

Eimeridae

Coccidiosis

Apical Complexan Organelles

Conoid: It is a formation that develops as a conical-like protrusion at the head of the protozoa that takes the shape of a missile when going to the cell. This structure helps to enter the cell.

Polar Ring: There are preceptors that work in the selection of host, tissue and cells.

Rhoptri: This structure is in the form of a double sac and contains the enzymes. Thanks to this enzyme, the protozoa enter the cell unbreakable and contains to develop. This secretion inactivates the cell-related receptors and breaks the defense mechanisms of the cell.

Micronems are muscular formations that act to move by sliding. **Subpellicular microtubules** are a large number of support and evacuation organelles located under the pellicle.

Eimeriidae

■ <u>Eimeriidae</u>	<u>Number of sporocyst</u>	<u>Number of sporozoite</u>
■ <i>Eimeria</i>	4	2 in each sporocyst
■ <i>Isospora</i>	2	4 in each sporocyst
■ <i>Wenyonella</i>	4	4 in each sporocyst
■ <i>Tyzzeria</i>	None	8

- *Eimeria* species cause eimeriosis in cattle, sheep, goat, horse, swine and poultry.
- *Isospora* species cause isosporiosis in carnivores and poultry.
- *Wenyonella* and *Tyzzeria* species cause wenyonellosis and tyzzeriosis in poultry.

Unsporulated *Eimeria* oocyst

Shape, color, wall structure, micropyle, polar granule and polar cap vary according to *Eimeria* species.

There is a protoplasm mass called as sporont in the unsporulated oocyst.

Sporulated *Eimeria* oocyst

There are differences according to the type, color and size of oocysts. Sporocyst, sporozoites, oocyst residuum, stieda body, refractile globules, polar granule, micropyle, polar cap are found in a sporulated oocyst. Infection occurs by oral taking of these sporulated oocysts.

Sporulated *Isospora* oocyst

Sporulated *Tyzzeria* oocyst

Sporulated *Wenyonella* oocyst

COCCIDIOSIS in MAMMALIANS

COCCIDIOSIS in CATTLE

- There are 16 species belonging to *Eimeria* and *Isospora* genus.
- From these, *E. bovis*, *E. zuernii*, *E. ellipsoidalis*, *E. auburnensis* and *E. alabamensis* are pathogenic species and they cause clinic coccidiosis. The other species are *Eimeria bukidnonensis*, *E. cylindrica*, *E. brasiliensis*, *E. canadensis*, *E. illinoisensis*, *E. pellita*, *E. subspherica*, *E. wyomingensis*, *E. bombayensis*, *E. mundaragi*, *E. kosti* and *Isospora aksaica*, *Isospora* spp.

E. bovis (28x20 μ m), *E. zuernii* (18x15 μ m), *E. ellipsoidalis* (21x15 μ m), *E. auburnensis* (38x23 μ m), *E. alabamensis* (19x13 μ m)

Development

- The infection occurs by oral taking of sporulated oocysts with weed, straw, food and water.
- *Coccidia* species are mostly located in digestive system (especially in intestines). A few species also locate in kidney and liver. Merogonic and gametogonic development are seen in epithelial cells of host's intestine, whereas sporogonic development occurs in the outdoor environment.
- The protozoa are thrown away as unsporulated oocyst with feces. Sporogony begins when there is adequate heat (27-30°C), humidity (usually 75% relative humidity) and sufficient oxygen in the environment. The duration of the sporulation varies depending on the species, usually lasts 2-3 days.

Development

Cattle are infected by taking of the sporulated oocysts. The oocyst wall is ruptured with the influence of acid, enzyme, CO₂ in the digestive system and peristaltic movements, and sporozoites are released.

Merogonic stage: The sporozoites enter the epithelial cells of jejunum and ileum, and trophozoites are formed. Two generations merogony occur in the biology of *E. bovis* and *E. zuernii*.

The merozoites enter the epithelial cells in the cecum and colon, and the gametocysts are formed.

- There are several risk factor in spreading of coccidiosis.
 - Crowded stables
 - Dirty barn conditions
 - Contamination of manger and waterer
- There is a positive correlation between herd size and intestinal protozoa (*Eimeria*, *Cryptosporidium*). Coccidiosis causes more serious problems in crowded industrial companies.
- Predispose factors:
 - Irregular and insufficient feeding
 - Feed changes
 - Stress
 - Delactation
 - High barn temperature
 - High barn humidity
 - Cold
 - Change of place
 - Viral, bacterial and helminthic diseases

Pathogenesis and Pathological findings

- Effective factors in pathogenesis:
 - The number of sporulated oocysts that are taken
 - The number of merogonic generation
 - The number of merozoites that are formed by merogony.
 - Location region of the protozoa in tissue and organ.
- The re-absorption of Na^+ and Cl^- ions in the intestine is hampered due to epithelial losses. In addition, there is a decrease in the amount of albumin and total protein in blood plasma. As a result of all these events, dehydration emerges in animals.
- The back legs of calves are contaminated with feces and blood.
- The intestine is filled with bloody and watery stools.

Autopsy

hemorrhage in the intestine

Acute coccidiosis

Clinical manifestations

■ Acute Coccidiosis

- It is seen in especially 1-3 month calves.
 - **Initial stage:** There is bad smelly, dark green colored and serous diarrhea.
 - **Middle stage:** The stool is very bad smelly and watery, includes mucous fluid, fibrous membrane.
 - **Last stage:** the anus does not close due to diarrhea. Feed consumption is stopped.

■ Subclinical coccidiosis

- This form is a latent infection (due to immunity) in older animals.

■ Peracute coccidiosis

- It is often seen in sporadic cases in calves and usually arises during the winter months when the stress factors also participate. This type of coccidiosis is called neurological coccidiosis (nervous coccidiosis) or neurologic syndrome of coccidiosis due to neural signs and meningoencephalitis.

Treatment in cattle

- Sulfaquinoxaline Therapeutic, 15 mg/kg , 4 days, p.o.
- Sulfamethazine Therapeutic, 50-100 mg/kg, 4 days, p.o.
- Sulfaguanidine Therapeutic, 100 mg/kg CA, 3 days, p.o.
- Sulfathiazole Therapeutic, 150 mg/kg, 3-6 days, p.o.
- Sulfadimidin Sodium Therapeutic, 50-100 mg/kg, p.o., until healed
- Sulfadimethoxine Therapeutic, 55 mg/kg (first day), 27.5 mg/kg, 4 days, p.o.
- Toltrazuril Therapeutic, 10 mg/kg, twice a day, 2 days, p.o.
- Furazolidon Therapeutic, 15-30 mg/kg, 3-7 days, p.o.
- Amprolium Therapeutic, 10 mg/kg, 5 days, p.o. Prophylactic, 5 mg/kg, 21 days with food.
- Ethopabat, Decoquinate Prophylactic, 23-143 mg/kg, 21 days with milk. Prophylactic, 0.5 mg/kg, 28 days with food.
- Monensin Prophylactic, 1 mg/kg, 30 days, with food.
- Lasalocid Prophylactic, 1 mg/kg, up to 6 weeks age, with food and milk
- Salinomycin Prophylactic, 0.7-1.2 mg/kg, with food

Prevention and Control

- Care, feeding and hygiene must be taken into account.
- Young and old animals must be grown in separate compartments.
- More animals than the capacity of stable should not be housed together.
- The stables should be made properly, there should be no cracks and crevices.
- The contamination of mangers and waterer with feces must be prevented.
- The barns must be cleaned daily. To eating food from the ground should be prevented.
- The calves should be controlled for other diseases (bacterial, viral and nematodal)
- Anticoccidial drugs can be used for prophylactic purposes.

COCCIDIOSIS in WATER BUFFALO

- *Eimeria ankarensis*, *E. azerbaijhanica*, *E. bareillyi*, *E. gokaki* and *E. ovoidalis* are coccidial agents of water buffaloes.
- Additionally, the species that are coccidial agents of cattle (*E. alabamensis*, *E. auburnensis*, *E. bovis*, *E. brasiliensis*, *E. bukidnonensis*, *E. canadensis*, *E. cylindrica*, *E. ellipsoidalis*, *E. subspherica*, *E. wyomingensis* and *E. zuernii*) can be found in water buffalo.
- Other information about the water buffalo coccidiosis is like that of the cattle coccidiosis.

COCCIDIOSIS in SHEEP and GOAT

- The most common and pathogenic species in sheep are *E. ovinoidalis*, *E. absata*, *E. faurei*, *E. intricata*, *E. bakuensis* **and** *E. parva*. Additionally, there are *E. crandallis*, *E. weybridgensis*, *E. marsica*, *E. pallida*, *E. granulosa*, *E. dalli*, *E. punctata*, *E. gilruthi* and *E. gonzalezi* species.
- The important species found in goats are *E. arloingi*, *E. christenseni*, *E. minasensis*, *E. alijeви* **and** *E. ninakohlyakimovae*. Additionally, there are *E. hirci*, *E. caprina*, *E. caproovina*, *E. apsheronica*, *E. jolchijeви*, *E. gilruthi*, *E. kocharii*, *E. pallida* and *E. punctata* species.

- Coccidiosis in sheep and goats is the problem of young animals.
- It is especially important in lambs and yearlings from two weeks up to three months old.
- It is a problem in especially crowded breeding.
- To kept together the youngsters and their mothers
- To kept large number of lambs and yearlings in the same compartments
- are the most important risk factors in spreading of the disease.

COCCIDIOSIS in CAMELS

- *Eimeria cameli*, *E. dromedarii*, *E. bactriani*, *E. rajasthani*, *E. nölleri*, *Isospora orlovi* and *I. cameli* are coccidial agents of camels, and *E. dromedarii* is the most common species.
- Young camels are susceptible to disease and the disease is severe in young camels
- Anorexia, progressive weight loss, watery diarrhea and dehydration are seen in sick animals.

COCCIDIOSIS in EQUIDAE

- There are *E. leuckarti*, *E. solipedium* and *E. uniungulati* species in horse and donkeys.
- Diarrhea and enteritis are seen in donkey-foals and colts.

COCCIDIOSIS in DOGS and CATS

- The species that cause coccidiosis in dogs and cats are located in *Isospora* genus. Therefore, this disease are called as Isosporiosis.
- *I. canis*, and *I. ohioensis* in dogs.
- *I. felis* and *I. rivolta* in cats.
- It is a problem of young animals.
- Stress, poor hygiene conditions, malnutrition and depressed immune system are risk factor of the disease.

Development

- *Isospora* species develop monoxene or facultative heteroxene.
- The oocysts that are thrown out with stool sporulate in 1-4 days. Endogenous development begins when the sporulated oocysts are taken by orally.
- Meragonic and gametogonic proliferation occur in epithelial cells of intestines.
- Sub-clinical infection is generally seen in carnivores.
- Dehydration, abdominal pain, vomiting, inappetency, weight lose, anemia, fever and depression are clinical manifestations of the disease.

COCCIDIOSIS in SWINES

- *E. deblickei*, *E. scabra*, *E. polita*, *E. suis* and *I. suis* are seen in swine, while *E. scabra*, *E. neodeblickei* and *E. deblickei* are seen in wild boars.
- *I. suis*, *E. deblickei*, *E. scabra*, *E. polita* and *E. spinosa* cause clinical coccidiosis.
- Clinical infections are noteworthy in piglets.
- Old animals play an important role in the spreading of the disease.

Coccidiosis in rabbits

E. perforans

E. intestinalis *E. media*

E. coecicola *E. flavescens*

E. stiedai

- *Eimeria stiedai* cause hepatic coccidiosis, while the others cause intestinal coccidiosis.

E. piriformis

E. magna

E. irresidua

- Hepatic and intestinal coccidiosis are seen in rabbits
- Both types of coccidiosis can be seen together or separately.
- The sporulated *E. stiedae* oocysts (the hepatic coccidiosis agent) rupture in the intestine and the sporozoites become free.
- The sporozoites passing from here to mesenteric lymph nodes reach to liver by the way of lymphatic system or hepatic portal system.
- Then, they enter in the epithelial cells of bile ducts and meragonic and gametogonic stages occurs in that region.

Pathogenesis and clinical manifestations

- **Hepatic coccidiosis**
 - Intrahepatic bile epithelia are affected and lesions occur as a result of epithelium destruction.
 - The inflammatory reactions, tissue destruction, jaundice and impairment of liver function occur in sick animals.
 - Inappetency, weight lose, ascites, hepatosplenomegaly, diarrhea and jaundice are clinical manifestations of the disease.
- **Intestinal coccidiosis**
 - These agents develop in different parts of digestive system and have different pathogenicity.
 - They cause inflammation in intestinal epithelial cells and related tissues.
 - Inappetency, inactivity and diarrhea are seen in sick animals.