Apicomplexa
(Sporozoa)
CRYPTOSPORIDIUM PARVUM
Cryptosporidiosis

- *Cryptosporidium* is a microscopic parasite that causes the diarrheal disease The disease are commonly known as "Crypto."
- There are many species of *Cryptosporidium* that infect humans and animals. The parasite is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it very tolerant to chlorine disinfection.
- While this parasite can be spread in several different ways, water (drinking water and recreational water) is the most common method of transmission. *Cryptosporidium* is one of the most frequent causes of waterborne disease among humans in the United States.
- *Cryptosporidium* lives in the intestine of infected humans or animals. An infected person or animal sheds Crypto parasites in the stool. Shedding of Crypto in the stool begins when the symptoms begin and can last for weeks after the symptoms (e.g., diarrhea).

Transmission

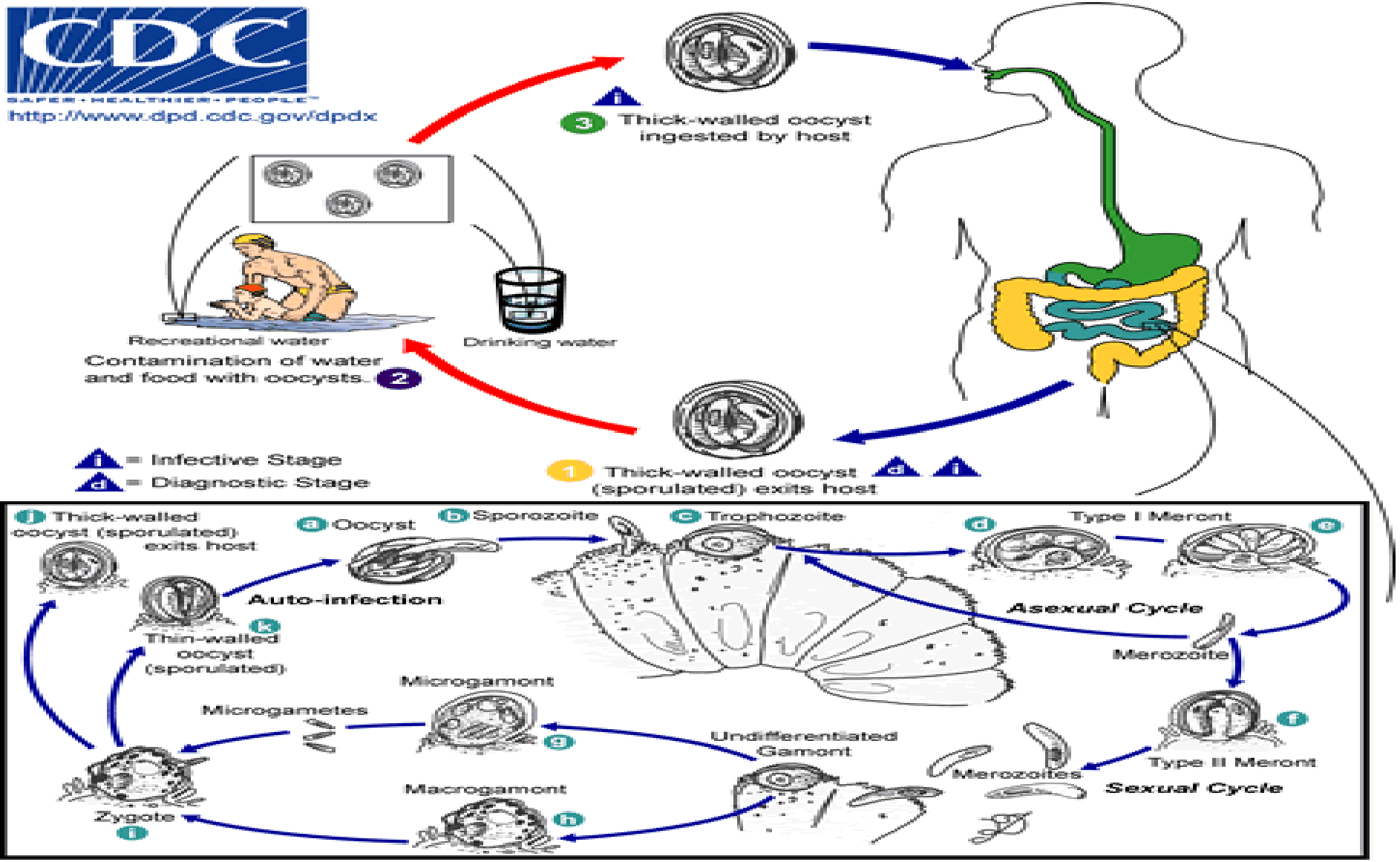
• *Cryptosporidium* may be found in soil, food, water, or surfaces that have been contaminated with the feces from infected humans or animals for these can transmitted:

•By putting something in your mouth or accidentally swallowing something contaminated with stool of a person or animal infected with Crypto.

• By eating uncooked food contaminated with Crypto. All fruits and vegetables you plan to eat raw should be thoroughly washed with uncontaminated water.

• By touching your mouth with contaminated hands. Hands can become contaminated through a variety of activities, such as touching surfaces (e.g., toys, bathroom fixtures, changing tables, diaper pails) that have been contaminated by stool from an infected person, changing diapers, By exposure to human feces through sexual contact.

Life cycle: Many species of Cryptosporidium exist that infect humans and a wide range of animals. Although *Cryptosporidium parvum* and *Cryptosporidium hominis* (formerly known as C. parvum anthroponotic genotype or genotype 1) are the most prevalent species causing disease in humans



Life Cycle

C. parvum undergoes both asexual (schizogony) and sexual (gametogony) multiplication in a single host (man, cattle, cat or dog). Man acquires infection by ingestion of food and drink contaminated with faeces containing oocysts of the parasite and possibly other routes such as respiratory secretions. After excysting from oocysts in the lumen of the intestine, sporozoites invade the epithelial cells and develop to trophoziets (uninucleate meronts)within parasitophprous vacuoles in the microvillous of the mucosal epithelium.

These Trophozoites multiply asexualy to produce type 1 meronts. Eight merozoites are released from each type 1 meront. These enter adjacent host cells to form additional type 1 meronts or to form type 2 .

Four merozoites are released from each type 2 meront. They enter host cells to form the sexual stages(gametoogony).After fertilization , an environmently resistant, thick-walled oocyst is formed that undergoes sporogony to formed sporulated oocyst, which released in faeces transmits the infection from one host to another. About 20% zygotes do not form a thickoocyst wall, but have only a unite membrane surrounding four sporozoites. These thin –walled oocysts represent autoinfective life cycle forms that can maintain the parasite in the host without repeated oral exposure to thick-walled oocysts present in the environment.

Clinical Manifestation

Symptoms begin 2 to 10 days after becoming infected with the parasite. The most common symptom of cryptosporidiosis is Watery diarrhea. Stomach cramps or pain, dehydration, nausea, vomiting, fever, weight loss.

Some people with Crypto will have no symptoms .

Persons with healthy immune systems, Symptoms usually last about 1 to 2 weeks (with a range of a few days to 4 or more weeks) .

The small intestine is the site most commonly affected, *Cryptosporidium* infections could possibly affect other areas of the digestive tract or the respiratory tract.

People with weakened immune systems may develop serious, chronic, and sometimes fatal illness. Examples of people with weakened immune systems include:

- People with AIDS;
- Those with inherited diseases that affect the immune system
- Cancer and transplant patients who are taking certain immunosuppressive drugs.

❖ In these patients *C. parvum* infections are not always confined to the gastrointestinal tract; additional symptoms (respiratorycryptosporidiosis, cholecystitis, hepatitis, and pancreatitis)have been associated with extraintestinal infections.

❖ The risk of developing severe disease may differ depending on each person's degree of immune suppression.

Diagnosis

Diagnosis is made by examination of stool samples. patients may be asked to submit several stool samples over several days. Most often, stool specimens are examined **microscopically** using different techniques (e.g., acid-fast staining, direct fluorescent antibody [DFA] , and/or enzyme immunoassays for detection of *Cryptosporidium* spp. antigens).

Histopathological examination :

Various life cycle stages of C. parvum can be detected in the microvillous region of intestinal mucosa obtained by biopsy.

Antibodies specific to *C. parvum* can be detected by IFA assays using endogenous stages of the parasite in tissue sections as antigens or intact oocysts as antigens . Specific anti- Crytosporidium IgG or IgM or both may be detected by enzyme – linked immunosorbent assay using crude oocyst preparations as antigens.

Molecular methods (e.g., polymerase chain reaction – PCR) are increasingly used in reference diagnostic labs, since they can be used to identify *Cryptosporidium* spp.

Treatment

Nitazoxanide has been FDA-approved for treatment of diarrhea caused by *Cryptosporidium* in people with healthy immune systems.

Isosporabelli known as Isosporiasis or Cystoisosporiasis

Morphology :

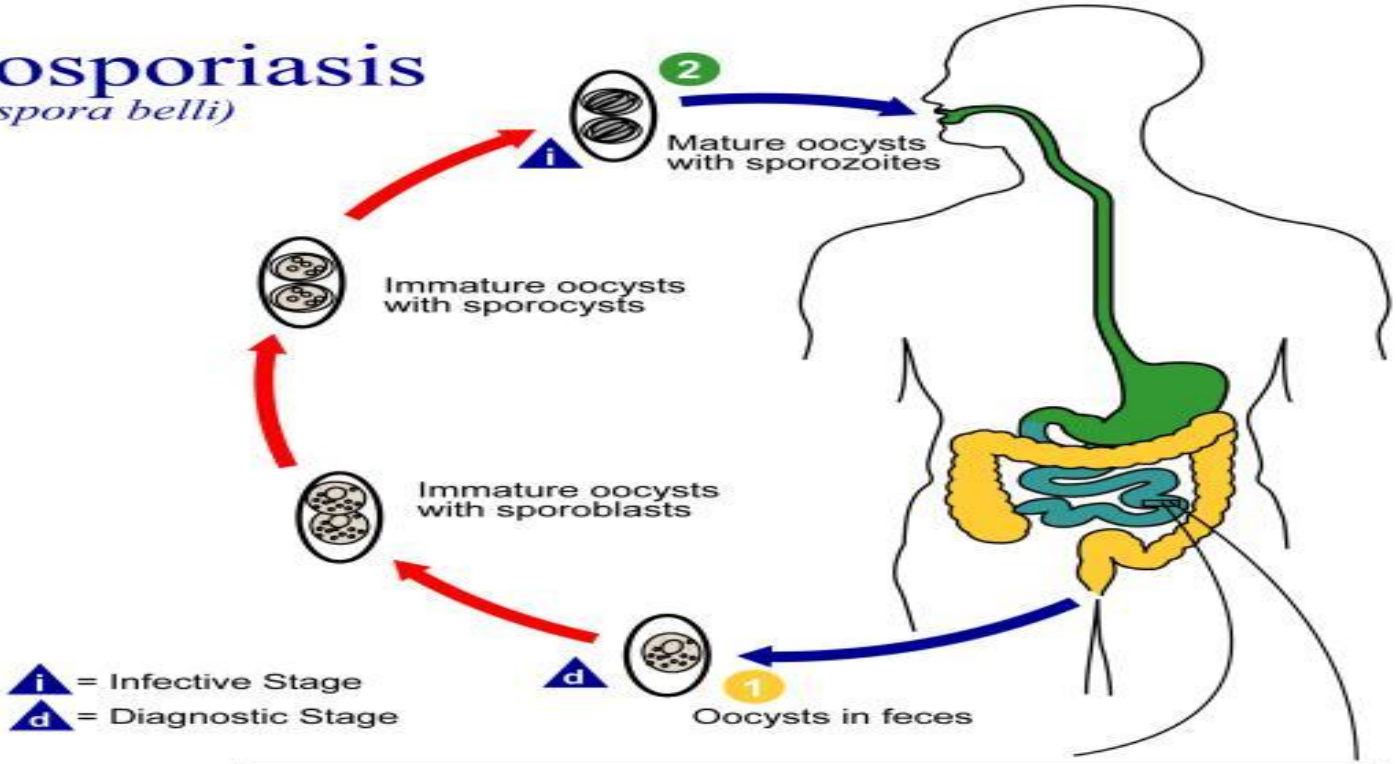
Unsporulated oocysts of *I. belli* are elongate-ovoidal in shape,. Inside each oocyst two sporpblasts which later on convert into sporocysts. Each sporocyst contains four crescent-shaped sporozoites. The oocyst is surrounded by a thin, smooth, two-layered cyst wall.

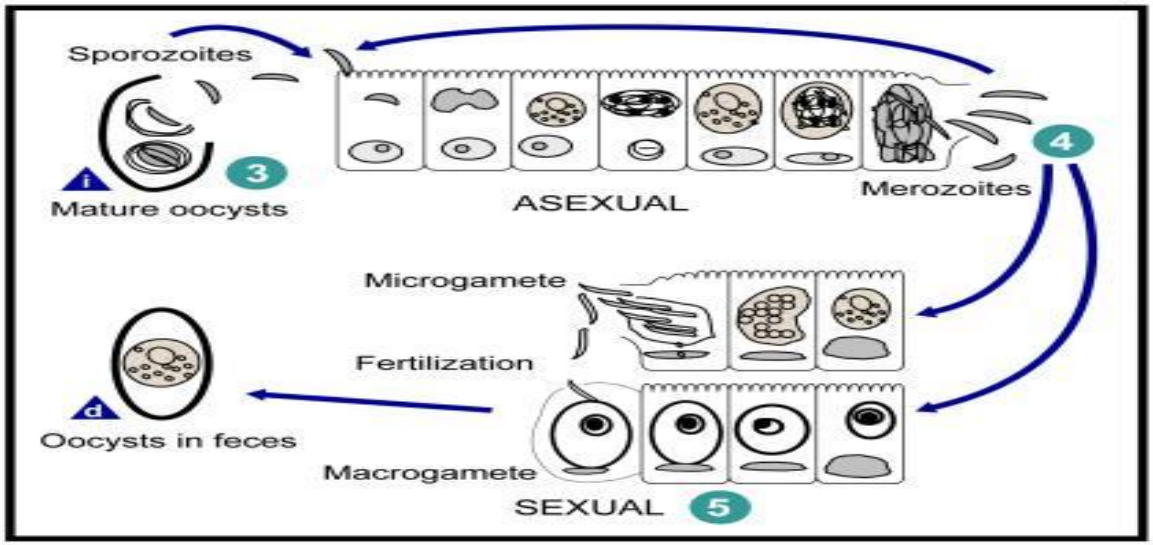
Life cycle :

Man acquires infection by ingestion of food and water contaminated with faeces containing oocysts . Eight sporozoites are released from two sporocysts in the upper small intestine and invade the epithelial cells of the distal duodenum and proximal jejunum. Inside the cytoplasm of the enterocyte, the parasite undergoes asexual multiplication (merogony)to produce trophozoites. Some of these trophozoites undergo sexual cycle (gametogony) and produce oocysts which are passed in the faeces. Usually the oocyst contains only one immature sporont but two may be present. Continued development occurs outside the body with the development of two mature sporocysts each containing four sporozoites . The sporulated oocyst is the infective stage of the parasite.

Isosporiasis

(Isospora belli)





Clinical Manifestation

Infection is usually asymptomatic.

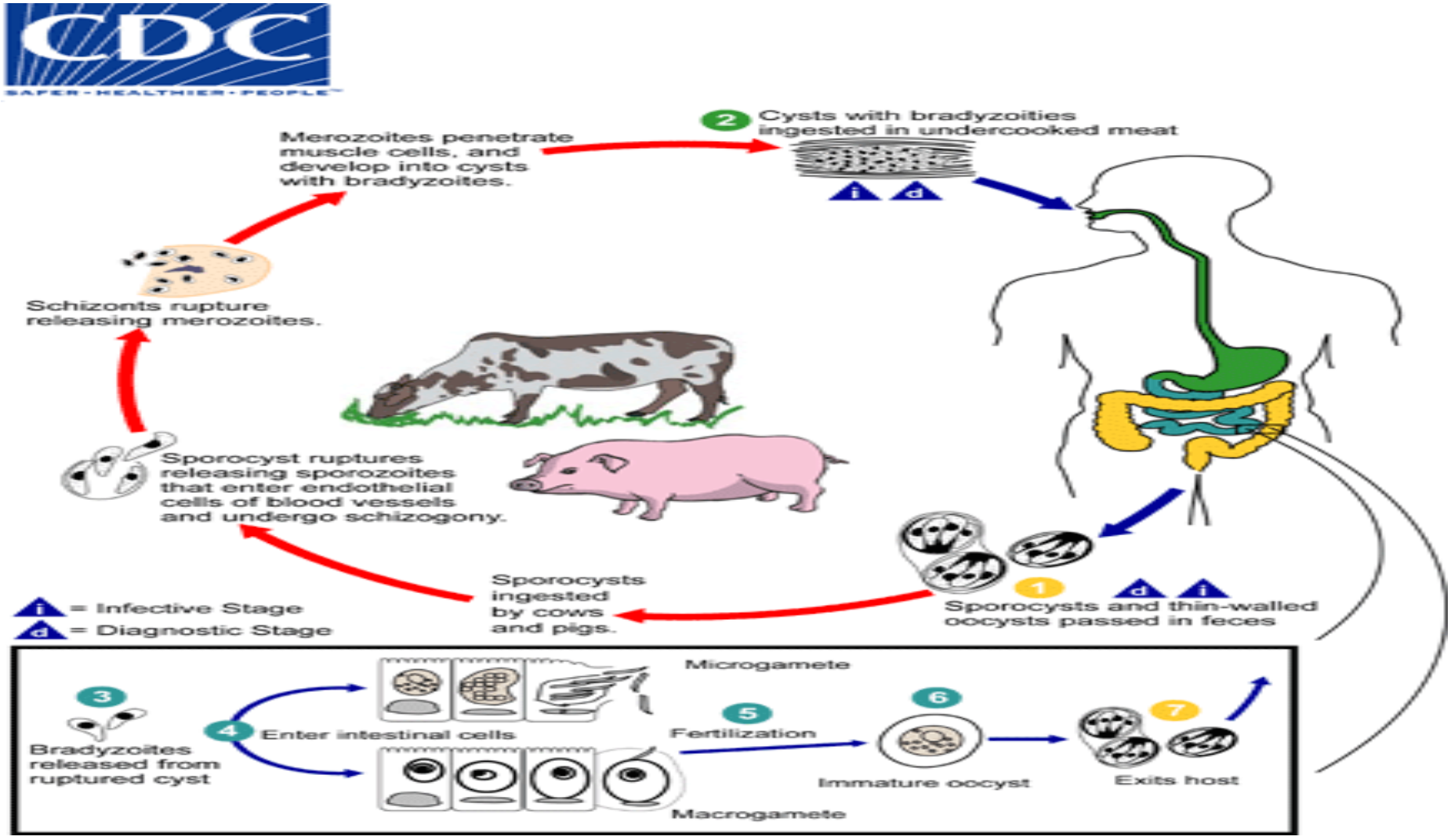
Clinical illness including abdominal discomfort,mild fever and diarrhoea develops a week after exposure. The illness is usually self-limited but protracted diarrhoea, lasting for several years, can be produced in immunocompromised persons, particularly in the HIV infected

Diagnosis can be established by the demonstration of characteristic *I. belli* oocysts in the faeces by examination of unstained or iodine-stained direct smear preparations. They stain red by the cold acid-fast technique. Zinc sulphate or formol-ether techniques can be employed for concentration.

Treatment with cotrimoxazole is effective.

Sarcocystis Spp. (sarcocystosis)

Sarcocystis hominis and *S. suihominis* use humans as definitive hosts and are responsible for intestinal sarcocystosis in the human host. Humans may also become dead-end hosts for non-human *Sarcocystis* spp. after the accidental ingestion of oocysts



Life cycle:

Both sporulated oocysts (containing two sporocysts) and individual sporocysts can be passed in stool. Sporocysts contain four sporozoites and a refractile residual body.

Sporocysts ingested by the intermediate host (cattle for S. hominis and pigs for S. suihominis) rupture, releasing sporozoites. Sporozoites enter endothelial cells of blood vessels and undergo schizogony, resulting in first-generation schizonts. Merozoites derived from the first-generation invade small capillaries and blood vessels, becoming second-generation schizonts. The second generation merozoites invade muscle cells and develop into sarcocysts containing bradyzoites, which are the infective stage for the definitive host.

Humans become infected when they eat undercooked meat containing these sarcocysts. Bradyzoites are released from ruptured cysts in the small intestine and invade the lamina propria of the intestinal epithelium. There, they differentiate into macro- and microgametocytes. Fusion of male and female gametes results in the formation of oocysts. Oocysts sporulate in the intestinal epithelium and are shed from the host in feces. Due to the fragile nature of the oocyst wall, individual sporocysts may also be detected in feces.

Clinical Manifestation

In cases of intestinal sarcocystosis, infections are often asymptomatic and clear spontaneously. Occasionally, mild fever, diarrhea, chills, vomiting and respiratory problems. When humans become infected with sarcocysts of non-human species, the infections are not intestinal but rather result in muscle cysts; symptoms such as myalgia, muscle weakness. In these cases, humans are dead-end intermediate hosts.

Laboratory Diagnosis

For intestinal sarcocystosis diagnosis is made by the observation of oocysts or sporocysts in stool.

When humans serve as dead-end hosts for non-human Sarcocystis spp., diagnosis is made by the finding of sarcocysts in tissue specimens.

Treatment

Currently, there is no proven therapeutic treatment for either intestinal or tissue sarcocystosis.