Online Only Lectures – Even More Worms

Speaker: Edward Mitre, MD

IDBR INFECTIOUS DISEASE BOARD REVIEW AUGUST 20-24 2022

Even More Worms

Edward Mitre, MD
Bethesda, MD

7/25/2022

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Disclosures of Financial Relationships with Relevant Commercial Interests

- None

Major Helminth Pathogens

TREMATODES	CESTODES	NEMATODES
Blood flukes *Schistosoma mansoni* *Schistosoma japonicum* *Schistosoma haematobium*	Intestinal tapeworms *Taenia solium* *Taenia saginata* *Diphyllobothrium latum* *Hymenolepis nana*	Intestinal *Ascaris lumbricoides* *Ancylostoma duodenale* *Necator americanus* *Trichuris trichiura* *Strongyloides stercoralis* *Paracapillaria philippinensis* *Enterobius vermicularis*
Liver flukes *Fasciola hepatica* *Clonorchis sinensis* *Opisthorchis viverrini*	Larval cysts *Taenia solium* *Echinococcus granulosus* *Echinococcus multilocularis*	Tissue Invasive *Wuchereria bancrofti* *Brugia malayi* *Onchocerca volvulus* *Loa loa* *Trichinella spiralis* *Angiostrongylus cantonensis* *Anisakis simplex* *Toxocara canis/cati* *Baylisascaris procyonis* *Gnathostoma spinigerum*
Lung flukes *Paragonimus westermani*		
Intestinal flukes *Fasciolopsis buski* *Metagonimus yokagawai*		

Intestinal Flukes

Fasciolopsis buski
("Giant Intestinal Fluke" 2cm w x 8 cm)
- acquisition: eating encysted larval stage on aquatic vegetation
- symptoms: usually asymptomatic
  - can cause diarrhea, fever, abdominal pains, ulceration, and hemorrhage

Dx: eggs in stool

Metagonimus yokagawai
(2.5mm x 0.75mm)
- acquisition: eating larvae in undercooked fish
- symptoms: diarrhea and abdominal pain

Major Helminth Pathogens

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Blood flukes *Schistosoma mansoni* *Schistosoma japonicum* *Schistosoma haematobium*	Intestinal tapeworms *Taenia solium* *Taenia saginata* *Diphyllobothrium latum* *Hymenolepis nana*	Intestinal *Ascaris lumbricoides* *Ancylostoma duodenale* *Necator americanus* *Trichuris trichiura* *Strongyloides stercoralis* *Paracapillaria philippinensis* *Enterobius vermicularis*
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Hymenolepis nana

"Dwarf tapeworm" (4-6 cm long)

Found worldwide → the most common cestode infection of humans

Predator (larval stage): rodents, humans
Prey (tapeworm stage): beetles!

Acquisition: by ingestion of eggs in contaminated food or water
OR by ingestion of infected grain beetle!

Symptoms: Often asymptomatic
With large parasite burdens, can cause
-loose stools, diarrhea
-crampy abdominal pain
-weakness

Diagnosis: finding eggs or proglottid segments in stool
(note: sometimes confused for pinworms)

Treatment: praziquantel 25 mg/kg x 1, repeat dose in 10 days
(higher than for most tapeworm infections)

H. nana egg in wet mount (note the hooklets)
CDC DpDx

H. nana scolex in stool sample (note the hooklets and suckers)
CDC DpDx

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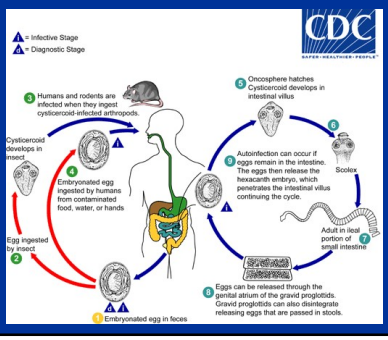
Hymenolepis nana

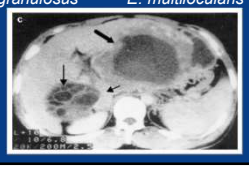


Echinococcus multilocularis

fox/rodent lifecycle

causes an infiltrative, tumor-like growth in liver
- → poorly demarcated
- → has a semi-solid nature (does not form large cysts)

E. granulosus *E. multilocularis*



Lancet 2003;362:1295-304

Major Helminth Pathogens

TREMATODES

Blood flukes
- *Schistosoma mansoni*
- *Schistosoma japonicum*
- *Schistosoma haematobium*

Liver flukes
- *Fasciola hepatica*
- *Clonorchis sinensis*
- *Opisthorchis viverrini*

Lung flukes
- *Paragonimus westermani*

Intestinal flukes
- *Fasciolopsis buski*
- *Metagonimus yokagawai*

CESTODES

Intestinal tapeworms
- *Taenia solium*
- *Taenia saginata*
- *Diphyllobothrium latum*
- *Hymenolepis nana*

Larval cysts
- *Taenia solium*
- *Echinococcus granulosus*
- *Echinococcus multilocularis*

NEMATODES

Intestinal
- *Ascaris lumbricoides*
- *Ancylostoma duodenale*
- *Necator americanus*
- *Trichuris trichiura*
- *Strongyloides stercoralis*
- *Paracapillaria philippinensis*
- *Enterobius vermicularis*

Tissue Invasive
- *Wuchereria bancrofti*
- *Brugia malayi*
- *Onchocerca volvulus*
- *Loa loa*
- *Trichinella spiralis*
- *Angiostrongylus cantonensis*
- *Anisakis simplex*
- *Toxocara canis/cati*
- *Baylisascaris procyonis*
- *Gnathostoma spinigerum*

Paracapillaria philippinensis

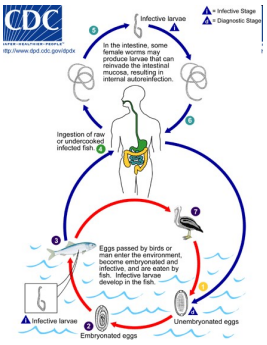
Epidemiology: primarily SE Asia

Risk factor: **eating raw freshwater fish**

Sxs:
often initially asymptomatic

Over time develop:
- borborygmus
- abdominal pain
- watery diarrhea

→ If not treated over weeks to months get large electrolyte losses and dehydration which can lead to death



Paracapillaria philippinensis

Pathogenesis:

Eat infected raw fish

→ larvae released into intestine

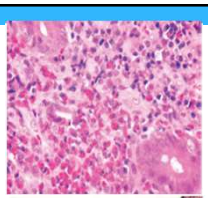
→grow to adults which burrow in mucosa

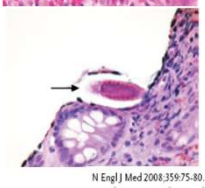
→ female worms lay eggs (oviparous)

→ some female worms are larviparous

→ some larvae burrow into the intestinal lining and develop into adults

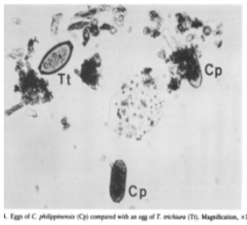
→ over weeks to months the worm burden increases (from a few worms to tens of thousands) and symptoms progress





N Engl J Med 2008;359:75-80.

Paracapillaria philippinensis



Cross J, Clin Micr Reviews, 1992

N Engl J Med 2008;359:75-80.

Dx: stool o/p (eggs similar to Trichuris)

Rx: 10 d course albendazole + supportive Rx (IVF, replete electrolytes, etc.)

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Enterobius vermicularis (pinworm)

- Found everywhere
- Fecal/oral
- Humans are the only hosts
- peri-anal itching (rare: appendicitis)

Dx: stool o&p exams not very helpful
→ "pinworm paddle test" early am before showering or defecating
→ eggs have one flat side

Rx: pyrantel pamoate, albendazole, or mebendazole single dose
→ **treat all members of household**
→ **retreat everyone in two weeks**
→ careful trimming of fingernails, handwashing, washing of bedclothes to rid house of eggs

Question

A 13 year old girl developed a pruritic rash on her foot after moving to rural northeast Florida. Which of the following helminths is the most likely cause of the rash?

Am Fam Physician 2010, 81(2): 203-4.

A. *Enterobius vermicularis*
B. *Ascaris lumbricoides*
C. *Trichuris trichiura*
D. *Toxocara canis*
E. *Anyclostoma caninum*

Cutaneous Larva Migrans

Creeping eruption caused by dog or cat hookworms

Ancylostoma caninum
Ancylostoma braziliense
Uncinaria stenocephala

- Worms migrate laterally
- Unable to penetrate basal membrane of human skin
- Can occur 2-8 weeks after exposure

Figure 1. Cutaneous Larva Migrans Caused by *Ancylostoma braziliense*.

N ENGL J MED 351;8 WWW.NEJM.ORG AUGUST 19, 2004

Nodding syndrome

Neurological disease
- *Progressive cognitive dysfunction*
- *Nodding seizures – especially when children start to eat*
- *Growth stunting*

→ ***associated with Onchocerciasis***

Tanzania 1960s
South Sudan 1990s
Northern Uganda 2007

A child in Uganda with nodding syndrome.
NPR 2/15/2017

May be due to cross-reactive antibodies, triggered by Onchocerca infection, that recognize leiomodin-1 in the hippocampus

Johnson et al, Science Translational Medicine 2017 v9 issue 377

Onchocerciasis in the U.S.?

The Emergence of Zoonotic *Onchocerca lupi* Infection in the United States – A Case-Series

Clinical Infectious Diseases® 2016;62(6):778–83

- *Onchocerca lupi → an infection of wolves*
- *as with O. volvulus, is transmitted by blackflies*
- *6 human cases reported to date*
- *3 with deep nodules near cervical spinal cord*
- *Southwestern U.S.(Arizona, New Mexico, Texas)*

Question

A 6 yo boy from Indiana who has a pet dog and likes to play in a sandbox presents with fever, hepatosplenomegaly, wheezing, and eosinophilia. He has never travelled outside the continental U.S.

The most likely causative agent acquired in the sandbox is:

A. *Anisakis simplex*
B. *Onchocerca volvulus*
C. *Enterobius vermicularis*
D. *Toxocara canis*
E. *Anyclostoma braziliense*

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Toxocariasis (and Baylisascariasis)

Due to dog (*Toxocara canis*), cat (*Toxocara cati*), and raccoon (*Baylisascaris procyonis*) ascarids.

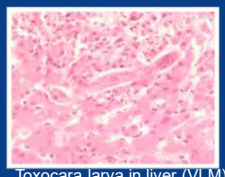
Humans acquire infection by ingestion of animal feces.
In humans → larvae hatch in intestine and migrate to liver, spleen, lungs, brain, and/or eye.

Symptoms

Visceral Larva Migrans (VLM)
usually 2-5 year olds
fever, eosinophilia, hepatomegaly
also wheezing, pneumonia, splenomegaly

Ocular Larva Migrans (OLM)
often in 10-15 year olds
retinal lesions that appear as solid tumors

Baylisascaris often more severe and more likely to cause CNS disease (eosinophilic meningitis)



Toxocara larva in liver (VLM)
CDC DPDx

Toxocariasis

Dx: Clinical picture + Toxocara antibody testing
(serum and intraocular fluid by ELISA testing)

NOTE: Toxocara IgG is only supportive b/c many individuals have + Ab due to prior exposure

Rx: usually self-limited disease.
acute VLM or OLM can be Rx with albendazole and steroids

Gnathostoma spinigerum and hispidum

Undercooked freshwater fish (ceviche!), frogs, birds, reptiles
Asia (esp Thailand), Central/South America, parts of Africa

→ Disease due to migrating immature worms.
→ Often with peripheral eosinophilia

SKIN: migratory, painful subcutaneous swellings (recur every few weeks, can last for years)
creeping eruption/cutaneous larva migrans

TISSUE: visceral larva migrans
eosinophilic meningoencephalitis
radiculomyelitis
ocular disease (anterior and posterior uveitis)

Dx: empiric or by biopsy, no antibody test available in the U.S.

Rx: can be difficult, may require 3 weeks of albendazole

Good Luck!

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