

Common Protozoan Infections of Livestock and Their Diagnosis, Treatment and Sustainable Control

Sanku Borkataki, Anish Yadav and Pankaj Goswami*

Division of Veterinary Parasitology

*Division of Veterinary Pathology

Faculty of Veterinary Sciences & Animal Husbandry, R.S.Pura

SKUAST-Jammu

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Veterinary Protozoology is one of the major sub-divisions of Veterinary Parasitology deals with study of various protozoa that affect domestic and wild animals. The word Protozoa originated from Greek mythology, Proto means First and Zoa means Animal. Majority of these unicellular animals live independently in their natural habitat seeking own food materials and utilizing free water and oxygen for their metabolism. However, the parasitic protozoa are dependent on their hosts for developmental stimuli, nutrition, digestive enzyme and control of maturation.

Most of the protozoa possess two stages: Trophozoite and Cyst. The trophozoites are growing, feeding and motile stage whereas the cyst stage protects the protozoa from harsh environment by a capsule. The cystic stage is mostly infective stage of the protozoa.

Reproduction of protozoa may be asexual or sexual. Binary fission is the most common form of asexual reproduction. Schizogony, budding, endodyogeny and endopolygeny are the other form of asexual multiplication. Conjugation and syngamy are the sexual form of reproduction. Some protozoa have complex life cycle requiring two different host species e.g. asexual in vertebrate host and sexual in arthropod vector. Others require only single host.

Protozoan parasites are found in various locations in the body of their host. They have selectivity for their habitat.

The most suitable habitats in their host are:-

1. Alimentary canal.
2. Blood and cerebrospinal fluid.
3. Reproductive tract.
4. Reticulo- endothelial system.
5. Cell tissues of various organs in intracellular or extracellular position.

Different techniques employed for detection of protozoan parasites depend upon the location and the stage of parasite present.

Various methods of diagnosis of protozoan infection:

1. Microscopic examination of secretions (tissue fluid) and excretions (faeces / urine/ reproductive tract discharge)
2. Examination of blood.
3. Examination of biopsy/ skin scraping.
4. Histopathological examination of various infected tissues
5. Laboratory or experimental animals / Vector infectivity test.
6. Serological study.
7. In vitro cultivation.

A detailed knowledge pertaining to the morphology of different stages of protozoan parasite, their host and site of predilection, life cycle and pathogenesis are essential for their identification / diagnosis, through the above examination procedures to formulate effective control.

TRYPANOSOMA

These are leaf shaped haemoprotozoans found in blood, which are intercellular except *T.cruzi* which is intracellular as it is found within cells of reticuloendothelial system and in cardiac muscles.

Hosts- Horses, dogs, camels, cattle, buffaloes, sheep and goat **Location-** Blood **Vectors-** *Tabanus*, *Stomoxys*, *Lyperosia*

Three species most prevalent in India- *T.evansi* (Surra), *T.equiperdum* (Dourine) and *T.equinum* (Mal-de-Cadres).

Note:

1. The fusiform shape and the monomorphic condition
2. The presence of well developed flagellum and undulating membrane.
3. Centrally placed nucleus
4. Sub terminally placed kinetoplast at the posterior end
5. Pointed posterior end.

Diagnosis

1. Based on history of prevalence of *Trypanosoma* infection and biting flies especially Tabanids.

2. Clinical symptoms
3. Laboratory examination

TRITRICHOMONAS

These are flagellate protozoans occurring in the genital tract of cattle. The parasites are transmitted by coitus thus creating a great problem to the breeding programmes.

Species involved: *T. foetus*

Site: Genital organs

Host: Cattle and Bulls are permanent carrier of infection

Abortion – 8 to 16 weeks after conception

Morphology:

1. Organisms are pear shaped
2. Four flagellae are present of which flagella trails posteriorly. Three flagella project anteriorly and a posterior flagellum (Recurrent).
3. A filamentous costa arises from the blepharoplasty and runs along the base of the undulating membrane.
4. A sausage shaped parabasal body is present
5. One prominent nucleus is present.

Diagnosis

1. Based on Herd history. Constant pyometra after abortion is classical history based diagnosis of *Tritrichomonas* infection.
2. Main diagnostic approach should be the examination of the vaginal or uterine discharge for the detection of organisms.
3. If abortion occurs, the amniotic and allantoic fluid and stomach content of the foetus should be examined for the presence of organisms.

Entamoeba

These are found in the intestine of vertebrates and invertebrates and usually do not cause any serious illness in domestic animals.

Site: Small intestine

Hosts- Man, dog, cattle and buffaloes
Species of bovines- *E.bovis*

Salient morphology

1. Organisms are pleomorphic.
2. There are mainly two phases of development like cyst and trophozoite stage.

Trophozoite stage

1. One nucleus present
2. Presence of food vacuole

Cyst stage

1. Infective stage of the parasite
2. Cysts have one to eight nuclei.

Diagnosis

1. Examination of the faecal sample for the presence of the trophozoites or cysts
2. Clinical symptoms

CRYPTOSPORIDIUM

Cryptosporidiosis is water borne infection caused by parasites belonging to genus *Cryptosporidium* which is responsible for a potentially severe disease in new born calves.

Host: Ruminants

Species: *C.parvum*

Transmission: Ingestion of oocysts

Location: Intestine

Causes watery diarrhoea, dehydration and death in severe cases

Diagnosis

1. Modified Zeil Nelson staining- Fix faecal smear in methanol. Dry smear and add carbol fuchsin and allow to react for 3 minutes. Wash with running tap water. Decolourise with 5% sulphuric acid or acid alcohol for 1minute. Wash and add Loffer's alkaline methylene blue and allow to react for 2 minutes. Wash with water, dry and examine under low power microscope and high power microscope.

Observation: Small oocyst, spherical to oval in shape. Pink to red color in blue

THEILERIA

These are tick borne haemoprotozoan disease occurring in the R.B.C and lymphocytes of ruminants. The disease caused by protozoa is known as bovine tropical theileriosis, east coast fever and corridor disease.

Species- *T.annulata* mainly and *T.orientalis*

Host-Cattle and Buffaloes

Vector-

Hyalomma sp.

1. The multiplying schizont stage is found in lymphocytes as Koch blue bodies. The irregularly oval or round bodies with a blue matrix consisting of pinkish dots representing the merozoites.
2. The infective stage is gametocytes, found in R.B.C as piroplasms, comma shaped

2. Examination of wet blood smear
3. Lymph node biopsy

BABESIA

Babesiosis is a tick borne haemoprotozoan disease of ruminants occurring particularly in R.B.C's.

Vector- *Boophilus sp.*

Hosts- Cattle, Buffalo, Sheep, Goat

Location- R.B.C's

Species: *B.bovis*, *B.bigemina*

Disease caused- Red water fever, Texas fever, Malignant jaundice

Salient morphology:

1. Pear shaped appearance . The inner side of the organism form an acute angle.
2. The organisms are clearly visible by Romanowsky staining. The cytoplasm takes blue colour and the nucleus takes red colour.
3. Non- specific round, oval amoeboid forms of the organisms are also found which occurs singly.

Diagnosis

1. History of the area is important for the diagnosis of disease.
2. The clinical signs particularly coffee coloured urine is most characteristic feature in this disease.
3. Examination of thick or thin blood smear shows piroplasms in R.B.C
4. Wet blood smear- A drop of fresh blood is put on a clean glass slide and it is mixed with a drop of water. Then this is covered with a cover slip and examined under microscope (oil immersion). The movement of the parasite become visible.

ANAPLASMA

Anaplasmosis is a rickettsial organism which resembles blood protozoa. The infection is pathogenic and widespread in different parts of the country.

Vector- Ticks (*Boophilus*, *Dermacentor*, *Hyalomma*, *Ixodes* and *Rhipicephalus*)

Species: *Anaplasma marginale*, *A.centrale* and *A.ovis*

Host: Bovine, Sheep and Goat

Disease produced: Gall sickness

Salient characters:

1. Organisms occur inside the erythrocytes as round, filamentous, oval or disc like

Diagnosis

1. Examination of thick and thin blood smear using Leishman or Giemsa stain intracytoplasmic inclusion bodies.
2. In 80% cases, organisms are found located near the margins of the erythrocytes.
3. The disease mostly seen in cattle above 18 months of age.
4. The blue dot of chromatin.
5. Diagnosis

1. Clinical manifestation like high fever, icterus, anaemia, reduction in milk yield
2. Blood smear examination shows organisms at margins in *A.marginale* and in centre

EIMERIA

Organisms, commonly called coccidia, are typically intracellular parasites of the epithelial cells of the intestine of vertebrates

Host: Cattle, Buffalo, Sheep and Goat

Infective stage: sporulated oocyst

Salient features:

1. After sporogony, the oocyst develops four sporocysts each containing two sporozoites.
2. The disease is transmitted through contaminated food and water

Diagnosis

1. Previous records and the history of the herd
2. Characteristic symptoms like bloody diarrhoea, rectal tenesmus, loss of appetite, fever, debility, etc.
3. Faecal examination for the presence of oocysts of coccidia.
4. Confirmatory diagnosis of acute coccidiosis is done by detection of characteristic intestinal lesions on post mortem examination of recently died animals.
5. Detection of oocysts in diarrhoeic faeces easily confirms sub-acute and chronic cases.

SARCOCYSTIS

These are cyst forming isosporan which occurs in skeletal and heart muscles of cattle. It is most pathogenic disease where first generation schizont develops in the endothelium of arterioles at 7 day post infection and second generation of schizont at 19-45 days post infection.

Species: *S.cruzi* is most pathogenic in cattle, *S.hirsuta* and *S.hominis*

Transmission- through ingestion of infected carcass containing cysts

Salient features:

1. The crescent or sickle shaped bodies with blunt and pointed ends
2. The nucleus, placed near the blunt end

Diagnosis

1. Clinical signs like anaemia, anorexia, fever, excessive salivation, abortion, loss of body weight, loss of hair particularly at tip of tail
2. Detection of antibodies in serum in acute sarcocystosis
3. ELISA to detect circulating antigen in mice and pigs.

4. PCR using species specific primer.

TOXOPLASMA

Toxoplasma is an obligate intracellular parasite transmitted in three primary ways; Congenital, carnivorous and faecal oral route.

Definitive host- Cat

Intermediate host- All other vertebrates

Location- Visceral organs

Note:

1. The arc shaped bodies, blunt at one end and pointed at other end.
2. The presence of spherical nucleus in the centre.

Toxoplasma gondii (cyst) - Mouse brain impression smear

1. The very spherical cyst
2. The collection of bradyzoites within

Diagnosis:

1. Examination of faecal sample for detection of the oocyst of *Toxoplasma* sp is done. The oocyst are very typical having two sporocysts. Each sporocyst has four sporozoites.

Control measures:

Protozoan infection in livestock and bird has a substantial socioeconomic impact in production also associated with high morbidity and mortality despite recent advances in prevention and treatment. The need for improved epidemiologic surveillance, more accurate diagnostic tools, and newer medications to combat resistance, and faster vaccine development continues to be considerable. Coccidia and Cryptosporidium are both protozoal parasites that can cause infection in young animals, particularly calves, leading to scour which is frequently fatal if left untreated. Protozoa are spread by a resistant infective stage called an oocyst that can survive outside the host animal. Infection can rapidly multiply if young calves are mixed with older calves or pens are used repeatedly, allowing a build up of oocysts to occur. Protozoa cause severe damage to the lining of the intestine and calves that survive the infection will show stunted growth and poor condition for some time. Reduction of oocyst numbers (and environmental challenge with other pathogens like coronavirus) can be achieved with aggressive cleaning of contaminated areas. Ideally all organic material should be removed and surfaces are subjected to a steam clean. A disinfectant should be applied and the areas should be allowed to dry. Hygiene, good colostrum intake and preventative treatment all play a role in their control, allowing calves to grow efficiently. Trypanosomiasis controlled is dependent upon therapy and control of blood sucking flies. *Trypanosoma equiperdum* control is achieved by quarantine regulation. In case of trichomonad infection, infected bulls are very difficult to treat. Segregation of

infected bull and breeding rest in infected cow are the main target to control the infection. Segregation of infected animal from young non infected cattle. Artificial insemination is the best method of control practices. Amoebiasis control mainly depends upon improvement in personal hygiene, good sanitation, improve sewage disposal and avoidance of food contamination with faecal content. Most of the infection of toxoplasmosis are asymptomatic. No satisfactory treatment is known against this disease. Public health education and awareness camp upon advice on potential danger of pregnant woman and children in connection with cat. Control of Babesiosis and theileriosis mostly depend upon the control of tick vector. This can be done by regular dipping of animals and therapeutic control of infected animals.

Drugs used for different Protozoan Parasites

Disease	Drug	Compound	Dose/Route
Trypanosomiasis	Berenil	Diminazene diacetuarate	3.5 mg/kg, deep I/M
	Triquin	Quinapyramine sulphate & chloride	0.025ml/kg b.wt, s/c
	Triquin-S	Quinapyramine sulphate	3.5 mg/kg, s/c
	Naganol/Gilpol	Suramin	0.4-0.5 g/45kg bw followed by 0.3g/45 kg after 1 st and 2 nd week
	Antrycide Prosalt	Quinapyramine sulphate & chloride	0.025ml/kg b.wt. s/c
Babesiosis	Berenil	Diminazene diacetuarate	3.5 mg/kg, deep I/M
Theileriosis	Butalex	Buparvaquone	2.5 mg/kg, I/M
Anaplasmosis	Oxytetracycline	Oxytetracycline	5mg/kg b.wt.I/M
Canine hepatozoonosis	Oxytetracycline-LA	Oxytetracycline	5mg/kg b.wt.I/M
Coccidiosis	Amprolsol Powder 20% w/v	Amprolium	30gm in 25-50 lit of water for 5-7 days

	Coxistac	Salinomycin	1gmin 1 ton of feed
	Sulphamin Bolus/inj	Sulphadimidine	100mg/kg b.wt
Trichomoniasis	Flagyl tab/susp	Metronidazole	66mg/kg b.wt for 5 consecutive days