

## **Sporozoa**

### **Sporozoa belong to:**

#### **Phylum: Apicomlexa**

- 1- Class: Haematozoa , Occur in the blood of their vertebrate host This class contains two orders : a) Order : Haemosporida , containing the genus plasmodium which causes Malaria. b) Order : Piroplasmida, containing the genus : Babesia ,which is rare and accidental parasite of man. They complete their life cycle in two host.
- 2- Class : Coccidea , Parasites of this class either undergo whole of their life cycle in a single host ,typically in the epithelial cells of the gut or divide a similar cycle between two hosts :

**Toxoplasma, Cryptosporidium, Cyclospora, Isospora and Sarcocystis**

#### **Malaria Parasites**

Malaria parasites belong to the genus plasmodium .There are approximately 156 named species of plasmodium which infect various species of vertebrates. Four are known to infect human :

**P. falciparum , P. vivax, P.malariae and P.ovale.** (All species cause malaria disease). Worldwide, distribution some two billion individuals are at risk 100 million develop overt clinical disease and 1.5 - 2.5 million die every year. Nearly 85% of these cases and 90% of carriers are found in tropical Africa. The incident of malaria is

increasing due resistance of vectors to insecticides and drug resistant parasites.

### **Transmission:**

Man get infection by the bite of infected female anopheles mosquito , infection may also be transmitted by : \* Transfusion of blood from a patient of malaria, this known **as transfusion malaria** , plasmodium can remain viable in refrigerated blood for up to 10 days. \* Transmission of infection to fetus through some placental defect. this is known **as congenital malaria** \* By the use of contaminated syringes particularly in drug addicts

### **Life cycle :**

The life cycle of plasmodium starts with a zygote in the stomach of a female mosquito ,The zygote is active and moves through the stomach or midgut wall. The parasite at this stage is called an ookinate .Under the lining of the gut , the ookinate becomes rounded forms a cyst ,and is called an oocyst. The grown oocyst begins a series of nuclear division , followed by cytoplasmic cleavage to produce thousands of sporozoites enter the lumen of the mosquito's salivary glands to enter the new host with the saliva when the mosquito bites man ( **That is the sexual cycle or Sporogony**). When sporozoites are ingested into a host they rapidly (within 30 minutes ) enter liver parenchyma cells .They begin a process of multiple divisions known as merogony . Merogony in liver cells

results in the production of thousands of merozoites . These merozoites penetrate red blood cells to become ( ring -form trophozoite), and thus enter the general circulation. Then they undergo another phase of merogony. As the parasite with the erythrocytes grow, they ingest and digest the host cell's hemoglobin ; the indigestible iron part of the hemoglobin molecule forms the characteristic brown or black material pigment ,then develop to trophozoite which irregular in shape ( amoeboid stage) developing to ( schizont) with division of chromatin surrounded by pieces of cytoplasm.

Schizont ruptures with the liberation of merozoites ,they in turn invade fresh erythrocytes After undergoing erythrocytic schizogony some merozoites are transformed into gametocytes .Gametogony occurs in the erythrocytes of capillaries of internal organs. Mature gametocytes enter the peripheral blood from where they are carried to vector when it bites the patient. ( **That is the a sexual cycle or Schizogony**)

### **Pathogenesis of plasmodium**

1-The plasmodium that invade the red blood cells grow and segment at the expense of these host cells, which rupture when schizogony is complete. The debris of ruptured cells , the released merozoites and their metabolic products stimulate chemoreceptor of the temperature regulating mechanism of the host to conserve heat ,As the number

of the invaded red cells increases and the quantity of pyrogen release from the ruptured cells at one line (simultaneously) becomes sufficient to produce the characteristic chills and fever of malaria attack

2- Malaria is characterized by anoxemia (deficiency in the content of the blood ) and anoxia in adjacent tissues . there increased permeability of capillary walls, constriction of blood vessel: and stagnation of blood in capillaries , particularly in the brain .

3- The anemia accompanying malarial infections result in part from direct destruction of the red cells by the intraerythrocytic parasites,an in part by the phagocytosis of nonparasitized erythrocytes.

4- Serious disturbance of liver function apparently occur in all infection include congestion, degeneration, necrosis and atrophy of parenchymal cell.

5- There is some evidence that plasmodia may produce a toxin that profoundly affects the basic metabolic processes of host tissue cells by inhibiting respiration and oxidative phosphorylation. These events begin during the erythrocytic phase of the cycle

6- The species of plasmodia differ greatly in their ability to multiply in the blood, *P.vivax* prefers to invade the youngest erythrocytes ,,whereas *P.malariae* prefers the older red cells, *P. falciparum* , on

the other hand, invade erythrocyte of all ages and thus ,is capable of parasitizing a very high percentage of erythrocytes.

7- Due to the varying number of merozoites produced in schizogony by the species of plasmodium . P.falciparum multiplies more rapidly than other species. The parasitemia of P. falciparum also tends to be higher because more than one parasite frequently develop in a single erythrocyte, that cause a very high hemolytic jaundice and anemia.

8- Another serious complication of P. falciparum infection is blackwater fever ; massive intravascular haemolysis results in excretion of altered hemoglobin in the urine, which is consequently very dark . the exact mechanism of haemolysis in blackwater fever is not known. An autoimmune mechanism has been suggested. Parasitized and quinized red blood cells ,during previous infection act as antigen against which antibodies are formed. whith subsequent infection and treatment with quinine , there is massive destruction of both infected and uninfected red blood cells.

9- Infection with P. falciparum can also lead to abortion if blood of placenta become blocked by parasitized cell depriving the fetus of oxygen and nutrients.

10- All plasmodia species cause anemia, splenomegaly hepatomegaly and fever peaks ( Exhibits; hot , cold and sweating stage )

### **Diagnosis :**

Although the clinical picture of regularly recurrent fever and splenomegaly suggest malaria , the only sure confirmation is by finding parasites on thick or thin blood films stained with one of the Romanosky stains, usually Giemsa's or Leishman's. Suitable tests are indirect immunofluorescence ( IFAT ). Enzyme – linked immunosorbent assay ( ELISA )

### **Treatment :**

**Chloroquine** was the standard treatment for acute malaria for many years. However, resistance to this drug in *P.falciparum* is widespread. Less commonly *P.vivax* may also be chloroquine - resistant. Quinine is the most reliable alternative to chloroquine .Tetracycline and clindamycin with quinine exhibit some anti-malarial activity . Mefloquine and halofantrine are also active against chloroquine – resistant strains

### **Prevention and control :**

Infection with malaria can be prevented in two ways, either by avoidance of infected mosquito bites, such as by screening windows , spraying inside houses with insecticides and the use of mosquito net at night impregnated with prophylactic drugs such as proguanil hydrochloride or chloroquine.