

Anaplasmosis

Anaplasmosis, formerly known as gall sickness, traditionally refers to a disease of ruminants caused by obligate intraerythrocytic bacteria of the order Rickettsiales, family Anaplasmataceae, genus *Anaplasma*. Bovine anaplasmosis is of economic significance in the cattle industry.

- The *Anaplasma* genus also includes *A phagocytophilum* (compiled from species previously known as *Ehrlichia phagocytophila*, *E equi*, and human granulocytic ehrlichiosis agent, *A bovis* (formerly *E bovis*), and *A platys* (formerly *E platys*), all of which invade blood cells other than erythrocytes of their respective mammalian hosts.

Etiology

Clinical bovine anaplasmosis is usually caused by ***A marginale***. An *A marginale* with an appendage has been called *A caudatum*, but it is not considered to be a separate species. Cattle are also infected with ***A centrale***, which generally results in mild disease. ***A ovis*** may cause mild to severe disease in sheep, deer, and goats. ***A phagocytophilum*** has recently been reported to infect cattle.

Geographic Distribution

Cattle, sheep, goats, buffalo, and some wild ruminants can be infected with the erythrocytic *Anaplasma*. Anaplasmosis occurs in tropical and subtropical regions worldwide, including South and Central America, the USA, southern Europe, Africa, Asia, and Australia.

Transmission

- Up to 17 different tick vector species have been reported to transmit *Anaplasma* spp.
- After feeding on an infected animal, biological transmission may occur. A replicative cycle occurs in the infected tick.
- Mechanical transmission via biting dipterans occurs in some regions.
- Transplacental transmission has been reported and is usually associated with acute infection of the dam in the second or third trimester of gestation.
- Anaplasmosis may also be spread through the use of contaminated needles or dehorning or other surgical instruments.

Epidemiology

- There is a strong correlation between age of cattle and severity of disease.
- Calves are much more resistant to disease (although not infection) than older cattle. This resistance is not due to colostral antibody from immune dams.
- In endemic areas where cattle first become infected with *A marginale* early in life, losses due to anaplasmosis are minimal.
- After recovery from the acute phase of infection, cattle remain chronically infected carriers but are generally immune to further clinical disease.
- However, these chronically infected cattle may relapse to anaplasmosis when immunosuppressed (eg, by corticosteroids), when infected with other pathogens, or after splenectomy.
- Carriers serve as a reservoir for further transmission.

- Serious losses occur when mature cattle with no previous exposure are moved into endemic areas or under endemically unstable situations.

Pathogenesis

Anaplasmosis is characterized by progressive anemia due to extravascular destruction of infected and uninfected erythrocytes. The prepatent period of *A marginale* is directly related to the infective dose and typically ranges from 15–36 days (although it may be as long as 100 days).

Clinical Findings

1. In animals <1 yr old anaplasmosis is usually subclinical, in yearlings and 2-yr-olds it is moderately severe, and in older cattle it is severe and often fatal.
2. After the prepatent period, peracute (most severe but rare), acute, or chronic anaplasmosis may follow.
3. Generally, 10%–30% of erythrocytes are infected at peak rickettsemia. Maximum rickettsemias in excess of 50% can occur with *A marginale*
4. RBC count, PCV, and hemoglobin values are all severely reduced.
5. Macrocytic anemia with circulating reticulocytes may be present late in the disease.
6. Animals with peracute infections die within a few hours of the onset of clinical signs.
7. Acutely infected animals lose condition rapidly. Milk production falls.
8. Inappetence, loss of coordination, breathlessness when exerted, and a rapid bounding pulse are usually evident in the late stages.
9. The urine may be brown but, in contrast to babesiosis, hemoglobinuria does not occur.
10. A transient febrile response (41°C) occurs at about the time of peak rickettsemia.
11. **Mucous membranes appear pale and then yellow.**
12. Pregnant cows may abort. Surviving cattle recover over several weeks, during which hematologic parameters gradually return to normal.

Diagnosis

- ✓ *A marginale*, together with the hemoprotozoa *Babesia bovis* and *B bigemina*, are the causative agents of tick fever in cattle.
- ✓ Microscopic examination of Giemsa-stained thin and thick blood films is critical to distinguish anaplasmosis from babesiosis and other conditions that result in anemia and jaundice, such as leptospirosis and theileriosis.
- ✓ In Giemsa-stained thin blood films, *Anaplasma* spp appear as dense, homogeneously staining blue-purple inclusions 0.3–1 µm in diameter. *A marginale* inclusions are usually located toward the margin of the infected erythrocyte, whereas *A centrale* inclusion bodies are located more centrally.
- ✓ Chronically infected carriers may be identified with a fair degree of accuracy by serologic testing using ELISA, complement fixation, or card agglutination tests.
- ✓ At necropsy, thin blood films of liver, kidney, spleen, lungs, and peripheral blood should be prepared for microscopic examination.

Treatment

1. **Imidocarb** is also highly efficacious against *A marginale* as a single injection (as the dihydrochloride salt at 1.5 mg/kg, SC, or as imidocarb dipropionate at 3 mg/kg).

2. Prompt administration of tetracycline drugs (tetracycline, chlortetracycline, oxytetracycline, rolitetracycline, doxycycline, minocycline) in the early stages of acute disease (eg, PCV >15%) usually ensures survival.
3. A commonly used treatment consists of a single IM injection of long-acting oxytetracycline at a dosage of 20 mg/kg.
4. Blood transfusion to partially restore the PCV greatly improves the survival rate of more severely affected cattle.
5. The carrier state may be eliminated by administration of a long-acting oxytetracycline preparation (20 mg/kg, IM, at least two injections with a 1-wk interval)
6. Elimination of the carrier state requires the use of higher repeated doses of imidocarb (eg, 5 mg/kg, IM or SC, two injections of the dihydrochloride salt 2 weeks apart).

Control

- Prevent tick bites
 - Wear protective footwear, clothing
 - Use insect repellents
 - Remove ticks as soon as possible

Prevention

- Infection with live *A centrale* is used as a vaccine to provide cattle with partial protection against the disease caused by *A marginale*.
- *A centrale* (single dose) vaccine produces severe reactions in a small proportion of cattle.
- Nonliving *A marginale* purified from infected bovine erythrocytes and adjuvant have been used in the past but may not currently be available.
- Immunity generated by using multidose killed vaccine protects cattle from severe disease on subsequent infection, but cattle can still be susceptible to challenge with heterologous strains of *A marginale*.
- Long-lasting immunity against *A marginale* is conferred by preimmunization with live rickettsia, combined with the use of chemotherapy to control severe reactions.
- The use of attenuated strains of *A marginale* as a live vaccine has been reported, with instances of severe reactions also occurring.