HELMINTHIC INFESTATIONS IN CHILDREN
INTRODUCTION

• Helminthic infestations contribute significantly to global burden of disease.
• Humans are the primary hosts for the most of helminthic infections.
• Most worms produce in human sexually by producing eggs and larvae.
• These pass out of body and infect the secondary host.
• Immature forms invade humans via skin or GIT and mature to adult worms with characteristic tissue distribution.
CLASSIFICATION OF HELMINTHS

Helminths

Nematodes

Platyhelminths

Cestodes

Trematodes
## DIFFERENCES

<table>
<thead>
<tr>
<th></th>
<th>Cestode</th>
<th>Tremaode</th>
<th>Nematode</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shape</strong></td>
<td>Tape like segmented</td>
<td>Leaf like unsegmented</td>
<td>Elongated, cylindrical unsegmented</td>
</tr>
<tr>
<td><strong>Sexes</strong></td>
<td>Not separated</td>
<td>Not separated</td>
<td>Separate</td>
</tr>
<tr>
<td><strong>Head end</strong></td>
<td>Suckers, hooks</td>
<td>Suckers</td>
<td>No suckers/hooks</td>
</tr>
<tr>
<td><strong>Alimentary canal</strong></td>
<td>Absent</td>
<td>Present, incomplete, no anus</td>
<td>Present</td>
</tr>
<tr>
<td><strong>Body cavity</strong></td>
<td>Absent</td>
<td>Absent</td>
<td>Present</td>
</tr>
</tbody>
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PATHOGENESIS

- Hookworm suck-0.03-0.15ml/worm/day
- Mechanical interference-intestinal obstruction
  - hydatid cyst
- Round worms deprive the host of the nutrients
  - cysticercoids
- Hypersensitivity reaction-tissue damage
MODE OF INFECTION

• Through ingestion of fecal contaminated material.
  e.g. A.lumbricoides, enterobius vermicularis,
  H.nana,T.solium/T.saginata

• By piercing the skin.
  e.g Hookworm, Schistosomiasis, Strongaloides

• By ingestion through intermediate host.
  e.g. Diphyllobothrium latum, Dracunculosis medinensi
CLINICAL FEATURES

- Abdominal pain – Ascaris, Hook worm
- Cough – Ascaris, P.Westermani
- Diarrhea – Schistosoma
- Dysentery – E.Coli, Schistosoma
- Dysuria – Entrobius
- Headache – T.Solium
- Pruritus – Entrobius, Filaria, Hookworm
INVESTIGATIONS

• Gastrointestinal Worms
  • Sedimentation method
• Stool for Ova & Cyst
  • Concentration method
INVESTIGATIONS CONT...

• Anal Swab
• Stool Culture
• Systemic Worms

Peripheral smear – Thik, Thin
DEC Provocation test - Microfilaria
LIFE CYCLES
ASCARIASIS

Adult worms live in the lumen of the small intestine. A female may produce approximately 200,000 eggs per day, which are passed with the feces.

After infective eggs are swallowed, the larvae hatch, invade the intestinal mucosa, and are carried to the lungs.

The larvae penetrate the alveolar walls, ascend the bronchial tree to the throat, and are swallowed.

Upon reaching the small intestine, they develop into adult worms.
ASCARIASIS

• Ascaris lumbricoides, ova are viable in soil.

• Transmitted by contaminated food or fingers.

• Abdominal cramps, weight loss, anorexia, diarrhea, vomiting.

• Worms may present in stools.

• Stool for ova.

• Treatment – Mebendazole, Pyrantel P, Albendazole
1 = Infective Stage
\[ \text{d} = \text{Diagnostic Stage} \]

1. Fecal egg
2. Fertilized egg
3. Unfertilized egg will not undergo biological development.

CDC
http://www.dpd.cdc.gov/dpdx
Ascaris lumbricoides

Fertile
Decorticated
Embryonated
Unfertilized
HOOK WORM

• Eggs are passed in the stool. The released rhabditiform larvae grow in the feces and/or the soil, and after 5 to 10 days they become filariform larvae that are infective.

• These infective larvae contact the human host, penetrate the skin and are carried through the veins to the heart and then to the lungs. They penetrate into the pulmonary alveoli, ascend the bronchial tree to the pharynx, and are swallowed.

• The larvae reach the small intestine, where they reside and mature into adults. Adult worms attach to the intestinal wall with resultant blood loss by the host.
HOOK WORM

- Ancylostoma duodenale, Necator americanus
- Takes 0.5 ml blood / day / worm
- Eggs $\rightarrow$ soil $\rightarrow$ larva $\rightarrow$ penetrate skin $\rightarrow$ circulation $\rightarrow$ reaches alveoli $\rightarrow$ cough / swallowed $\rightarrow$ develop to worm intestine $\rightarrow$ excreted
- Itching, abdominal pain, Anemia, Malnutrition
- Stool for ova, Peripheral smear for IDA
- Treatment – Mebendazole, Pyrantel P, Albendazole
- Prevention by fecal contamination of soil
1. Eggs in feces

2. Rhabditiform larva hatches

3. Filariform larva penetrates skin

4. Filariform larva

5. Adults in small intestine

- i = Infective Stage
- d = Diagnostic Stage
HOOK WORM

Adult hook worm

Hook worm egg
HOOKWORM CREEPING ERUPTION
PIN WORM

• Eggs are deposited on perianal folds. Self-infection occurs by transferring infective eggs to the mouth with hands that have scratched the perianal area.

• Person-to-person transmission can also occur through handling of contaminated clothes or bed linens or contact with contaminated curtains, carpeting, etc.

• Following ingestion of infective eggs, the larvae hatch in the small intestine and the adults establish themselves in the colon.

• Gravid females migrate nocturnally outside the anus and deposit their eggs while crawling on the skin of the perianal area.
Embryonated eggs ingested by human

Eggs on perianal folds
Larvae inside the eggs mature within 4 to 6 hours.

Larvae hatch in small intestine

Adults in lumen of cecum

Gravid female migrates to perianal region at night to lay eggs

i = Infective Stage

= Diagnostic Stage
ENTEROBIUS VERMICULARIS

Pin worm

Pin worm- egg
TRICHURIS TRICHURA- WHIP WORM

• The unembryonated eggs are passed with the stool. In the soil, the eggs become infective.

• After ingestion (soil-contaminated hands or food), the eggs hatch in the small intestine, and release larvae that mature and establish themselves as adults in the colon.

• Female worms in the caecum shed up to 20,000 eggs per day.

• The life span of the adults is about 1 year.
1. Unembryonated eggs passed in feces.
2. 2-cell stage
3. Advanced cleavage
4. Embryonated eggs are ingested.
5. Larvae hatch in small intestine
6. Adults in cecum

= Infective Stage
= Diagnostic Stage

CDC
S A F E R • H E A L T H I E R • P E O P L E™
http://www.dpd.cdc.gov/dpdx
WHIP WORM

Whip worm

Whip worm- egg
STRONGYLOIDES

• Adults in duodenum → eggs → hatch in mucosa → rhabditiform larva → mature & penetrate tissue → Filariform larva → this cause autoinfection or inhabit in soil and penetrate skin of other host

• Immunosuppressed patients have fatal disseminated form known as Hyperinfection syndrome
• Pruritic rash, wheezing, cough, hemoptysis, abdominal pain, diarrhea, vomiting
• Larva in feces, duodenal aspirates (string test), sputum
• Thiabendazole, Ivermectin
The filariform larvae enter the circulatory system, are transported to the lungs, and penetrate the alveolar spaces. They are carried to the trachea and pharynx, swallowed, and reach the small intestine where they become adults.

The filariform larvae hatch from embryonated eggs.

Eggs are produced by fertilized female worms.

Development into free-living adult worms.

New generation of adults:

The filariform larvae develop into infective filariform.

Infected filariform larvae penetrate the intact skin initiating the infection.

Autoinfection: Rabditiform larvae in large intestine, become filariform larvae, penetrate intestinal mucosa or perianal skin, and follow the normal infective cycle.

Eggs deposited in intestinal mucosa, hatch, and migrate to lumen.

Infected filariform larvae are excreted in stool.

Adult female worm in the intestine.

Rabditiform larvae in the intestine.

Ear = Infective Stage

△ = Diagnostic Stage
TAENIASIS

- Taenia saginata – beef tape worm
- Adults → Intestine → egg-laden distal part break off → excreted → disintegrated → ova (soil) → ingested by cattle → egg hatch → larva migrate and encyst in skeletal muscle → ingested (humans) → mature
- Abdominal pain, passage of worms in stools, diarrhea
- Treatment - Praziquantel
Oncospheres hatch, penetrate intestinal wall, and circulate to musculature

Cattle (T. saginata) and pigs (T. solium) become infected by ingesting vegetation contaminated by eggs or gravid proglottids

Humans infected by ingesting raw or undercooked infected meat

Scolex attaches to intestine

Adults in small intestine

Eggs or gravid proglottids in feces and passed into environment

1 = Infective Stage
2 = Diagnostic Stage
TAPE WORM

Inside intestine

Tape worm- egg
NEUROCYSTICERCOSIS

Embryonated eggs ingested by human host

Oncospheres hatch, penetrate intestinal wall, and circulate to musculature

Humans infected by ingesting raw or undercooked infected meat

Oncospheres develop into cysticerci in pig muscle

Cysticerci may develop in any organ, being more common in subcutaneous tissues as well as in the brain and eyes

Scrolex attaches to intestine

Eggs or gravid proglottids in feces and passed into environment

Adults in small intestine

= Infective Stage

= Diagnostic Stage

Neurocysticercosis
ECHINOCOCCUS

• Echinococcus granulosus – dog tapeworm
• Adult → sheep intestine → eggs → ingested (humans) → hatch → larva penetrate mucosa → blood → produce cyst in liver, lung, kidney, bone, brain
• Presentation depends on site of cyst which causes pressure, vessel erosion
• If cyst ruptures – cough, dyspnea, wheezing, urticaria, chest pain, hemoptysis
• Investigation – radiological, cytologic, serologic
• Treatment – Surgical removal, Albendazole
SCHISTOSOMIASIS

- Japonicum, Mansoni, Mekongi – Intestine
- Haematobium – Urinary tract
- Snails → Larva → Penetrate skin → migrate to liver → mature to adult → migrate to portal vein → Circulation → Ova → escape of ova into bowel or bladder → excreted → ingested by snails
- Maturation – tender hepatosplenomegaly
- Bladder – dysuria, hematuria, reflux, stone, incontinence
- Final stages – hepatic fibrosis, portal hypertension, splenomegaly
- Investigation – stool, rectal biopsy
- Treatment – Praziquantel
PREVENTIVE MEASURES

• Proper disposal of feces

• Personal protection
  - food
  - water
  - skin

• Diminishing the reservoir of infection

• Health education: Personal Hygiene
PREVENTIVE MEASURES

- Personal hygiene:
- Wash hands after defecation
- Nail cutting
- Daily bath
- Avoid scratching perianal region
- IEC
Thank You