Zoonoses

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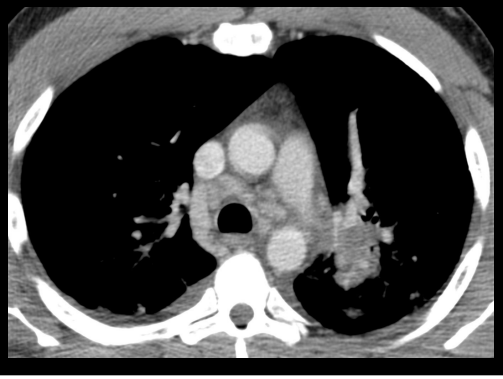
CHESTRAD 2023
A Case Review and Lecture Series
Saturday 15th July - Sunday 16th July - Monday 17th July
27 CPD Points

1

Lung Cancer or Tularemia?



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Introduction

- Zoonoses is derived from the Greek *zoon* meaning animal and *nosos* meaning illness.
- Spread to humans via animal bites, arthropod vectors, and direct contact.
- Some zoonotic infectious agents can mutate and undergo human-to-human spread and become more virulent, more deadly, and more difficult to contain and treat.

3

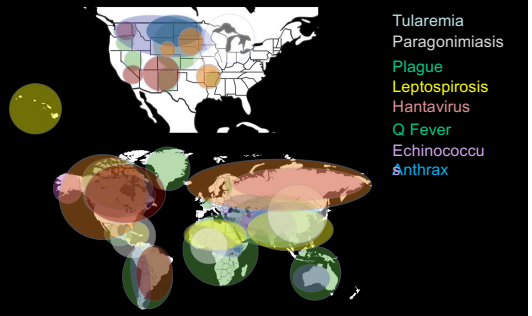
Objectives

- Identify some zoonotic organisms and their respective animal vectors
- List signs and symptoms of infection
- Illustrate cardiothoracic imaging findings of zoonoses
- State diagnostic tools

4

Zoonoses

- Tularemia
- Plague
- Anthrax
- Leptospirosis
- Hantavirus
- Echinococcus
- Paragonimiasis
- Q Fever



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Tularemia

- *Francisella tularensis* - first isolated in Tulare, CA in a dead ground squirrel
- Edward Francis and his team of investigators established link in 1921
- Possibly used as biological warfare in the Neshite-Arzawan conflict in 1320–1318 BC via diseased rams causing the “Hittite Plague”.

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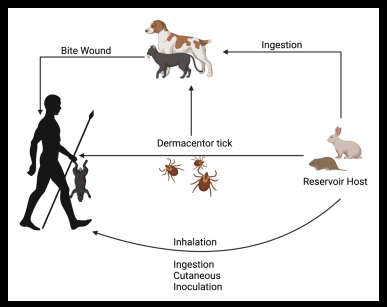
Tularemia

- Rabbits and rodents
- Entry through skin, eyes, mouth, lungs
- Route of entry affects clinical manifestations
- Pneumonic tularemia is the most deadly



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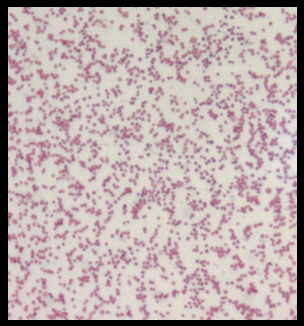
Tularemia

- Mass-like consolidation most common
- Marked lymphadenopathy
- Scattered lung nodules
- Patchy consolidation with pleural effusion less common



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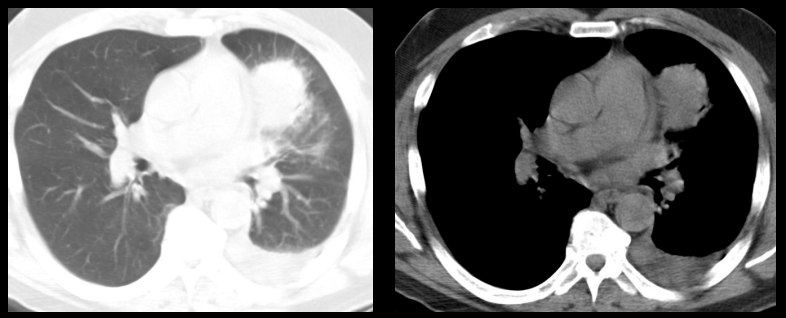
Tularemia



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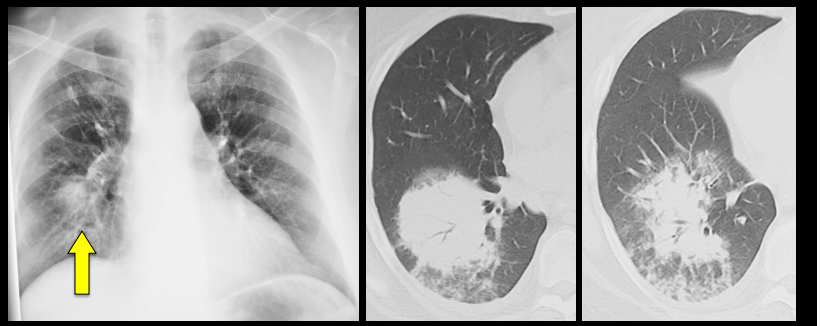
Tularemia



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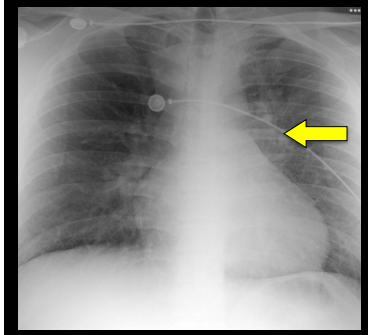
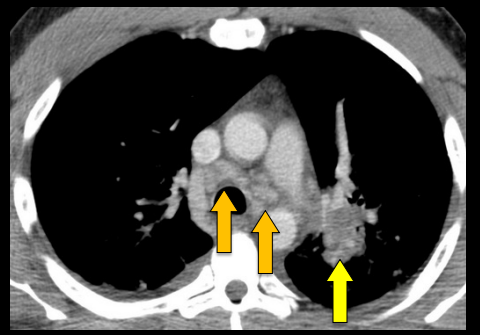
Tularemia

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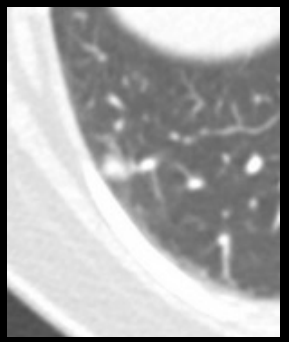
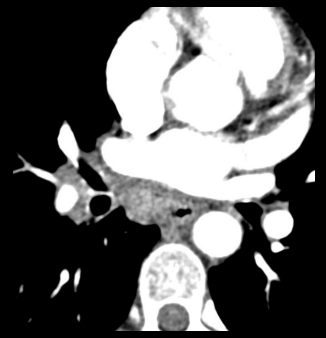
Tularemia

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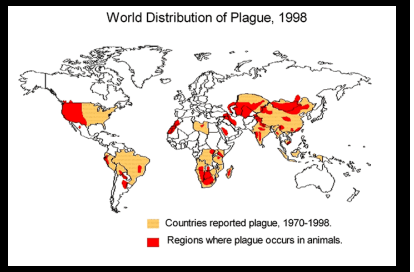
Plague

- *Yersenia pestis* – plague epidemics/pandemics reported throughout history
- Cause of Black Death in 14th century Europe
- Endemic in Peru, Madagascar, and Congo
- Carriers of the recessive gene causing Familial Mediterranean Fever have natural immunity



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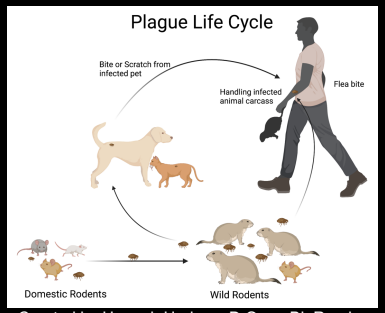
Plague

- Rodents
- Entry through skin, mucous membranes, lungs
  - Bubonic plague
  - Pneumonic plague
  - Septicemic plague



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Plague

- Nodules and masses initially
- Rapid progression to diffuse lung consolidation
- High index of suspicion required
- Pneumonic plague often fatal if not treated promptly

Li Y-F. et al. *BMC Infect Dis* 2016

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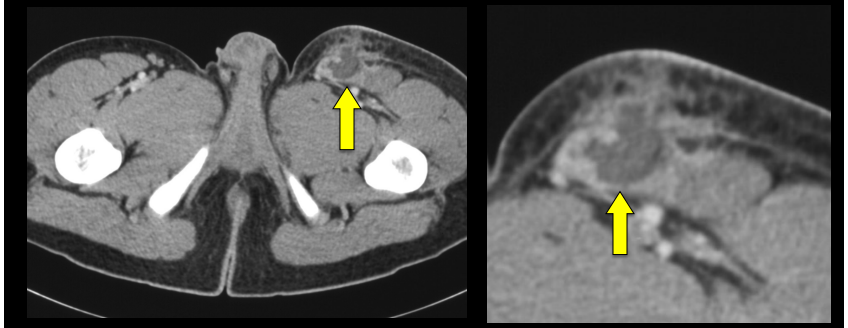
Plague



🔑 Hematogenous spread can lead to pneumonic plague

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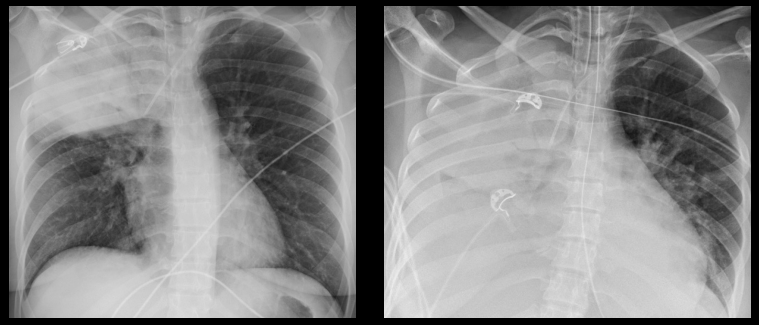
Plague



🔑 Radiographic progression is often very fast

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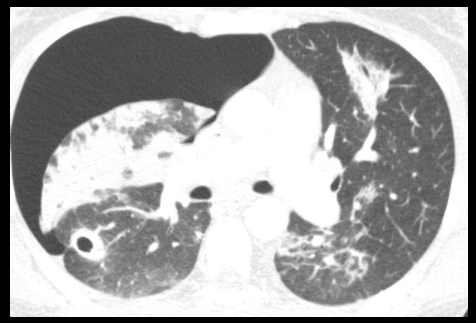
Plague



🔑 Hemorrhagic necrosis and increased lung compliance → barotrauma

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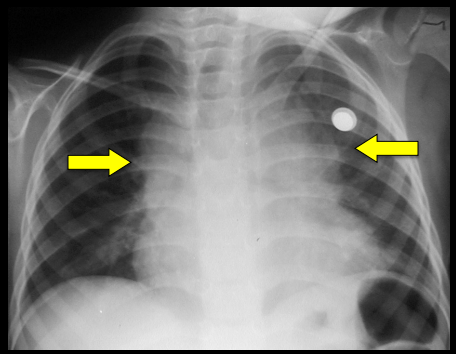
Plague



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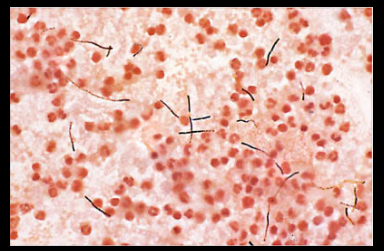
Anthrax

- *Bacillus anthracs* – studied by Koch when he developed his postulates of the germ theory of disease



Borio L et al. *JAMA* 2001

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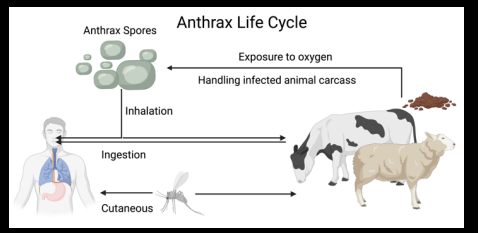
Anthrax

- Domesticated livestock
- Entry through skin, mucous membranes, lungs, ingested
  - Cutaneous anthrax
  - Inhalation anthrax
  - Gastrointestinal anthrax



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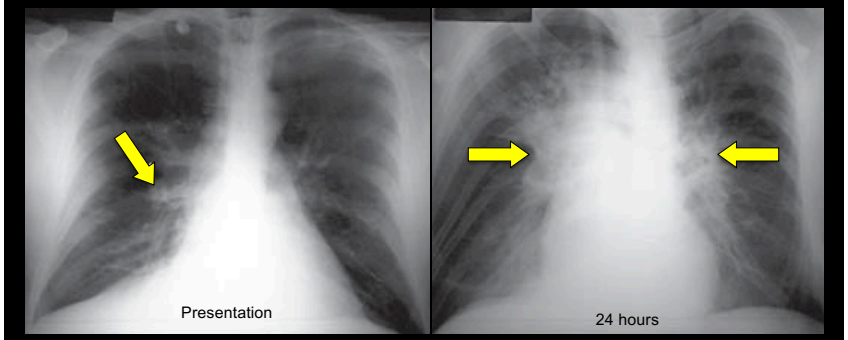
Anthrax



Borio L et al. *JAMA* 2001

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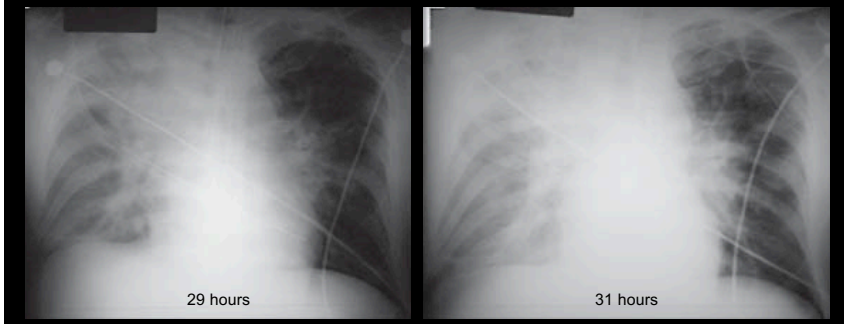
Anthrax



Borio L et al. *JAMA* 2001

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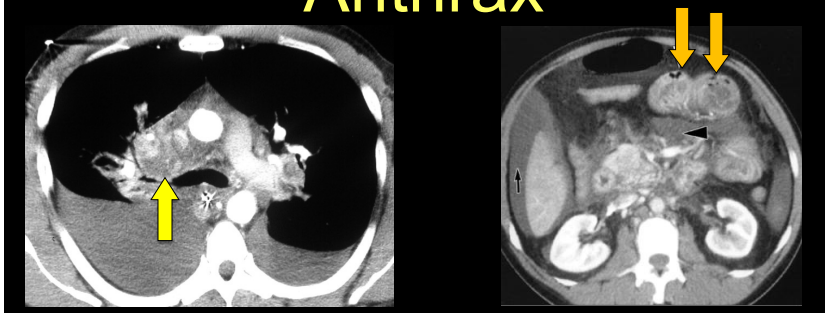
Anthrax



Wood BJ et al. *AJR* 2003

🔑 Lymphadenopathy most common finding and often apparent on CXR

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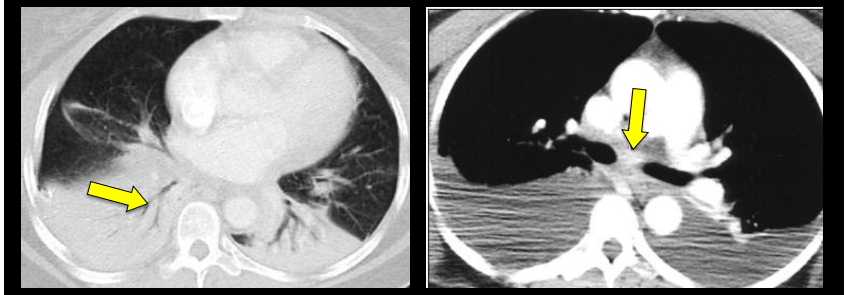
Anthrax



Wood BJ et al. *AJR* 2003

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Leptospirosis

- Weil 1886
  - Febrile illness
  - Icterus, splenomegaly, renal failure, and conjunctivitis
  - Associated with outdoor occupations where people were in contact with water.
- *Leptospira interrogans* (spirochete) identified in 1907 by Stimson on autopsy

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Leptospirosis

- Descriptions in ancient texts of similar clinical syndromes
  - Europe: cane cutters disease and swine-herd's disease
  - China: rice field jaundice
  - Japan: Akiyami (autumn fever)

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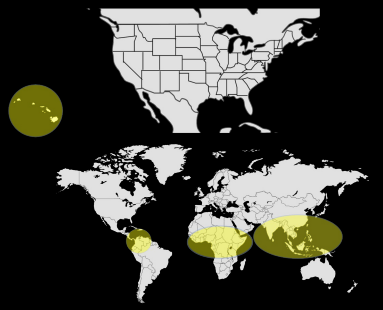
Leptospirosis

- Most widespread zoonosis in the world
- Tropic and subtropic regions most common
- Rural farming most common
- Occasional outbreaks associated with floods



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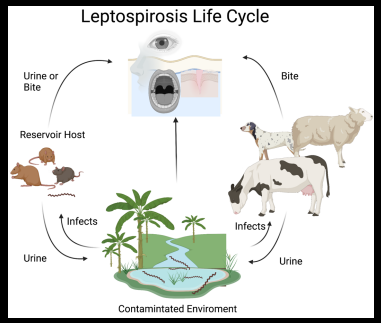
Leptospirosis

- Rodents (especially rats), domestic animals
- Entry through skin, and mucous membranes
- Occasionally through bite
- Rarely through ingestion



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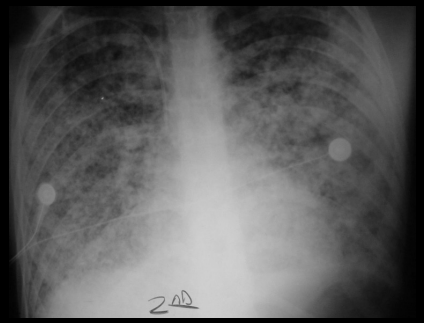
Leptospirosis

- Chest radiographic abnormalities can proceed positive serologic tests
- Diffuse nodules can coalesce into dense consolidation
- Pleural effusions and lymphadenopathy uncommon



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Leptospirosis

Barnacle J et al. *J Intensive Care* 2020

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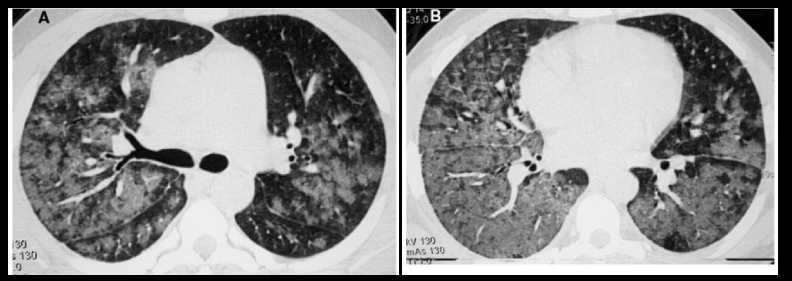
Leptospirosis



Marchiori E et al. *Lung* 2011

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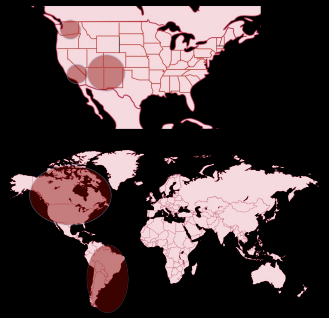
Hantavirus

- Orthohantavirus
- Two strains
  - Old World - hemorrhagic fever with renal syndrome (HFRS)
  - New World - hantavirus pulmonary syndrome (HPS)



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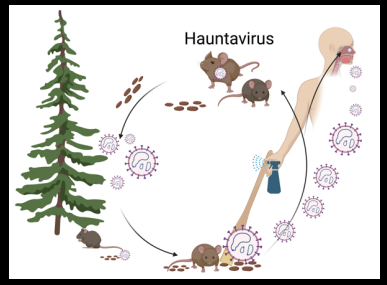
Hantavirus

- Rodents – virus shed in urine, feces, and saliva
- Entry through inhalation
- Cabins, sheds, barns, garages, storage buildings
- Housecleaning
- Construction, utility, and pest control
- Campers and hikers in infested shelters/camps



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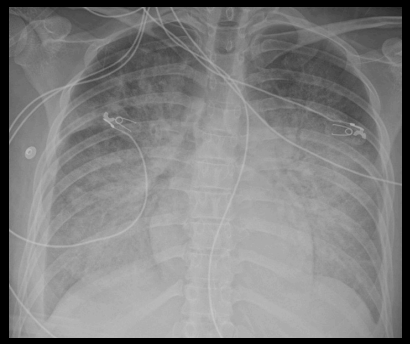
Hantavirus

- Imaging findings are those of lung edema without cardiac dysfunction
- Rapid progression
- Vascular permeability



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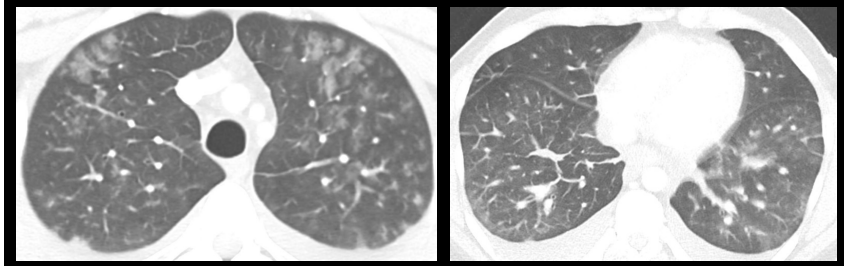
Hantavirus



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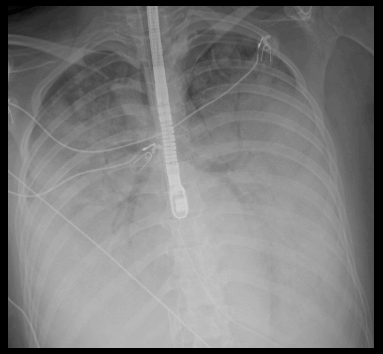
Hantavirus



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Echinococcosis

- *Echinococcus granulosus* and *Echinococcus multilocularis*
- Sheep and goats are intermediate hosts
- Dogs definitive host

CDC.gov

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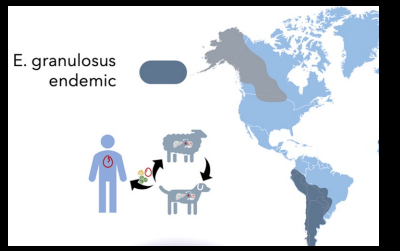
Echinococcosis

- Domestic pets
- Accidental ingestion of fecal contaminated soil, water, or food
- The dog is typically infected after ingesting infected animal (sheep)



Calame P. *Insights Imaging* 2022

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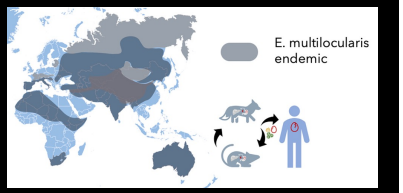
Echinococcosis

- Foxes, coyotes, dogs
- Transmission through fecal contaminated food and water
- Echinococcus eggs stay viable in soli for up to a year



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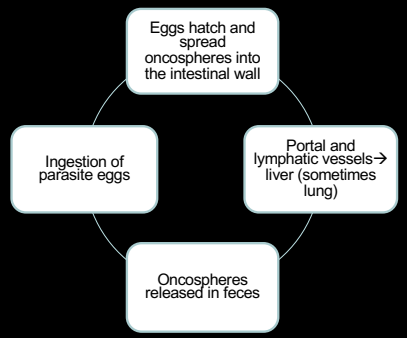
Echinococcosis



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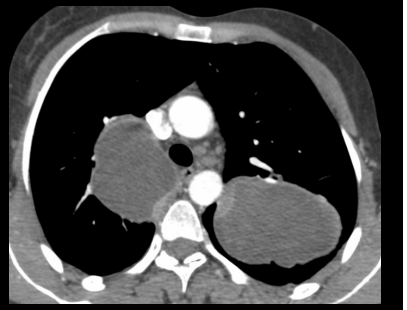
Echinococcosis

- Well circumscribed cyst
  - –Peripheral calcifications
  - –No internal enhancement
  - –Can be multiple



Echinococcus granulosus

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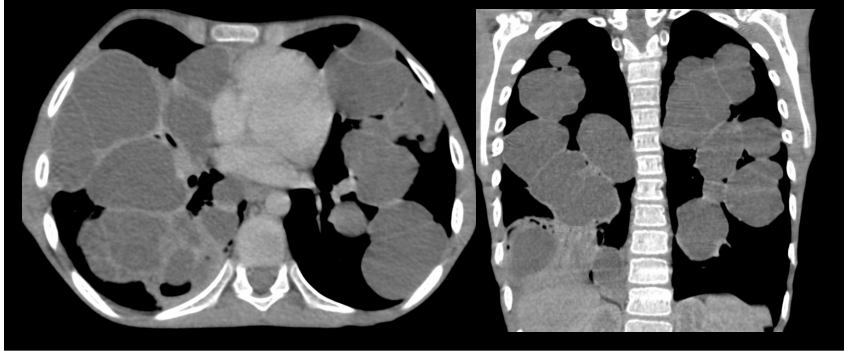
Echinococcosis



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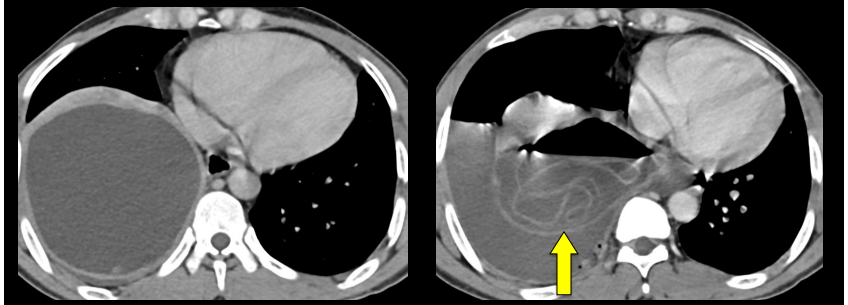
Echinococcosis



Echinococcus granulosus

🔑 Anaphylaxis more common with hepatic cyst rupture

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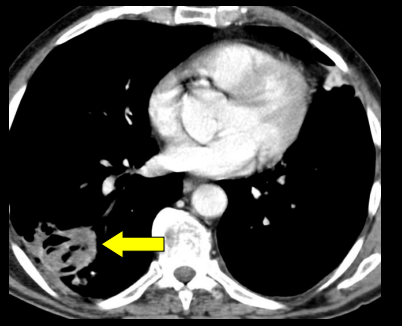
Echinococcosis

- Infiltrative mass
  - –Internal calcifications
  - –No internal enhancement
  - –Cystic component depends on degree of necrosis



Echinococcus multilocularis

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Paragonimiasis

- *Paragonimus westermani* (lung fluke)
- Usually acquired from eating raw or undercooked crab or crayfish
- First human case reported on autopsy in 1879 in Taiwan

CDC.gov

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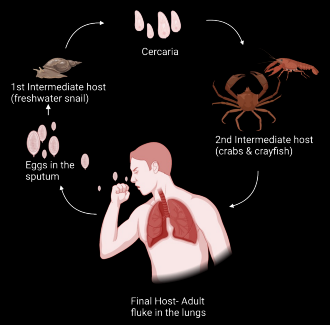
Paragonimiasis

- Usually acquired from eating raw or undercooked crab or crayfish
- Juvenile worms pass through the intestinal wall, peritoneal cavity, diaphragm, and pleural space
- Mature into adult flukes in the lung



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Paragonimiasis

- Single or multiple small lung cysts
- Irregular linear opacities extending from the pleural surface
- Nodules
- Pleural effusion

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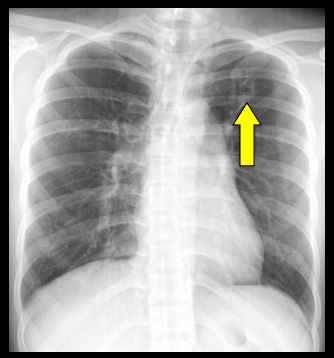
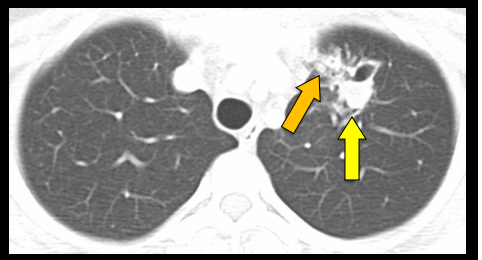
Paragonimiasis





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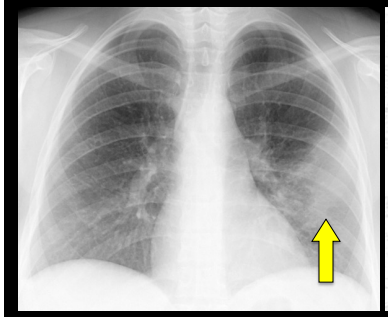
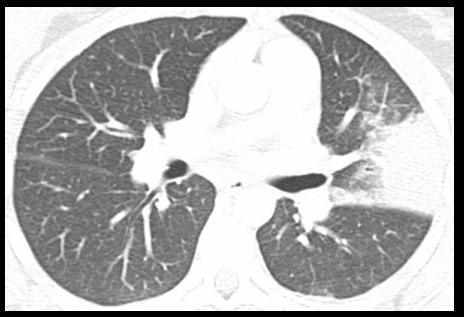
Paragonimiasis





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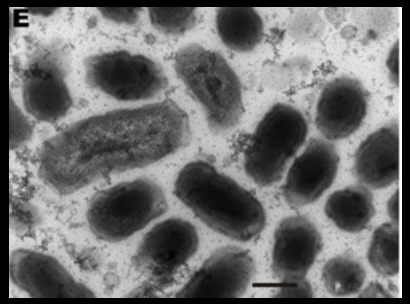
Q Fever

- *Coxiella burnetii*
  - Initially thought to be a species of *Rickettsia*
  - Now in the gammaproteobacterial class
  - Related to *Legionella* and *Francisella*
- First describe in Brisbane abattoir workers in 1935



CDC.gov

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Q Fever

- Found worldwide except New Zealand
- Q-Vax whole cell inactivated vaccine developed in Australia
- 2001 Australian program for at risk workers

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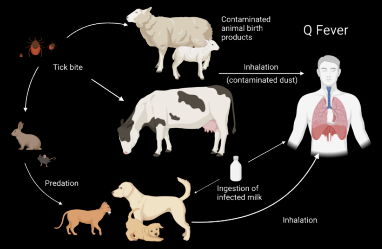
Q Fever

- Route of acquisition may influence clinical presentation of disease
  - Pneumonia occurs via inhalation of contaminated aerosols
  - Granulomatous hepatitis results from ingesting raw milk
- Presents as flu-like illness
- Many infections asymptomatic



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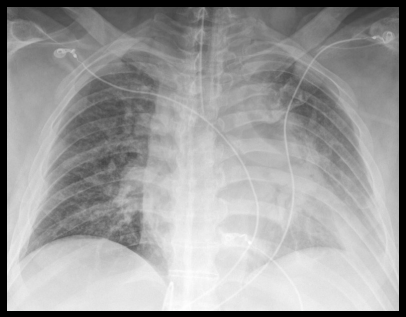
Q Fever

- Imaging features indistinguishable from community acquired pneumonia
- Cross-sectional imaging rarely performed



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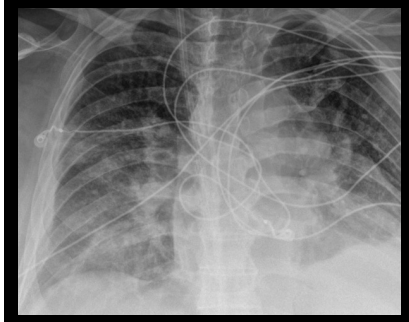
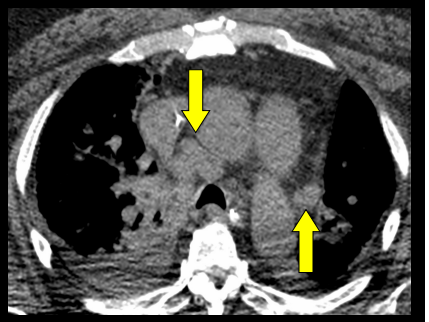
Q Fever





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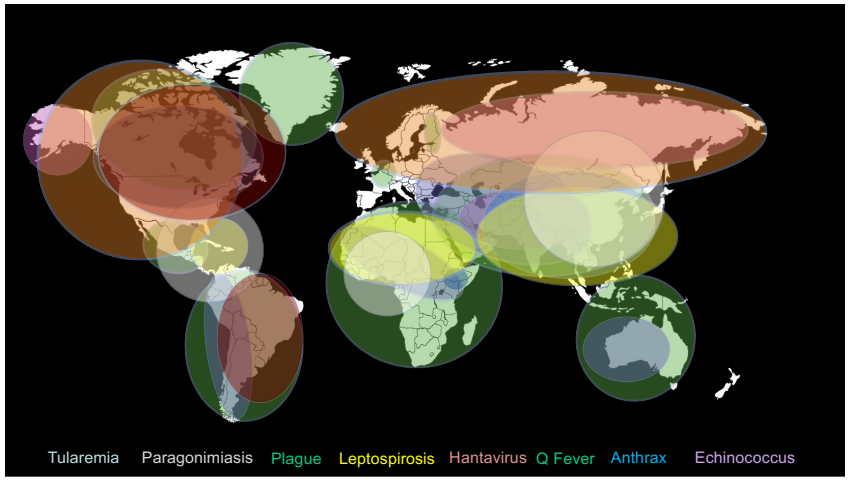

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Summary

- Zoonoses can be acquired through occupational, recreational, and domestic contact with animals
- While imaging patterns are not specific to any one zoonosis, rapid radiologic progression is common among many
- Careful attention to animal contacts and travel history can help make a diagnosis of zoonosis

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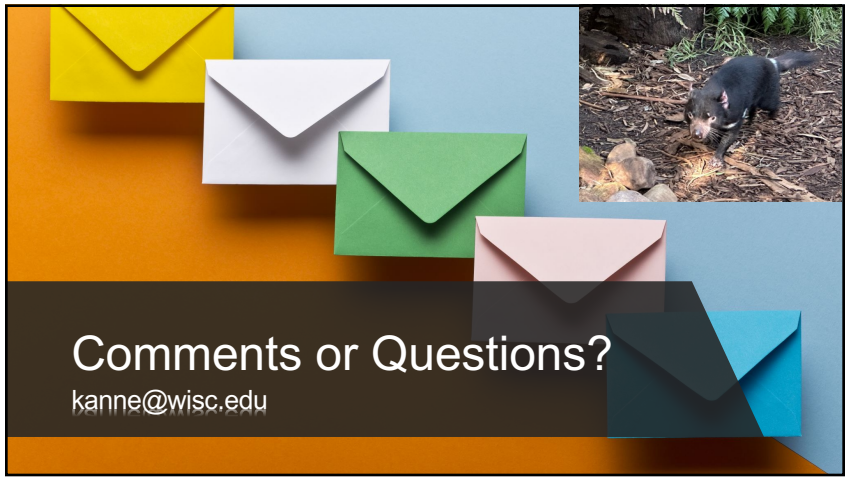

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