Giardiasis

*Giardia lamblia*

*Giardia intestinalis*
Giardiasis

- Most common causative agent of epidemic & endemic diarrhoea throughout the world
- Prevalence - 2-5% in industrialised countries, 20-30% in developing countries
- Reported from throughout India
- Caused by *Giardia intestinalis* / *Giardia lamblia*
- Man is the main reservoir
- Inhabit duodenum, jejunum & upper ileum
- *G. intestinalis* exists in 2 stages – trophozoite & cyst
Morphology of *Giardia lamblia* trophozoite

- Pear shaped, rounded anterior end, posterior end pointed (looks like monkey face)
- Size: 12 to 15 µm long x 5 to 9 µm wide
- Dorsal surface convex, ventral surface concave
- Ventral surface bears **sucking disk** to adhere to surface of intestinal cell
- Bilaterally symmetrical: 2 **nuclei**, 2 **axostyles**, 4 pairs of **flagella** (2 anterior, 2 posterior, 2 ventral, and 2 caudal)
- Actively moving and feeding stage
  - Habitat: small intestine
  - May invade the common bile duct.
Morphology of *Giardia lamblia* trophozoite

Scanning EM view of trophozoite surface showing the adhesive disk (text photo on p. 92)
Morphology of *Giardia lamblia* trophozoite

Light microscope photos of trophozoites
Morphology of *Giardia lamblia* cyst

- ovoid in shape
- 8-12 µm long x 7-10 µm wide
- thick cyst wall
- 4 **nuclei** present, either clustered at on end or present in pairs at opposite ends
- **Axostyle** runs diagonally through the cyst
- **Flagella** shorten and are retracted within cyst
  - provide internal support
- The cyst forms as trophozoites become dehydrated when they pass through the large intestine
- Cyst may remain viable in the external environment usually water) for many months.
Giardia lamblia cyst
Giardiasis

*Giardia intestinalis* (=lamblia)

**Trophozoites**

**Cysts**
• Infective form – **mature cyst** passed in feces of man

• Routes of transmission
  – Feco-oral
    • ingestion of contaminated water – most important
    • Ingestion of contaminated food
  – Person to person – day care, nursing homes, mental asylums (poor hygiene)
  – Sexual – sexually active homosexual males
Life Cycle

- Acquire infection – ingestion of mature cysts
- **Excystation** occurs in stomach & duodenum within 30 minutes
- **2 trophozoites** hatch from one cyst
- Trophozoites multiply by binary fission & colonize in duodenum & upper jejunum
- Trophozoites adhere to enterocytes by ventral suckers
- **Encystation** occurs in transit down the colon
- Axonemes retract, cytoplasm condense & thin tough hyaline wall is secreted
- Encysted trophozoite undergo nuclear division – mature **quadrinucleate cyst**
Giardia – Life cycle

Humans acquire infection through consumption of contaminated water or food, or by the fecal-oral route on or by hands or fomites.

Contamination of water, food, or hands/fomites with infective cysts.

Trophozoites are also passed in stool but they do not survive in the environment.

Excystation occurs in the small intestine. Two trophozoites are released from each cyst.

The trophozoites multiply by longitudinal binary fission. They remain in the lumen of the proximal small bowel where they can be free or attached to the mucosa by a ventral sucking disk.

Encystation occurs as the parasites transit toward the colon. Both cysts and trophozoites can be found in the feces (diagnostic stages). The cyst is the stage found most commonly in non-diarrheal feces. Cysts are resistant forms and are responsible for transmission.
Giardia lamblia life cycle

- Excysts in duodenum
- Trophozoites on mucosa of duodenum
- Trophozoite and cyst in feces (diagnostic stages)
- Cyst (infective stage)

Man

External Environment

Multiplies by longitudinal binary fission
Pathology

- Do not invade tissues
- Feed on mucous secretions
- May localise in **biliary tract** to avoid the acidity of duodenum
- Cause inflammation of duodenum & jejunum
- Cause **malabsorption** as the parasite coats the mucosa & damage epithelial brush border
- Stool contains large amounts of mucous & fat but no blood
Giardiasis: The Disease

- **Asymptomatic**: largest group
- **Acute**: self-limiting infection, acute watery diarrhoea, abdominal cramps, bloating, flatulence
  - Stool is profuse & watery in earlier disease
  - Voluminous, foul smelling & greasy (steatorrhoea) later
- **Chronic**: chronic diarrhoea with malabsorption syndrome, steatorrhoea
Laboratory Diagnosis
Parasitic Diagnosis

Samples

- Stool
- Duodenal contents
  - Duodenal fluid (Entero test)
  - Duodenal/jejunal biopsy

**Entero test** – gelain capsule containing a nylon string with a weight is swallowed by the patient. Free end of the string is fixed to the mouth. Capsule dissolves & the string is released in the duodenum. After overnight string is removed & bile stained mucus collected.
Parasitic Diagnosis
Microscopy

Direct Wet Mount

- Trophozoite with falling leaf motility in saline mount
- Cyst in iodine mount

Stained stool smears

- Trichrome
- Iron haemotoxylin
Laboratory Diagnosis
Parasitic Diagnosis

Antigen detection (Coproantigen)

- ELISA
- Sensitivity & specificity high

Culture

- Not done routinely
- Diamonds medium
Laboratory Diagnosis

Serodiagnosis
• ELISA
• Epidemiological purpose

Molecular diagnosis
• DNA probes & PCR for research purpose
Prevention

• Avoid food & water that might be contaminated
  – filtration of water (be sure filter is fine enough to trap the cysts)
  – boiling water
  – addition of a tincture of iodine are effective in killing cysts (chlorination of water does not effect the cysts)

• Practice good hygiene
  – Wash hands thoroughly with soap and water
    • after using the toilet
    • before handling or eating food
Treatment

- Nitroimidazole derivatives
  - Metronidazole
  - Tinidazole
  - Drugs of choice
- Acridine dye
  - Quinacrine
- Nitrofurans
  - Furazolidone
Trichomoniasis

*Trichomonas vaginalis*
Trichomoniasis

• Sexually transmitted disease of worldwide importance

• It is cosmopolitan in distribution, however prevalence is not uniform because of sanitary and hygiene habits (depends on surroundings).
  
  – 20-40% in Women
  – 15% in Men
Pathology

Women

• Asymptomatic in most cases

• **Vulvovaginitis**
  – Purulent vaginal discharge (**leukorrhea**)
  – Malodourous smell
  – Strawberry cervix
    • Punctate haemorrhages in mucosa
  – Vulval & vaginal epithelium fiery red and inflamed
  – Dyspareunia

• **Urethritis**
  – Dysuria
  – Increased frequency of micturition
Pathology

Men

• Usually asymptomatic
• **Nongonococcal urethritis**
  – Pain in urethra
  – Testicular pain
  – Purulent to mucoid discharge
• Epididymitis
• Prostatitis
• Superficial penile ulcerations
Trichomonas

- Trophozite is the only stage present in the life cycle, **cystic stage absent**
- 3 species in humans
  - *T. vaginalis*
  - *T. tenax*
  - *T. hominis*
- Characteristic jerky motility
- Multiplies by longitudinal binary fission
3 species of *Trichomonas* occur in humans

- *Trichomonas hominis*
- *Trichomonas vaginalis*
- *Trichomonas tenax*
General Morphology of the *Trichomonas* trophozoite

- Pear shaped
- 7 – 23 in length
- 4 flagella extend anteriorly
- 1 flagellum extends posteriorly along the cell membrane to form an **undulating membrane**
- **Costa**, a rigid cord attaches the undulating membrane to the cell membrane and gives the undulating membrane support
- **Axostyle** runs down the middle of the body & ends in a pointed tail like extremity
- Round nucleus in the anterior portion
Trichomoniasis
*Trichomonas vaginalis*

Trophozoites
Trichomonas vaginalis – Life Cycle

1. Trophozoite in vaginal and prostatic secretions and urine
2. Multiplies by longitudinal binary fission
3. Trophozoite in vagina or orifice of urethra

△ = Infective Stage
◆ = Diagnostic Stage

sexual intercourse

Diagram showing the life cycle of Trichomonas vaginalis.
Life Cycle of *Trichomonas vaginalis*
**Trichomonas vaginalis**

- It lives in the reproductive and urinary system of people. (obligate parasite)
- **Obligate parasite** – cannot live without close association with vaginal, urethral or prostatic tissues
- Infects *squamous epithelium* but not columnar epithelium
- High incidence of symptomatic infection is seen in **women**
- Zinc and other inhibitory substances probably inhibit their growth in men
• Natural flora (bacteria) keep the pH of the vagina at 4-4.5 and ordinarily this discourages infections.

• *T. vaginalis* can survive at a low pH.

• Once established it causes a shift toward alkalinity (pH 5-6) which further encourages its growth.
Laboratory Diagnosis

Samples in women
- Vaginal discharge
- Endocervical specimen

Samples in men
- Urethral discharge
- Prostatic fluid
- Early morning first voided urine sediment
- Semen
Laboratory Diagnosis

Parasitic Diagnosis-Methods of examination
• Microscopy
• Culture
• Antigen detection (ELISA)

Serodiagnosis- limited value

Molecular diagnosis
• DNA probes – more sensitive & highly specific
• PCR- highly sensitive & specific
Parasitic Diagnosis
Microscopy

**Wet mount**
- Easy, useful & economic
- 80% sensitivity in symptomatic females
- T. vaginalis trophozoites seen with characteristic jerky & twitching motility

**Acridine orange stain**
- Rapid & accurate method
- Sensitivity same as wet mount

**Direct fluorescent antibody staining**
- Rapid & more sensitive
- Requires a fluorescent microscope
Parasitic Diagnosis
Culture

• Gold standard
• Most sensitive
• Media – Diamond, Lash & kupferberge
• Media contains yeast extract, horse serum & antibiotics
• Observed for 7 days
• Culture usually positive after 48 hrs
• Done in patients with suspected trichomoniasis but wet mount negative
Treatment

• Metronidazole – highly effective

• Clotrimazole topical
Prevention

• Detection & treatment of cases – both partners

• Avoidance of sexual contact with infected partners

• Use of condoms