University of Zambia
School of Medicine

BABESIA

3rd /4th Year MBChB

2023

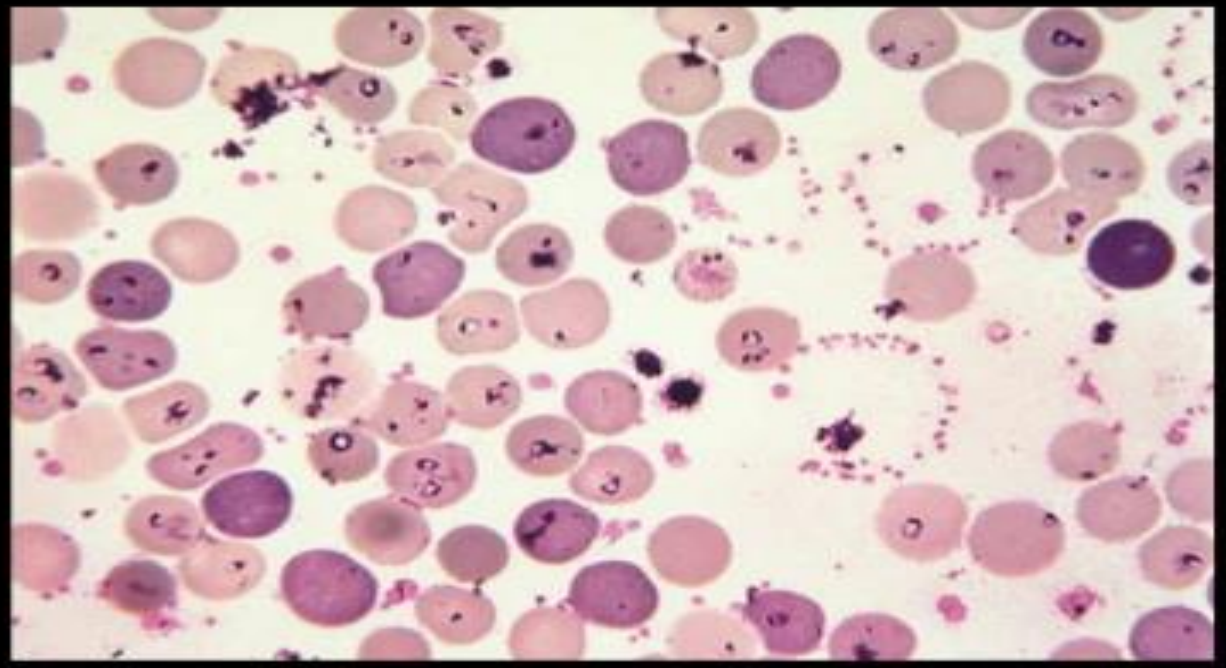
Taxonomy

- **Kingdom**: Protista
- **Phylum**: Apicomplexa
- **Class**: Aconidasida
- **Order**: Piroplasmida
- **Family**: Babesiidae
- **Genus**: Babesia

Babesia

- Aetilogical agents: Babesia microti, B. divergens, B. bovis
- Disease = babesiosis
- Babesia is a tick-transmitted protozoan parasite of both domestic and wild animals e.g cattle, horses, sheep, cats, dogs, rodents
- **HABITAT:**
- Red blood cells of the vertebrate hosts
- Intraerythrocytic protozoan parasites

Morphology



Intraerythrocytic *Babesia microti*

- Easily misdiagnosed as *Plasmodium* in areas high in Malaria prevalence due to its "ring shape"
- Variation in shape and size
- Do not produce pigment

MORPHOLOGY

- Range in shape from single, round or piriform bodies, to amoeboid or ring forms, to dividing forms usually made up of 2 or 4 daughter cells.

- May resemble malaria parasites morphologically

- Show no evidence of pigment formation in infected RBCs

Hosts

- Definitive host: Deer tick
- Vector: Ixodes scapularis (Deer tick)
- Intermediate host: human, white-footed mouse and other rodents

LIFE CYCLE

- Babesiosis is transmitted by Ixodid or hard bodied ticks e.g Dermacentor, Ixodes and Rhipicephalus.

- Organisms are ingested by the tick when it feeds, multiply within epithelial cells of the tick's gut, and then spread throughout its body.

- In some species of ticks, such as Ixodes ricinus infected with Babesia bovis, organisms invade the ovaries and are passed through the egg to the developing larval stage [trans-ovarial transmission].

- Sporozoites are then transmitted to the vertebrate host in the salivary secretions during the tick's next blood meal. Thus, the tick can serve as both vector and reservoir for the parasite.

- In other tick species, such as I. dammini, infected with B. microti, infections are acquired during the larval or nymphal stage and are transmitted by the subsequent stage after the tick has molted [trans-stadial passage].

Life Cycle

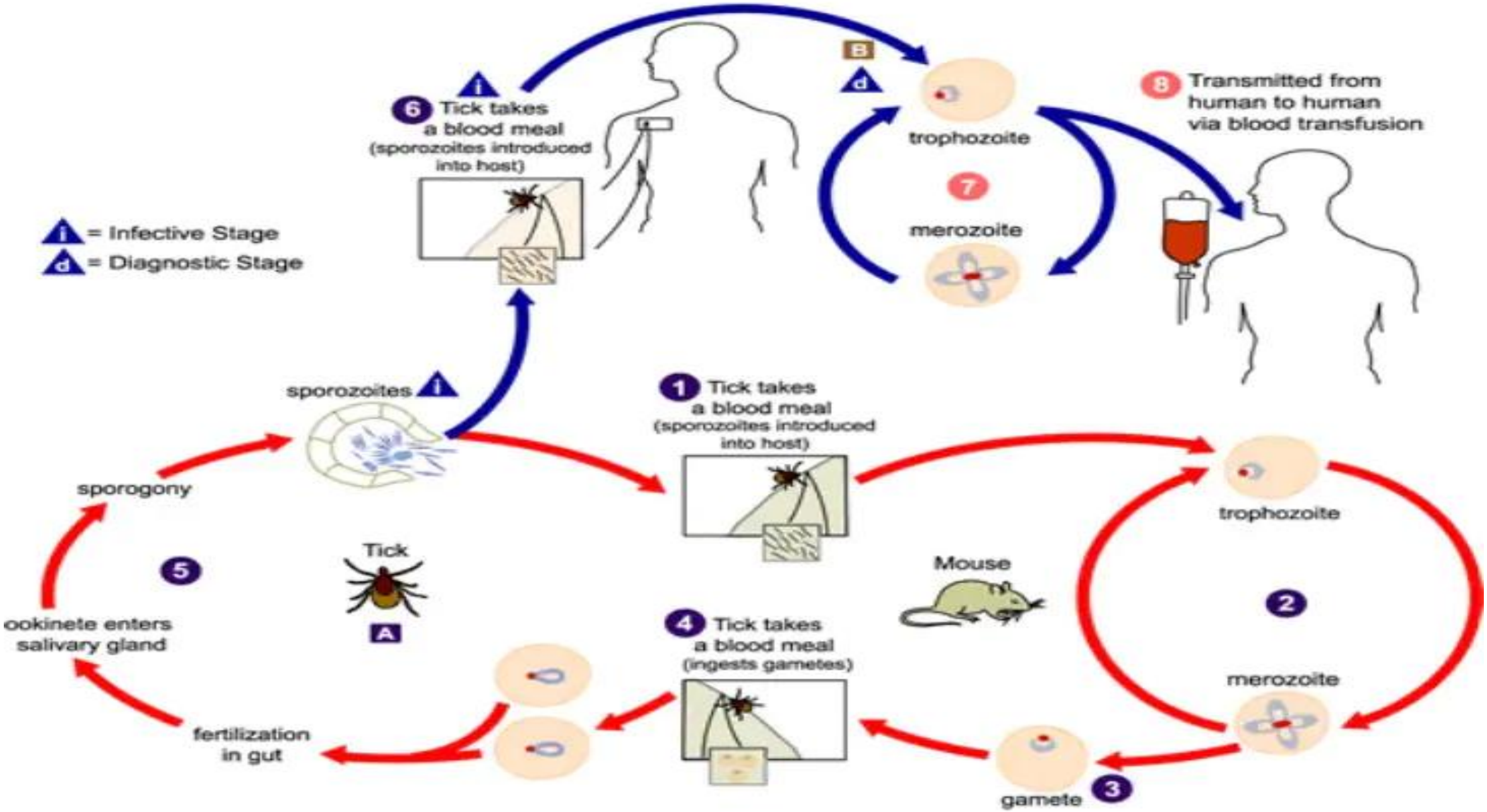
- Within the vertebrate host, Babesia is an intraerythrocytic parasite (trophozoites differentiates); however, unlike malaria, it does not have an exoerythrocytic stage of development.

- Babesia multiplies asexually by budding within RBCs, usually producing 2 or 4 daughter parasites (merozoites).

- When infected RBCs rupture, other erythrocytes are invaded and the cycle is repeated.

LIFE CYCLE

- In the blood, parasites undergo male and female differentiation (micro- and macrogametes are formed referred to as ray bodies).
- The Deer tick (definitive host) takes a blood meal ingesting gametes, which can undergo fertilization within the gut – zygote – motile ookinete - sporozoite
- Resulting in sporozoite formation and spread to salivary glands
- During a blood meal, the tick infects the human host
- Inoculation occurs by a tick larva, nymph or adult


i = Infective Stage
d = Diagnostic Stage
6 Tick takes a blood meal (sporozoites introduced into host)
i
B
d
trophozoite
7
merozoite
8 Transmitted from human to human via blood transfusion
sporozoites
i
1 Tick takes a blood meal (sporozoites introduced into host)
trophozoite
sporogony
Tick
5
Mouse
2
merozoite
ookinete enters salivary gland
A
4 Tick takes a blood meal (ingests gametes)
fertilization in gut
gamete
3

TRANSMISSION

- Tick bites containing infective sporozoites
- Blood transfusion especially from asymptomatic donors
- Transplacental/perinatal infection.

PATHOGENESIS

- Incubation period is 1 to 4 weeks

- Multiplication of organisms within, and the subsequent destruction of RBCs result in :
  - Haemoglobinuria
  - Acute renal failure
  - Haemolytic anaemia due to destruction of RBCs
  - Jaundice due to unconjugated hyperbilirubinaemia.

- Splenectomised individuals are more susceptible to infection with B.divergens than persons with intact spleens. Asplenic patients infected with B.microti and B.divergens tend to have higher levels of parasitaemia and more severe illness. In fact most of the cases are fatal.

CLINICAL SYMPTOMS

- **A. *Babesia microti* infections:**

- Symptoms of B. microti infection appear 1 to 4 weeks after the tick bite.

- They range in severity from asymptomatic to prolonged, severe illness.

- Mild hepatosplenomegaly, Haemolytic anaemia and elevated reticulocyte counts

- Urinalysis reveals proteinuria and haemoglobinuria.

CLINICAL SYMPTOMS

- **B.** *Babesia divergens* infections

- Mostly occur in asplenic patients [84%].

- Is always fulminant, and haemolytic; progresses within a few days to jaundice, haemoglobinaemia, haemoglobinuria and renal failure.

- Fever, hypotension and jaundice are the major findings on physical examination.

DIAGNOSIS

- Microscopic examination of Giemsa-stained thin blood smears thin blood smears .
- Babesia species are annular, oval and piriform.
- Ring form is the most common and strongly resembles the ring forms of *P. falciparum.*
- Antibody detection:
  - Indirect Immunoflourescent Antibody [IFA] detects IgM &IgG
- PCR

DIAGNOSIS

- **DIFFERENCES BETWEEN *B. microti* AND *P. falciparum*.**
- **1.** In Giemsa-stained blood films, the cytoplasm is coalesced into 4 masses with nuclear material to form the ‘tetrad’ or ‘maltese cross’ of 4 mature merozoites. This stage is found infrequently in human blood smears, but is diagnostic of *B. microti*

- **2**. The ring forms have a peripheral location , as with *P. falciparum*, but the large clear central white vacuole and the absence of brown [hemozoin] pigment are characteristic of *B. microti*

- **3**. The absence of schizonts and gametocytes on the blood film further distinguishes *B. microti* from *P. falciparum*

TREATMENT

- **1.** Combination of Clindamycin and oral Quinine (treatment of choice)

- **2.** A combination of Atavoquone-Azithromycin regimen has few side effects.

PROGNOSIS

- Most cases of Babesiosis are subclinical or are mildly symptomatic

- Most cases of fatalities occur in patients with asplenia

PREVENTION

- Avoidance of areas endemic for Ixodid ticks, e.g. Ixodid scapularis.
- Tucking pants into boots or socks.
- Wearing white or light-colored clothes enables the ticks to be spotted more easily.
- A spray of permethrin to clothes is very helpful.
- Screening blood donors for Babesia.

EPIDEMIOLOGY

- Europe : *B. divergens* most common
- USA [mostly caused by *B. microti*].
- Africa: South Africa, Mozambique, Ivory Coast and Egypt [*B. microti*].