

# 9 - Zoonoses

Speaker: David M. Aronoff, MD



## Zoonoses

David M. Aronoff, MD, FIDSA, FAAM  
John B. Hickam Professor of Medicine  
Chair, Department of Medicine  
Indiana University School of Medicine  
aronoff@iu.edu

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## • Disclosures of Financial Relationships with Relevant Commercial Interests

- None

## Zoonoses: Important!

- Most recent epidemics & pandemics have been caused by zoonotic pathogens
- Emerging coronaviruses, hemorrhagic fever viruses, arboviruses, influenza A viruses & bacteria have caused recent major zoonotic epidemics



## Case

A 38-year-old healthy man in western Canada, presented with 5-days of fever, chills, night sweats, diffuse myalgias, & arthralgias. Months earlier, he had killed a black bear & froze meat. 2 days before symptom onset, he & 4 household members ingested bear meat that had been thawed & cooked as meatballs. Three other household members also fell ill in the same time frame, but with milder symptoms. The meatballs had not been thoroughly cooked. 2 days after ingestion, the patient noted vague abdominal discomfort & nausea. 8 days after ingestion, he reported intense fever & chills, mild headache, severe prostration, myalgia in proximal limb muscles, transient abdominal pain, & pink-tinged urine. He denied vomiting, diarrhea, chest pain, shortness of breath, adenopathy, or rash. The fever lasted for 9 days total primarily at night.



## Case

P/E: VS & exam findings normal

Labs: mildly increased WBC count ( $10.4 \times 10^9/L$ ), with hypereosinophilia ( $3.3 \times 10^9/L$ ; normal  $<0.50$ ). AST = 61U/L (normal 15 to 45), creatine kinase (762 U/L; normal 55 to 170), & CRP (64.6 mg/L; normal  $<10$ ).

Bilirubin, creatinine, & INR normal.

HIV screening & blood cultures at 5 days of incubation negative.

*Trichinella* serology on a sample 1 week after ingestion of bear meat was **negative**.



## Question #1

Which of the following is the most likely infectious diagnosis?

- Acute trichinellosis from ingestion of viable *Trichinella* larvae
- Coxiella burnetii* infection (Q fever) from ingesting raw bear meat
- Bacteremic *Streptobacillus moniliformis* from inadvertent cutaneous inoculation while preparing bear meat
- Acute *Necator americanus* infection





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## Case

PREVIEW QUESTION

25 yr male presented in July with painful right inguinal mass of one week's duration. He is otherwise well. Married. Monogamous. No hx penile or skin lesion. Fishing last week in Northern Virginia creek, hiked through wooded area. Picked ticks off legs & neck. Has kitten & dog. Exam: T37°C, 5 cm tender red mass in right midinguinal area, fixed to skin. Genitalia normal. Aspiration of soft center: 5 cc yellow pus. Gm stain neg. cephalexin 250 mg qid. One week later: mass unchanged. Culture neg. Syphilis FTA & HIV neg.

## Question #2

PREVIEW QUESTION

Most likely dx:

- A. *Bartonella henselae*
- B. *Treponema pallidum*
- C. *Haemophilus ducreyi*
- D. *Francisella tularensis*
- E. *Klebsiella (Calymmatobacterium) granulomatis*

## Purulent Inguinal Node

- *Bartonella henselae*: young cats
  - **Stellate abscess** on bx. **Warthin Starry** stain positive early
  - Dx: serology, PCR, or DFA on pus
- Tick borne tularemia ("glandular"): this case *could be* tularemia
  - Exposure to wild animals or their ticks
  - Gram stain, routine culture negative
  - Patient should be **systemically ill** (fevers, chills, malaise common)
  - **Uncommon**: 100-200 cases per year in the USA
- Chancroid: painful genital ulcer with adenopathy (can be purulent)
- No suppurative lymph nodes in syphilis or granuloma inguinale (*Klebsiella granulomatis*) (painless ulcers)

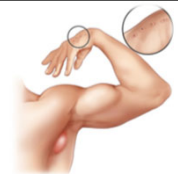
## Purulent Inguinal Node (continued)

- *Staphylococcus aureus*. Gram stain of pus & culture positive. Distal lesion may be present.
- Lymphogranuloma venereum (LGV)-
  - Sexually transmitted (no history in this case)
  - *Chlamydia trachomatis* L1-L3: genital lesion usually inapparent
  - Painful inguinal &/or femoral lymphadenopathy. "Groove sign"
  - Can form "Stellate abscesses" on bx
  - (+) Nucleic acid amplification test on urine, rectal swab, or wound



## Cat Scratch Disease

- *B. henselae* causes most cases
- >13,000 cases in the USA per year<sup>1</sup>
- 80% <21 yrs old
- Clinical findings:
  - Acute suppurative lymphadenitis proximal to bite, scratch, lick of young cat
  - Fever, headache, poor appetite, & exhaustion
  - Cats have chronic bacteremia but seem healthy
- Cat fleas may transmit between cats & occasionally to humans



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### Symptoms of Cat Scratch Fever

- Skin bumps or rash.
- Swollen, painful lymph nodes.
- Muscle, bone or joint aches.
- Loss of appetite/weight loss.
- Fever.
- Fatigue.

### DIAGNOSIS

- Compatible clinical syndrome
- Fastidious, slow-growing
  - Hold 21 days
- Serology (but cross reactive with other *Bartonella* spp.)
- Molecular (PCR) on tissue/nodes

### Cat Scratch Disease

- Papule or pustule often at inoculation site if sought
- Often self-limited
- Encephalitis, **stellate retinitis**, uveitis rare

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### Cat Scratch Disease

Rx: 10% drain spontaneously  
If not, node aspiration improves pain & helps exclude *Staph. aureus*

**Treatment = AZITHROMYCIN x 5 d**  
(TMP/SMX, clarithromycin, ciprofloxacin or rifampin as alternatives)

Treat to prevent serious complications, since up to 14% of patients will have dissemination, with potential infection of the liver, spleen, eye, or CNS

### Warthin Starry Silver Stain

### Cat Scratch Lymphadenopathy

Stellate abscesses, necrotizing granulomas  
Necrotic area with neutrophils surrounded by palisading histiocytes

<https://clinicalgate.com/nodes-thymus-and-spleen/>

**Lymph nodes showing central abscess formation surrounded by palisaded histiocytes**

<https://basicmedicalkey.com/cat-scratch-disease/>

### ANTHRAX

Cutaneous anthrax treated with doxycycline

At diagnosis      6 days later      4 weeks after diagnosis

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### ANTHRAX

- Skin (95%): pruritic papule on skin exposed to goat hair, animal hides. Small **vesicles around an ulcer**. +/- pain. **Edema**. Mild systemic symptoms.
- DX: *Aerobic*, encapsulated, sporulating **Gram positive** bacillus seen on smear, culture of vesicle fluid (alert the lab!)
- RX: Penicillin but "weaponized" strains resistant to multiple antibiotics
- Inhalation (5%), ingestion (<1%)
- Anthrax rare in USA

Edema  
Vesicles  
Necrotic ulcer

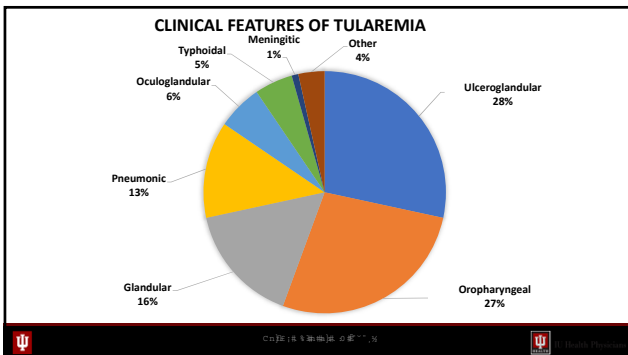
<http://www.pcds.org.uk/clinical-guidance/anthrax>

<http://www.nejm.org/doi/full/10.1056/NEJM0802093>

### TULAREMIA

### TULAREMIA

- Highly infectious gram-negative **coccobacillus** *Francisella tularensis*
- Vectors = **Ticks** (*Dermacentor variabilis* > *Amblyomma americanum*) & **Deerflies**
- Direct inoculation = rabbits, squirrels, muskrats, beavers, cats (bites)
- Hunters **skinning animals** (old days); farmers, veterinarians
- Red tender local lymph node inoculation site may form ulcer
- **Ulceroglandular** is the most common manifestation
- Risk of bioweaponization



### AN OUTBREAK OF PRIMARY PNEUMONIC TULAREMIA ON MARTHA'S VINEYARD

KATHERINE A. FELDMAN, D.V.M., M.P.H., RUSSELL E. ENSCORE, M.S., SARAH L. LATHROP, D.V.M., Ph.D., BELA T. MATYAS, M.D., M.P.H., MICHAEL MCGUILL, D.V.M., M.P.H., MARTIN E. SCHRIEFER, Ph.D., DONNA STILES-ENOS, R.N., DAVID T. DENNIS, M.D., M.P.H., LYLE R. PETERSEN, M.D., M.P.H., AND EDWARD B. HAYES, M.D.

**ABSTRACT**  
**Background** In the summer of 2000, an outbreak of primary pneumonic tularemia occurred on Martha's Vineyard, Massachusetts. The only previously reported outbreak of pneumonic tularemia in the United States occurred on the island of Martha's Vineyard (1 to 21), infection with *F. tularensis* can result in various clinical presentations, depending on the route of inoculation, the dose of the inoculum, and the virulence of the organism. Primary pneumonic tularemia results from the inhalation of contaminated aerosols.

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## TULAREMIA

- Incubation period: 3-5 days but up to 3 weeks
- DX: Serology; PCR
- Culture of *F. tularensis* is lab hazard. Notify the lab!
- Neg routine culture, needs chocolate agar or BCYE (like *Legionella*)
- RX: **gentamicin** (or streptomycin), **FQs**, **doxycycline**
- Prophylaxis (bioterrorism) doxycycline

BCYE – buffered charcoal yeast extract

Maurin & Gyuranecz. Lancet (2016)  
Nelson CA, et al. CID (2024)



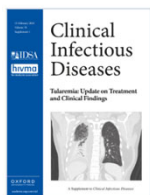
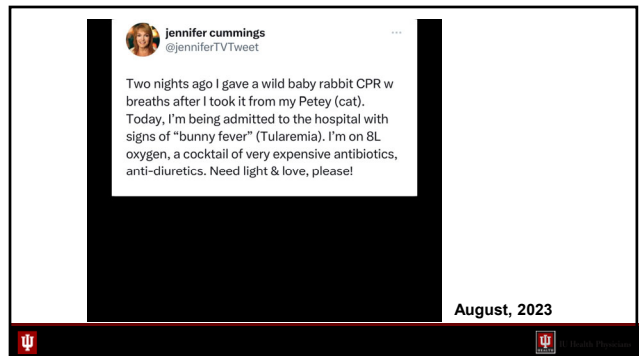
## Glandular Tularemia

68-year-old with 1 wk fever then 2 mo progressive, painful swelling on R. side of neck

Exposure to a sick cat

Diagnosis made by + IgM (1:1280)

Improved with 4 wk doxycycline



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15 February 2024

**SUPPLEMENT**  
**Volume 78, Issue**  
**Supplement\_1, 15**  
**February 2024**  
**Tularemia: Update on**  
**Treatment and Clinical**  
**Findings**





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**PLAGUE**

- *Yersinia pestis*
- Exists in the USA
  - Rodent flea bite
  - Prairie dogs, cats (outdoor/indoor)
- Fever, nausea & swollen, painful lymph nodes
- Sepsis, pneumonia-hematogenous or aerosol in crowded conditions

**PLAGUE**

- Gram negative coccobacillus
- **Bipolar-staining** bacilli
- **Safety pin** appearance
  - *Yersinia pestis*: lab hazard
- Treatment: **Streptomycin** >> doxy, cipro



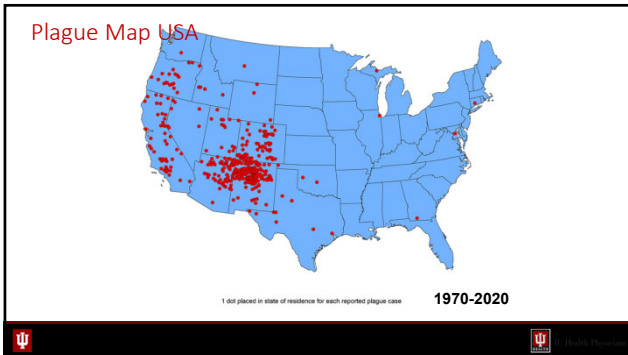


**Notes from the Field**

**Diagnosis and Investigation of Pneumonic Plague During a Rabies Disease Outbreak in Wyoming, 2018**

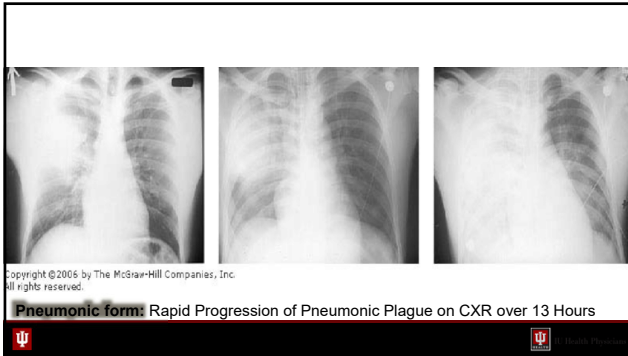
On September 20, 2018, the Wyoming Department of Health (WYDOH) received a report of a pneumonic plague case in a 45-year-old male patient who had been bitten by a cat. The patient was hospitalized and died on September 27, 2018. The patient's cat was found to be infected with *Y. pestis* and was euthanized. The patient's cat was found to be infected with *Y. pestis* and was euthanized. The patient's cat was found to be infected with *Y. pestis* and was euthanized.

- <10 cases of human plague per year in USA, mostly rural West
- Typically, in northern New Mexico, northern Arizona, southern Colorado, California, southern Oregon & western Nevada
- Humans usually exposed from the **bites of fleas** carrying *Y. pestis*
- **Household pets can get infected** if they hunt rodents infected with plague or are bitten by an infected flea
- Pets can transfer the infection to humans via tissue or bodily fluids (e.g., respiratory droplets from cough or sneezes) or can carry home fleas that in turn bite humans

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## Question #3

- 28 yr old male presents with temp 39°C, diffuse myalgia, headache, malaise. Returned 2 days ago from “Iron Man” race with running, biking, swimming in lake, climbing in Hawaii. Numerous mosquito bites. Exam: Conjunctival suffusion but no other localizing findings.
- WBC 14,500 with 80%PMN, no eos or bands. Platelets 210k.
- Bili 2.4, ALT 45, AST 52, Alk Phos 120, Cr 1.6. Hct 45%. BC neg. UA: normal

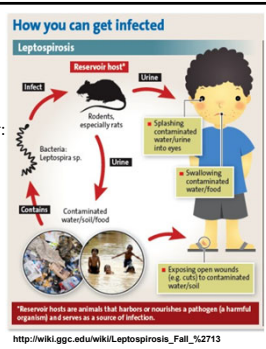
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Most likely diagnosis:

- A. Malaria
- B. Dengue
- C. Ehrlichiosis
- D. Leptospirosis
- E. Zika

## LEPTOSPIROSIS

- Spirochetes excreted in urine of infected host & able to survive in wet environment
- Exposed intact skin to animal urine in water: veterinarians, farmers, loggers, triathletes, white water rafting, trapping
- Urine from cows, pigs, dogs, raccoons, rats, mice.
  - Summer & early Fall



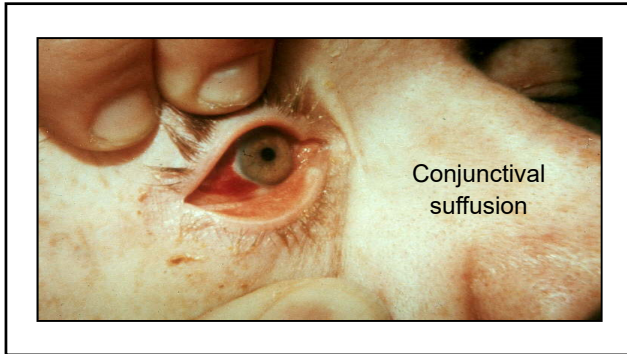
## LEPTOSPIROSIS

- Fever, myalgia, headache (aseptic meningitis late in course)
- Conjunctival suffusion, +/- rash
- In severe cases: jaundice (Weil syndrome), azotemia, pulm. hemorrhage
  - Jaundice: *bilirubin is high out of proportion to transaminase elevation*
- Lab: serology by agglutination test, culture urine in Fletcher's medium
  - PCR & sequencing emerging
- Rx: **doxycycline** for outpatients, IV penicillin for inpatients
  - Jarisch-Herxheimer in first 2 hr



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### Question #4

A 41 year old car salesperson from Baltimore was admitted for a febrile illness & found to have *Brucella melitensis* in their blood culture. They had attended a dinner a month prior where some family members from Greece had brought food from home.

About two weeks prior to onset of fever, they had bought some lamb & beef at a farmer's market outside Baltimore.

### Question #4

The most likely source of the brucellosis was which of the following:

- A. Home made sausage from Greece
- B. Home made goat cheese from Greece
- C. Cole slaw from a Baltimore delicatessen
- D. Beef tartar, meat from the farmer's market
- E. Lamb kabobs, meat from the farmer's market

### BRUCELLOSIS

- Brucellosis is primarily transmitted through **direct contact** with infected animals or their bodily fluids, including vaginal discharges, aborted materials & semen
- Brucellosis can also be transmitted through the **ingestion** of raw or unpasteurized dairy products from infected animals, including milk & cheese (unpasteurized)
- Those who work closely with livestock, such as farmers, veterinarians & livestock handlers, are at a heightened risk

Qureshi KA, et al. *Ann Med* (2023)

### BRUCELLOSIS

- An illness characterized by acute or insidious onset of fever & one or more of the following: fever, night sweats, arthralgia, headache, fatigue, anorexia, myalgia, weight loss, arthritis/spondylitis, meningitis, or focal organ involvement (endocarditis, orchitis/epididymitis, hepatomegaly, splenomegaly).
- Nodes, liver, spleen may be enlarged
- Rare in the US, with 80–120 cases reported annually; most of these are associated with *Brucella* exposures abroad

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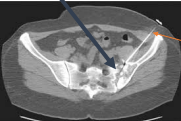
### Animal Sources of *Brucella*

<b>DOGS</b> • <i>Brucella canis</i>	<b>CATTLE</b> • <i>Brucella abortus</i>	<b>SHEEP &amp; GOATS</b> • <i>Brucella melitensis</i>
<b>SHEEP</b> • <i>Brucella ovis</i>	<b>PIGS</b> • <i>Brucella suis</i>	<b>RATS</b> • <i>Brucella neotomae</i>

Qureshi KA, et al. *Ann Med* (2023)

### BRUCELLOSIS

Later onset lesions in **bone, liver**  
Epididymo-orchitis<sup>1</sup>, endocarditis  
sacroiliitis, tenosynovitis, meningitis



Biopsy needle

Malodorous perspiration

Qureshi KA, et al. *Ann Med* (2023)

### BRUCELLOSIS (con't)

- WBC normal or low, anemia, plt can be low
- DX: Bone marrow/blood/tissue culture, serology, PCR
  - **LET THE LAB KNOW YOU ARE WORRIED ABOUT BRUCELLA**  
(lab safety issue!)
- RX: Doxy plus rifampin or strep/gent
  - TMP-SMX in pregnant or young children

Qureshi KA, et al. *Ann Med* (2023)

### Question #5

This common cause of acute hepatitis is acquired via fecal-oral transmission or from undercooked meats, especially pig/wild boar. It is particularly severe in pregnant patients, causing stillbirths & maternal mortality.

- A. Epstein Barr virus
- B. Cytomegalovirus
- C. Hepatitis E virus
- D. Hepatitis A virus

Qureshi KA, et al. *Ann Med* (2023)

### Inhalation of animal products

Qureshi KA, et al. *Ann Med* (2023)

### Case

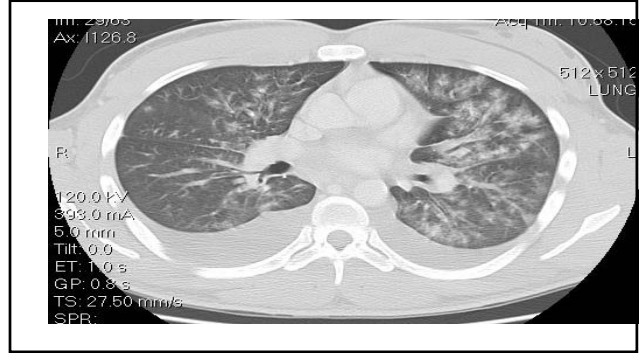
- A 22 year old previously healthy male contractor returned from Afghanistan one week prior to presentation. He had a three day history of fever, myalgia, arthralgia, mild headache & cough. He had vomited once & had mild midepigastic, nonradiating pain.
- The facility he was hired to guard was adjacent to the path that the local sheep & goat herders used on their way to market & he had purchased a wool rug from one of the locals. He remembers shaking it hard to get rid of the dust.
- He reported that some members of his guard unit also had flu-like illness from which they recovered without treatment.

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## Case

- Examination was normal except for a variable temperature up to 102°F
- WBC 3.3K, platelets 121K, creatinine 1.2, AST 144, ALT 154, alk phos 88, total bilirubin 0.6
- Admission chest Xray was normal
- Ceftriaxone was begun but the patient remained febrile & had the chest CT shown on the next slide



## Question #6

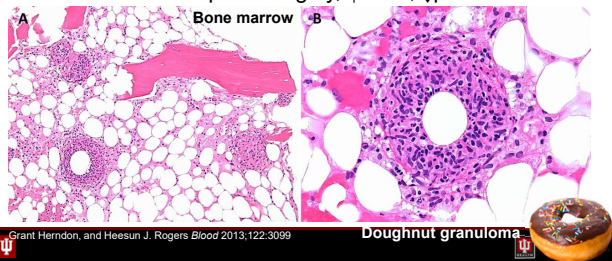
Which of the following is the most likely diagnosis?

- A. Brucellosis
- B. Anthrax
- C. Leptospirosis
- D. Q fever
- E. Visceral leishmaniasis

## Q FEVER

- *Coxiella burnetii*: tiny coccobacillus
  - Infects cows, sheep, goats, cats, etc.
- Spores survive in straw, manure, meat, *parturient tissue* for months.
  - Aerosol, ingest raw milk
- Acute pneumonia (in half cases), fever, headache, hepatosplenomegaly
- **Chronic endocarditis** on native or prosthetic valves
- **Granulomatous hepatitis**
  - Doughnut granulomas
- DX: serology, valve PCR; specific tissue stain; hard to culture
- RX: acute: Doxycycline or levofloxacin or azithromycin
- Chronic: doxycycline plus hydroxychloroquine

A 54-year-old man with a history of multiple myeloma presented with intermittent fevers, chills, fatigue, & weight loss for 1 month. +splenomegaly, ↑LFTs, ↓plt



# The End

**Thank you!**  
[aronoff@iu.edu](mailto:aronoff@iu.edu)

@DMAronoff (Twitter, Bluesky)  
david.aronoff (Insta, Threads)