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# Parasitic Pulmonary Infections



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# Disclosure

- I have no financial or intellectual conflicts of interest related to this topic



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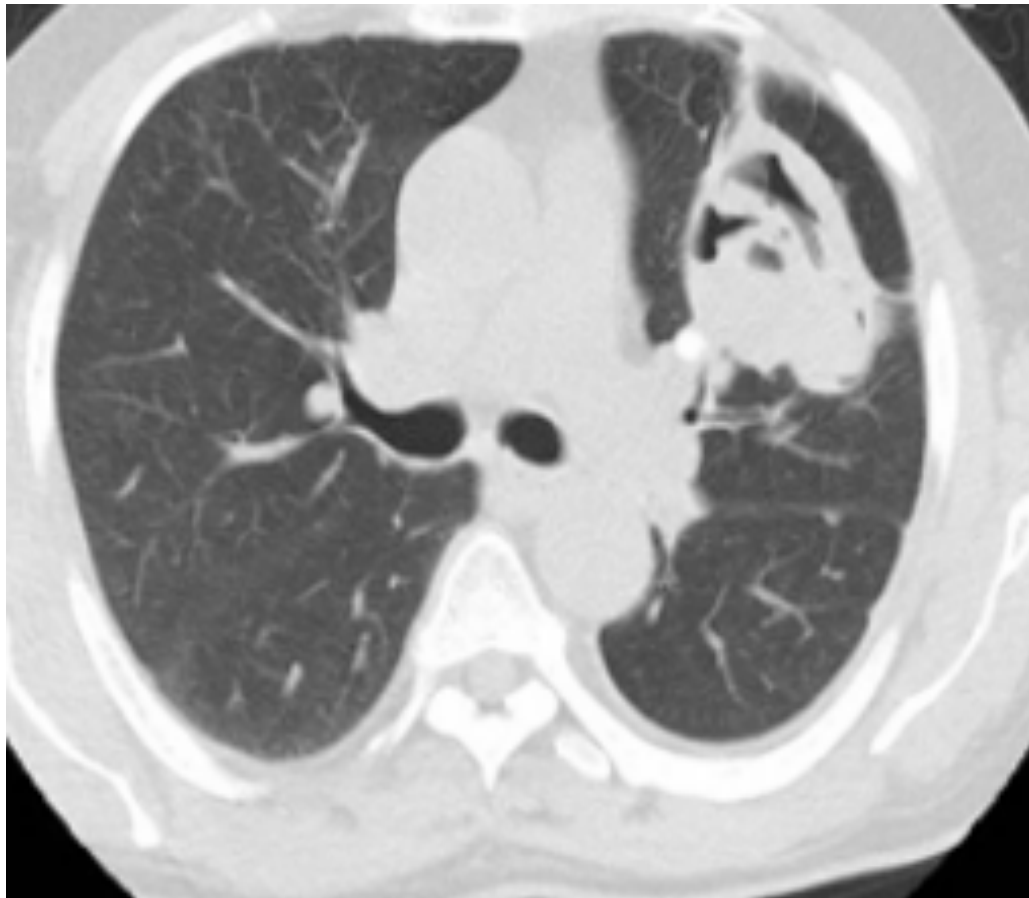
- Approach to parasitic pulmonary infections
  - Differential diagnosis according to manner of presentation
  - Immune status
  - Eosinophilia pattern
- Pulmonary hydatid disease
- Paragonimiasis
- Pulmonary Strongyloidiasis

# Question 1

- A 24-year-old man presented with left-sided tightening chest pain for three days and a few hours of productive coughing with blood-clotted sputum. The patient reported unintentional weight loss during the last month, intermittent night sweats but no fever or lethargy. His medical history was unremarkable, and he took no medicine. He had previously smoked for six months. The patient, a refugee from a rural Syria, had lived in Denmark for one year. He was exposed to sheep and dogs during his childhood.

# Question 1

General physical examination revealed fever, a temperature of 39°C, a heart rate of 76 beats per minute, a respiratory rate of 22 breaths per minute, and a blood pressure of 130/70 mm Hg. Apart from this, the clinical examination was unremarkable. Blood samples revealed an elevated CRP of 197 mg/l, leukocytosis ( $15.4 \times 10^9/L$ ) with a strong component of granulocytosis, but no eosinophilia



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# Question 1

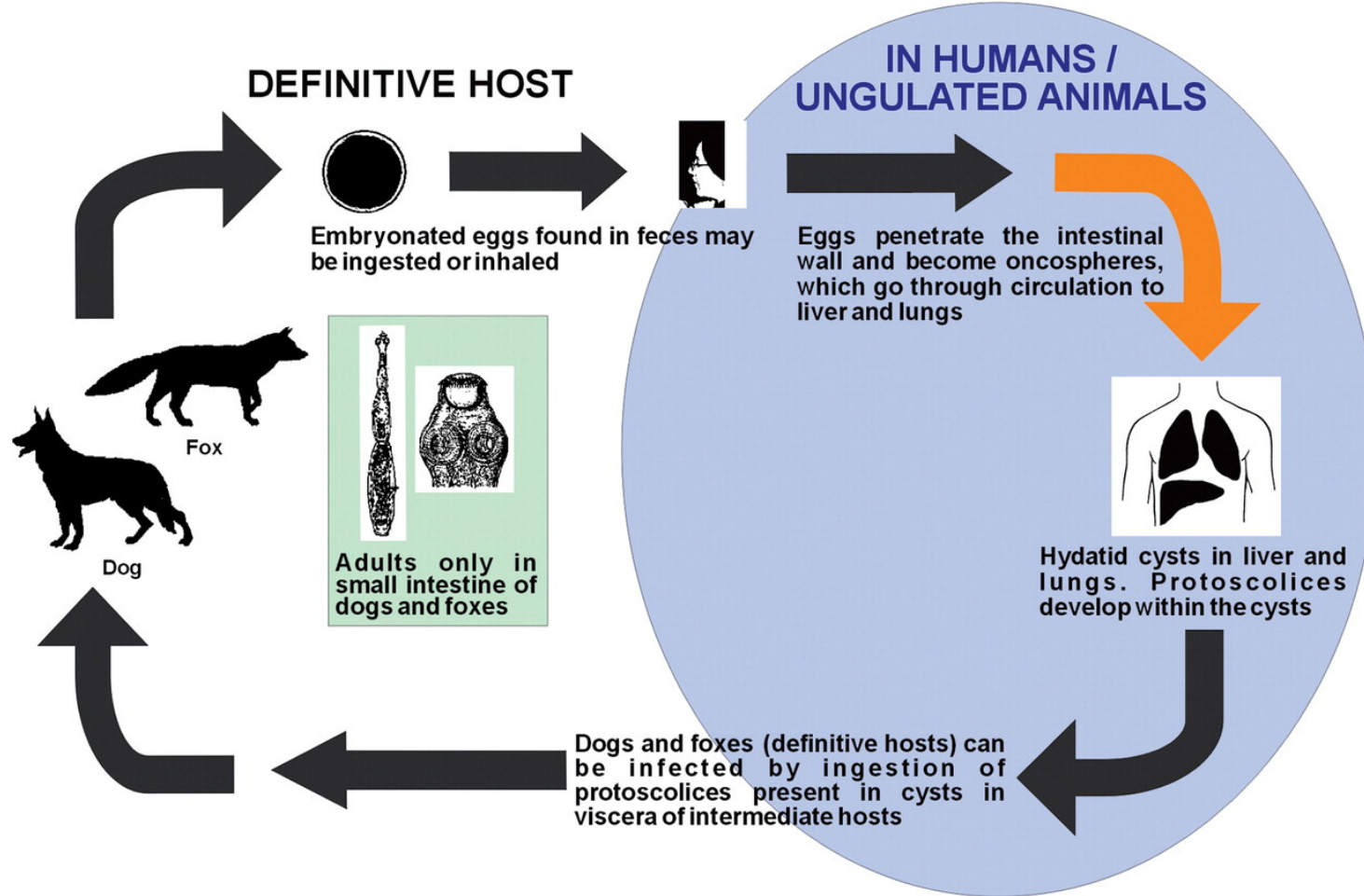
- What is the next best step in management?
  - Percutaneous aspiration
  - Transthoracic needle biopsy
  - Surgical excision
  - Medical management

# Question 1

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# Focal Lung Lesions--Cystic

- Hydatidosis
  - Caused by the larvae of *Echinococcus* tapeworm species
  - Majority by *E. granulosus*
  - Worldwide distribution, especially in South America, Middle East, sub-Saharan Africa, Russia and China
  - Less commonly exposed to *E. multilocularis*, which causes alveolar echinococcosis



# Hydatid Disease

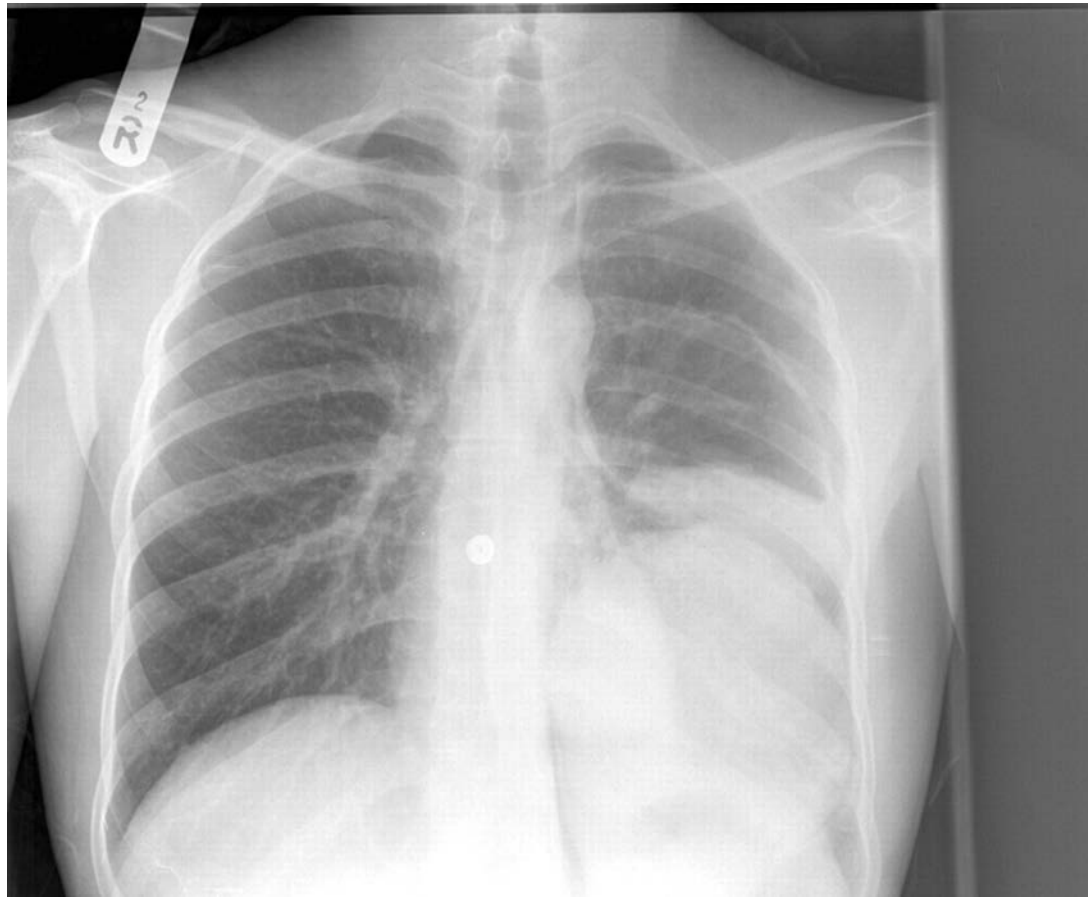
- Dogs are the definitive host
- Humans accidental intermediate hosts when consuming food contaminated with eggs
- Ingested eggs hatch, migrate from the intestine to the circulation
  - Eggs can also be inhaled, causing primary lung disease
- Travel to liver or lungs; cystic metacestodes develop
- Parasite grows to form a cyst filled with fluid
- Lungs can also be involved through transdiaphragmatic spread following rupture of liver cysts (85-90% single organ; 70% solitary cyst)

# Hydatid Disease

- Pulmonary presentation
  - Primary infection is asymptomatic and may remain so for years
  - Cysts often discovered incidentally on imaging
  - As cysts grow may cause symptoms related to compression of adjacent structures (cough, hemoptysis, chest pain)
  - Cyst rupture will cause chest pain and may may cause a hypersensitivity reaction, ranging from hives to anaphylaxis
  - Cysts may become secondarily infected and cause abscess or empyema formation
  - Calcification rare in pulmonary cysts unless non-viable

# Hydatid Disease

- Diagnosis
  - Less than 15% have eosinophilia, which generally occurs only if there is rupture and leakage
  - Serology can be supportive, but is not sensitive (50%)
    - False negatives common if cyst is intact
  - May need to rely on imaging characteristics and exposure history
  - Percutaneous aspiration and biopsy not recommended
  - Might occasionally see degenerated hooklets in sputum or pleural fluid

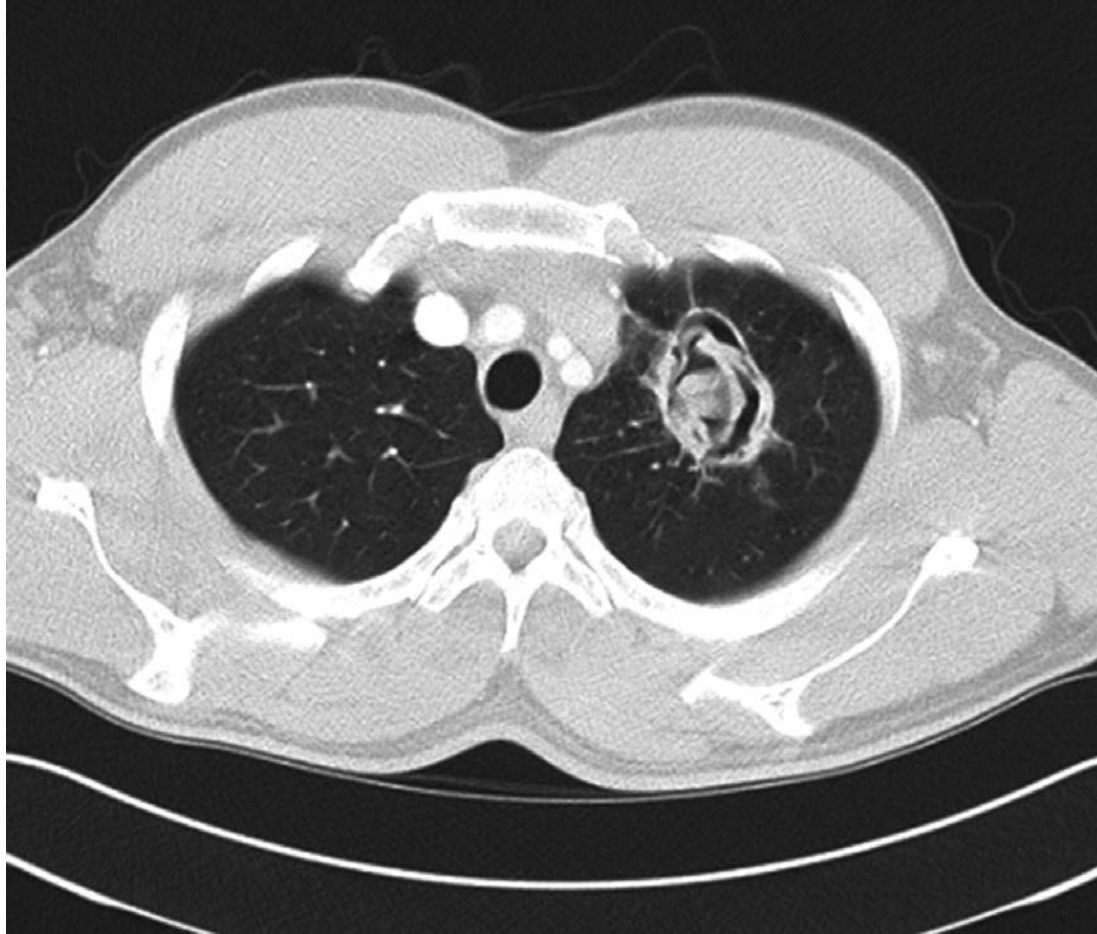


H Kunst et al. Thorax 2011;66:528-536

Cysts seen as single or multiple well-defined homogeneous lesions surrounded by normal lung tissue

Posterior segments and lower lobes most common





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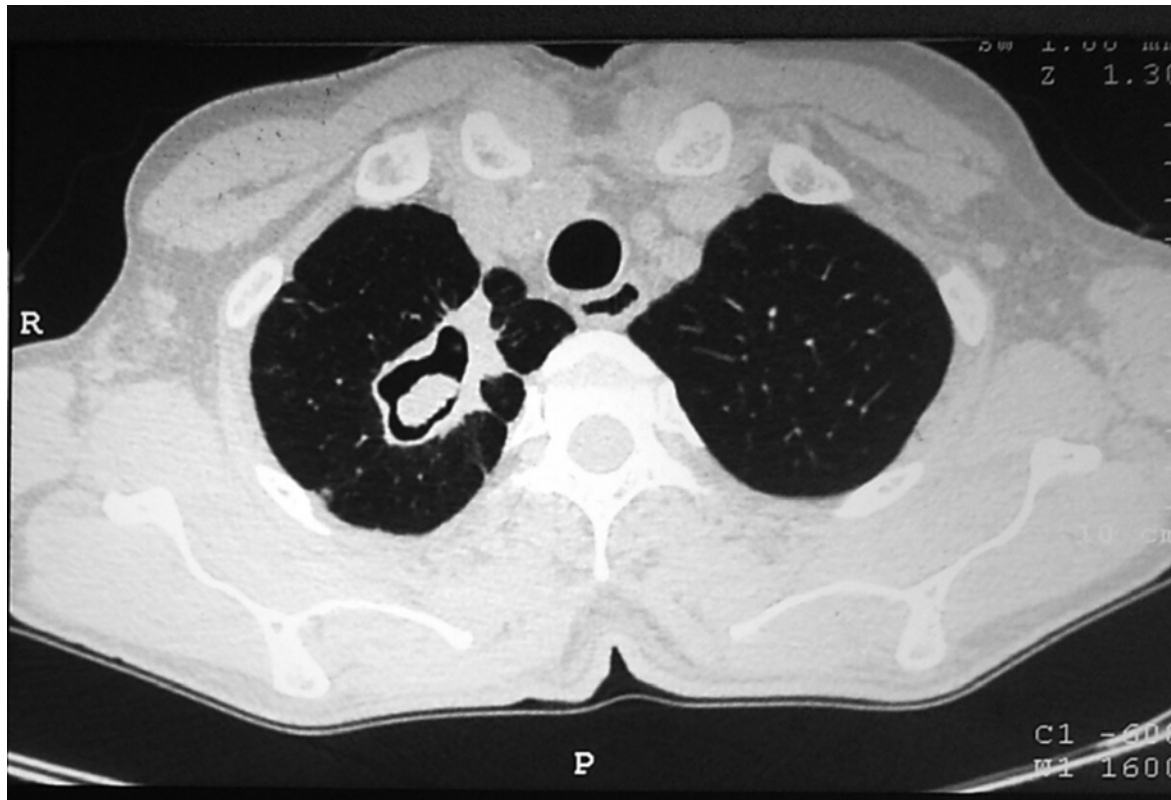
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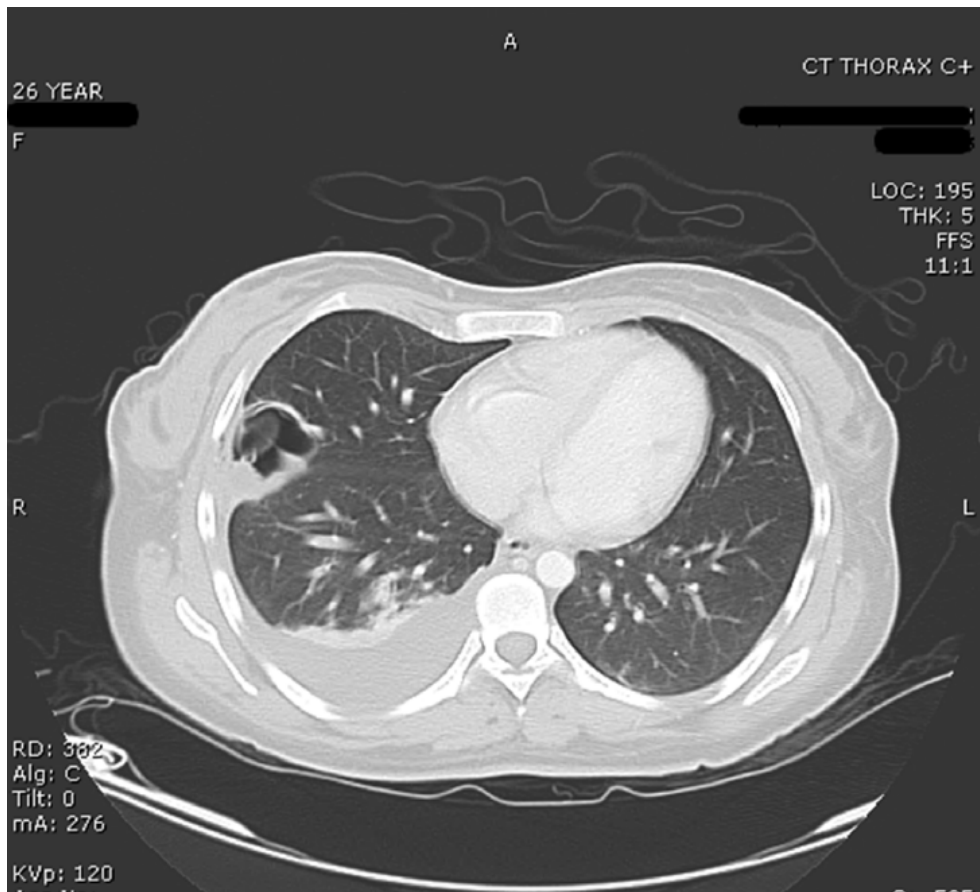
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## Monad's Sign



When fluid is completely expectorated, remaining solid components fall to the dependent part of the cavity, creating a mass within a cavity

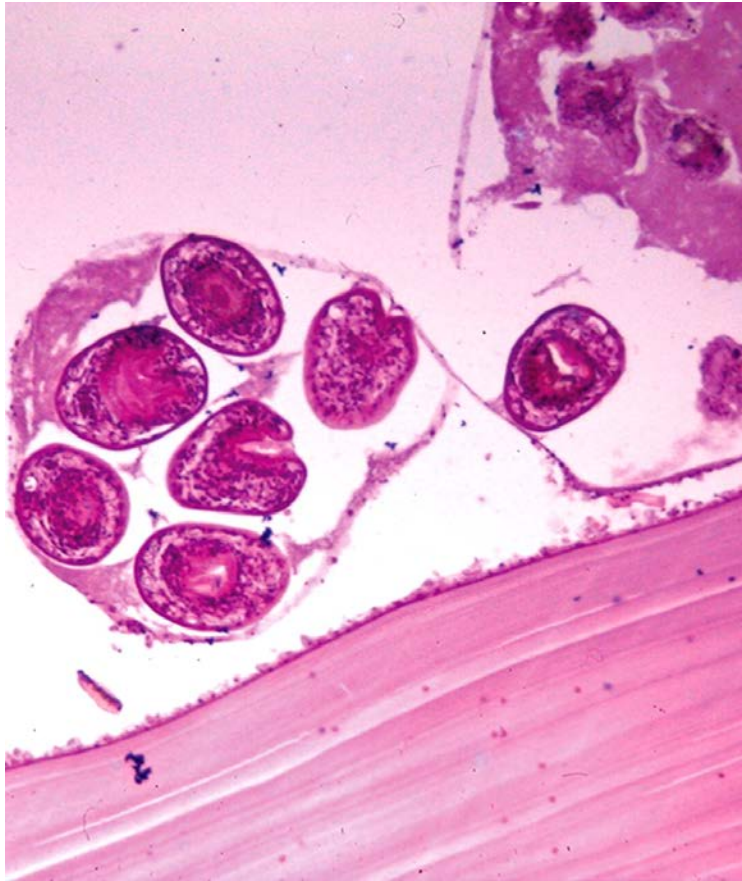


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Photomicrograph (original magnification,  $\times 40$ ; hematoxylin-eosin stain) obtained after surgical resection demonstrates the inner germinal layer, to which several daughter protoscolices of *E granulosus* are attached.

# Hydatid Disease

- Management
  - Surgical resection with careful attention to avoid cyst rupture
    - Recent literature suggests pre-treatment with albendazole might prevent/attenuate hypersensitivity if cyst ruptures\*
    - Postoperative therapy with a benzimidazole can reduce recurrence
    - In cases of multiple cysts or patients who cannot undergo operative resection, consider PAIR procedure
    - Case reports of complete resolution with oral albendazole alone

# Question 1

- What is the next best step in management?
  - Percutaneous aspiration (risk of rupture/dissemination/anaphylaxis)
  - Transthoracic needle biopsy (also risk of rupture)
  - Surgical excision
  - Medical management (considered only in non-surgical candidates)



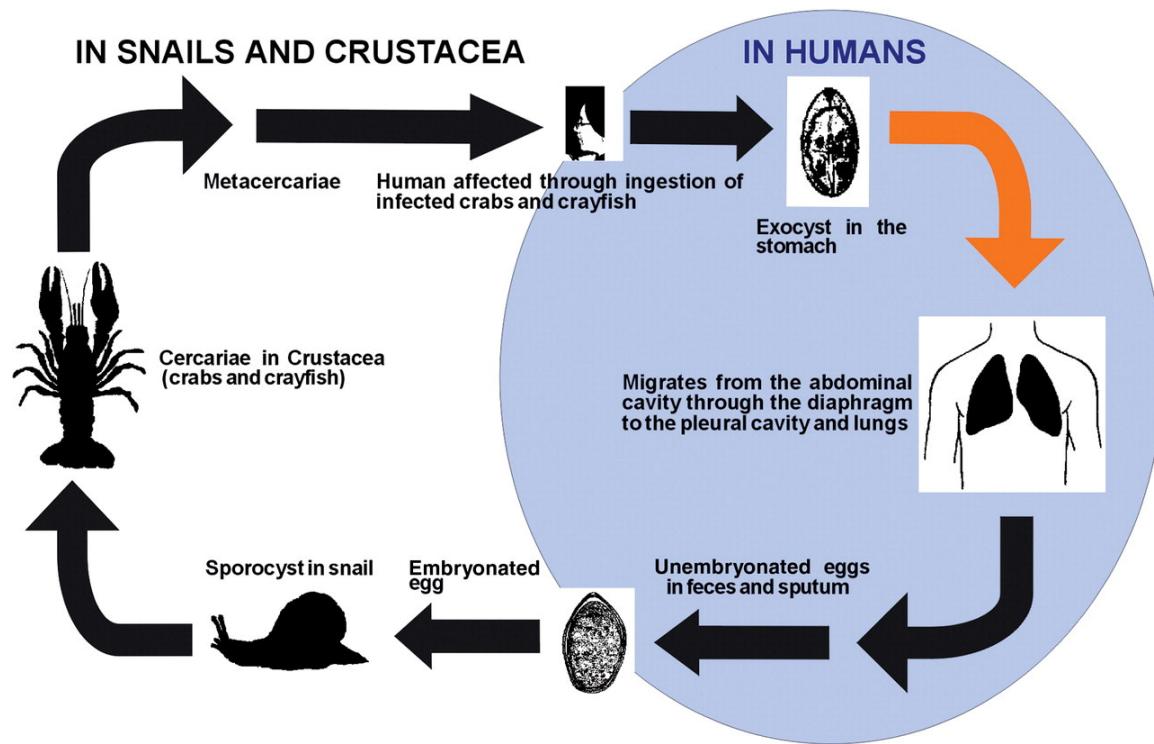
# Focal Lung Lesions--Coin

- Dirofilariasis
  - Dog heartworm *D. immitis*
  - Transmitted via mosquito to humans
  - Pass through the RV, but fail to mature and are lodged in pulmonary circulation
  - Most patients asymptomatic; most common presentation is coin lesion on imaging
  - No reliable serologic testing easily available; definitive dx by seeing worm on biopsy
  - Almost never needs to be treated. PET scanning can be useful in ruling out malignancy

# Focal Lung Lesions—Consolidation

- Paragonimiasis

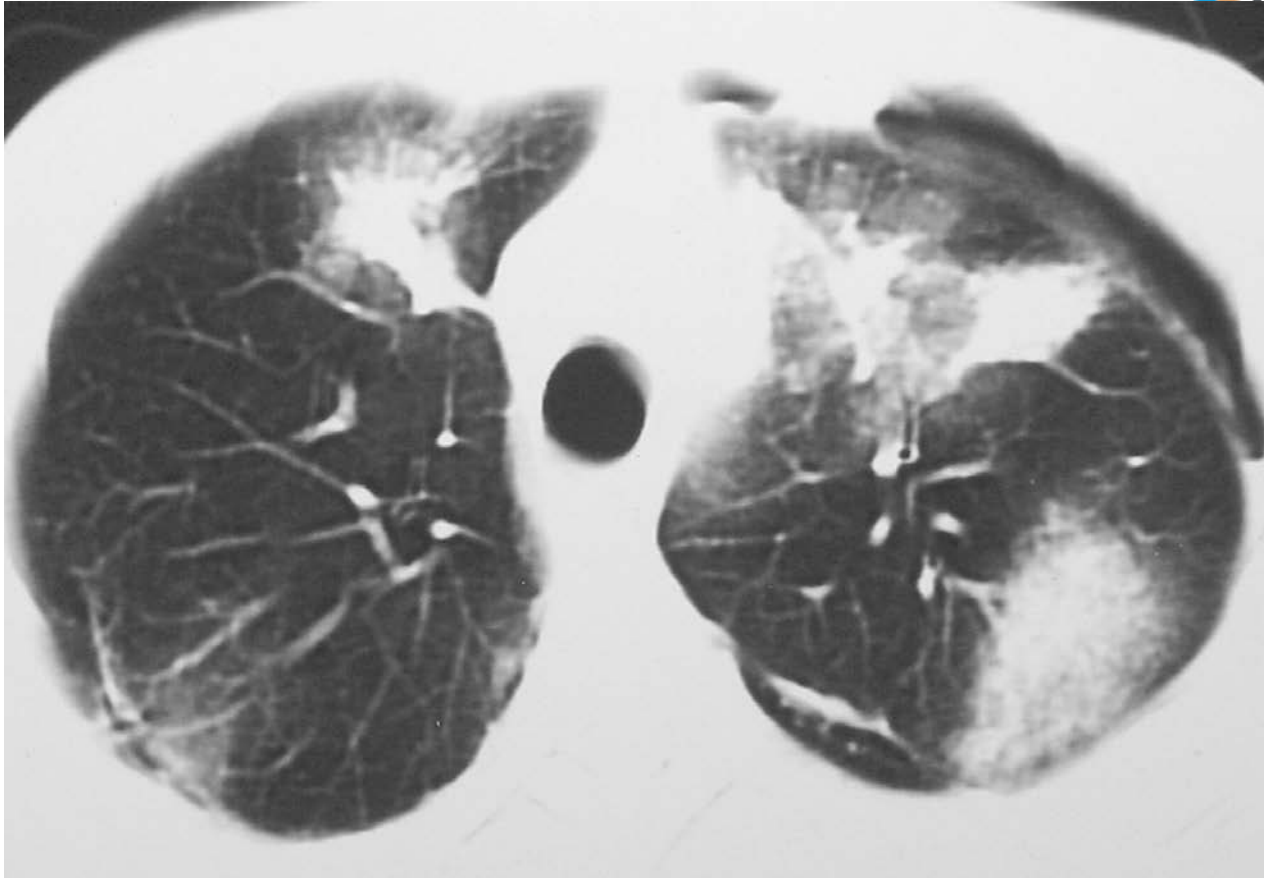
- Lung flukes;  
*Paragonimus westermani*  
most common





# Paragonimiasis

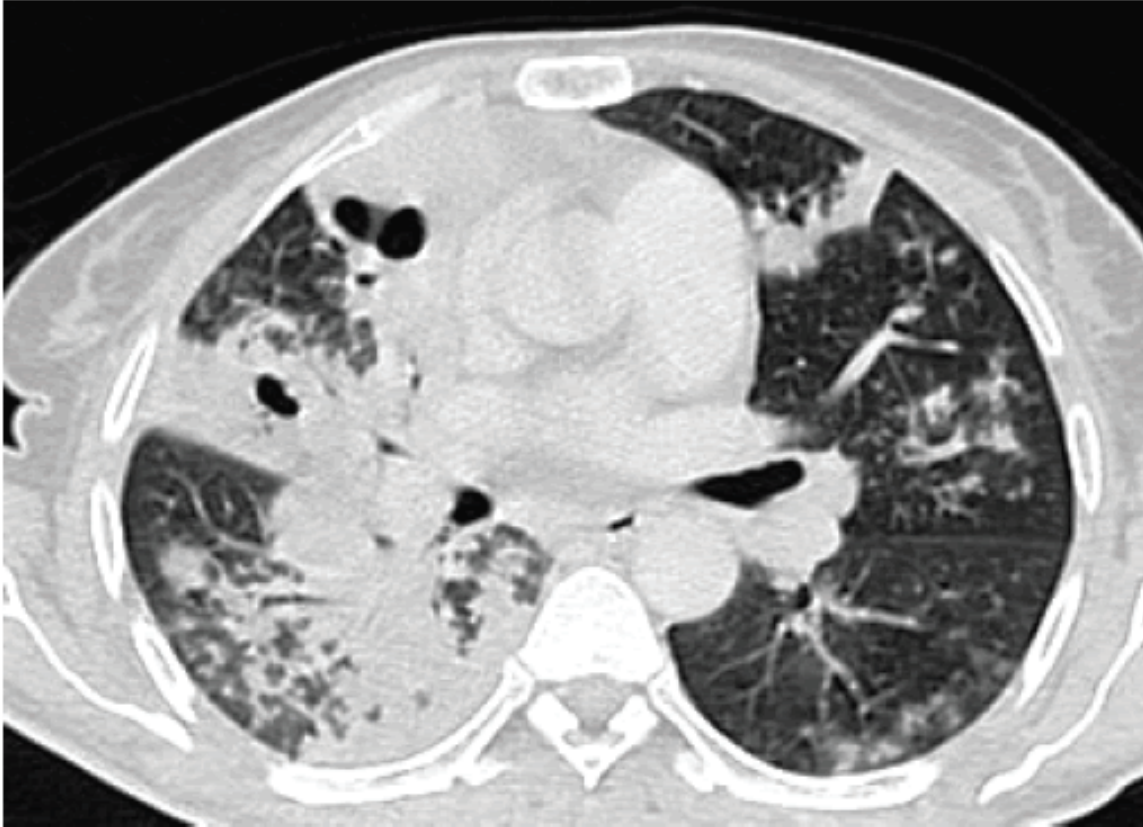
- Patients may present with chest pain, hemoptysis, chronic cough and fever
- Imaging will reveal patchy airspace consolidation, cystic shadows, and ring shadows; pleural thickening common
- Peripheral linear opacities are suggestive of worm migration
  - Peripheral or subfissural nodules with necrotic center common—often connected to linear track
- Isolated reports that intracystic worms can be detected on CT scanning
- Often confused with TB or malignancy; non-resolving CAP common; can be confused with chronic eos pneumonia



Paragonimiasis in a 35-year-old man. CT scan demonstrates bilateral ill-defined areas of consolidation and areas of ground-glass attenuation associated with left pneumothorax.

# Paragonimiasis

- Eosinophilia common; serum IgE may also be elevated (>80% of patients)
- Operculated eggs can be detected in sputum, BAL, feces
- CDC has highly sensitive and specific ELISA
- Treatment with praziquantel TID for two days



Pleuritis, empyema,  
abscess, fistula formation

## Question 2

- A 72 yo female from the Philippines was admitted with weakness, poor appetite, occasional coughing and dull back pain. No fever, dyspnea, chest pain, diarrhea or vomiting was noted. CXR done 6 weeks prior to presentation revealed a large left pleural effusion. Thoracentesis revealed a thick, anchovy like fluid.

# Question 2

- What is the next best step in the management of this patient?
  - Chest tube placement
  - Pleurodesis
  - Initiation of praziquantel therapy
  - Initiation of tinidazole therapy

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# Focal Lung Lesions--Consolidation

- Amoebiasis
  - Caused by *Entamoeba histolytica*; fecal-oral transmission
  - Trophozoites mature and form cysts in the intestine
  - In rare cases, the cysts can cause invasive amoebiasis....often leading to liver abscess
    - Risk factors include male sex, ASD, malnutrition, alcoholism and immunocompromised state
  - Amoebic pleuropulmonary disease the most common complication (15%) via direct extension; particularly in HIV infected individuals
  - Right pleural effusion and basal lung disease



# Amoebiasis

- Eosinophilia rare
- Trophozoites seldom found in sputum, pleural fluid
  - Expectoration of “anchovy like sauce” suggestive
- *E. histolytica* adhesin may be detected in feces
- Organism specific IgG-class antibodies
  - Trophozoites in pleural fluid, abscess fluid, or sputum
- Tinidazole or metronidazole, followed by diloxanide furoate or paromomycin

# Question 2

- What is the next best step in the management of this patient?
  - Chest tube placement (pleural fluid typically not complicated)
  - Pleurodesis (effusion will respond to treatment and does not recur)
  - Initiation of praziquantel therapy (used for worm infections, predominantly schistosomiasis)
  - Initiation of tinidazole therapy

# Diffuse Lung Disease—Transient Pulmonary Infiltrates

- Ascariasis
  - *Ascaris lumbricoides* round worm; fecal-oral transmission
  - Eggs hatch in intestine and larvae migrate via portal circulation to liver then lung
  - Larvae ascend to trachea, are swallowed, and develop into adults in the intestine
  - A small number of patients are symptomatic during larval migration (Loeffler's syndrome)
    - Allergic response with cough, wheeze, dyspnea, chest pain, fever
    - Peripheral eosinophilia common during migration, IgE elevates
  - Single dose of albendazole is treatment of choice

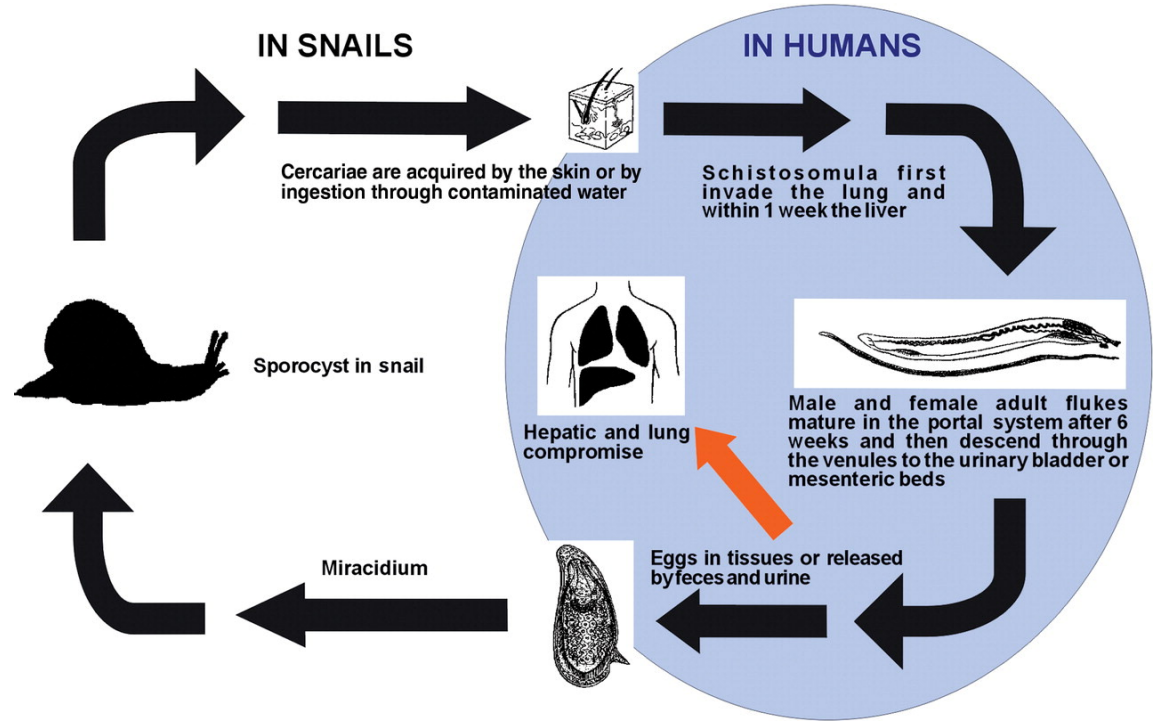
# Diffuse Lung Disease---Transient Pulmonary Infiltrates

- Hookworm Infections
  - Ancylostomiasis
  - Pulmonary manifestations mild
- Toxocariasis
  - Most infections in children and symptomatic

# Alveolar/Interstitial Changes

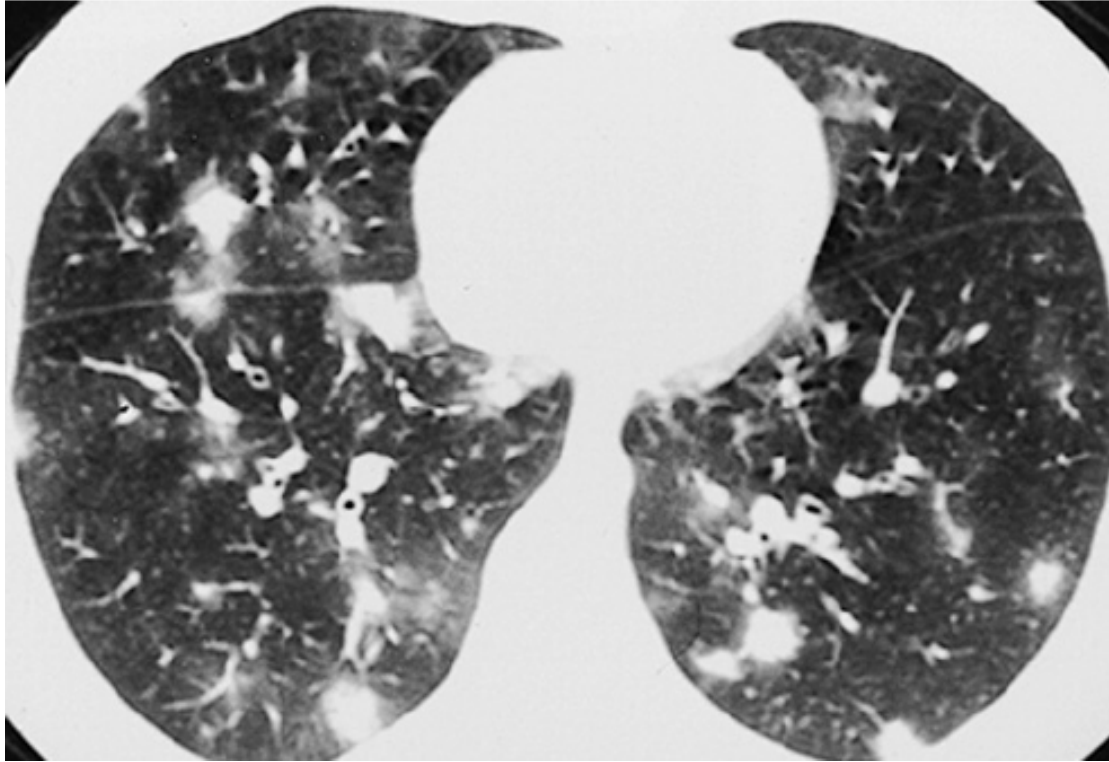
- Schistosomiasis

- Endemic in the tropics;  
*S. mansoni*, *S. haematobium*, *S. japonicum*



# Schistosomiasis

- Initial release of eggs may cause acute schistosomiasis (Katayama Fever)
  - Fever, chills, weight loss, diarrhea, abdominal pain, myalgias
  - Lymphadenopathy, HSM, peripheral eosinophilia
  - Diffuse pulmonary infiltrates
- Pulmonary infection fairly uncommon
- Chronic disease commonly causes pulmonary hypertension
- Peripheral eosinophilia in 65% of cases
- Treatment with praziquantel; less effective in advanced disease

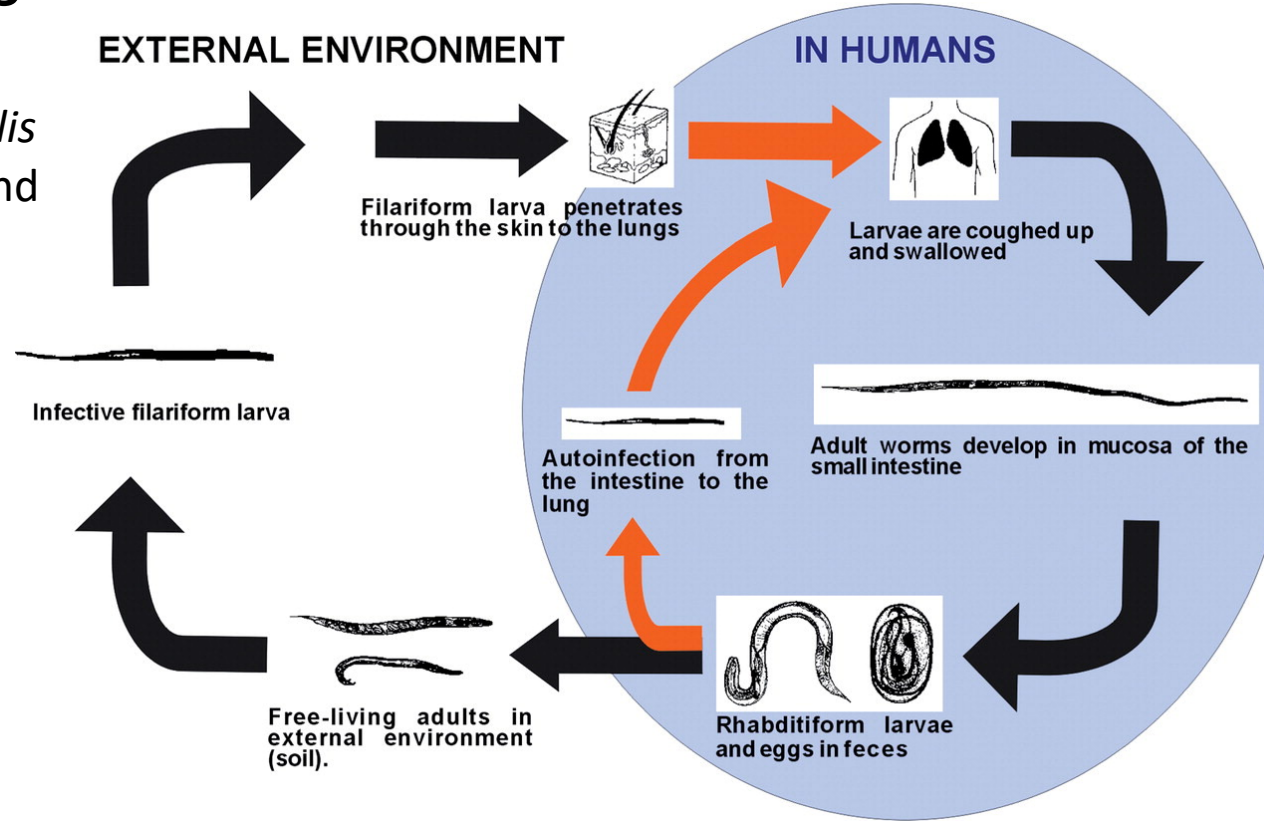


Nodular or ill-defined reticulonodular changes; interstitial and granulomatous changes in chronic disease; may see GGO

# Alveolar/Interstitial Changes

- Strongyloidiasis

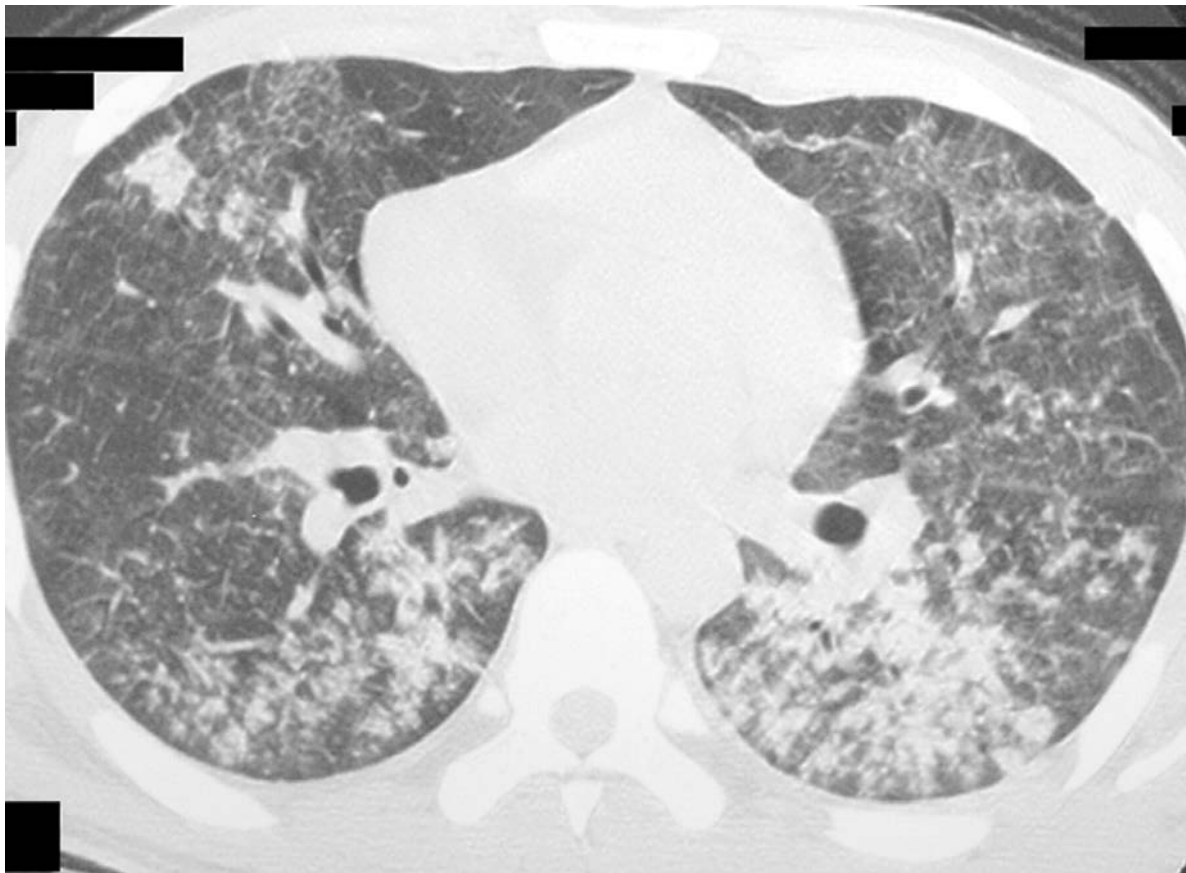
- Nematode  
*Strongyloides stercoralis*  
prevalent in tropical and  
subtropical regions



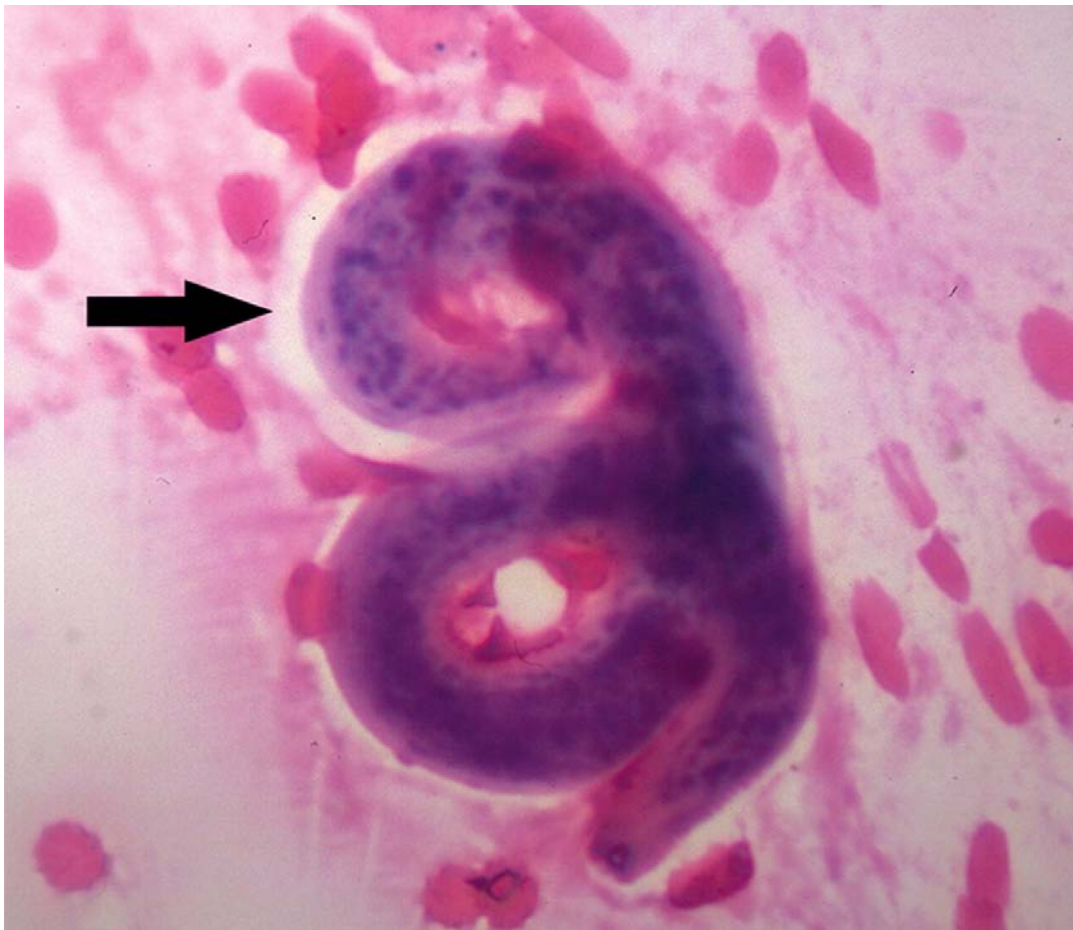


# Strongyloidiasis

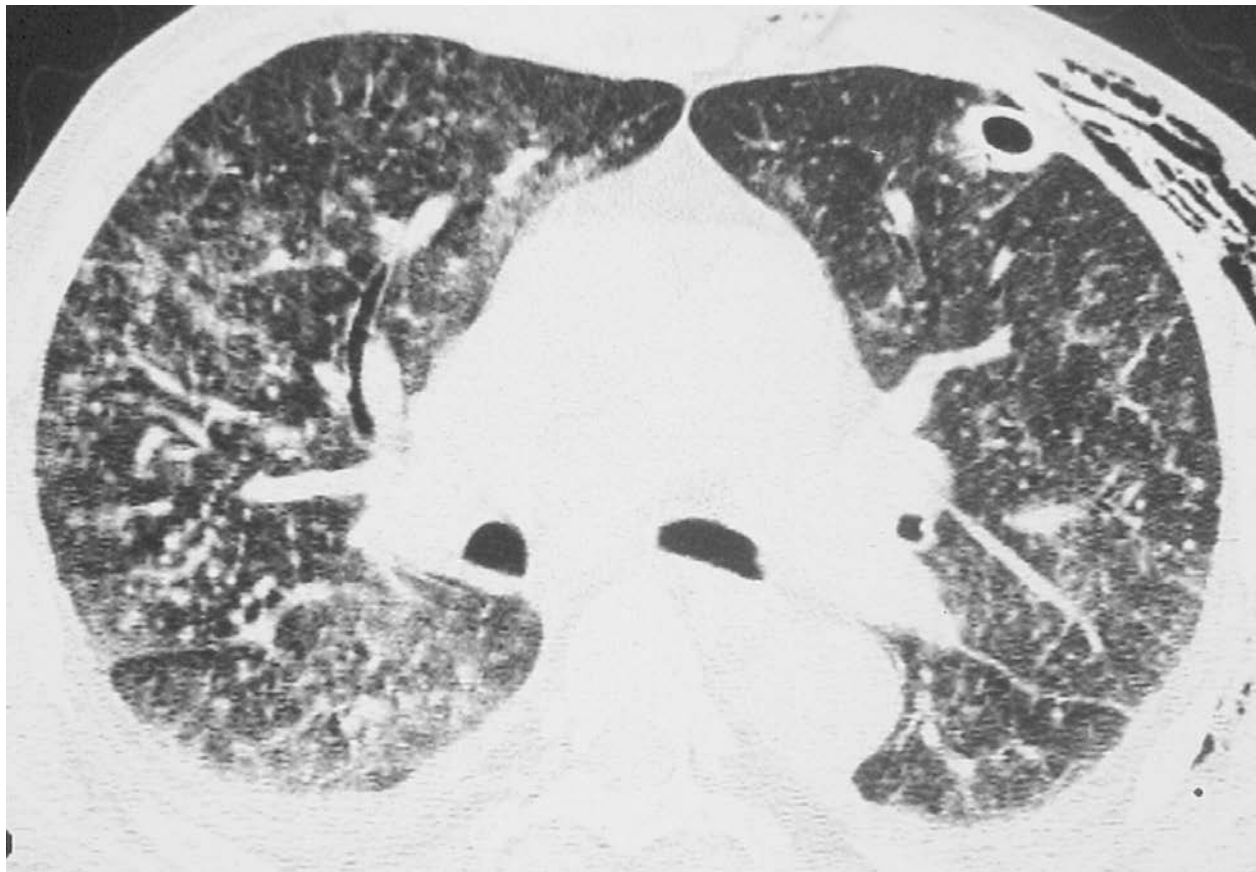
- Infection typically asymptomatic; mild symptoms during lung migration possible;
- Peripheral eosinophilia common
- Hyperinfection syndrome may occur in immunocompromised hosts; can progress to ARDS
- Diffuse bronchopneumonia can occur if gut bacteria accompany lung migration, which can also lead to ARDS
- Asthma-like symptoms may be present in immunocompetent patients
- In extensive disease may see diffuse alveolar hemorrhage



Strongyloidiasis in an 18-year-old man with hemoptysis. High-resolution CT clearly delineates areas of consolidation



Photomicrograph (original magnification,  $\times 40$ ; Giemsa stain) obtained after bronchoalveolar lavage shows a larva of *S. stercoralis* (arrow) surrounded by erythrocytes



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Hyperinfection syndrome and strongyloidiasis in a 63-year-old man with hemoptysis and chronic renal failure who was being treated with corticosteroids. High-resolution CT scan of the lungs demonstrates areas of ground-glass attenuation and micronodules that display a miliary pattern.

# Strongyloidiasis

- Definitive diagnosis made by finding larvae in the stool, sputum or duodenal aspirates
- Treatment with ivermectin is effective

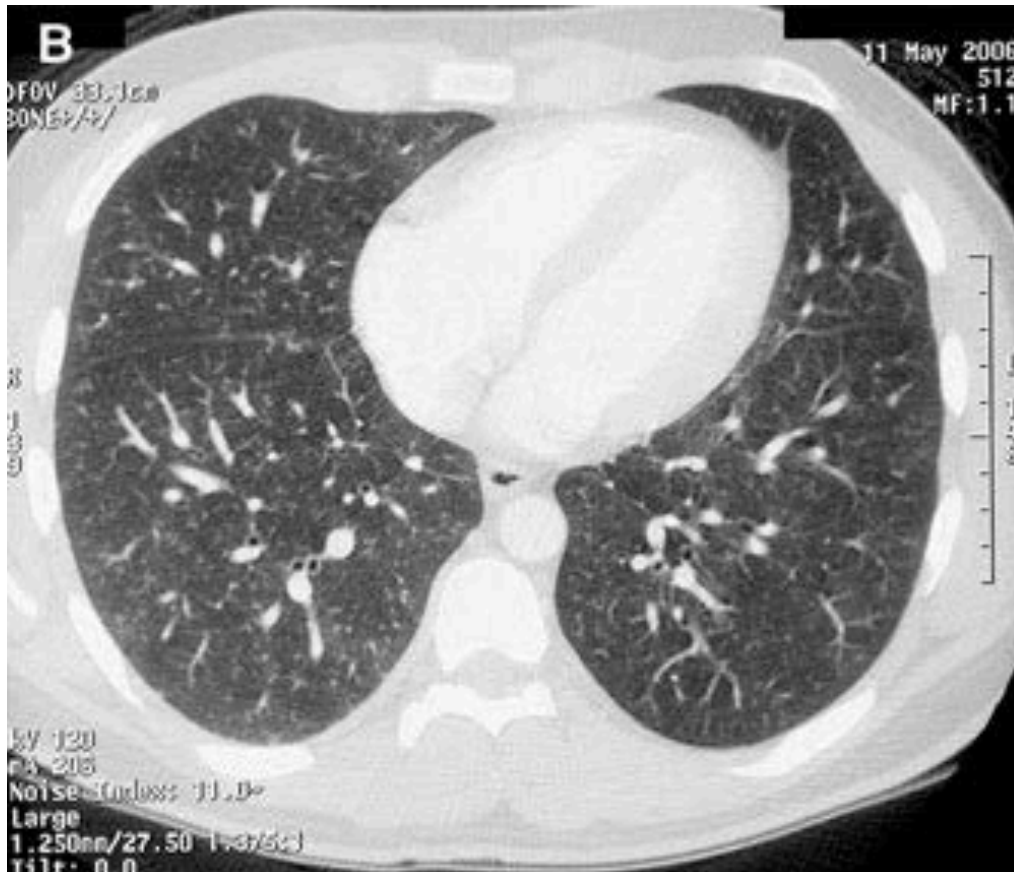
# Pulmonary Manifestations of Malaria

- *Plasmodium falciparum, malariae, ovale*
- Severe, complicated malaria characterized by MODS and ARDS (ARDS frequently associated with cerebral malaria); pregnant women particularly prone
- DAH also common in severe disease
- Thick and thin blood smears still the gold standard
- Intravenous artesunate useful in severe infection



# Tropical Pulmonary Eosinophilia

- Results from hypersensitivity to lymphatic *Wuchereria bancrofti* and *Brugia malayi*
- Slow onset over several months
  - As opposed to Loeffler’s syndrome (strongyloidiasis, ascaris) more acute
- Cough, dyspnea and wheezing, worse at night; “asthma-like symptoms”
- Peripheral eosinophilia present; serum IgE elevated; sputum can show Charcot-Leyden crystals
- Treatment with diethylcarbamazine; sometimes in combination with albendazole



Reticulonodular  
infiltrates; mediastinal  
adenopathy



# Airways Manifestations

- Ascariasis---may see parasite in the airways
- Strongyloidiasis----Bloody BAL; parasite in BAL
- TPE---BAL shows more than 50% eosinophils
- Schistosomiasis---BAL eosinophil predominance
- Paragonimiasis---bronchial stenosis due to mucosal edema
- Echinococcus---sac-like cyst in the airway

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