived nucleic acid sequence was used to design PCR primers specifically targeting the equine hemoplasma and a survey of 117 horses at a single breeding farm was done to estimate the prevalence of the hemoplasma. The hemoplasma was detected in 31horses and 7 of those horses were reported with poor condition and poor performance. Nine of the 31 horses had anemia (Ht < 0.32), 10 horses had a low level Parasitology (Ht = 0.32–0.34) and 12 horses were non-anemic (Ht > 0.34). Younger horses (< 1yr) were affected more by the infection than older horses .(4,10,12).

Mycoplasma haemofelis in horses

Hemoplasmas of Camels

According to DNA sequence analysis of the 16s small subunit ribosomal RNA gene, *Mycoplasma haemolamae* of camels resembled other Hemomycoplasma spp. such as *Mycoplasma wenyonii*, *Mycoplasma suis*, and *Mycoplasma haemofelis*, and were thus classed as Haemotrophic mycoplasmas within the Mycoplasma genus (Haemoplasmas) (16,17), Moreover, Depending on the specific organism, dose, and host susceptibility, the effects of infection could be ranged from subclinical to fatal anemia, However, Individuals who are immunocompromised or have a simultaneous condition are more likely to get hemoplasmas (18).



***Mycoplasma haemolamae* of camels**

Epidemiological properties of Hemomycoplasmosis

The disease has an important animal health problem worldwide, Since more than 30 countries and regions had reported the diseases in at least 14 kind of host animals in different species of vertebrate, including ruminants, monogastric animals rodents and pigs(19). Methods of spread of the microorganism mostly mechanical. Include Biological transmitters such as *Dermacentor andersoni*, Haematopinus lice, flies and fleas also serve as vectors for transmission, Moreover, Blood transfusions, and the common use of contaminated needles and surgical instruments, Furthermore, Transplacental transmission,Transmission via contaminated food but this rout still not confirmed (20). On the other hand, Haemomycoplasmas show a seasonal trend and peak in late summer and early fall season.

The economic impact of the disease

The diseases have debilitating impact on animal health(3,4) and loses occur due to

A- Retard growth rate and loss of body weight

B- Decrease productivity

C-late maturity

D-Acute illness and & death

E- Premature slaughter

F-Rejection of some body parts at meat inspection

Zoonotoc impact

Hemomycoplasmosis can transmitted to human(9,11). The first human case was reported in 1991, afterwards approximately 180 human cases (from farmers & veterinarians)have been sporadically reported With sigs of Fever, hemolytic anemia, Swollen lymph nodes of the neck, Enlarged liver and spleen, Leucopenia, neutropenia, thrombocytopenia and Subclinical myocarditis(16).

Diagnosis:

The diagnosis could done by stained Blood smears for identification of the microorganism, Serological tests which done by CFT, IHT, c-ELISA, Moreover, Molecular technique by PCR(3,4).

Treatment

It had been documented that the organism were sensitive to

- Oxytetracyline and doxycycline,chortetracycline (Long term)
- Imizol (Imidocarb dipropionate) 2.2 mg /kg BW one time ,can repeated if necessary

Other choice for treatment include, Enrofloxocin, 10mg/kg once a day for 14 days,azithromycin 15 mg/kg twice a day, Moreover, Supportive treatment is always advised (3,6,9).

Methods for control of Hemomycoplasmosis

Several methods for control are advices which include

1-Prevent the contact between host and living agents by…

a-Restriction of the source of infection

b-Restriction of the movement of animals
2- Reduce the exposure of the infection by good management ,housing and prophylaxis
3- Control of the biological and mechanical transmitters
4-Treat the diseased animals
5-Increase resistance of the host by vaccination

II. Conclusions

This disease is considered one of the serious infectious diseases that affect animals and humans alike, causing severe harm to animals in terms of anemia and lack of production, as well as weakening and killing sick animals. It has become necessary to develop preventive plans to control and limit the spread of this disease.

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