Pulmonary manifestations of Echinococcus and other parasites

Esther Freeman
Harvard Medical School
Radiology Clerkship
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Our patient Ms. R

- 29 year old female presenting with left-sided inspirational chest pain and “bubbling” sound
- 1 year ago, had left-sided rib/chest/LUQ pain
- Smoker
- No known history of trauma
- HIV negative
- Lived in St. Petersburg Russia until she was 17
- Remote travel to Turkish resort, Virgin Islands
- Fever of 101.5 F
Patient R: Complex Mass on PA CXR
Patient R: Complex mass on PA CXR

= thin walled cavity

= hyperdense solid component
Patient R: Complex mass on lateral CXR
Differential diagnosis of a cystic structure in the lung parenchyma

- Infection
  - Abcess
  - TB
  - Aspergillosis
  - Pneumocystis pneumonia (PCP)
  - Echinococcus

- Super-infected congenital lesions, such as
  - Bronchogenic cyst
  - Congenital cystic adenomatoid malformation (CCAM)

- Squamous cell carcinoma:
  - Primary
  - Metastasis

- Emphysema
- Post-traumatic bullae
Patient R: Complex mass on non-contrast chest CT
Patient R: Complex mass on chest CT w/ contrast

BIDMC, PACS
Patient R: Complex mass on chest CT w/ contrast
Has our differential changed?

The mass is thin-walled with an air crescent sign:

- Infection
  - Abcess
  - TB
  - Aspergillosis
  - Pneumocystis pneumonia (PCP)
  - Echinococcus

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  - Bronchogenic cyst
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- Squamous cell carcinoma:
  - Primary
  - Metastasis

- Emphysema
- Post-traumatic bullae
Companion Patients 1 & 2: Lung Abscess on CXR and CT

Companion Patient 1
Thick-walled abscess with an air fluid level

Companion Patient 2

http://www.mevis.de/~hhj/Lunge/xSammlungInf2Fr.html
Companion Patients 3 & 4: Cavitary TB on CXR and CT

Companion Patient 3
Thick-walled

Companion Patient 4
Infiltrate with multiple cavities

*Radiographics. Tuberculosis from head to Toe. 2000;20:449-470*
Companion Pt 5: Mobile aspergilloma within pulmonary cystic cavity (CT)

Companion Patient 5

“Air crescent sign”

Companion Pt 5: Mobile aspergilloma within pulmonary cystic cavity (CT)

“Air crescent sign”

Companion Pt 6: PCP Pneumonia (CT)

Companion Patient 6

Companion Patient 7: Bronchogenic Cyst on CXR and CT

Companion Patient 7

Companion Patient 8: Complicated bronchogenic cyst on CXR and CT

Companion Patient 8

Thick-walled, air fluid level

Companion Pts 9, 10, &11: Congenital cystic adenomatoid malformation (CCAM)

Companion Patient 9

Companion Patient 10

Companion Patient 11: Infected w/ air fluid levels

Radiographics Rosado-de-Christenson and Stocker 11 (5): 865.

Radiographics. Berrocal et al. 2003;24:e17
Companion Pt 12: Primary Squamous Cell Carcinoma on CT

Companion Patient 12
Multiple, thick-walled cavities

Companion Patients 13 & 14: Cavitating metastases of squamous cell carcinoma on CXR and CT.

Companion Patient 15: Bullous emphysema on CXR and CT

Radiographics. 2002;22:S119-S135

Companion Patient 15: Hx of IV drug use and smoking
Companion Patient 16: thick-walled pneumatocele w/ air fluid level

*Radiographics. Pneumomediastinum Revisited.* 2000;20:1043-1057
Companion Patient 17: Pneumatocele (post staph)

Let’s return to Patient R

She returned to the hospital 10 days later with worsening symptoms
2nd presentation to hospital

- Worsening chest pain radiating to left shoulder
- Chills
- Increasing “cough attacks”
- Negative Weinberg reaction
Patient R: Complex mass on PA CXR over time

Day 1

Day 10

BIDMC, PACS
Patient R: Complex mass on CXR over time

Day 1 vs. Day 10
Patient R: Mass on non-contrast chest CT (2nd presentation to hospital)
Patient R: Mass on non-contrast chest CT

(2nd presentation to hospital)
Narrowed Differential Diagnosis

- Infection
  - Echinococcus
  - Abscess
- Super-infected congenital lesions, such as
  - Bronchogenic (congenital) cyst
  - Congenital cystic adenomatoid malformation
Diagnosis: Echinococcus (Hydatid Disease)
Echinococcus

- Echinococcus = cestode (tapeworm)

- Cystic echinococcus:
  - *Echinococcus granulosus, E multilocularis, E vogeli*

- Infection from ingesting foods/fluids contaminated w/egg-containing feces

- Released larvae (oncospheres) invade bowel wall, migrate to portal system initially

- In lung, can be unilocular, alveolar or polycystic
Echinococcus (E Granulosus)

users.unimi.it/parassit/immagini.htm

http://www.atlas.or.kr/
Echinococcus life cycle

DEFINITIVE HOST (DOG)

Ingestion of contaminated viscera

Pedicle or stalk

Daughter cyst

Scolex

Hydatid sand

Cyst

IMMATURE FORMS

Daughter vesicle (brood capsule)

LAYERS

PERICYST (Modified host cells)

MIDDLE LAMINATED MEMBRANE (ACellular)

GERMINATIVE

ADULT WORM

Proglottide

Hooklets

EGG

Ingestion while grazing

Intermediate host (sheep)

Human hydatidosis

Dogs

Sheep

Ingested eggs are passed in dog's feces and ingested by sheep, which are the intermediate hosts. The eggs hatch in the abomasum of the sheep, releasing oncospheres that penetrate the intestinal mucosa and enter the bloodstream. The oncospheres then travel to various organs, where they develop into cysts. The definitive host (dog) acquires the infection by ingesting the infected sheep where the cysts develop. The life cycle is completed with the release of new eggs in the dog's feces.
Echinococcus worldwide

Red = E granulosus; Black = E multilocularis; Green = E vogeli

Companion Patients 18 & 19: Echinococcus in the liver on CT

Companion Patient 18

Companion Patient 19

Radiographics. Hydatid Disease: Radiologic and Pathologic Features and Complications 2000;20:795-817
Routes to lung

- Transdiaphragmatic
  - Parasite migrates from liver to pleural cavity
- Hematogenous spread
  - Direct hematogenous dissemination to lung possible
  - 10-30% of patients have only lung involvement
Companion Patient 20 & 21: Unilocular vs. polycystic echinococcus on CT

Unilocular cystic: E granulosus
(lung involvement more common)

Polycystic: E vogeli
(lung involvement rare)

Pathology: Echinococcal Lung Cyst
Typical Clinical Presentation of lung involvement

- Asymptomatic for months – years
- Cough
- Hemoptysis
- Bilioptysis
- Chest pain
- Fever
- Symptoms relating to complications (next slide)
Complications

- Hepatic complications:
  - Rupture & anaphylaxis
  - Infection
  - Exophytic growth
  - Peritoneal seeding
  - Transdiaphragmatic migration
  - Perforation into hollow viscera
  - Biliary communication
  - Portal vein involvement
  - Abdominal wall invasion
  - Hematogenous spread

- Pulmonary complications:
  - PE
  - Pneumothorax
  - Rupture & anaphylaxis (less severe)
  - Bacterial infection of cyst post-rupture
Treatment

- Albendazole, Mebendazole, Praziquantel
  - Long course
  - Ideally, pre-surgery
- Surgery
Other Parasitic Infections with Thoracic Manifestations

- **Protozoa**
  - Amebiasis
  - Malaria
  - Trypanosomiasis

- **Nematodes**
  - Ascariasis
  - Strongyloidiasis
  - Dirofilariasis

- **Cestodes**
  - Cystic echinococcosis

- **Trematodes**
  - Schistosomiasis
  - Paragonimiasis
Protozoa: Malaria

- *P. falciparum, P. vivax, P. ovale, P. malariae*
- Fever, chills, sweating, anemia, leucopenia, splenomegaly
- Diagnosis: trophozoites within erythrocytes on smear
- Pulmonary manifestation: ARDS

http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Malaria_il.htm
Companion Patient 22:

*P falciparum* malaria - ARDS

Trematodes: Schistosomiasis

- *S. hematobium, S. mansoni, S. japonicum*
- 2nd cause of mortality due to parasites
- Infection from skin exposure to water infected w/ cercariae excreted by snails
- Penetrate skin, migrate to lung then liver

Lifecycle of Schistosomiasis

IN SNAILS

Cercariae are acquired by the skin or by ingestion through contaminated water

Sporocyst in snail

IN HUMANS

Schistosomula first invade the lung and within 1 week the liver

Hepatic and lung compromise

Male and female adult flukes mature in the portal system after 6 weeks and then descend through the venules to the urinary bladder or mesenteric beds

Eggs in tissues or released by feces and urine

Schistosomiasis

Day 1-2 SKIN

Day 4-7: LUNG

Day 8: PORTAL

Companion Patient 23: Early pulmonary schistosomiasis on CT

Companion Patient 24: Advanced pulmonary schistosomiasis - cor pulmonale
Protozoa: Amebiasis

- *Entamoeba histolytica*
- 3rd cause of mortality from parasites
- Liver abscess most common non intestinal
- Pleuropulmonary involvement next most common manifestation
  - Direct from liver abscess
  - Hematogenous spread
  - Aspiration
Amebiasis lifecycle
Companion Patients 25 & 26: Amebiasis

Companion Patient 25
Pleural effusion, consolidation

Companion Patient 26
Elevation of hemidiaphragm, consolidation, cavitation

Let’s return to our patient, Ms. R

She underwent left lower lobectomy
Patient R: CXR s/p lobectomy

Day 10 (course), immed post surg

Day 12 (course), post op day 2

Portable AP semi-upright

PA
Patient R: CXR s/p lobectomy

Day 28 (course), post op day 18
In conclusion…

A Dipyldium caninum says goodbye…

http://ipath.blogs.com/photos/uncategorized/tapeworm_1.jpg
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