Microbiology

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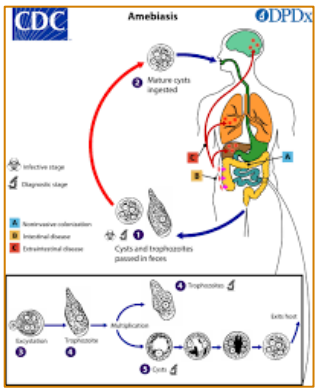
Protozoal Infections

- **Classification of Phylum Protozoa**
  1. According to the Organ of Locomotion
     - Class Rhizopoda (Amoebae): Move by pseudopodia
     - Class Ciliata (Ciliates): Move by cilia
     - Class Zoomastigophora (Flagellates): Move by flagella
     - Class Sporozoa (Plasmodia & Coccidia): Move by gliding
  2. According to the Habitat
     - Intestinal Protozoa
     - Blood Protozoa
     - Tissue Protozoa
     - Urogenital Protozoa
  3. Common Protozoa Examples
     - Amoeba: *Entamoeba histolytica*
     - Ciliates: *Balantidium coli*
     - Flagellates: *Giardia lamblia, Trypanosoma, Leishmania*
     - Coccidia: *Cryptosporidium, Plasmodium, Babesia, Toxoplasma, Sarcocystis*
     - Urogenital Protozoa: *Trichomonas vaginalis*

- **Intestinal Protozoan Infections**
  - ***Class: Rhizopoda (Amoebae)***
  - Types of Amoeba:
    - ✓ Amoebae of the large intestine: *Entamoeba histolytica* (pathogenic)
    - ✓ Amoeba of the buccal cavity: *Entamoeba gingivalis* (pathogenic)
    - ✓ Free-living amoebae: *Naegleria fowleri, Acanthamoeba* (pathogenic)
    - ✓ Non-pathogenic amoeba: *Entamoeba coli*
  - ***Entamoeba histolytica***
    - ✓ *Geographical Distribution*: Worldwide, especially in areas with poor sanitary conditions.
    - ✓ *Habitat*: Large intestine (caecum, colonic flexures, sigmoidorectal region).
    - ✓ *Definitive Host (D.H.):* Humans
    - ✓ *Reservoir Hosts (R.H.):* Dogs, pigs, rats, monkeys
    - ✓ *Disease*: Amoebiasis / Amoebic dysentery
    - ✓ *Morphological Stages*
      1. Trophozoite (vegetative form)
      2. Cyst:
         - Immature cyst (uninucleate or binucleate)
         - Mature cyst (quadrinucleate)
    - ✓ *Mode of Infection*
      - Contaminated food/water (ex. green vegetables)
      - Handling food by infected food handlers
      - Flies and cockroaches
      - Autoinfection (faeco-oral)
      - Homosexual transmission
    - ✓ *Clinical Presentation*
      - Intestinal Amoebiasis:



- Asymptomatic infection: Most common, trophozoites stay in the intestinal lumen as commensals. (Asymptomatic patient known as a healthy carrier and cyst passers)
- Symptomatic infection:
  - Acute amoebic dysentery: Presented with fever, abdominal pain, tenderness, tenesmus (difficult defecation) and frequent motions of loose stool containing mucus, blood and trophozoites
  - Chronic infection: Occurs if acute dysentery is not properly treated with low grade fever, recurrent episodes of diarrhea alternates with constipation and only cysts are found in stool
- Complications:
  - Haemorrhage: due to erosion of large blood vessels.
  - Intestinal perforation :peritonitis.
  - Appendicitis.
  - Amoeboma (Amoebic granuloma) around the ulcer : stricture of affected area.
  - Trophozoites of E. histolytica invade the mucosa and submucosa of the large intestine by secreting lytic enzymes, leading to the formation of amoebic ulcers.
  - The ulcer is flask-shaped with deeply undermined edges containing cytolized cells, mucus, and trophozoites.
  - The most common sites for amoebic ulcers are the cecum, colonic flexures, and sigmoidorectal regions due to decreased peristalsis and slowed colonic flow in these areas, which facilitates invasion.

- Extra-intestinal Amoebiasis:

1. ***Liver***
   - Amoebic liver abscess or diffuse amoebic hepatitis.
   - Commonly affects the right lobe, either due to spread via the portal vein or extension from a perforating ulcer in the right colonic flexure.
   - Clinical Presentation (CP) includes fever, hepatomegaly, and pain in the right hypochondrium.
2. ***Lung***
   - Lung abscess results in pneumonitis with symptoms such as chest pain, cough, and fever.
   - Amoebic lung abscesses usually occur in the lower part of the right lung due to direct spread from liver lesions through the diaphragm.
   - Rarely, trophozoites may reach the lungs via blood.
3. ***Brain***
   - Brain abscess can lead to encephalitis, which is often fatal.
4. ***Skin***
   - Cutaneous amoebiasis (also called Amoebiasis cutis) may occur due to:
     - Extension of acute amoebic colitis to the perianal region.
     - Rupture on the abdominal wall from hepatic, colonic, or appendicular lesions.

Giardia lamblia (Intestinal Flagellate)

- *Names:* Giardia duodenalis or Giardia intestinalis
- *Causative agent* of giardiasis and is the only common pathogenic protozoan found in the duodenum and jejunum of humans
- *Giardia forms:* the trophozoite and the cyst forms.
- *Morphology*: Heart-shaped trophozoite, 4 pairs of flagella, 2 nuclei with prominent central karyosome.

- 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.
- The swaying or dancing motion of the trophozoits in fresh preparations is unmistakable.
- Cysts are found in the stool –often in enormous numbers. As the parasites pass into colon they typically encyst.

✓ *Transmission*: Fecally contaminated water/food, direct fecal contamination (e.g., daycare centers).

✓ *Clinical Aspects*:
- **Giardiasis**: Can range from asymptomatic to severe diarrhea and malabsorption.

✓ *Diagnosis*: Detection of cysts in formed stool or trophozoites in diarrhea by enzyme immunoassays(EIAs) detect Giardia antigen in stool

✓ *Treatment*: Antigiardial drugs (e.g., Metronidazole, Tinidazole).

➢ ***Cryptosporidium (Intestinal Sporozoa)***

✓ *Species*: *Cryptosporidium hominis, C. parvum*

✓ *Pathogenesis*: Infection of the small intestine, causing severe diarrhea in immunocompromised individuals.

✓ Known as *parasites* of rodents, fowl, rhesus monkeys, cattle, and other herbivores and have probably been an unrecognized cause of self-limited, mild gastroenteritis and diarrhea in humans.

✓ Cryptosporidium *inhabits* the brush border of mucosal epithelial cells of the gastrointestinal tract, especially the surface of villi of the lower small bowel

✓ *Clinical Aspects*:
- Immunocompetent: Self-limited watery diarrhea.
- Immunocompromised: Severe, chronic diarrhea.

✓ *Diagnosis*: Oocyst detection in stool (acid-fast stain, direct fluorescent antibody test).

✓ *Treatment*: Nitozoxanide for all patients over 1 year.

➢ ***Balantidium coli (Intestinal Ciliated Protozoa)***

✓ *Disease*: Balantidiasis / Balantidial dysentery is the largest intestinal protozoa of humans

✓ *Morphology*: Ciliated, oval-shaped trophozoite.

✓ *Pathogenesis*: Trophozoites may invade the large bowel and terminal ileum causing ulcers.

✓ *Treatment*: Oxytetracycline, followed by Iodoquinol or Metronidazole.

- **Urogenital Protozoan Infections [Sexually transmitted protozoan infection]**

➢ ***Trichomonas vaginalis (Flagellated Protozoa)***

✓ *Morphology*: It is peard- shaped with undulating membrane lined with flaellum

✓ *Disease*: Trichomoniasis

✓ *Transmission*: Direct contact with infected epithelial cells of the genitourinary tract.

✓ *Pathogenesis:*
- Direct contact of T vaginalis with the squamous epithelium of the genitourinary tract results in destruction of the involved epithelial cells and the development of a neutrophilic inflammatory reaction and petechial hemorrhages.
- In females: it causes low-grad inflammation limited to vulva vagina and cervix causing frothy yellow or creamy discharge.
- In males: it may infect the prostate, seminal vesicles and urethra.

✓ *Clinical Presentation*:
- In females: Vaginitis with frothy yellow discharge.

- In males: Prostate and urethra infection.

✓ *Diagnosis*: Wet mount for motile trophozoites.

✓ *Treatment*:

- Metronidazole (topical or systemic)
- Tinidazole, Ornidazole: are equally effective with fewer side effects

- **Blood and Tissue Protozoan Infections**

➢ ***Trypanosoma (Haemoflagellate)***

✓ *Types*:

- African trypanosomiasis (African sleeping sickness): Caused by *T. brucei gambiense* (West African) and *T. brucei rhodesiense* (East African).
- American trypanosomiasis (Chagas' disease): Caused by *T. cruzi*.

✓ *Morphology:*

- spindly, uniflagellate stages and a rounded, amastigote form

✓ *Transmission*:

- *African trypanosomiasis*: Transmitted by the tsetse fly (*Glossina spp.*).
- *Chagas' disease*: Transmitted by reduviid bugs (blood-sucking insects).

✓ *Definitive host:* Human, dog, cat, rats…etc.

✓ *Habitat in the Definitive host*: Trypomastigote in blood and Amstigote in tissue

➢ ***Leishmania spp. (Flagellated Protozoa)***

✓ It is a *flagellated* protozoan

✓ *Life cycle* requires two hosts :

a) vertebrate ; mammalian host

b) Invertbrate vector ; female sand fly

✓ Obligate *intracellular* organism

✓ *Infects primarily* phagocytic cells and macrophages

✓ The *incubation period* ranges from 10 days to 2 years,

✓ *Clinical Syndromes*: [according to what part of the body is affected most]

- *Cutaneous Leishmaniasis*: *L. tropica*, *L. major*
- *Mucocutaneous Leishmaniasis*: *L. braziliensis*
- *Visceral Leishmaniasis*: *L. donovani*

✓ *Transmission*: Bite of sandfly, blood transfusion, direct contact (nasal secretions) and Mother to baby

✓ *Treatment*: Depends on the clinical form (cutaneous or visceral).

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