Clinical Parasitology

Tropical Medicine
International Health

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<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Animalia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subkingdom</td>
<td>Protozoa</td>
</tr>
<tr>
<td>Phylum</td>
<td>Sarcomastigophora</td>
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<tr>
<td>Phylum</td>
<td>Apicomplexa</td>
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<tr>
<td>Phylum</td>
<td>Ciliophora</td>
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<td>Phylum</td>
<td>Microspora</td>
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<tr>
<td>Subkingdom</td>
<td>Metazoa</td>
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<td>Phylum</td>
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<tr>
<td>Phylum</td>
<td>Platyhelminthes</td>
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<tr>
<td>INTESTINE</td>
<td>SYSTEMIC</td>
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<tr>
<td><strong>Protozoa</strong></td>
<td><strong>Toxoplasma</strong></td>
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<tr>
<td><em>Entamoeba histolytica</em></td>
<td>malaria</td>
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<tr>
<td><em>Giardia</em></td>
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<td><em>Cryptosporidium</em></td>
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<td><strong>Nematodes</strong></td>
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<td><em>Trichuris</em></td>
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<td>hookworm</td>
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<td><strong>Cestodes</strong></td>
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<td><strong>Trematodes</strong></td>
<td><strong>Schistosoma</strong></td>
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<tr>
<td>intestinal flukes</td>
<td>liver flukes</td>
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</table>
Intestinal protozoa
Protozoa

..“eukaryote”..has genetic material encased in a nuclear membrane (unlike bacteria and viruses)

..classified traditionally by morphology (eg. organelles of locomotion), life cycle and mechanisms of reproduction etc.
Kingdom Animalia

Subkingdom Protozoa

Phylum Sarcomastigophora

Subphylum Sarcodina

Subphylum Mastigophora

Phylum Apicomplexa

Phylum Ciliophora

Phylum Microspora

Entamoeba

Giardia

Cryptosporidium

Balantidium

microsporidium
Mastigophora: movement with flagella - e.g. Trichomonas, Giardia

Sarcodina: pseudopodia, e.g. Entamoeba histolytica

Apicomplexa: apical complex, no locomotor apparatus; sexual reproduction, e.g. cryptosporidium, malaria, toxoplasma

Ciliophora: movement with cilia, e.g. Balantidium.
<table>
<thead>
<tr>
<th>Pathogenic</th>
<th>Commensal (non-pathogenic)</th>
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<tbody>
<tr>
<td>Entamoeba histolytica</td>
<td>Entamoeba hartmani</td>
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<tr>
<td>Balantidium coli</td>
<td>Entamoeba dispar</td>
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<tr>
<td>Giardia lamblia</td>
<td>Entamoeba coli</td>
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<tr>
<td>Dientamoeba fragilis</td>
<td>Endolimax nana</td>
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<tr>
<td>Cryptosporidium parvum</td>
<td>Iodamoeba bütschlii</td>
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<td>Enterocytozoon bieneusi</td>
<td>Chilomastix mesnili</td>
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<tr>
<td>Septata intestinalis</td>
<td>Trichomonas hominis</td>
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<tr>
<td>Cyclospora cayetanensis</td>
<td>Blastocystis hominis</td>
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<tr>
<td>Isospora belli</td>
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</tbody>
</table>
Trophozoite: any stage in a protozoan’s life cycle which can ingest food. In practice also refers to the motile form.

Cyst: the non motile form which is protected by a distinct membrane or cyst well. This is an infective stage of the parasite.

Excystation: the process of emergence of the trophozoite from the cyst (vs. encystation)

Pseudopod: literally means false foot; temporary cytoplasmic processes at the surface of the trophozoite
Intestinal protozoa
Entamoeba histolytica
(amoebiasis)

Subphylum Sarcodina
cyst

No stain

trophozoite

Hematoxylin stain
AMOEBIASIS

1) assymptomatic carrier state

2) acute amoebic dysentery

3) amoebic liver abscess

4) amoeboma
Amoebic dysentery

Presentation
Bloody, mucousy diarrhea
Fever
Abdominal pain

Diagnosis
Amoebic (hematophagous trophozoites) in stool
Mixed WBCs in stool
Patchy inflammation seen on colonoscopy
Stool PCR or antigen capture
Entamoeba histolytica trophozoite with ingested RBCs “hematophagous”
Anchovy paste
AMOEBIC LIVER ABSCESS

Presentation
1. persisting fever
2. RUQ or epigastric pain and/or shoulder pain
3. rarely diarrhea

Diagnosis
1. ultrasound
2. raised WBC
3. serology
4. aspirate microscopy
5. response to metronidazole 750 t.i.d.
Laboratory problems

1. sensitivity
2. specificity
## Sequential Stool Examination for E. histolytica

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<thead>
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<td><strong>Trophozoite</strong></td>
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<td><strong>Cyst</strong></td>
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<td></td>
<td>No cyst</td>
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</tbody>
</table>

**Fig. 4.** Protozoa Found in Stool Specimens of Man

*Adapted with permission from MM Brooke, DM Melvin, Morphology of Diagnostic Stages of Intestinal Parasites of Man, USDHEW PHS Publication No. 1966, 1969*
size ranges of the various organisms.

mites up to 200 μ may occasionally be found.
Entamoeba histolytica

Cogwheel distribution of chromatin and central karyosome
Entamoeba histolytica or dispar

E. histolytica (~10%)  E. dispar (~ 90%)

(antigen capture, PCR, culture and zymodemes)
Drugs for Entamoeba histolytica

Tissue: ..metronidazole, tinidazole, secnidazole, ornidazole
    ..emetine
    ..dehydroemetine
    ..chloroquine

Bowel lumen: ..paromomycin (Humatin)
    ..diiodochlorhydroxyquin (Diodoquin)
    ..diloxanide furoate (Furamide)
Epidemiology of *Entamoeba histolytica*

Humans the only source (not a zoonosis)

Fecal-oral transmission

Our understanding is in transition because of mis-identified cases.

*E. histolytica/dispar*

- from developing countries is ~10% *E. histolytica*;
- from developed countries is ~1% *E. histolytica*
Which finding doesn’t fit *E. histolytica* amoebiasis?

1. High White count
2. Enteritis
3. Colitis
4. Blood in stool
5. WBCs in stool
6. Right shoulder pain
Giardia lamblia

Subphylum mastigophora
Giardia on small intestine mucosa
Normal
small intestine mucosa
Villus atrophy and crypt hyperplasia
Giardia epidemiology:

- fecal oral spread

- prevalence 3-5% in Canada; increased in travellers, backpackers, institutions, day care centres

- zoonosis - found in most mammals; esp. beaver (“beaver fever”), cattle, cats, dogs, etc.
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th><strong>Signs</strong></th>
<th><strong>Laboratory</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>diarrhea</td>
<td>mild abdominal tenderness</td>
<td>no leukocytes in stool</td>
</tr>
<tr>
<td>flatulence</td>
<td></td>
<td>no mucous in stool</td>
</tr>
<tr>
<td>abdominal cramps</td>
<td></td>
<td>giardia cysts/trophs intermittently in stool</td>
</tr>
<tr>
<td>decreased appetite</td>
<td></td>
<td>giardia cysts/trophs in duodenal aspirate</td>
</tr>
<tr>
<td>± weight loss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>± nausea</td>
<td></td>
<td></td>
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<tr>
<td>no fever</td>
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</tbody>
</table>
Giardia treatment

Metronidazole 250-750 mg tid x 7-10 days
Atabrine 100 mg tid x 10 days
Giardia causes which?

1. Gas
2. Fever
3. Dysentery
4. WBCs in the stool
5. Colitis
6. Beaver constipation
*Cryptosporidium parvum*

Phylum apicomplexa
Cryptosporidium 3-5 microns
CRYPTOSPORIDIUM

Epidemiology:  - bovine reservoir (zoonosis)
  - epidemic contamination of municipal water

Biology: - lives in small intestine epithelial cell membrane
  - Apicomplexa life cycle

Clinical: - diarrhea 2-3 weeks (chronic in AIDS)
  - cholecystitis
Cyclospora cayetanensis

Phylum apicomplexa
7-10 microns (Kinyoun acid-fast stain)
Cryptosporidium 3-5 microns  
Cyclospora 7-10 microns
Cyclospora cayetanensis

Taxonomy: Apicomplexa

Epidemiology: in travellers to tropics (Nepal, Americas) : raspberries, basil from Guatemala, Mexico

Biology: lives in small intestine epithelial cells

Clinical: prolonged diarrhea (2-6 wks)

Treatment: Septra
# Treatment of intestinal protozoa

<table>
<thead>
<tr>
<th>Protozoa</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entamoeba histolytica</td>
<td>Metronidazole, diloxanide furoate, didodohydroxyquinoline</td>
</tr>
<tr>
<td>Giardia</td>
<td>Metronidazole, atabrine</td>
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<tr>
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<td>Nil</td>
</tr>
<tr>
<td>Cyclospora</td>
<td>Septra</td>
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</table>
INTESTINAL PROTOZOA STAINS

1. Hematoxylin - *E. histolytica*, *Giardia*, *D. fragilis*, *Isospora*

2. Modified Ziehl-Neelsen - *Cryptosporidium*, *Cyclospora*

3. Trichrome - *Microsporidium*
Trichomonas vaginalis

Taxonomy: Mastigophora (like Giardia)

Epidemiology: reservoir is human urogenital tract, sexual transmission

Biology: causes inflammation of vaginal and urethral epithelium

Clinical: vaginal discharge

Treatment: metronidazole
Concepts to remember
Commensalism (shared dinner table)
Zoonosis (inhuman life cycle)

Future challenges
1. Host immune reaction to protozoa
2. The protozoan’s host immune avoidance
3. Laboratory diagnostic tools PCR, antigen capture, proteomics
4. Orphan drugs
5. Lack of Cryptosporidium treatment