Subphylum: Mastigophora (Flagellates)

These protozoa have whip-like appendages called flagella as the organs of locomotion. In some species, the flagellum runs parallel to the body surface, to which it is connected by a membrane called the **undulating membrane**. Flagellates parasitic are divided into 2 groups:

- **Kinetoplastida:** These possess a kinetoplast from which a single flagellum arises. They are the **hemoflagellates** (trypanosomes and *Leishmania*).
- **Flagellates without kinetoplast:** These bear multiple flagella. *Giardia*, *Trichomonas*, and other luminal flagellates belong to this group.

There are two groups of flagellates:

A- **Luminal and Intestinal flagellates**

- *Giardia lamblia*
- *Trichomonas vaginalis*
- *Trichomonas tenax*
- *Trichomonas hominis*

B- **Blood and tissue flagellates**

Trypanosoma species

Leishmania species

Giardia lamblia

It is the most common protozoan pathogen and is worldwide in distribution *Giardia lamblia* (also referred to as *Giardia duodenalis* or *Giardia intestinalis*) is the causative agent of giardiasis and is the only common pathogenic protozoan found in the duodenum and jejunum of humans, it is the only protozoan parasite found in the lumen of the human small intestine. It exists in two forms: Trophozoite (or vegetative form) and Cyst.

Epidemiology

The endemic is very high in areas with low sanitation, especially tropics and subtropics. High-risk groups include infants, young children, international adoptees, travelers, immunocompromised individuals, and patients with cystic fibrosis Visitors to such places frequently develop traveler's diarrhea caused by giardiasis through contaminated water. Giardiasis is a well-recognized cause of enteric disease among international travelers in the United States, Canada, and Europe. In the United States in 2012, a total of 15,223 cases were reported.

Morphology

It exists in two forms: Trophozoite (or vegetative form) and Cyst. The trophozoite of *G. lamblia* is a pear-shaped organism, is rounded anteriorly and pointed posteriorly. Dorsally, it is convex and ventrally, it has a concave sucking disc. The trophozoite is bilaterally symmetrical, containing two ovoid to spherical nuclei, each with a large karyosome, usually centrally located, peripheral chromatin is absent, has four pairs of flagella (One pair of flagella originates from the anterior end and one pair extends from the posterior end, the remaining two pairs of flagella are located laterally), blepharoplast, from which the flagella arise (4 pairs), two of axostyles (rod-like supporting organelles), running along the midline, two sausage shaped parabasal or median bodies, lying transversely posterior to the sucking disc. A large concave sucking disk on the ventral surface helps the organism to adhere to intestinal villi. As the parasites pass into the colon, they typically encyst, and the cysts are passed in the stool. They are oval with four nuclei, flagella, and claw-shaped median bodies. The cysts (and, less frequently, trophozoites) are excreted in stool. thick-walled, highly resistant, and 8–14 μm in length; they contain two nuclei as immature forms and four as mature cysts.

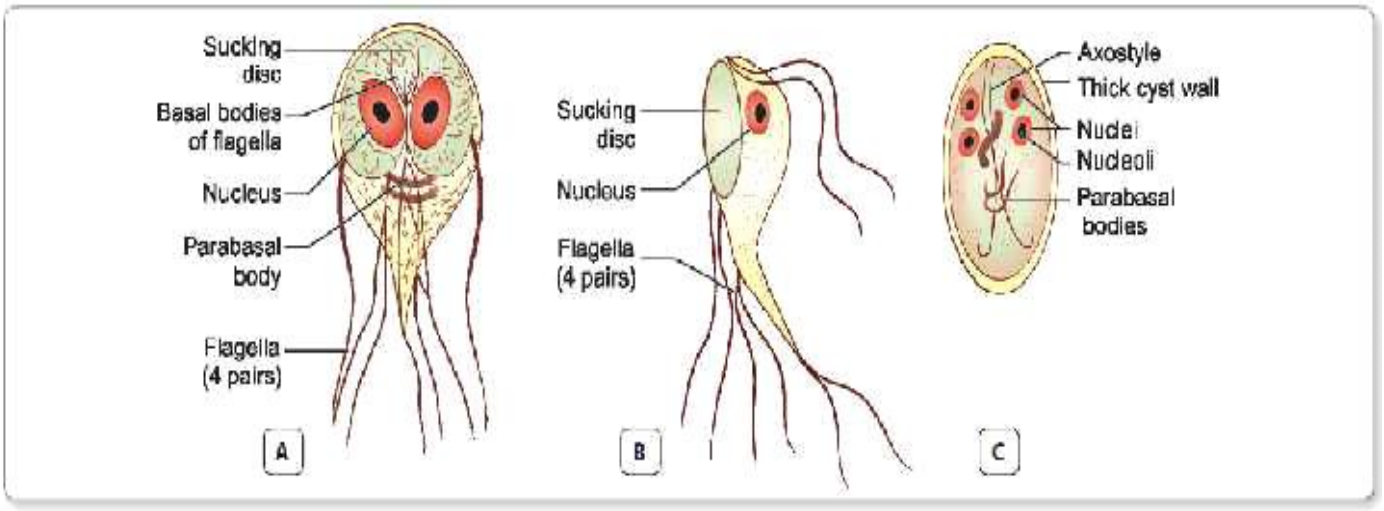
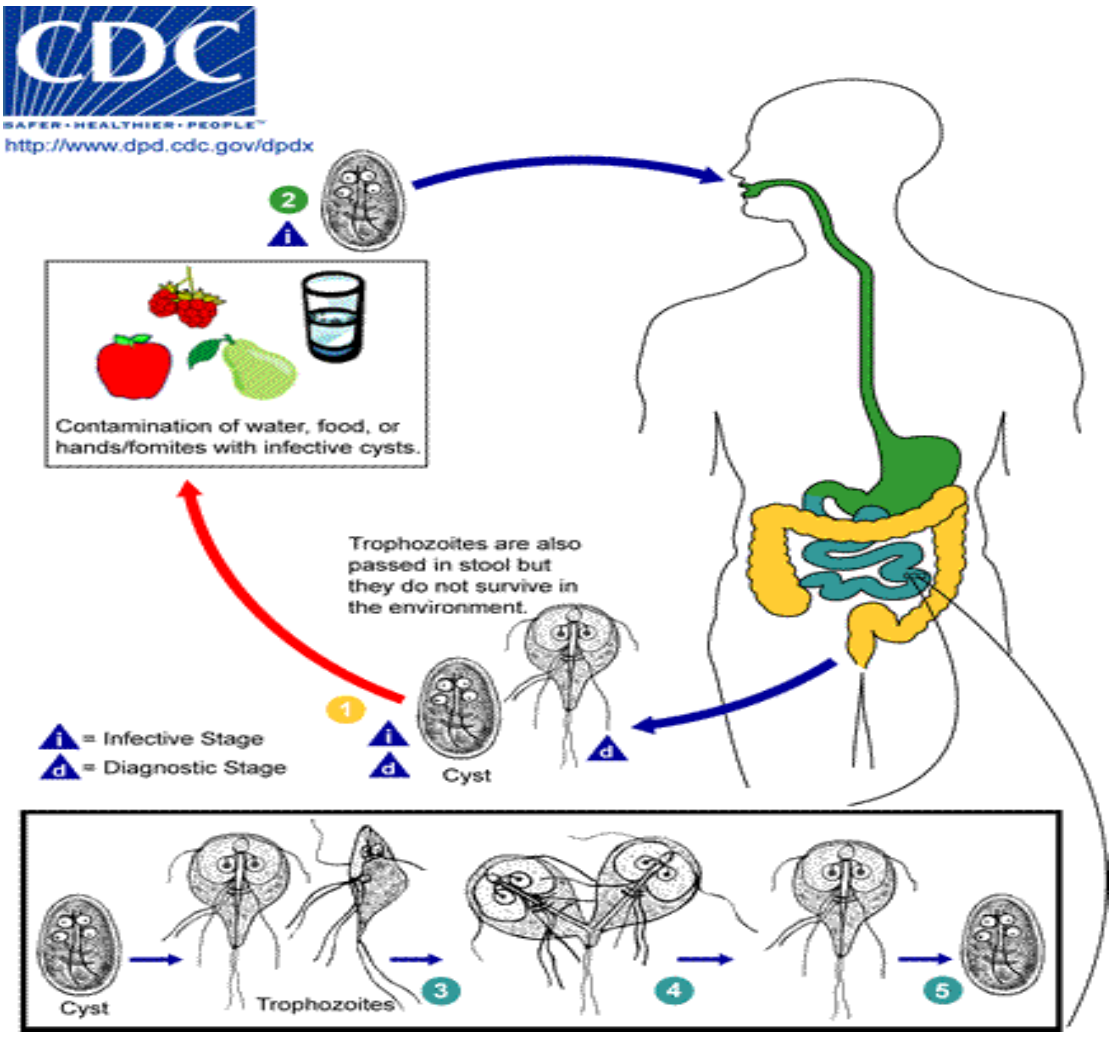


Fig. 4.2: Trophozoite. A. Ventral view; B. Lateral view; C. Quadrinucleate Cyst

Life Cycle

Giardia passes its life cycle in one host, the infective cyst mature cyst. Man acquires infection by ingestion of cysts in contaminated water and food. Within half an hour of ingestion, the cyst hatches out into two trophozoites, which multiply successively by binary fission and colonize in the duodenum. The trophozoites live in the duodenum and upper part of jejunum, feeding by pinocytosis. During unfavorable conditions, encystment occurs usually in colon. Cysts are passed in stool and remain viable in soil and water for several weeks. There may be 200,000 cysts passed per gram of feces.



Transmission

Giardia is found in soil, food, water, or surfaces that have been contaminated with the feces from infected humans or animals. *Giardia* transmission can occur by accidentally swallowing the parasite; a person cannot become infected through contact with blood.

Pathogenesis

Humans are infected by ingestion of fecally contaminated water or food containing giardia cysts or by direct fecal contamination. *G. lamblia* is typically seen within the crypts of duodenal and jejunal mucosa. It does not invade the tissue, but remains tightly adhered to intestinal epithelium by means of the sucking disc. They may cause abnormalities of villous architecture by cell apoptosis and increased lymphatic infiltration of lamina propria. Cysts can survive in water for up to 3 months. Cysts may be found in large numbers in the stools of entirely asymptomatic persons.

Giardia may lead to mucus diarrhea and fat malabsorption (steatorrhea). The large numbers of parasites attached to the bowel wall may cause irritation and low-grade inflammation of the duodenal or jejunal mucosa, with consequent acute or chronic diarrhea associated with crypt hypertrophy, villous atrophy or flattening, and epithelial cell damage.

Clinical Features

Clinical disease - Giardiasis

Symptoms of malaise, weakness, weight loss and abdominal cramps. Collecting multiple stool samples over several days is recommended to increase the likelihood of microscopically detecting cysts in smears. The stool contains excess mucus and fat but no blood. Occasionally, *Giardia* may colonize in the gallbladder, causing biliary colic and jaundice. Incubation period is variable. but is usually about two weeks.

Diagnosis

1- Trophozoites and cyst are found by examination of saline wet preparation of fresh diarrheic stool.
2- aspirate duodenale or jejunal.
3- Elisa to detect IgM in serum provides the evidence of current infection
4- from .4-Biobsy from the upper intestinal

Treatment

Metronidazole (flagyl) and tinidazole are the drugs of choice. Cure rates with metronidazole are more than 90%. Tinidazole is more effective than metronidazole. Furuzolidone and nitazoxamide are preferred in children, as they have fewer adverse effects. Parmomycin, an oral aminoglycoside can be given to symptomatic pregnant females.

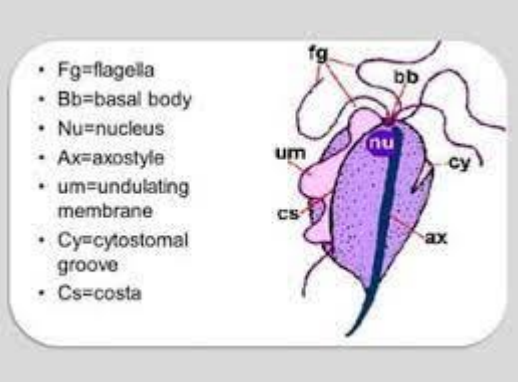
Prevention

1- by treatment of drinking water filtration.
2- chemical treatment methods.

Trichomonas tenax

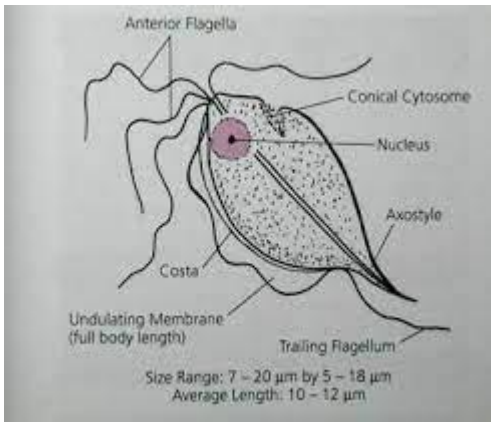
Trichomonas tenax is an anaerobic commensal flagellated protozoan, the infection received much less attention than other parasitic diseases which inhabit the oral cavity as commensals, although have the potential to become opportunistic pathogens in the cases of poor oral hygiene and poor periodontal health. It seems to have the capacity to be involved in the inflammatory process of gum disease.

It may be found in the dental plaque, and periodontal area. The importance of oral infections has been increased recently since the parasite is believed to enter the respiratory tract by aspiration from the oropharynx and then cause bronchopulmonary trichomoniasis,. Transmission is through droplet spray, saliva, and kissing or use of contaminated drinking water and dishes.



Trichomonas hominis

Carries 5 anterior flagella and an undulating membrane that extends the full length of the body. It is a common commensal of caecum. Transmission occurs in trophic form by fecal oral route.



<u>- Genital flagellata</u>

– *Trichomonas vaginalis* (vagina and urethra)

Trichomonas vaginalis

Trichomonas vaginalis is one of the commonest sexually transmitted pathogens in the world, with an estimated 170 million cases occurring each year. The epidemiology of the disease is still poorly understood Trichomonas differs from other flagellates, as they exist only in trophozoite stage. Cystic stage is not seen.

Morphology

It is pear-shaped or ovoid and measures 10–30 μm in length and 5–10 μm in breadth with a short undulating membrane reaching up to the middle of the body. It has four anterior flagella and fifth running along the outer margin of the undulating membrane, which is supported at its base by a flexible rod, costa. A prominent axostyle runs throughout the length of the body and projects posteriorly like a tail. In females, it lives in vagina and cervix and may also be found in urinary bladder. In males, it occurs mainly in the anterior urethra, but may also be found in the prostate.

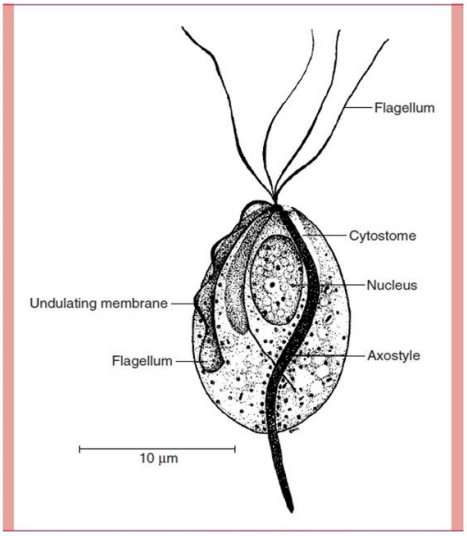


FIGURE 54–1
Trichomonas vaginalis.

Life Cycle

The trophozoite cannot survive outside and so infection has to be transmitted directly from person to person. Sexual transmission is the usual mode of infection. Trophozoites divide by binary fission. As cysts are not formed, the tropohozite itself is the infective form. Incubation period is roughly 10 days. *T. vaginalis* trophozoites reside on the mucosal surface of the vagina in infected women. The growing trophozoites multiply by longitudinal binary fission and feed on local bacteria and leukocytes. The most common infection site of T. vaginalis in males is the prostate gland region and the epithelium of the urethra.

Pathogenesis

The trophozoite is found in the urethra & vagina of women and the urethra & prostate gland of men. After introduction by sexual intercourse, proliferation begins which results in inflammation & large numbers of trophozoites in the tissues and the secretions. The onset of symptoms such as burning, and itching also be present. Red punctate lesions may be present upon examining the vaginal mucosa of infected women and discharge is often sudden and occurs during or after menstruation as a result of the increased vaginal acidity. The vaginal secretions are liquors, greenish or yellowish, sometimes frothy, and foul smelling. Infection in the male may be latent, with no symptoms, or may be present as self-limited, persistent, or recurrent urethritis.

Clinical features

Clinical disease - trichomoniasis.

Most infected women at the acute stage are asymptomatic or have a scanty, watery vaginal discharge. In symptomatic cases vaginitis occurs with more extensive inflammation, along with erosion of epithelial lining, and painful urination, and results in symptomatic vaginal discharge, vulvitis and dysuria.

Diagnosis

- Microscopic examination (Vaginal or urethral discharge, in males, trophozoites may be found in urine or prostatic secretions).
- Direct fluorescent antibody (is more sensitive than the wet mount).

- Culture (is recommended when direct microscopy is negative is the most sensitive (95%) method for the diagnosis of *T. vaginalis* infection.
- Serology (ELISA is used for demonstration of *T. vaginalis* antigen in vaginal smear).
- Molecular method PCR

Treatment

Metronidazole 2 g orally as a single dose or 500 mg orally twice a day for 7 days is the drug of choice.

Prevention

- Both male & female sex partners must be treated to avoid reinfection.
- Good personal hygiene, avoidance of shared toilet articles & clothing.