

Topic: Toxoplasmosis of animals and man (*Toxoplasma*)

Family: Sarcocystidae

Sub-family: Toxoplasmatinae

Genus: *Toxoplasma*

Species: *T. gondii*

Oocyst of *Toxoplasma* contain 2 sporocysts, each with 4 sporozoites. Feline act as definitive host. Schizogony, gametogony occur in the enteric cell of feline and sporogony occur outside the host.

Cat act as definitive host and intermediate host are all warm blooded animal including man and birds.

Life cycle: The definitive host is cat in which schizogony and gametogony occurs in the intestine. Cat may be infected by.....

1. Ingestion of sporulated oocyst or,
2. Ingestion of tachyzoites (in rodent) or,
3. Ingestion of bradyzoites in cyst.

Infection in animal other than cats may be transmitted by ingestion of meat infected with tachyzoites or bradyzoites or transplacentally.

Oocyst: size is 11-13 μ m by 9-11 μ m. Sporulation occur outside the host in 2-3 days. This is an important zoonotic protozoa. Schizogony and gametogony occurs in the enteric cells of the DH i.e. feline. But in intermediate host, extraintestinal development occur and produce tachyzoite or bradyzoite (Cyst) which is infective for DH along with sporulated oocyst.

Developmental stage of *T.gondii*:

There are 2 stages of development..

1. Enteroepithelial cycle occur in cat where schizogony and gametogony occurs.
2. Extraintestinal cycle occur in cat and other mammalian host. Here tachzoite and bradyzoite form occur.

Difference between Tachyzoite and Bradyzoite:

Sl.No	Tachyzoite	Bradyzoite
1.	Rapidly multiplying form of acute infection	Slowly multiplying form seen in chronic infection
2.	Develop in the lamina propria, mesenteric lymph node and distant organ in cat	Develop mainly in brain, heart and skeletal muscle.
3.	In other animal, tachyzoite is the first stage found and develop in a vacuole of variety of cell type such as fibroblast, hepatocyte, reticular cell, myocardial cell and they are known as terminal colonies, pseudocyst, aggregates	Bradyzoites in the cyst are closely packed together, somewhat lancet-shaped and possess a terminal nucleus
4.	8-16 or more organisms accumulate together in a host cell	Cyst may contain 60,000 organisms

Development in definitive host:

DH infected by injection of infective stage tachyzoites, bradyzoites or sporulated oocysts. Excystation occurs in the stomach and intestine. The bradyzoite penetrates to the epithelial cells of small intestine and a series of asexual generations (type A to E) are followed by sexual cycle. Type A is the smallest asexual stage. Type B is characterized by centrally located nucleus and prominent nucleolus division occurs by endodyogeny and endopolygeny. Type C organisms are elongate and have sub-terminal nucleus, division occurs by schizogony. Type D organisms are smaller than type C and divide by endopolygeny. Type E organisms are elongate and multiply by schizogony. Probably the merozoite released from schizonts of type D and E initiate gamete formation. Gametocyte occurs in the small intestine 3-15 days after infection. The microgamete penetrates mature macrogamete. An oocyst wall is formed surrounding the fertilized gamete. Unsporulated oocyst released with faeces. Sporulation occurs outside the host within 1-5 days.

Most of the bradyzoites enter the epithelial cell of intestine, some penetrate the lamina propria and multiply as tachyzoites. Within few hours after infection, *T.gondii* may spread to extra-intestinal tissues of cats via lymph and blood. The extra-intestinal cycle in cat is similar with that of non-feline host with 2 exceptions

1. Tachyzoite have not been demonstrated in feline intestinal epithelial cells as they occurs in non-feline host
2. *Toxoplasma* type D and E are non-infectious to mice by any route. Therefore feline enteroepithelial forms donot directly give rise directly to tachyzoites.

The asexual enteroepithelial stages after tachyzoite or oocyst administration are not known. Tissue cyst are first formed after ingestion of oocyst and tachyzoite and then the bradyzoite return to the intestine to initiate tissue cyst induced cycle.

Development in the intermediate host:

The IH become infected by ingestion of sporulated oocyst or infected meat of animals, or congenitally through placenta. After ingestion, the oocyst rupture in the intestine and releasing 8 sporozoites. Sporozoite then multiply intracellularly in the intestinal epithelium and in associate lymph node and tachyzoite are formed. These spread throughout the body through lymph and blood and eventually encyst. the brain, skeletal and cardiac muscle and liver. A tissue cyst collection of bradyzoite surrounded by well-defind host cell membrane These are microscopic and survive in the host cell as long as host lives.

On ingestion of infected meat having tissue cyst of *T. gondii* , proteolytic enzyme dissolve the cyst wall , release bradyzoite. After entering the host cell, the bradyzoite transform to tachyzoite. In the host cell, tachyzoite may undergo repeated division ultimately encysting in tissues. The cycle is completed when tissue cyst is ingested by cat.

Transplacental transmission occurs when non-infected host become infected during pregnancy. *T. gondii* multiply in placenta and then spread to foetal tissues. Although transplacental transmission can occur at any stage of gestation, the foetus is more infected if the dam become infected during first half of gestation.

T. gondii can be transmitted by blood or platelet transfusion and organ transplante.

Pathogenesis of toxoplasmosis in general:

- Most of the infections are asymptomatic

- Congenital infection in man and sheep
- Tachyzoite stage produce area of necrosis, parasitism reaches high level and animal succumb during this period
- *Toxoplasma* may appear in secretions and excretions such as urine, faeces, milk, conjunctival fluid and saliva (rarely).
- *Toxoplasma* can survive inside the macrophage.

Toxoplasmosis in Man:

Infection may be

- i. Acquired or,
- ii. Congenital

Most of the cases in children are congenital in origine. Congenital infection occur only when a woman has a primary infection during pregnancy. Severity of damage to the foetus was greater with early infection in mother than later. The outcome of congenital infection results in fetal damage. In severe infection, acquired in early pregnancy, 'Abortion' is common sequel. In less severe infection , it causes cerebral calcification, choroidoretinitis, hydrocephalus or microcephaly.

Diagnosis:

Difficult to diagnose

1. Inoculation of suspected material to mice intra peritonially. 1-14 days later, general fatal infection occur.
2. Dye test(Sabin-Feldman dye test)
3. CFT

Treatment: No satisfactory treatment is available

Doraprime found effective in monkey and human

Pyrimethamine with triple sulphur drug widely used.

Recently, a vaccine called 'Toxovax'is used in UK to protect ewes.