Common Infections in Tropical Region

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Liver Abscess

- Pyogenic liver abscess (~80%)
  - Direct spread: biliary tract, portal circulation or bowel
  - Hematogenous seeding
- Amoebic liver abscess (~10%)
  - E. histolytica
- Fungal liver abscess (~10%)
  - Candida spp.

Tropical Region

Areas lie between the Tropic of Cancer and Tropic of Capricorn belts

- Warm 25-28°C
- Wet and dry season
- Rainy

A 45-year-old female

Poorly controlled type 2 DM presented with a 1-week fever and right upper quadrant abdominal pain. She had a history of chronic intermittent abdominal discomfort for a year. CT abdomen showed multiple ring enhancing lesions at the liver and gall stones.

Needle aspiration and stain showed gram-negative rod with bipolar staining, gram-positive cocci and gram-positive bacilli. Melioidosis titer was positive with titer 1:64. What is the diagnosis?

A. Pyogenic liver abscess
B. Melioidosis
C. Primary bacteremic liver abscess
D. Liver metastasis
E. Fasciola hepatica infestation

Liver Abscess

- Pyogenic liver abscess
  - Direct spread: biliary tract, portal circulation or bowel
  - Hematogenous seeding
    - Mixed organisms: E. coli, anaerobes e.g. Bacteroides fragilis, Actinomyces israelii
    - Hematogenous seeding: monomicrobial
      - Burkholderia pseudomallei
      - Klebsiella pneumoniae
      - Viridans streptococci: S. anginosus group (S. anginosus, S. intermedius, S. constellatus)

Blood culture and abscess fluid examination
Pus Gram Stain

- Polymicrobial
- Actinomyces

Melioidosis

- Caused by a gram-negative bacterium, *Burkholderia pseudomallei*
- Category B bioterrorism

Risk factors

- Incubation 1-21 days (average 9 days), longest 62 yr.
- 75 to 81% rainy season
- Incidence peaks between age 40 and 60 years
- 80% of patients have one or more risk factors:
  - Diabetes (23 to 60%)
  - Heavy alcohol use (12 to 39%)
  - Chronic pulmonary disease (12 to 27%)
  - Chronic renal disease (10 to 27%)
  - Thalassemia (7%)
  - Glucocorticoid therapy (<5%)
  - Cancer (in 5%)

Clinical Classification

- Disseminated septicemic melioidosis
- Non-disseminated septicemic melioidosis
- Multifocal localized melioidosis
- Localized melioidosis
- Probable melioidosis
- Subclinical melioidosis

Clinical Manifestations

Clinical Manifestations

- Pneumonia (51%)
- Genitourinary infection (14%)
- Skin infection (13%)
- Bacteremia without evident focus (11%)
- Septic arthritis or osteomyelitis (4%)
- Neurologic involvement (3%)
- Internal-organ abscesses and secondary foci in the lungs, joints, or both - common

Clinical Manifestations

- Acute fulminant septic illness to a chronic infection (symptoms for >2 months for 11% of cases)
- May mimic cancer or tuberculosis – the great imitator
- Over half of patients have bacteremia on presentation, and septic shock develops in approximately one fifth

Clinical Manifestations

- Suppurative parotitis 40% in children in Thailand and Cambodia (extremely rare in Australia)
- Prostatic melioidosis - 20% of male (in Australia)
- Neurologic melioidosis
  - Brain-stem encephalitis w/wo cranial-nerve palsy (esp. CN VII)
  - Myelitis with peripheral motor weakness
- Recurrent melioidosis occurs 1 in 16 patients, often in the first year
  - About 25% reinfection
  - 75% relapse
- Mortality 40%

A 45 years old female, DM

A middle-age man with diabetes

A middle-age man with diabetes
Diagnosis

- Culture is a must
- Serologic testing alone is inadequate for confirming the diagnosis, especially in endemic regions (> 50% positive)
- Empirical therapy for melioidosis should not be continued if B. pseudomallei is not detected in adequate cultures of specimens obtained before therapy
- Molecular identification – PCR, sequencing is useful

Treatment

Initial intensive therapy (10-14 days)
- Ceftazidime 50 mg/kg of body weight (up to 2 g), every 6–8 hr
- Meropenem 25 mg/kg (up to 1 g), every 8 hr
- Imipenem 25 mg/kg (up to 1 g), every 6 hr

Oral eradication therapy (3-6 months)
- TMP-SMX - based on body weight
  - > 60 kg: TMP/SMX DS 2 tabs q 12 hr
  - 40–60 kg: TMP/SMX SS 3 tabs q 12 hr
  - < 40 kg, adult TMP/SMX SS 2 tabs q 12 hr
  - < 40 kg, child 8 mg of TMP/kg and 40 mg of SMX/kg, every 12 hr

Klebsiella pneumoniae genotype K1

- Community-acquired Klebsiella pneumoniae invasive infection
- magA gene is associated with HMKP
- Liver abscess, endophthalmitis, osteomyelitis, pneumonia, brain abscess/meningitis (distinctive syndrome)
- Bacteremia-common
- Prevalent in East and Southeast Asians: Taiwan, Korea, Thailand, Singapore

A 70-year-old woman

- Presented with prolonged fever for 1 month
- Significant weight loss
- Non-productive cough
- Desaturation
- AntiHIV-negative
**Imagings**

**CXR**

Serum cryptococcal antigen-positive 1:32

**CT Chest**

**A Man with Abdominal Mass**

- A 66-year-old man
- Diagnosed normal pressure hydrocephalus (NPH) and vascular dementia for 2 years post programmable VP shunt
- Chronic headache for 1 years
- Chronic abdominal pain with palpable mass for 6 months

**Imagings**

**CT abdomen**

**CT brain**

**Aspiration of pseudocyst**

- Culture: *Cryptococcus gattii*
- CSF cryptococcal antigen > 1:1024
- Serum cryptococcal antigen 1:8

**A 88-year-old woman**

- Diagnose vascular dementia for 1 year
- Headache and alteration of consciousness for 2 months
- Seizure
- Brain tissue from autopsy
  - Encapsulated budding yeasts

**Identification of *C. gattii***

L-canavanine glycine bromothymol blue (CGB) agar

*C. neoformans vs. C. gattii*
C. gattii Gone Wild on World Tour

C. gattii was thought to be restricted to tropical and subtropical regions, BUT not any more

C. gattii Outbreak in Vancouver Island 1999-2007

- Long incubation period: 6 (2-11) months
- VGIIa 86.3%, VGI 6.5%

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of case</td>
<td>218</td>
</tr>
<tr>
<td>Persons living on Vancouver, n(%)</td>
<td>161 (73.9)</td>
</tr>
<tr>
<td>Age, year mean (range)</td>
<td>58.7 (2-92)</td>
</tr>
<tr>
<td>Clinical assessment, n(%)</td>
<td>167 (76.6)</td>
</tr>
<tr>
<td>Respiratory syndrome</td>
<td>17 (7.8)</td>
</tr>
<tr>
<td>Respiratory and CNS syndrome</td>
<td>22 (10.1)</td>
</tr>
<tr>
<td>Other/unknown</td>
<td>12 (5.5)</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>16 (7.3)</td>
</tr>
<tr>
<td>Immunocompromised, n(%)</td>
<td>70 (33)</td>
</tr>
</tbody>
</table>

Clinical Characteristics

<table>
<thead>
<tr>
<th>C. neoformans</th>
<th>C. gattii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host (mainly in)</td>
<td>Immunocompromised</td>
</tr>
<tr>
<td>Organ involvement</td>
<td>CNS &gt; Lungs</td>
</tr>
<tr>
<td>Complications</td>
<td>Less</td>
</tr>
<tr>
<td>Cryptococcoma</td>
<td>Hydrocephalus</td>
</tr>
<tr>
<td>Antifungal susceptibility</td>
<td>More susceptible to fluconazole</td>
</tr>
<tr>
<td>Treatment response</td>
<td>Good</td>
</tr>
</tbody>
</table>

A 17-year old man

- β Thal/HbE disease
- Chronic leg ulcer for 2 months after flood

Human pythiosis (Pythiosis insidiosi)

- Organism: *Pythium insidiosum*
- A water mold closely related to algae more than fungi (Oomycetes)
- Non-septate broad hyphae with branching
- Produce sporangia
- Aquatic motile biflagellated zoospore

Pythium insidiosum antibody- Positive
Epidemiology & Pathogenesis of Human Pythiosis

- Tropical and subtropical regions
- Mostly in Thailand
- Direct contact to contaminated sources
- Risk factors
  - Hematological diseases
    - Thalassemia-hemoglobinopathy syndrome – mostly
    - Non-thalassemia: PNH, AA, AML, ITP
    - Mechanism: unknown (may be related to iron overload?)
  - No underlying disease (ocular form)

Clinical Syndromes of Pythiosis

Human pythiosis in Thailand (102 cases: 1985-2003)

- Localized forms
  - Cutaneous/subcutaneous pythiosis (5%)
  - Ocular pythiosis (33%)
- Systemic forms
  - Vascular pythiosis (59%)*
  - Disseminated pythiosis (3%)

Overall mortality 40%
Limb amputation 78%
Enucleation/evisceration 78% (ocular form)

Diagnosis of Human Pythiosis

- Direct microscopic examination
- Culture (gold standard)
- Histopathology
- Serology***
  - Immunodiffusion test (ID)
  - Immunochromatographic test (ICT)
- Molecular identification
  - PCR
**Treatment**

- **Surgical treatment**
  - Radical surgery: the main effective treatment
- **Vascular pythiosis**:
  - Resection of infected arteries
  - BK, AK amputation
  - Aneurysmectomy
  - Thrombo-embolectomy not recommended
  - Grossly normal looking not indicate adequate excision
  - Microscopic demonstration of organism-free surgical margin needed***

**Medical Treatment**

Medical treatment alone is ineffective

- Pythium immunotherapy
- SSKI (saturated solutions of potassium iodide)
- Itraconazole+terbinafine

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**2-year-old boy with periorbital cellulitis extended to nasopharynx and maxillary sinus**

1 year course of Itraconazole plus terbinafine

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**Dengue vaccine**

- Dengvaxia® (CYD-TDV)
- Live attenuated vaccine (4 subtypes)
- 3 injections: 0, 6, 12 months
- Approved in 9-45 years old
- Moderate efficacy: 65%
  - DEN3-4 (75%) > DEN1 (50%) > DEN2 (35%)
- Higher efficacy in serological evidence of previous dengue exposure
- Decreased severity (90%) and decrease hospitalization 80%  

**Plasmodium Life Cycle**

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**Malaria**

- > 90% Pf
- > 90% Pv
- Mixed:
  - Parasite: mostly in Africa (especially West Africa) and the islands of the western Pacific
  - In Thailand: P. vivax: 56.8%, P. falciparum: 42.5%
Severe Falciparum Malaria

**Clinical**
- Impaired consciousness
- Pronation
- Multiple convulsions
- Deep breathing and respiratory distress
- Acute pulmonary edema and acute respiratory distress syndrome
- Circulatory collapse or shock
- Acute kidney injury
- Clinical jaundice plus evidence of other vital organ dysfunction
- Abnormal bleeding

**Laboratory**
- Hypoglycemia (< 40 mg/dl)
- Metabolic acidosis
- Severe normocytic anemia (hemoglobin < 5 g/dl)
- Hemoglobinuria
- Hyperlactataemia (lactate > 5 mmol/l)
- Renal impairment (Cr > 3 mg/dl)
- Pulmonary edema (radiological)

Parasitemia ≥ 5% or schizontemia is associated with severity.

Severe Knowlesi Malaria

- *P. knowlesi* replicates every 24 h → rapidly increasing parasite densities
- Severe disease and death in some
- Severe disease are similar to severe falciparum malaria, with the exception of coma
- Patients with *P. malariae*-like infections (band form) and unusually high parasite densities (parasitemia > 0.5% by microscopy) should be managed as *P. knowlesi* infection
- Definitive diagnosis is made by PCR

What you should know?

- New species *P. knowlesi*: Malaysia, Indonesia, Philippines, Thailand (Yala, Krabi, Phrae, Phuket, Chantaburi)
- *Knowlesi* malaria can be severe
- Erythrocytic stage of *P. knowlesi* is 24 h (shortest)
- *P. vivax* infection can be severe (increased mortality)
- *P. vivax* and *P. ovale* relapse weeks to months later (hypnozoites)
- Treating the hypnozoite with a second agent (primaquine)
- When *P. vivax* and *P. ovale* are transmitted via blood, treatment with primaquine is not necessary
  - No sporozoites that form hypnozoites in blood

Antimalarial Drug Activity in the Life Cycle of Plasmodia

**Treat Acute attack**
- Artesunate
- Quinine
- Methohexital
- Chloroquine
- Tetracycline
- Atovaquone
- Proguanil

**Prevent transmission**
- Primaquine, Artesunate

**Prevent relapse**
- Primaquine, proguanil, tetracycline
Treatment of Uncomplicated Falciparum Malaria

**RCPT**
- First-line drugs
  - Artesunate 4 mg/kg/day for 3 days + mefloquine 25 mg/kg in divided dose (3 tabs then 2 tabs)
- Second-line drugs
  - Quinine 10 mg/kg + doxycycline 3 mg/kg OD or BID, or clindamycin 10 mg/kg bid 7 days
  - Artesunate 2 mg/kg/day + doxycycline 3 mg/kg OD or BID, or clindamycin 10 mg/kg bid 7 days

Followed by
- Primaquine 30 mg once
- Dihydroartemisinin (DHA)-Piperaquine (40/320 mg) 3 days
  - <60 Kg 3 tabs OD
  - 60-80 Kg 4 tabs OD
  - >80 Kg 5 tabs OD

Followed by
- Primaquine 30 mg once

**MoPH**
- Artemisinin combination therapy (ACT)
  - Artesunate+mefloquine
  - DHA-piperaquine

Treatment of Uncomplicated Malaria

- Pregnant woman
  - Quinine+clindamycin (alternative DHA-pip) (MoPH)
- Second or third trimester
  - Artesunate (RCPT)
  - DHA-piperaquine (MoPH)
- Do not use doxycycline or primaquine (even single dose)

- Relapsed Pf malaria within 2 months- do not use mefloquine
  - Use quinine+doxy/clinda or artesunate+doxy/clinda

Treatment of Severe Malaria

- First-line drugs
  - Artesunate IV
    - 2.4 mg/kg IV PUSH at 0, 12, and 24 h Day 1 then 2.4 mg/kg once a day, if improved
    - Change to oral ACT for 3 days (DHA-pip, MoPH, Artesunate-mef, RCPT)
- Second-line drugs
  - Quinine IV
    - Loading 20 mg/kg IV DRIP > 4 h then 10 mg/kg IV DRIP in 2-4 h q 8 h, if improved
    - Change to oral ACT for 3 days (DHA-pip, MoPH, Artesunate-mef, RCPT) or
    - Change to quinine+doxy/clinda or artesunate+doxy/clinda for 7 days

What is the diagnosis?

- A. Infective endocarditis
- B. Leptospirosis
- C. Dengue hemorrhagic fever
- D. Gram-negative sepsis with DIC
- E. Scrub typhus

A 18 years old male, no underlying disease
Leptospirosis

- *Leptospira interrogans*
- Reservoir: 160 mammals, most important - rodent esp. rat (shed in urine)
- Transmission: skin contact with water, soil
- Incubation period: 2-26 days (average 10 days)

Four broad clinical categories

(i) a mild, influenza-like illness
(ii) Weil's syndrome characterized by jaundice, renal failure, haemorrhage and myocarditis with arrhythmias
(iii) meningitis/meningoencephalitis
(iv) pulmonary haemorrhage with respiratory failure

Clinical Manifestations

- Subclinical infection 40-70%
- Symptomatic cases – 90% mild or anicteric form
  - Acute febrile illness with a biphasic course (leptospiremic and immune phases) - good prognosis
  - Nonspecific signs and symptoms (flu-like)
- Severe or icteric leptospirosis (Weil disease) – 10%
  - Mortality 10%
  - Multiple organ involvement
  - Loss of biphasic fever

Clinical Course

<table>
<thead>
<tr>
<th>Anicteric leptospirosis</th>
<th>Icteric leptospirosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Incubation period 2-20 days)</td>
<td>(Incubation period 2-20 days)</td>
</tr>
<tr>
<td>Leptospiremic phase</td>
<td>Immune phase</td>
</tr>
<tr>
<td>3-7 days</td>
<td>0-30 days</td>
</tr>
<tr>
<td>Immune phase</td>
<td>Leptospiremic phase</td>
</tr>
<tr>
<td>0-30 days</td>
<td>3-7 days</td>
</tr>
<tr>
<td>Fever</td>
<td>Jaundice</td>
</tr>
<tr>
<td>Myalgia, Headache,</td>
<td>Hemorrhage</td>
</tr>
<tr>
<td>Nausea, Vomiting,</td>
<td>Acute renal failure</td>
</tr>
<tr>
<td>Abdominal pain, Conjunctival suffusion</td>
<td>Myocarditis</td>
</tr>
<tr>
<td>Associated symptoms</td>
<td>Hemorrhagic pneumonitis</td>
</tr>
<tr>
<td>Meningitis, Encephalitis, Rash</td>
<td>Meningoencephalitis</td>
</tr>
<tr>
<td>Leptospires present in</td>
<td>Hypotension</td>
</tr>
<tr>
<td>Blood</td>
<td>Blood</td>
</tr>
<tr>
<td>CSF</td>
<td>CSF</td>
</tr>
<tr>
<td>Urine</td>
<td>Urine</td>
</tr>
</tbody>
</table>

Diagnosis

- Antibody detection (IgG, IgM)
  - IFA
  - Need 4-fold rising for diagnosis
  - Single cutoff titer varies (for IFA ≥ 1:400)
- PCR

Treatment

- Mild leptospirosis
  - *Doxycycline*, ampicillin, or amoxicillin
- Severe leptospirosis
  - Intravenous penicillin G - drug of choice
  - Third-generation cephalosporins: cefotaxime and ceftiraxone
A 42 years old A farmer
Fever with headache for 10 day
Myalgia
The diagnosis is.....
Scrub typhus

Rickettsioses

- Spotted fever group (15 rickettsioses)
  - Rocky Mountain spotted fever (RMSF) caused by *Rickettsia rickettsii*
  - Rickettsialpox caused by *Rickettsia akari*
  - Thailand: Thai tick typhus (*R. honei*)
    - *R. helvetica*, *R. conorii*, *R. felis*

- Typhus group
  - Epidemic (louse-borne) typhus caused by *Rickettsia prowazekii*
  - Endemic (murine) typhus caused by *Rickettsia typhi*

- Scrub typhus group
  - Caused by *Orientia tsutsugamushi*

Clinical Characteristics

- Small, painless, gradually enlarging papule, which leads to an area of central necrosis and is followed by eschar formation (30-50%)
  - At axilla, perineum, groin, under breast line

- Eschars

  - Chigger
  - Eschar

Severe Scrub Typhus

- Pneumonitis, ARDS
- Encephalitis, aseptic meningitis
- Rarely, acute renal failure, shock, and disseminated intravascular coagulation (DIC)
- Cardiac involvement is often minor and rare, but can cause fatal myocarditis

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- Pneumonitis, ARDS
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- Cardiac involvement is often minor and rare, but can cause fatal myocarditis
**Diagnosis and Treatment**

**Diagnosis:**
- Serology by IFA
  - IgM titer ≥ 1:400, IgG titer ≥ 1:1,600 or
  - 4-fold rising 14 D apart with titer ≥ 1:200

**Treatment:**
- Doxycycline 100 mg po bid 3 days after symptoms resolve
- Azithromycin in pregnancy or IV azithromycin in severe form

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**Murine typhus**

- Headache, fever, muscle pain, joint pain, nausea and vomiting
- MP rash 40-50% - about six days after the onset
- Neurological signs 45% - confusion, stupor, seizures or imbalance
- Symptoms may resemble those of measles or rubella

**Investigation and treatment**
- Same as scrub typhus

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**A woman with severe murine typhus and ARDS**

5 days after treatment

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**A man post liver transplantation**

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**Intestinal nematodes**

**Treatment:** Albendazole 400 mg x 1 day
Capillaria philippinensis

- Undercooked fish
- Chronic voluminous diarrhea
- Malabsorption syndrome
- Size: 40x20 µ
- Peanut-shaped egg
- Flattened bipolar plugs
- Rx: Albendazole 400 mg PO x 10 D
- Mebendazole 200 mg BID x 20 D

Strongyloides stercoralis

Acute infection:
- 1/3 - asymptomatic
- Larva currens, Löeffler’s syndrome, diarrhea

Chronic persisting infection:
- Triad: urticaria, abdominal pain, diarrhea

Hyperinfection syndrome: Exacerbation of GI, pulmonary symptoms and increased numbers of larvae in stool and sputum

Complication: Gram negative bacteremia
- Rx: Ivermectin 200 µg/kg PO ODx2d
- For hyperinfection: repeat treatment every 15 days while stool positive, then 1 more treatment cycle
- Hyperinfection in immunocompromised: 200 µg/kg OD until neg. for 2 wks
- Albendazole 400 mg PO BID x 7 d (less effective)

Gnasthostoma spinigerum

- Eating Raw fish or contaminated water with cyclops
- Larval gnasthostomiasis
  - Intermittent subcutaneous migratory swelling
  - Ocular gnasthostomiasis
  - Eosinophilic myeloencephalitis
- Dx: antibody detection (ELISA)

Rx: Surgery
- Albendazole 400 mg/d x 21 d or
- Ivermectin 150-200 µg/kg single dose

Angiostrongylus cantonensis

Angiostrongyliasis
- Eosinophilic meningoencephalitis
- Dx: antigen detection (ELISA)
- Rx: No specific treatment, CSF removal
  - Prednisolone 60 mg/day x 14 days

Visceral Larva Migrans

- Ingest egg of dog/cat ascarids
  - Toxocara canis, Toxocara cati
- Mostly asymptomatic
- Visceral /ocular larval migrans
- Dx: Toxocara antibody (ELISA)

Rx: Supportive
- Prednisolone
- Albendazole 800 mg bid x 5-20 d (intestinal parasites only)

Cutaneous Larva Migrans

- Raised, erythematous, serpiginous, tunnel-like lesion 2-3 mm
- Containing serous fluid

Etiology
- *Angiolystoma braziliense* (cat, dog hookworm)
- *Angiolystoma caninum* (dog hookworm)
- Human hookworm
- *Strongyloides stercoralis* (larva currens)

Rx: - Albendazole 200-400 mg PO bid x 3-5 d
- Ivermectin 200 mcg/kg PO once
Taeniasis

- Eat undercooked pork (cysticercus cellulosae)

- Eat undercooked beef (cysticercus bovis)

- Eat Taenia solium egg or autoinfection

Rx of intestinal parasite:
- Praziquantel 10 mg/kg PO once

Taenia egg:
- Diameter 40 µ
- Round shaped
- Thick shell with radial striation

Cysticercosis

- Vesicular cyst
- Colloidal cyst

- Granular stage
- Calcifications

- Multiple rice-grain like calcification

Treatment of Neurocysticercosis

- Anticonvulsant therapy: mainstay of management of neurocysticercosis-associated seizure disorders

- Antiparasitic therapy
  - Symptomatic patients with multiple, live cysticerci ➔ cyst reduction, fewer and decreased seizure recurrences
  - Not benefit in patients with calcified cysts
  - Concomitant steroids
    - Desmethylzone 0.1 mg/kg/d 1 day prior antiparasitic drugs x 10 days
    - Combined albendazole (15 mg/kg/day) plus praziquantel (50 mg/kg/day)
    - Higher rate of complete resolution of brain cysts at 6 mo compared to standard dose of albendazole (64% vs. 37%, RR 1.75, 95% CI 1.10–2.79, p=0.014)

Flukes

- Opisthorchis viverrini
  - Undercooked fish

- Paragonimus westermani, Paragonimus heterotremus
  - Eat metacercaria in undercooked shrimp, crab

- Fasciolopsis buski
  - Giant intestinal fluke (largest human parasite)

Schistosomiasis (Blood flukes)

- Mesenteric venule:
  - S. japonicum, S. mansoni, S. mekongi

- Venule of lower urinary tract:
  - S. haematobium

- Thailand: S. japonicum

- Clinical form:
  - Schistosomiasis dermatitis: Acute schistosomiasis 2–8 wks
  - Chronic schistosomiasis

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Intestinal Protozoa

- Cryptosporidium parvum
- Cyclospora cayetanensis
- Cystoisospora belli
- Giardia lamblia

- Treatment
  - Cryptosporidium spp.: No effective treatment (Nitazoxanide)
  - Cyclospora cayetanensis, Cystoisospora belli: TMP-SMX DS 1 tab bid x 7–10days
  - Giardia lamblia: Tinidazole 2 g po x 1, Metronidazole 750 mg po tid x 7–10 days
  - Albendazole 400 mg po OD x 3 days