"Heeey…. fecal oral transmission???"

Medfools Parasites Chart for USMLE I

Parasitology Notes for USMLE I

PROTOZOA – INTESTINAL and UROGENITAL

Entamoeba Histolytica *(bloody diarrhea)*

Diseases	Characteristics	Habitat/Trans	Pathogenesis	Diagnosis	Treatment
Amebic dysentery- bloody, mucus diarrhea, **liver and pulmonary abcess.** **Mostly asymptomatic.**	Trophozoite has **single nucleus and ingested RBC**, cysts have **4 small nuclei.** Prevalent among male homosexuals.	No animal reservoir. **Fecal-oral transmision.**	Excyst in ileum, invade colonic epithelium, cause necrosis (**teardrop ulcer**), spread (**liver, lung**)	**ID trophozoites and cysts** in stool. **Serology positive** in invasive amebiasis **Absence of PMNs.**	Metronidazole, iodoquinol. Cysts removed by filtration, killed by boiling, not chlorination.

Giardia lamblia *(Nonbloody diarrhea)*

Giardiasis- nonbloody, foul smelling diarrhea, nausea, anorexia, flatulence, abdominal cramps for wks/months. Outbreaks at **day care centers, mental hospitals.**	**Pear shaped trophozoite,** 2 nuclei, 4 pairs flagella, suction disk. **Thick walled oval cyst w/ 4 nuclei** 5% US stools have cysts, 50% asymptomatic carriers.	**Fecal contamination of food/water.** Homosexual transmission.	Excyst in duodenum, attaches-NO invasion, inflammation, malabsorption of protein/fat.	**Trophozoites/cysts** in stool, **string test**, serology.	Metronidazole Cysts removed by filtration, killed by boiling, iodine, not chlorination.

Cryptosporidium *(Nonbloody diarrhea)*

Cryptosporidiosis in immunocompromised- watery nonbloody diarrhea, fluid loss, malnutrition		**Fecal-oral transmision** of oocysts from **human/animal** sources.	Complex cycle occurs in epithelial cells of jejunum, NO invasion	ID **kinyoun acid-fast** (red) oocytes in stool smear.	**No effective therapy. Try azithromycin**

Trichomonas vaginalis *(NO cyst form)*

Trichomoniasis- vaginal itching w/ watery **foul smelling, green** vaginal discharge. Men asymptomatic.	**No cyst. Pear shaped trophozoites, 4 anterior flagella, undulating membrane** (jerky movement) 25-50% sexually active women infected	Sexual contact.	Infects vagina, prostate. Predisposing factor is loss of vaginal acidity		Both partners: **metronidazole**

PROTOZOA – BLOOD and TISSUE

Plasmodium

Diseases	Characteristics	Habitat/Trans	Pathogenesis	Diagnosis	Treatment
Malaria- fever, chills, HA, myalgias, arthralgias two wks post bite. Fever spikes accompanied by nausea, vomiting, abdominal pain, **drenching sweats. Splenomegaly** is common. **Anemia** due to **lysis of RBCs, splenic sequestration** of damaged RBCs. P. *falciparum* causes most severe malaria-can infect RBCs at all stages and causes adherence of RBCs to cerebral vascular endothelium via **knob proteins ("cerebral malaria".)** P.*ovale,* P. *vivax* cause **benign malaria**. P. *malariae* produces fevers each 72 hours, others every 48 hrs. P. *falciparum* can cause almost constant fever.	Endemic to 91 countries, 300-500 million cases, mostly **sub-Saharan Africa.**	Female ***Anopheles*** mosquito	**Asexual Schizogony** in humans Exoerythrocytic phase: Mosquito injects **sporozoites** which attack **hepatocytes**, sporozoites replicate, differentiate into **merozoites** which infect RBCs. Erythrocytic phase: **Merozoites** in RBCs, diferentiate into **ring shaped trophozoites,** develop into **schizonts** filled with merozoites. Merozoites lyse RBCs **at regular intervals** and further infect RBCs. **Sexual Sporogony** in mosquitoes Some blood merozoites develop into male/female **gametocytes** in RBCs. Female mosquito eats these RBCs, form one female **macrogamete** or 8 spermlike **microgamete** in gut. **Diploid zygote** differentiates into **motile ookinete** which burrows through gut wall. **Oocyst** w/ haploid **sporozoites** form on stomach wall, sporozoites released and migrate to mosquito **salivary glands.** Female mosquito injects **sporozoites** into next human victim (sucker.)	**Thick and thin Giemsa stained smears**. Usually ring shaped trophozoites are ID.	Acute malaria w/ **chloroquine** which kills merozoites, sporozoites in blood. **Mefloquine** used in P.*falciparum* resistant to chloroquine. **Primaquine** to get **hepatic** stages of P. *ovale* and P. *vivax.* Prophylax w/ chloroquine/ mefloquine. Prevent w/ **pyrimethamine** impregnated bednets. (kills mosquito cycle)

Toxoplasma gondii

Toxoplasmosis- usually asymptomatic, can cause hererophil antibody-negative **infectious mononucleosis.** Life threatening encephalitis in immunocompromised b/c **reactivation of dormant cysts. Transplacental transmission** results in stillbirth or fetal infection (encephalitis, retinitis, microcephaly, mental retardation)	5-50% seropositivity rate in US	Cat host. Humans eat **cysts in meat or cat feces**	Cysts rupture and invade gut mucosa, ingested by macrophages, differentiate into tachyzoites (rapidly multiplying trophozoites), disseminate to **brain, muscle.**	**Serology** or crescent shaped trophozoites	**Sulfadiazine and pyrimethamine**

Trypanosoma cruzi *(Chagas disease)*

Chagas diesease- Acute: edematous nodule (Chagoma) at bite site (**periorbital,** perioral), fever lymphadenopathy, H/Smegaly, resolves in 2 months **Indeterminate**- low levels of parasitemia, serological evidence of infection **Chronic**- **myocarditis** (arrythmia, dilated cardiomyopathy, CHF), **megacolon, megaesophagus**. Death usually by arrythmia.	**Rural Central and South America, Southern US**	**Humans, animal reservoirs. Reduviid** (kissing) bug as vector	Reduviid bug ingests **trypomastigotes** from animal's blood, trypomastigotes multiply in gut, **excreted** at bite, invade skin, disseminate in blood, amastigotes proliferate **inside macrophages and myocardium,** amastigotes differentiated into blood borne trypomastigotes which are taken up by reduviid bug at next meal.	**Thick and thin** blood smears for trypomastigotes. **Serology Muscle biopsy** revealing amastigotes. **Xenodiagnosis**	**Nifurtimox** kills trypomastigotes, NO therapy for chronic form.

Trypanosoma gambiense/rhodesiense ***(African sleeping sickness)***					
Trypanosomal chancre (many organisms) at bite site. **African sleeping sickness- Cyclical fever**, **lymphadenopathy, demyelinating encephalitis,** HA, insominia, slurred speech, ataxia, mood changes, **somnolence**, coma.	Trypomastigotes, **no amastigotes.** **Sub-Saharan Africa**	**Tsetse fly** vector. **"Sleep-Sleep fly"** Human and **animal** reservoirs.	Skin to blood/LN to CNS **Antigenic variation** of **VSGs** –variable surface glycoproteins	ID trypomastigotes in **blood smear**, LN or CSF.	**Suramin** in pre encephalitis stage. **Melarsoprol** for CNS involvement.
Leishmania donovani ***(Kala-azar)***					
Kala-azar (visceral leishmaniasis)- RES involvement. Chronic low grade fever, anorexia, weight loss, **skin hyperpigmentation.** Bone marrow involvement results in **anemia, leukopenia, thrombocytopenia** and **secondary infections, coagulopathies. Massive splenomegaly.** Disease lasts months to years.	Mediterranean/ Middle East, Saharan Africa, India	**Sandfly vector. Dog, fox, rodent reservoirs**	Female sandfly **ingests macrophages** containing **amastigotes,** amastigotes differentiate into **promastigotes** in sandfly gut, multiply, migrate to **pharyx,** transmitted to humans w/ bite, in human **macrophages** promastigotes differentiate back into amastigotes.	ID amastigotes **in spleen, LN, BM biopsy**. **Leshmanin** DTH skin test negative, poor cellular response.	**Sodium stibogluconate**
Leishmania tropica, mexicana, braziliensis ***(Cutaneous, mucocutaneous)***					
Ulcers confined to **skin/mucous membranes**, often **superinfected** by bacteria. Multiple satellite nodules coalesce and ulcerate. **In diffuse cutaneous leishmaniasis,** lesions grow/spread all over skin. **Disfiguring granulomatous lesions** destroy **nasal cartilage** (like lepromatous leprosy) L. *tropica* – Cutaneous – Old world L. *mexicana* – Cutaneous – Americas L. *braziliensis* – Mucocutaneous -- Central/South America		**Sandfly vector. Forest rodent reservoirs**	Basically like L. *donovani*	ID **amastigotes in skin lesions**	**Sodium stibogluconate**
Pneumocystis carinii ***(PCP)***					
Pneumonia- acute fever, nonproductive cough, dyspnea, tachypnea. CXR shows **diffuse, bilateral infiltrates** or may be normal. **Untreated cases fatal.**	**Classified as a fungus**	Inhalation of **cysts. NOT person-person**	Cysts establish life long latent infection in lungs. In immunocompromised, **cysts reactivate** and induce exudative inflammation which compromises gas exchange in the alveoli.	**Silver stained** induced **sputum** specimen, **bronchoalveolar lavage fluid, bronchial tissue biopsy** reveal *pneumocystis.*	**TMP-SMZ** **Pentamidine** Prophylax when CD4 < 200

CESTODES					*Hermaphroditic flatworms*
Taenia solium ***(Pork tapeworm)***					
Diseases	Characteristics	Habitat/Trans	Pathogenesis	Diagnosis	Treatment
Cysticercosis- HA, vomiting, seizures, uveitis, retinitis **Taeniasis-** usually asymptomatic	**Solex w/ 4 suckers, circle of hooks**		Gravid proglottids ingested by pigs (intermediate hosts), develop into larvae which burrow holes in blood vessels, go to skeletal muscle. Humans eat raw pork containing **cysticerci** (encysted larvae), mature in gut. If humans eat eggs, larvae spread to **eyes/brain** where they encyst to form cysticerci. **Space filled/calcified lesions.**	**ID gravid proglottids w/ 5-10 uterine branches** in stool. Cysts by Xray or CT. Larvae may be **floating in vitreous.**	**Niclosamide** **Praziquantel** Treat asymtomatics to prevent autoinnoculation, **cysticercosis**
Taenia saginata ***(Beef tapeworm)***					
Taeniasis- asymptomatic **No cysticercosis** in humans	**Solex w/ 4 suckers, no hooklets**		Same life cycle, except cattle host.	**Gravid proglottids w/ 15-25 uterine branches.** (remember COWS are bigger than PIGS, more branches)	**Niclosamide** **Praziquantel**
Diphyllobothrium latum ***(Fish tapeworm)***					
Mostly asymptomatic or Megaloblastic anemia (B12 deficiency) due to preferred uptake of B12 by worm.	**Solex w/sucking grooves, no hooks. Gravid uterus in rosette form. Eggs oval w/ operculum.** (diagnostic)	**Scandinavia** and Japan.	Eggs in fresh water, ingested into **crustaceans,** differentiate into larvae for **fish**. Humans infected by eating **undercooked fish.**		**Niclosamide** **Praziquantel**
Echinococcus granulosus ***(Dog tapeworm)***					
Unilocular hydatid cyst disease- usually **asymptomatic**, may cause hepatic dysfunction. Cyst contents cause **anaphylaxis**	**Scolex and 3 proglottids** (small)	**Dogs definitive hosts, sheep intermediate, humans dead end.**	Worms in dog intestine dump eggs, ingested by sheep or humans. **Oncospheres** form and spread to organs (**liver**), form **hydatid cysts.** Dogs eat slaughtered sheep, cycle complete		**Niclosamide** **Praziquantel** Stop feeding the dogs sheep bits!
Hymenolepsis nana ***(Dwarf tapeworm)***					
Usually asymptomatic	Most common tapeworm in US, esp. **SE USA**	No intermediate host	Eggs directly infectious for humans. **Many worms found**, unlike others which exist singly	Eggs in stool	**Niclosamide** **Praziquantel**

TREMATODES — *Flukes*

Schistosoma (snails)

Diseases	Characteristics	Habitat/Trans	Pathogenesis	Diagnosis	Treatment
Schistosomiasis- itching at site of penetration ("swimmer's itch"), fever, chills, diarrhea, lyphadenopathy, **eosinophilia**. Chronic infection leads to GI hemorrhage, H/Smegaly, death by **ruptured esophogeal varicies.** **S. *haemoatobium*** infection can cause **bladder cancer.**	Schistosomes are separate sexes that live attached to each other. **Females reside in male grooves.** 200 million cases worldwide		**Free swimming cercariae penetrate human skin,** differentiate into larvae, enter venous circulation, mature into adult form. Females lay eggs spread to **gut or bladder**, excreted in **feces or urine.** Eggs hatch in fresh water, **penetrate snails**, differentiate to **free swimming cercariae.** Pathogenesis mediated by host granuloma response to antigenic **eggs** in organs. Schistosomes coast themselves in host antigens, **immune evasion.**	**Characteristic eggs in feces, urine.**	**Prizaquantel**

Trematode	Affected veins	Eggs	Endemic areas
S. *mansoni*	**L**arge intestine	**L**arge lateral spine	Africa, Caribbean
S. *japonicum*	**S**mall intestine	**S**mall lateral spine	Orient
S. *haematobium*	Bladder	Large **Terminal** spine	Africa, Mid East

(think of bladder as **terminal** organ of GU system)

Chlonorchis sinensis (snails, fish)

Oriental liver fluke- mostly asymptomatic, or upper abdominal pain, anorexia, hepatomegaly, **eosinophilia** with high worm burden		**Korea, China, Japan**	Humans infected by eating **undercooked fish** containing encysted larvae. Larvae excyst in duodenum, immature flukes enter **biliary ducts**. Host inflammatory response causes **hyperplasia/fibrosis of biliary tree.** Adults pass eggs in feces. Eggs eaten by **fresh water snails** (1st intermediate host), hatch in snail gut into **free swimming cercariae**. Cercariae encyst under scales of **fish** (2nd intermediate host) and cycle repeats	**Typical operculated eggs in stool**	**Prizaquantel**

Paragonimus westermani (snails, crabs)

Lung fluke- chronic cough w/ **bloody sputum** (resembles TB), Dyspnea, pleuritic chest pain, recurrent **secondary bacterial pneumonias.**		**Orient, India**	Humans eat **undercooked crabs**, containing encysted larvae which excyst in small intestine. Larvae penetrate intestinal wall and **through diapragm into lung.** Adults make eggs which are coughed up, swallowed, excreted into fresh water. Eggs develop into miracidia and enter **fresh water snails** (1st host) in which they develop into **free-swimming cercariae** which enter **crabs** (2nd host) and cycle repeats.	ID **operculated eggs in sputum or feces**	**Prizaquantel**

NEMATODES - INTESTINAL — *Roundworms*

Enterobius vermicularis *(Pinworm)*

Diseases	Characteristics	Pathogenesis	Diagnosis	Treatment
Perianal itching	Life cycle confined to humans	Humans infected by ingesting eggs. Eggs hatch in small intestine, larvae migrate to colon. Male/female mating, **female migrates to anus at night to release eggs.** Larvae carried to mouth my fingers which have scratched itchy skin, cycle repeats	**Recover eggs by famous Scotch tape method** **Eggs NOT in stool**	Mebendazole kills adults.

Trichuris trichiura *(Whipworm)*

Mostly asymptomatic, maybe diarrhea	Worldwide, **Southern US**	Humans eat eggs in **soil** contaminated with **human feces.** Adult worms burrow into intestinal mucosa, **do not cause anemia**, unlike hookworms	**Eggs in stool**	Mebendazole

Ascaris lumbricoides

Ascariasis- mostly asymptomatic, but **ascaris pneumonia** can result from damage of **larvae migration through lung, inducing inflammation with eosinophilic exudate**	Common in tropics. Largest nematodes, 25cm.	Humans eat eggs in **soil** contaminated with **human feces.** Eggs hatch in small intestine, larvae migrate through gut mucosa into bloodstream to lungs, coughed up and swallowed. Mature in small intestine, persist in lumen, **do not attach, live off ingested food.** Thousands of eggs laid daily, passed in feces, form embryos in warm soil. Human ingestion completes cycle.	ID corrugated eggs in Stool	**Mebendazole** Pyrantel pamoate

Ancylostoma/Necator *(Hookworm)*

Microcytic anemia- weakness pallor, pneumonia with eosinophilia		Cycle like *Ascaris*, except *larvae* in soil penetrate skin. Adults use cutting plates to attach to intestine. Major damage is by **loss of blood**.	Eggs in stool.	**Mebendazole** Pyrantel pamoate

Strongyloides stercoralis

Strongyloidiasis- mostly asymptomatic, **pnemonitis can occur,** and gut mucosal damage. **<u>Eosinophilia can be striking.</u>**	**Tropics, SE Asia, Southern US**	Two life cycles. One in humans, one in soil. Infectious **larvae penetrate skin, migrate to lungs, alveoli, trachea** where they are swallowed. In small intestine, larvae become adults, enter mucosa and produce eggs. Eggs hatch, larvae passed in stool. In **soil**, larvae differentiate into male/females, mate, produce **infectious larvae.**	**LARVAE, not eggs in stool**	Thiabendazole

Trichinella spiralis

Trichinosis- Gastroenteritis, followed 1-2 wks later with fever, muscle pain, **periorbital edema, eosinophilia.**	Worldwide, esp. E. Europe, W. Africa	**Pigs reservoir in US.** Infection by eating raw pork (or Bear!) containing larvae encysted in muscle. Adult forms arise and release larvae into blood with dissemination to organs. **Larvae only develop in striated muscle.**	**Muscle biopsy.**	No Treatment for trichinosis. **Thiabendazole for early infections** kills adult worms.

NEMATODES - TISSUE — *Roundworms*

Wuchereria bancrofti *(Filariasis)*

Diseases	Characteristics	Pathogenesis	Diagnosis	Treatment
Filariasis- adult worms cause obstruction of lymphatics, causing **edema.** Fever, lymphangitis, cellulitis develop. **Elephantiasis-** occur in patients repeatedly infected.	Tropics, 200-300 million infected	**Female *Anopheles* mosquito** deposits infective larvae on skin while biting. Larvae penetrate skin, enter LN, mature **one year later** into adults that produce **microfilariae. These circulate in blood, esp. at night**, and are ingested by mosquitoes in which they produce infective larvae. Microfilariae do NOT cause symptoms	**Thick blood smears taken at night** show microfilariae	**Diethylcarbamzaine** effective vs. microfilariae. No tx vs. adults

Oncocerca volvulus *(River Blindness)*

Subcutaneous inflammation, pruritis, papules, nodules form in response to adult worm proteins. Microfilariae migrate through tissues, ultimately concentrating in the eyes. Leads to **blindness.**	Millions infected in Africa, Central America	**Female blackfly** (THINK BLACK=blindness)deposits infective larvae on skin while biting. Larvae enter wound, migrate to subcutaneous tissue, where they differentiate into adults in **dermal nodules.** Female produces microfilariae that are ingested when another blackfly bites. Microfilariae develop into infective larvae to complete the cycle.	**Microfilariae in tissue biopsy**	Ivermectin vs. microfilariae. Suramin vs. adults.

Loa loa

Loiasis- hypersensitivity rxn results in localized subcutaneous edema. Adult worm may be seen **crawling across conjuctiva,** usually harmless.	Only tropical central and western **Africa**	**Deer fly (mango fly)** deposits infective larvae on skin. Larvae enter wound, wander around body, develop into adults. Females release **microfilariae** which enter blood **during the day** (compare to *Wuchereria*). Deer fly infests microfilariae which differentiate into infective larvae.	**Microfilariae in blood smear**	**Diethylcarbamazine**

Dracunculis medinensis *(Guinea fire worm disease)*

Dracunculiasis- worm protrudes from skin ulcer, wind up on stick over days.	**W.H.O. says just 17 countries have this disease as of 4/3/98. All in Africa.** (109 countries *Dracunculis free!)*	Humans infected by tiny crustaceans (copepods) swallowed in drinking water. Larvae released in small intestine, migrate to body, develop into adults. Adult females ulcerate skin, release larvae which are eaten by copepods.		Wind worm up on a stick over days.

Toxocara canis *(Visceral larva migrans)*

Visceral larva migrans- Blindness due to retinal involvement. Fever, hepatomegaly, eosinophilia are common.	**Dog is definitive host**	Dog sheds T.*canis* in eggs in soil. Humans eat eggs, hatch in small intestine, larvae migrate to organs (**eyes, liver, brain**), but are eventually encapsulated and die. Life cycle NOT completed in humans (**dead end host**.)	Larvae in tissue. **Hypergammaglobulinemia, eosinophilia.**	Diethylcarbamazine

*Note: if you're really interested about *Dracunculis,* visit the World Health Organization at http://www.who.org/