Cestodes
Taenia Solium
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Geographic Distribution

- Asia, Africa, the Philippines, South America, parts of Southern Europe and pockets of North America
General Recognition Features

- **Size** – Generally 3 meters or less
- **Proglottids** – less than 1000
General Recognition Features

- Scolex has four suckers with a rostellum that has a double circle of alternating large and small hooks (22-36)
- Proglottid is smaller than T saginata and has 7-13 lateral branches off the central uterus
T. saginata
T. solium
General Recognition Features

- Eggs
  - 31-43 um
  - Outer embryonal membrane
  - Brown shell
  - Embryo
Embryonal membrane

Brown shell

Embryo

Embryonal membrane
General Recognition Features

Cysticercus

- 5-10 mm
- In muscle of pork
- Invaginated scolex
- Scolex exvaginates and breaks off when digested out of the muscle
Cysticercus Hooks
Life Cycle

► Definitive host – man
► Stage leaving the body – gravid proglottids, occasional embryonated eggs
► Intermediate host – pigs and man
► Infectious stage for the definitive host – infectious eggs for cysticercosis, cysticerci for tapeworm infection
Life Cycle

- Infected tissue eaten by man
  - Cysticercus digested out of infected tissue
  - Scolex exvaginates and attaches to small intestine
  - Gravid proglottid segments found in feces
  - Eggs extruded
    - Infectious for 2-6 months

- Eggs or proglottids eaten by cattle or man
  - Eggs hatch in duodenum
  - Embryo passes to tissue via mesenteric venules or lymphatics
    - Cysticercus stage develops in tissue (infectious for 1 year)

- 2-3 months
- 10-12 weeks
- 5-12 weeks
Life Cycle

- Prepatent period – 5-12 weeks
- Patent period – decades
- 3 routes of egg ingestion
  - Heteroinfection - contaminated food and water
  - External autoinfection – perineal skin to mouth
  - Internal autoinfection – regurgitation proglottids to stomach
Transmission

- Eating of inadequately cooked pork
- Contaminated food and water
- Use of raw human sewage for agriculture
- Inadequate human fecal sanitation
Cysticerci
Pathogenicity

- Cysticercosis – encapsulation occurs around the cysticercus except in the eye or brain
Disease

► Tapeworm

- Generally asymptomatic except for passage of proglottids
- End of prepatent period – diarrhea and abdominal pain in ½ of the cases
- Rare – intestinal obstruction
**Disease**

► **Cysticercosis**

- **Major** – CNS, muscle, SQ tissues and eye
- **Other** – lung, heart, liver, other viscera
- **CNS** – Seizures, stroke, hydrocephalus, headache, nausea and vomiting, dizziness, diplopia, psychiatric problems, meningoencephalitis, visual loss, CSF (elevated protein, low glucose, increased cells)
- **Eye** – Shadows, uveitis, iritis, retinal detachment, atrophy of the choroid, conjunctival encapsulation
- **Mortality** – 25-65% in neurocysticercosis
Cysticercosis

- Morbidity is almost entirely due to CNS disease
- Prevalence of CNS disease is up to 2% in endemic areas. Many are asymptomatic clinically. Found on autopsy.
- It may take years from onset of infection to onset of symptoms
Laboratory Diagnosis

► Clinical suspicion

► Cysticerci identified
  ▪ Excised nodules or surgical specimens
  ▪ Mobile larvae seen in the eye
  ▪ Brain imaging (e.g., CAT scan, radiographs of muscle)
  ▪ Serology – ELISA (80% even in endemic areas). The enzyme immunotransfer blot assay is likely the antibody test of choice.
  ▪ Antigen detection in CSF and Blood

► Eggs identified

► Proglottids identified
Imaging

- Calcified lesions
- Small hypodense areas (< 2 cm) often (1/2 time) can have a central bright spot (scolex)
- Disc enhancement or ring around hypodense areas is associated with spontaneous resolution from the CT in 12 months
- Occasionally can see large cysts (6 cm). Must differentiate from hydatid disease, coenurosis or racemose cysticercosis
## Treatment of Tapeworm

<table>
<thead>
<tr>
<th>Medication</th>
<th>Adult</th>
<th>Pediatric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Praziquantel</td>
<td>5-10 mg/kg once</td>
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</tr>
<tr>
<td>Niclosamide</td>
<td>2 gm once</td>
<td>50 mg/kg once</td>
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</tbody>
</table>
Adverse Medication Reactions

Praziquantel (Biltricide – Bayer)

- Frequent: abdominal pain, diarrhea, malaise, headache, dizziness
- Occasional: neutropenia, GI disturbance, methemoglobinemia
- Rare: CNS symptoms, hypertension, arrhythmias
Adverse Medication Reactions

- Niclosamide
  - Occasional – abdominal pain, anorexia, diarrhea, emesis
  - Rare – dizziness, skin rash, drowsiness, perianal itching, unpleasant taste
# Treatment of Cysticercosis

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<tr>
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<tr>
<td>Albendazole</td>
<td>400 mg bid X 8-30d (can be repeated)</td>
<td>15 mg/kg/d (max 800 mg) in 2 doses X 8-30 d (can be repeated)</td>
</tr>
<tr>
<td>Praziquantel</td>
<td>50-100 mg/kg/d in 3 doses X 30d</td>
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Cysticercosis Treatment

► Initial therapy for single inflammed parenchymal cysticercosis or with calcified lesions – Rx seizures with anti-seizure medication

► Use of albendazole or praziquantel for parenchymal cysticercosis without seizures is controversial (JM Mcguire NEJM 2004;350:215)

► Patients with live parenchymal cysts who have seizures should be treated with albendazole + steroids (6 mg dexamethasone or 40-60 mg prednisone / day) (Garcia NEJM 2004:350:249)

► Patients with subarcahnoid cysts or giant cysts in the fissures treat for at least 30 days (Proano, NEJM 2001:345:879)

► Surgical intervention or shunting is indicated for hydrocephalus. Give 40 mg prednisone with the surgery.

► Arachnoiditis, vasculitis or cerebral edema – treat with prednisone 60 mg/d or dexamethasone 4-6 mg/d + albendazole or praziquantel (AC White Annu Rev Med 2000:51-187)

► Any cysticeroidicidal drug may cause irreparable damage when used to treat ocular or spinal cysts even when given with steroids. An ophthalmologic examination should always precede treatment to r/o introcular cysts.

The Medical Letter, August, 2004
Cysticercosis Treatment

- Ocular and spinal cysts – treated with surgery
Adverse Medication Reactions

Albendazole

- Occasional: diarrhea, abdominal pain
- Rare: leukopenia, alopecia, increased serum transaminase levels
Cerebrospinal fluid
Control Measures

► Prompt treatment of tapeworm infected humans
► Sanitary disposal of human feces
► Adequate meat inspection
► Cooking beef to >65C or freezing at -20C for 24 hours
► Stool examination of food handlers from endemic countries
► Avoid eating uncooked vegetables and fruits that cannot be peeled while traveling in developing countries