Parasites (Eukaryotes)

- Protozoa (unicellular)
- worms (Multicellular)

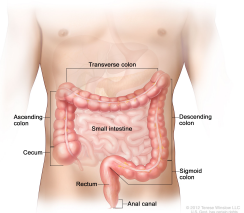
Protozoa:

① Entamoeba Histolyca: Amoebiasis

② Giardia Duodenallis: Giardiasis

③ Cryptosporidum parvum: Immunocompromised + Self-Limited Diarrhea

Entamoeba Histolyca



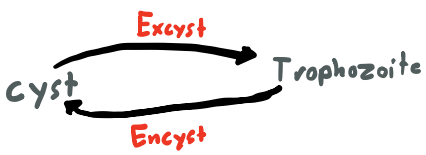
* Temperate, Poor Sanitation
* Large intestine (Colonic Flexures, Sigmoidrectal, Caecum) As A result of Fecal Stasis

Definitive Host: Parasite Reaches Maturity & reproduces Sexually (Human)

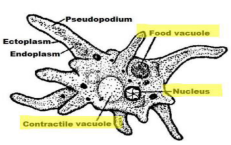
Reservoir Host: Organism Replicates & Doesn't Neccessarily complete it's Life Cycle. Dogs, Pigs, Rats, Monkeys

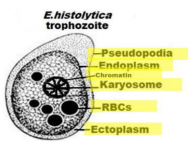
Disease: Amoebic dysentery or Amoebiasis

* 1 cyst → 8 trophozoites unlike Giardia 1 cyst → 2 trophozoites



1) Trophozoite stage: Active, Feeding, Motile





Features:

1) Finger-Like Projections (Pseudopodia) For Motion
2) Endoplasm (Plasmatic Membrane containing Nucleus & Karyosome
3) Karyosome (Fine Chromatin Granule)
4) Ingested RBCs is a pathognomonic Feature that differentiates it From Commensal Form

2) cyst stage (Luminal)

* You can Remember it by comparing to Bacterial spores

* Resistant
* when outside Body to resist Environmental changes

Luminal → cyst

Invasion → Trophozoite

A) Immature cyst (uni & Binucleate)

B) Mature cyst (Quadrinucleate) ← This only can cause infection

Features:

* Spherical in Shape
* Feco-oral Transmission

Infection Stages:

1) Ingestion Quadrinucleated cysts

2) Pass the Stomache & Excystation occur in the small Bowel (Trophozoite Formed)

3) Each Cyst Divides to Give 8 Mono Nucleated Trophozoites, They reach the Large intestines, 3 cases

* Invade Mucosa & subMucosa, Hematogenously spread through Blood circulation to Reach Liver, Brain, Lungs.
* Remain in Lumen without Establishing an infection.
* Encysted Again & Leave through Stool

Infective Stage: Quadrinucleate cyst, Anal-Oral Practices can be Trophozoite Transmission

* 80 % Asymptomatic
* 10 % Intestinal Amoeba
* 10% Brain, Liver

Mode of Transmission

1) Feco-oral
2) Flies & cockroaches, carry cysts From Feces
3) Autoinfection
4) Homosexuals

Clinical Pictures

1) **Asymptomatic** : Remain in Intestinal Lumen As Trophozoites, cyst Passers (Healthy Carriers) (Most common)

2) **Symptomatic** :

A) **Acute Ameobic dysentry** :

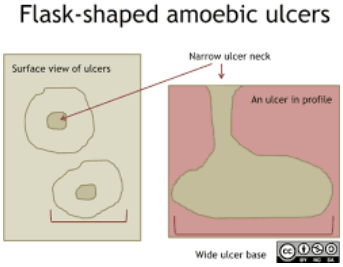
* Fever
* Abdominal Pain
* Tenderness
* Tenesmus
* Bloody Diarrhea containing Trophozoites

B) **Chronic infection** :

* Acute dysentery Not Treated Properly
* Low Grade Fever, Typical dysentry (Bloody Diarrhea)
* only cysts Present in Stool though

3) **Complications**: Trophozoites has ProteoLytic Enzymes For Invasion & ulceration, Hemorrhage, Narrowing in Lumen can occur too.

* intestinal Perforation
* Appendicitis
* Amoebic Granuloma



Cells, Mucus, Trophozoites

Extra - intestinal Amoebiasis: Spread to other organs through Blood

1) **Liver**: Ameobic Liver Abscess or Diffuse Ameobic hepatitis

* Affects Right Lobe — * Hematogenous via Portal vein
* Direct through ulcer Perforating Right Colic Flexure

Symptoms:

* Fever
* Right Hypochondrium Pain
* HepatoMegaly can Progress to HepatosplenoMegaly

2) **Lungs:** 2nd Most common Extra-intestinal After Liver, Right Lung More commonly since it's Above the Liver, it can be spread Hematogenously.

* If reaches Brain, causes Brain Abscess & Encephalitis which is Fatal.

3) **Cutaneous Amoebiasis:** * Extension of Acute Amoebic Colitis to PeriAnal Region
* Abdominal Region Rupture From Hepatic, Colonic, Appendicular Lesions.

Intestinal Amoebiasis Diagnosis

Direct Methods

Macroscopic
Bloody Diarrhea,
Loose Stool

Microscopic
1) Stool Examination
Loose Trophozoites
Formed stool Cysts
Direct smear & Iodine Dye
2) Sigmoidoscopy
To check For Trophozoite Presence in Ulcer
3) Barium Enema then X-ray
check For ulcer & Deformities

Indirect: SeroLogic Tests

N.B Test only Positive For Symptomatic Intestinal Amoebiasis carrier

Extra - Intestinal Tests

Direct:
1) X-ray: Liver space occupying Lesion, Lung Pleurisy with Diaphragm Elevation
2) Ultrasonography, CT scan, MRI: Liver Abscess
3) Aspiration: Liver Abscess, Trophozoite Detection

Indirect:
1) SeroLogical Tests
2) PCR
3) Blood Examination (Leukocytosis)
4) Liver Function Tests:
Function increases when Amoeba Present

Treatment

1) Asymptomatic Carrier: 1) Paro-mo-mycin or 2) Dilo-Xanide Furoate] Luminal

2) Intestinal Amoebiasis: 1) Metronidazole or 2) Tinidazole] Tissue

3) Extra-Intestinal Amoebiasis: 1) Metronidazole + 2) Paromo Mycin or 3) Dilo Xanide Furoate] Tissue + Luminal

Prevention

1) Fecal contamination Eradication

2) Boil water before use

3) Cysts Arent killed by Low Chlorine or Iodine Dose

4) wash vegetables Before use might be contaminated with water

Giardia Dudenalis

* watery diarrhea, Steatorrhea (As A result of Fat malabsorption it causes), No Invasion, No fever

* Associated with Poor sanitation & Hygiene

* common infection For Traveler's Diarrhea, and in Nurseries

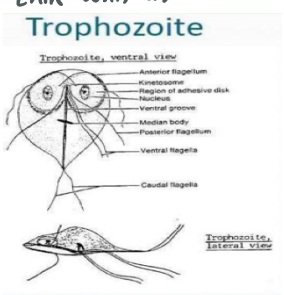
Pathogenesis in small bowel, upper part Dudenom & Jejunum unlike E. Histolytica which Affects Colon

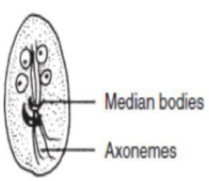
Has Another name Giardia Intenstinalis.

Can infect Animals like beavers not just Human beings

Structure & colonization:

Looks Like a Person with Hair, Glasses, and chin whiskers





6

1) Flagellated

2) Most commonly Found in Duodenal crypts

3) Attaches to Villi by it's Ventral Disk

4) Forms Cysts in jejunum post-exposure to Billiary secretions

Has Both Trophozoite & cyst Forms

* ♡ Heart-shaped Trophozoite

* 4 pairs of Flagella

* 2 Nuclei with Prominent central Karyosome

* 2 Axostyles

Motile, Falling-Leaf-Motion

* Median bodies (Paraventral Disks) For Attachment to Bowel's villi

* You won't see ingested RBCs Like in E. Histolytica

Epidmiology

1) viable cysts Feco-orally

2) can be Associated with Homosexuals

3) incubation Period 1-2 weeks, very Low infectious Dose 10.

4) Higher in Immunodefficient Patients.

Clinically

1) watery Diarrhea that later becomes greasy, Foul-smelling. (steatorrhea)

2) Abdominal cramps, Malaise, weight Loss

3) vomiting & Tenesmus not common

Infective Stage:

1) Quadranucleated cyst ingested & reaches small intestine

2) Each cyst gives rise to 2 trophozoites, 4 → 2 Binary Fission

3) Trophozoites utilize Attachment & cause MalAbsorptive Sydrome

* Diagnostic stage is Both Quadrenucleated cysts & Trophozaites

* Asymptomatic usually, Percentage of Asymptomatic Lower than E. HistoLytica

Lab Diagnosis

1) Stool Analysis, cysts & sometime trophozoites

2) Antigen detection: Immunochromatographic Assays are commonly used Diagnostic tests for detection of presence of specific antigens or antibodies for Giardia lamblia

Treatment

1) Tinidazole: single dose injection

2) Metronidazole (Flagyl): given to Anaerobic Bacterial infections & Microaerophillic Bacteria, side-effect di-sulfiramLike reaction

What is a disulfiram-like reaction?

A disulfiram-like drug is a drug that causes an adverse reaction to alcohol leading to nausea, vomiting, flushing, dizziness, throbbing headache, chest and abdominal discomfort, and general hangover-like symptoms among others

Cryptosporidum spp

* immunocompromised patients with HIV causing persistent diarrhea

* causes cryptosporidiosis disease

* As name implies, live in small intestine villi crypts

* have no flagella move by gliding

* have sexual & asexual parts in their life-cycle

* Asymptomatic usually, watery diarrhea is a common symptom

* Intracellular Enteric Parasites infect Stomache, intestine, Bile Ducts epithelium

2 subtypes:

1) C. Parvum (Mammals including Humans)

2) C. Hominis (Primorily Humans)

How infection happens?

Begin with

1) ingestion of viable Oocyte 2) Each Oocyte → 4 sporozoites

3) Epithelial invasion, sporozoites → Merozoites → oocyte

Oocyte is infective & Diagnostic stage, Modified by acid-Fast stain, gives Red color after staining (without heating)

Prevalence of oocyte in Feces: 3-10%

Clinically

1) Copious Diarrhea: Severe continous intractable diarrhea, 3-17 Liters of stool per day.

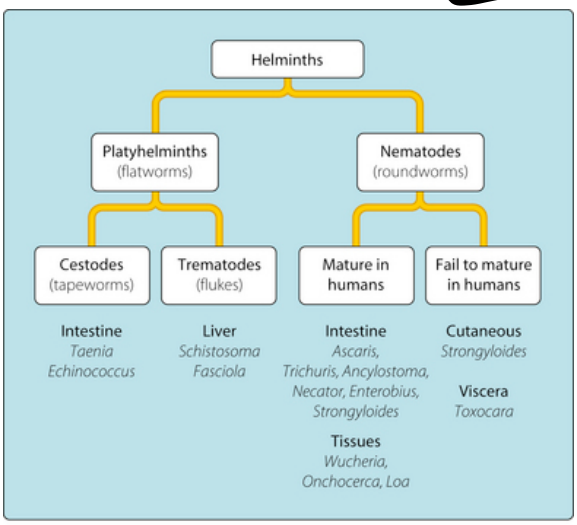
2) Abdominal Pain & vomiting

Diagnosis: Oocyte using Modified Acid-Fast stain

Treatment

1) Self-Limited + oral & venous rehydration 2) Nitazoxanide For HIV patients

Helminthes



* Helminths are Eukaryotic Multicellular

Divided into:

1) Flat worms → Trematodes, Cestodes

2) Round worms → Nematodes

* No Multiplication One Egg → one Larva → one Adult unlike Multiplication in Protozo

4 Types will be talked about

1) Ascaris Lumbricoides
2) Entrobius vermicularis
3) Echinococcus granulosus
4) Schistosomia Mansoni

Ascaris Lumbricoides

1) Round worm

2) Disease is called Ascariasis

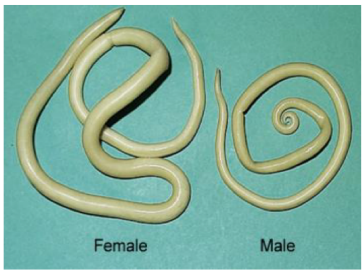
3) Separate sexes, Male & Female

4) well-developed digestive systems

Morphology:

* More than 1 billion Prevalence

* Male worm measures 15-20 cm Length
* Female worm measures 20-40 cm Length



in all Nematodes we're going to discuss Females are Longer & bigger

* Posterior end of male worm is curved while female is flat, copulatory spicule where mating with female is going to occur

Diagnosis: we Look for eggs, Brown papillated shell, thick bumps, Albuminous coat Essential for surviving

Mode of transmission

1) Feco-oral, reinfection possible

* Most cases Are Asymptomatic

Habitat: small intestine

Female Produces 200,000 eggs a day, capable of surviving harsh conditions, Dry & freezing

* Eggs excreted with feces aren't infectious, they require a period of maturation into Larva, 2-3 weeks

Diagnostic Stage:- A developmental stage of a pathogenic organism. that can be detected in stool, blood, urine, sputum, CSF or other human. body secretions. Infective Stage:- The stage of parasite at which it is capable of entering. the host and continue development within the host.

Infective stage: Embryonated egg After maturation, 2-3 weeks in soil

Diagnostic stage:
* Eggs, Fertilized or not
* Adult in stool
* Larva in sputum (Mucus made by Lungs)

* when they reach small intestine Larva will invade mucosa & submucosa & reach to the circulation then Lungs & then get out with the sputum, if swallowed again will reach small intestine again, and keep growing to become Adults.

* repeated sampling incase of sputum sampling, since it doesn't go out the lung in regular manner

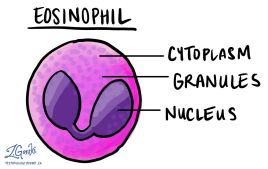
Loffler's syndrome: when larva passes through Lungs&bronchi.] Pulmonary symptoms, Eosinophillia

Spectrum of Disease

* Younger people & children have a higher infection rate.

GI manifestations: Malnutrition, Anemia, Malabsorption, steatorrhea, intestinal obstruction, Biliary obstruction (Jaundice)

* Eosinophillia



Parasites cause eosinophillia as they reach the Blood since body Leukocytes Eosinophils will be secreted (immune mechanism)

* Adult worms in Feces As they have spend more time to Mature in the body, Larva in gastric aspirates or sputum

* direct smear to look for eggs (Fertilized & unfertilized)

Treatment → Albendazole 400 Mg STAT immediately given without delay

Enterobius Vermicularis Pin Worm

* AUTOINFECTION !!!

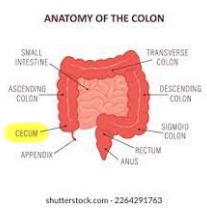
* Children Population, Enterobiasis Disease, 5-14 years

* Small, thin, white worms

* Female worm 8-13 mm, pointed PiN tail, 11,000 ova, Lives For a month

* Male measures 2-5 mm, Die Following Fertilization, passed in Feces

Habitat: Large intestine (caecum)



Modes of Transmission

No Pulmonary Route

* External, Autoinfection (Finger to Mouth) → Immediately infective unlike Ascaris Lumbricoides 4-6 hours only, which results in ↑ Autoinfection risk since if the baby itches PeriAnal region then touches their mouth reinfection occurs

* Thousands of eggs Lay down by female, if male is present Fertilization occurs & eggs migrate to the PeriAnal region, female can travel backward causing retrograde infection.

★ Most common complain PeriAnal itching (Pruritus)

Diagnostic stage: Eggs at Perional region

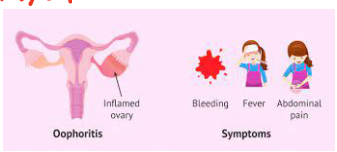
Infective stage: Embryonated Eggs

(Gravid) Adult
* Females migrate at night & deposit eggs at skin of PeriAnal region, immediate infection.

* sexual Transmission
* Direct, From Host
* infections associated with crowded Places

Clinical Picture

* Asymptomatic Typically
* PeriAnal Pruritus (itching at night), E. Vermicularis until proven otherwise
* Can migrate to nearby tissue causing, Appendicitis, oophoritis, ulcerative bowel lesions
* Microscopic identification, Flat-sided ovum



Diagnosis method, Cellophane (scotch tape) placed on the PeriAnal region then put on slide you'll see Football shaped eggs with flattened sides, Larva can be seen too

Treatment → Albendazole 400 mg STAT as single oral dose, repeated At week 2

Hyatid cysts (Echinococcus Granulosus)

Doesn't obey 1 to 1 rule

* Also called Dog Tapeworm
* Smallest tapeworm 3-9 mm long
* Found in small intestine of definitive Host, Canines (related to dogs)

> What are examples of definitive host?
>
> A definitive host is one that hosts the parasite until sexual maturity. An example of a parasite is malaria, which uses the mosquito as a definitive host. Nov 1, 2022

Human is Intermediate or Apparent Host & are considered a Dead end since the parasites life can't continue Leading to Hyatid cysts, Steps of infection:

1. Eating of Food contaminated with the feces of definitive Host which contains the E. granulosus Eggs.
2. Eggs ingested reach the small intestine, Hatch there producing Larva
3. Form cysts in Lung & Liver

Variety of mammals, (sheep, cattle, humans) can all be intermediate Hosts.

Choice of treatment here is Surgery, MUST DO Surgery but surgeons will be afraid if leakage occurs leading to Anaphylactic shock

Fluid cyst is a protective structure through Parasite Life cycle

* Potentially dangerous depends on location & size of cyst.
* many cysts remain undetected until they become Large enough to Affect other organs. Liver & Lungs most common

Diagnosis: Serology, incidentally by radiology

Treatment: Surgery, Albendazole

Schistomiasis

infection caused by Flatworm, schistoma

1) schistoma Mansoni
Superior Mesentric
(GI)

2) schistoma japonicum
Superior + inferior Mesentric
(GI)

3) schistoma haematobium
urinary Venous plexus

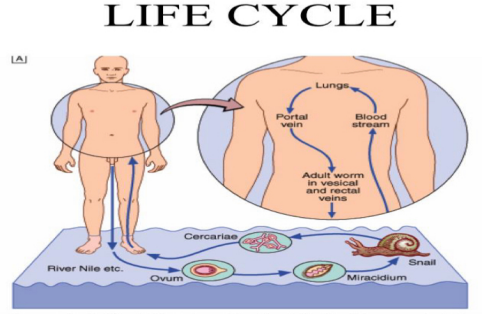
* Pathogenesis is mainly by the eggs rather than by adult schistosomes, they lay their eggs within small vessels of Portal system which triggers Granumalotous reaction & fibrosis in Portal system resulting in complications like * Hypertension
↓ results in
* HepatosplenoMegaly * Liver Failure
* Esophageal Varices

* 200 million are infected worldwide, 500-600 exposed to infection

* Inhabits Portal venous system

Life cycle

1) ovum of parasites in infected animal feces → gain access to Fresh Water
2) ciliated miracidium inside it is liberated
3) Enters intermediate Host (Fresh water snails it multiplies inside)

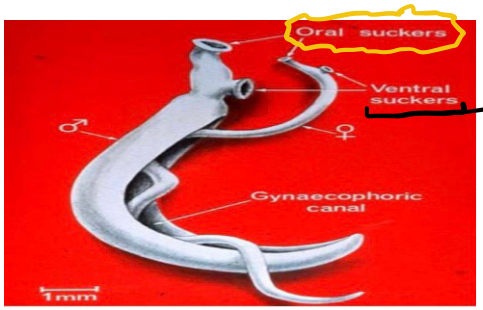


* Eggs hatch & release ciliated Miracidium
* snail Host
* Develop to Final stage Cercariae

After 2nd intermediate host it's called Metacercaraie

Infections cercaraie penetrate skin to reach Lungs & Liver then Portal system

Katayama Fever: acute systemic hypersensitivity occurs in response to migrating larva in the body.



Attachment to vessel walls

Male Form is Flat, Leaf-Like, has Gynacophoric Canal which enfolds Female

Not Hermaphrodite, has Male & Female

Pathogenesis:

* Skin Penetration causing itchy Rash
* Respiratory manifestations as a result of travel by Lungs
* Granulomatous reaction & sclerosis in Portal venous system as a result of deposited eggs.

Diagnosis:

* Clinical
* Biochemical, Hematological
* Detection of ova in stool for confirmation

Haematobium: Terminal spine

Japonicum: Curved rudimentary spine

Mansoni: Lateral spine

Treatment:

1. Mebendazole
2. Albendazole
3. ivermectin
4. Praziquental

single 40 mg/kg dose as treatment of choice.