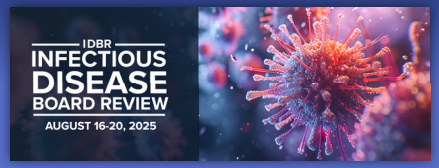

Zoonoses

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8/4/2025

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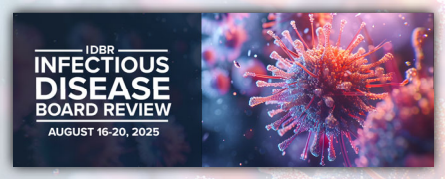


Disclosures of Financial Relationships with Relevant Commercial Interests

- List of disclosures or "None"

2

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

Judson SD & Rabinowitz PM. *Curr Opin Infect Dis* 2021, 34:385–392

3

Question #1

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 adapted from Cheung M, *et al. J Clin Micro* 61(4); 2023

4

23 Zoonoses
Speaker: David Aronoff, MD, FIDSA, FAAM

Question #1

P/E: VS & exam findings normal

Labs: mildly increased WBC count (10.4*10^9/L), with hypereosinophilia (3.3*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**.

Case adapted from Cheung M, *et al. J Clin Micro* 61(4); 2023

5

Question #1

Which of the following is the most likely infectious diagnosis?

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

6

Table 1. Zoonotic pathogens causing recent epidemics

Zoonotic pathogen	Reservoir host/Vector	Disease (key syndromes)	Major recent epidemics
SARS-CoV	Likely bats	SARS (pneumonia)	Global (2002–2003)
MERS-CoV	Dromedary camels	MERS (pneumonia)	Saudi Arabia, South Korea (2012–2019)
SARS-CoV-2	Unknown	COVID-19 (pneumonia)	Global (2020–present)
Ebola virus	Likely bats	Ebola virus disease (haemorrhagic fever)	West Africa (2013–2016) DRC (2018–2020)
Lassa virus	Multimammate rat	Lassa fever (haemorrhagic fever)	Nigeria (2018)
Rift valley fever virus	*Aedes* and *Culex* mosquitoes	Rift valley fever (haemorrhagic fever)	East Africa (2006–2007)
Zika virus	*Aedes* mosquitoes	Zika virus disease (arthralgia/myalgia, rash)	Brazil, Americas (2015–2016)
Chikungunya virus	*Aedes* mosquitoes	Chikungunya fever (arthralgia/myalgia, rash)	Indian Ocean Islands, India (2004–2007)
Dengue virus	*Aedes* mosquitoes	Dengue fever (arthralgia/myalgia, rash, haemorrhage)	Americas (2010)
West Nile virus	Birds/*Culex* mosquitoes	West Nile disease (meningitis/encephalitis, paralysis)	United States (2002)
Influenza A viruses	Waterfowl, Poultry, Pigs	Influenza (pneumonia)	Global (2009)
Yersinia pestis	Rats/Fleas	Plague (sepsis, pneumonia)	Madagascar (2017)
Brucella spp.	Cattle, sheep, goats	Brucellosis (undulant fever, endocarditis)	China (2020)
Coxiella burnetii	Cattle, sheep, goats	Q fever (pneumonia, hepatitis)	Netherlands (2007)

Judson SD & Rabinowitz PM. *Curr Opin Infect Dis* 2021, 34:385–392

7

THERE ARE MANY

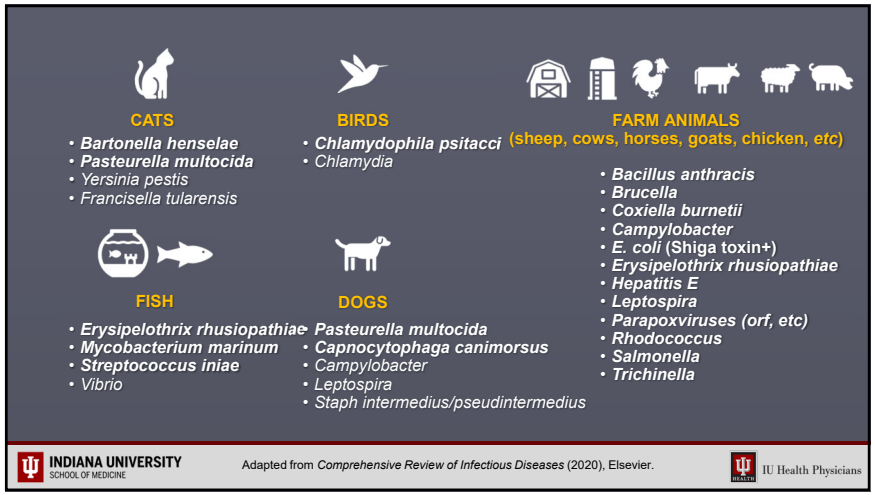
TABLE 1. Bacterial zoonoses by transmission mechanism and causative agent(s)

	Causative agent(s)
Bacterial zoonoses transmitted by direct contact with animals or infected animal materials	
Anthrax	*Bacillus anthracis*
Brucellosis	*Brucella* spp.
Cat scratch disease	*Bartonella* spp.
Erysipelothrix infections	*Erysipelothrix rhusiopathiae*
Glanders and melioidosis	*Burkholderia malei* and *Burkholderia pseudomallei*
Leptospirosis	*Leptospira interrogans* spp.
Mycobacterioses	*Mycobacteria* spp.
Q fever	*Coxiella burnetii*
Bacterial zoonoses transmitted principally by animal bites or scratches	
Pasteurellosis	*Pasteurella multocida* and other spp.
Capnocytophaga infections	*Capnocytophaga canimorsus*
Cat scratch disease	*Bartonella henselae*
Rat bite fever	*Spirillum minus* and *Streptobacillus moniliformis*
Vector-borne bacterial zoonoses	
Lyme borreliosis	*Borrelia burgdorferi* sensu lato (incl. *Borrelia garinii, Borrelia afzelii*)
Tick- and louse-borne relapsing fever borreliosis	*Borrelia recurrentis, Borrelia turicatae, Borrelia hermsii,* others
Plague	*Yersinia pestis*
Tularaemia	*Francisella tularensis*
Rickettsioses	Spotted fever and typhus group *Rickettsia* species
Ehrlichiosis and Anaplasmosis	*Ehrlichia chaffeensis, Anaplasma phagocytophilum*
Scrub typhus	*Orientia tsutsugamushi*
Foodborne bacterial zoonoses and intoxications	
Salmonellosis	*Salmonella enteritidis*
Campylobacteriosis	*Campylobacter* spp.
Listeriosis	*Listeria monocytogenes*
Escherichia coli O157:H7 infections	*Escherichia coli* STEC
Yersinia enterocolitica infections	*Yersinia enterocolitica*
Clostridium perfringens gastroenteritis	*Clostridium perfringens*
Botulism	*Clostridium botulinum*
Staphylococcal food poisoning	*Staphylococcus aureus*

Chikeka & Dumler *Clin Microbiol Infect* 2015; 21: 404–415

8

23 Zoonoses
Speaker: David Aronoff, MD, FIDSA, FAAM



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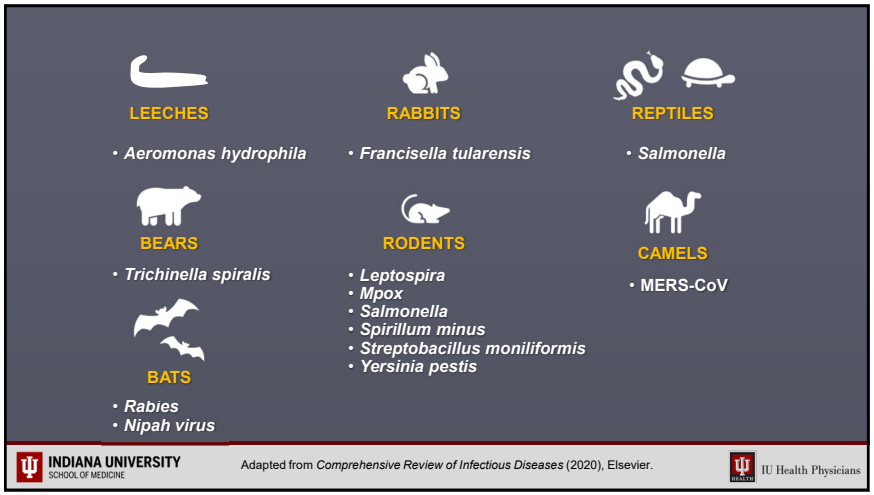

10

Zoonoses: Various Routes of Infection

- **Direct contact with animal or animal tissue**
  - Cat scratch disease, anthrax, tularemia, brucellosis
- **Contact with insect vector**
  - Tularemia, plague
- **Intact skin contact with animal urine**
  - Leptospirosis
- **Ingestion of animal product**
  - Brucellosis, hepatitis E
- **Inhalation of animal product**
  - Q Fever

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Direct Contact with Animal or Animal Tissue

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12

Question #2

25-year-old 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: T37ºC, 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.

13

Question #2

What is the most likely dx?

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

14

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)

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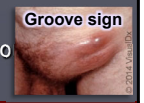
15

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 wo



INDIANA UNIVERSITY SCHOOL OF MEDICINE Image from https://www.skinsight.com/skin-conditions/adult/lymphogranuloma-venereum-lgv IU Health Physicians

16

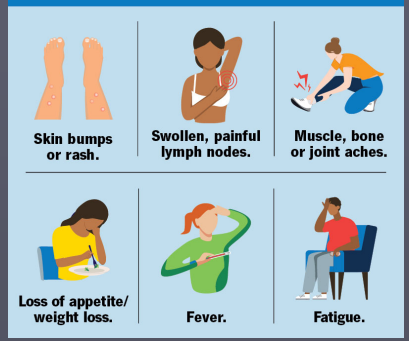
Cat Scratch Disease

- *B. henselae* causes most cases
- >13,000 cases in the USA per year[1]
- 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

1. Nelson CA, *at al. Emerging Infectious Diseases* 22 (2016)
Cat photo from http://www.catscratchmed.com
Cartoon from CDC.gov

17

Symptoms of Cat Scratch Fever



DIAGNOSIS

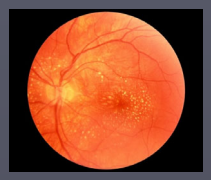
- Compatible clinical syndrome
- Fastidious, slow-growing
  - Hold 21 days
- Serology (but cross reactive with other *Bartonella spp.*)
- Molecular (PCR) on tissue/nodes

Image adapted from https://my.clevelandclinic.org/health/diseases/23537-cat-scratch-fever
Diagnostic info https://www.cdc.gov/bartonella/bartonella-henselae/

18

Cat Scratch Disease

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



Lipid exudates forming a macular star

Photos from http://www.catscratchmed.com,
http://imagebank.asrs.org/file/1173/cat-scratch-retinitis-with-macular-lipid,
http://www.nejm.org/doi/full/10.1056/ENEJMicm010038#t=article
Encephalitis reference: Fan, J & Ali H.) *Proc Bayl Univ Med Cent*. 2020 Jul; 33(3): 440–441

19

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, ciprofloxaxin 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

20

Warthin Starry Silver

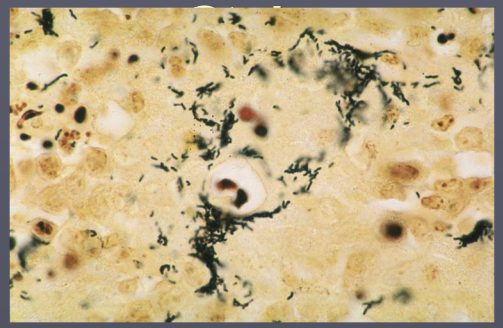


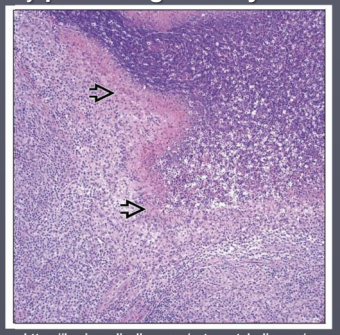
Photo by Andrew Margileth, MD.
from http://emedicine.medscape.com/article/214100-workup#c8

21

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/

22

Treatment of *B. henselae*

- The combination of doxycycline + rifampin is a principal treatment for ***disseminated*** *B. henselae* infections (as is doxy + gent)
- But a recent study reported a 39% treatment failure rate

Pizzuti M, *et al. Infection* (2024) 52:1307–1314

23

Anthrax

Images from https://www.dermnetnz.org/topics/anthrax

24

23 Zoonoses
Speaker: David Aronoff, MD, FIDSA, FAAM

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

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25

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

Edema
Vesicles
Necrotic ulcer

https://www.nejm.org/doi/full/10.1056/NEJMicm0802093

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26

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Image from cdc.gov

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27

Tularemia

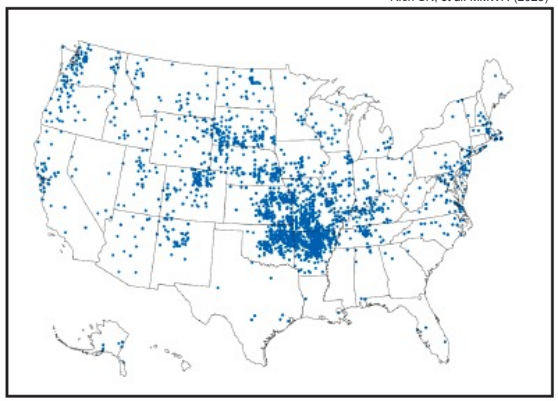
- Highly infectious gram-negative **coccobacillus** *Francisella tularensis*
- Teir 1 select agent with potential for misuse as bioweapon
- Vectors = **Ticks** (*Dermacentor variabilis* > *Amblyomma americanum*) & **Deerflies**
- Direct inoculation = rabbits, squirrels, muskrats, beavers, cats (bites)
- 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

28

~200 cases per year in the USA

FIGURE 1. Reported tularemia cases, by county of residence* — United States, 2011–2022

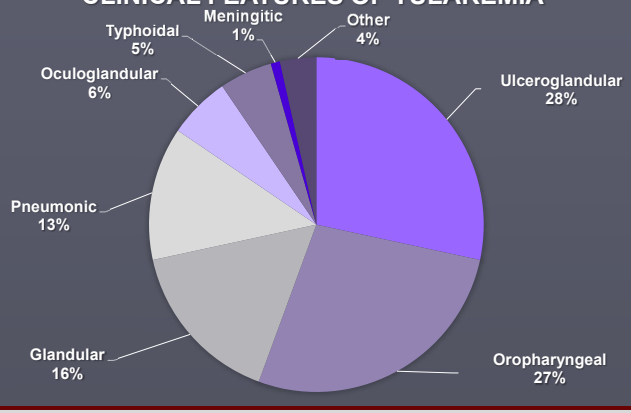
Rich SN, *et al. MMWR* (2025)



* Cases are indicated randomly within county of residence.

29

CLINICAL FEATURES OF TULAREMIA



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Nelson CA, *et al. CID* (2024)

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30

AN OUTBREAK OF PRIMARY PNEUMONIC TULAREMIA ON MARTHA'S VINEYARD

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 ... of pneumonic tularemia in the United ... curred on the ...

... 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 ... lts from the inhala... *tula*...

Lawn mowing & brush cutting

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N Engl J Med, Vol. 345, No. 22 · November 29, 2001

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31

Tularemia

- Incubation period: 3-5 days but up to 3 weeks
- DX: Serology; PCR; culture; DFA on clinical specimen
- 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

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Maurin & Gyuranecz. *Lancet* (2016)
Nelson CA, *et al. CID* (2024)
Rich SN, *et al. MMWR* (2025)

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32

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33

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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Marks, Laura, & Spec. "Glandular Tularemia." *New England Journal of Medicine* 379.10 (2018): 967-967.

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34

Volume 78, Issue Supplement_1

15 February 2024

SUPPLEMENT
Volume 78, Issue Supplement_1, 15 February 2024
Tularemia: Update on Treatment and Clinical Findings

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36

Contact with Insect Vector

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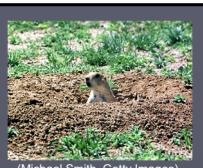
37

Plague

38

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



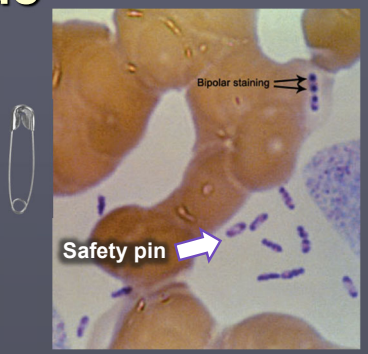
(Michael Smith, Getty Images)

(Eye of Science/Science Source)

39

Plague

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



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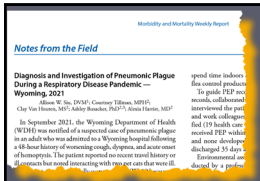


Notes from the Field

Diagnosis and Investigation of Pneumonic Plague During a Respiratory Disease Pandemic — Wyoming, 2021

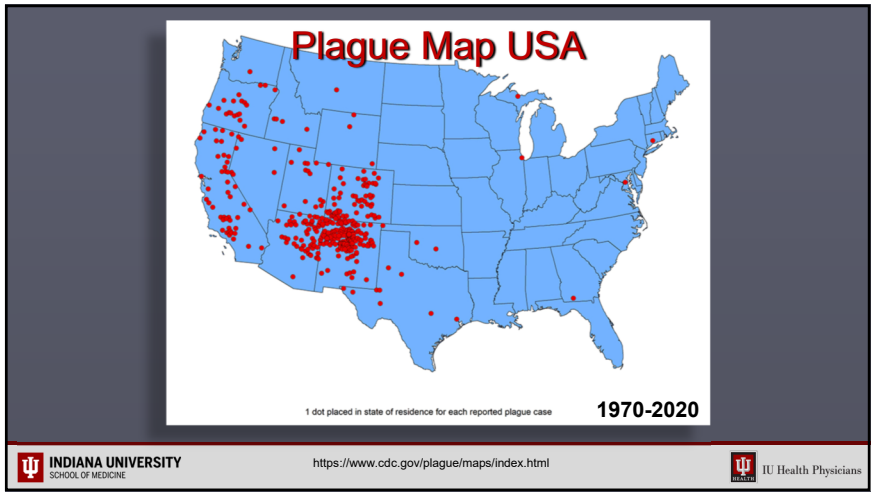
Oregon's first case of human plague in 8 years likely came from a pet cat

February 9, 2024

Wyoming woman catches rare pneumonic plague from cats

- <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

41



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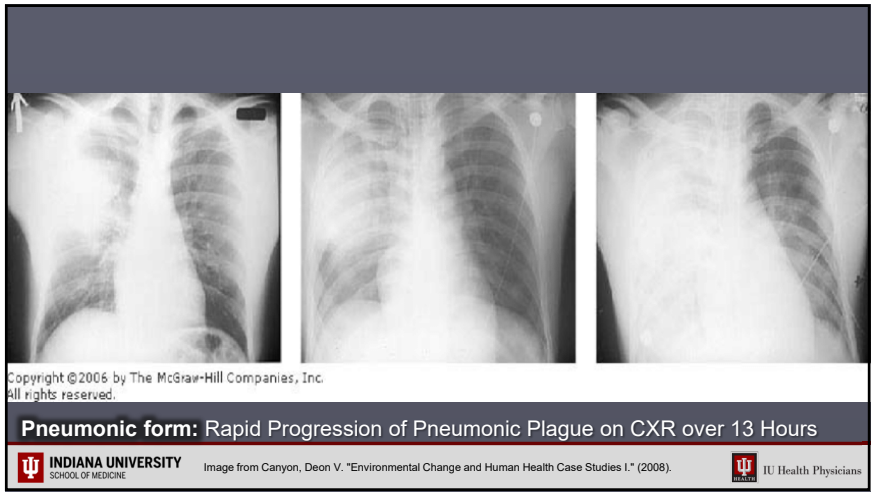

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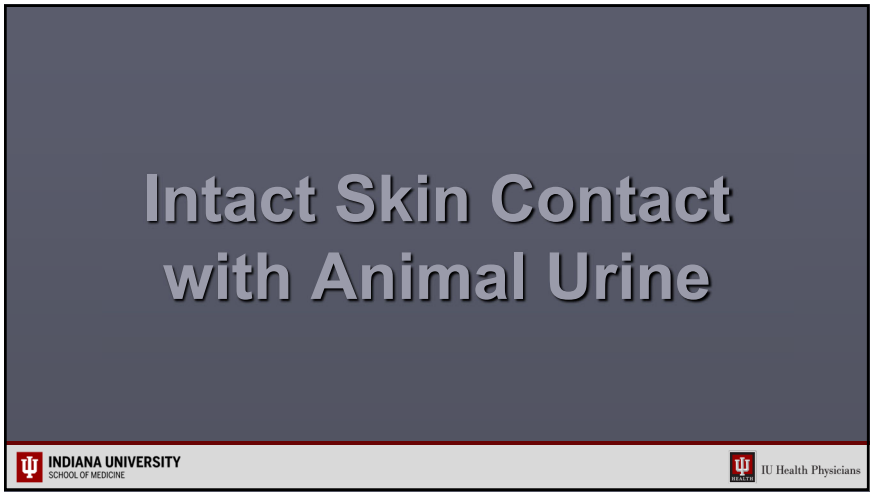


45

Question #3

PREVIEW QUESTION

- 28-year-old old male presents with temp 39ºC, 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

46

Question #3

PREVIEW QUESTION

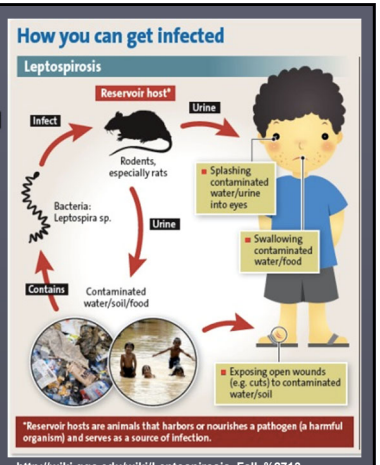
What is the most likely diagnosis?

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

47

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



http://wiki.ggc.edu/wiki/Leptospirosis_Fall_%2713

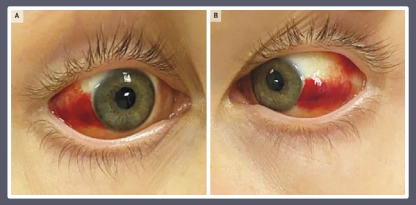
48

Leptospirosis

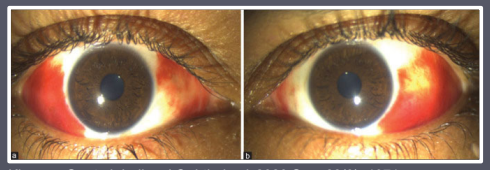
- Fever, myalgia, headache (aseptic meningitis late in course)
- **Conjunctival suffusion**, +/- rash
- In severe cases: jaundice (Weil syndrome), azotemia, pulm. hemorrhage
  - Jaundice: *bilirubin is high out of proportion to transaminase elevation*
- Lab: serology by agglutination test, culture urine in Fletcher's medium
  - PCR & sequencing emerging (Ciurariu E, *et al. Microorganisms* 2025)
- Rx: **doxycycline** for outpatients, IV penicillin for inpatients
  - Jarisch-Herxheimer in first 2 hr

49

Conjunctival suffusion & Leptospirosis



Rijnink E, *et al. N Engl J Med* 2022;387: e71



Khurana S, *et al. Indian J Ophthalmol*. 2020 Sep; 68(9): 1971.

50

Ingestion of Animal Products

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51

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.

52

Question #4

Which of the following is the most likely source of the brucellosis?

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

53

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

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

Animal Sources of *Brucella*

DOGS	CATTLE	SHEEP & GOATS
• *Brucella canis*	• *Brucella abortis*	• *Brucella melitensis*

SHEEP	PIGS	RATS
• *Brucella ovis*	• *Brucella suis*	• *Brucella neotomae*

Brucellosis

Later onset lesions in bone, liver

Epididymo-orchitis[1], endocarditis

sacroiliitis, tenosynovitis, meningitis

Biopsy needle

Malodorous perspiration (uncommon) "pathognomonic"[2]

1. Ip CCK, *et al. BMJ Case Rep* 2019;12:e230007. doi:10.1136/bcr-2019-230007
2. 2. Pappas G, *et al. NEJM* (2005)

Brucellosis (cont.)

- 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)

58

Question #5

What 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

59

Inhalation of Animal Products

60

Question #6

- 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 midepigastric, 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.

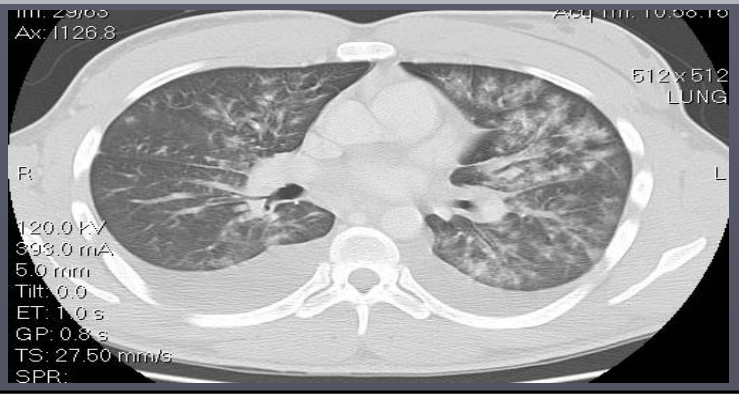
61

Question #6

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

62

Question #6



63

Question #6

Which of the following is the most likely diagnosis?

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

64

Q Fever

- *Coxiella burnetii*: tiny cocco baccilus
  - 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

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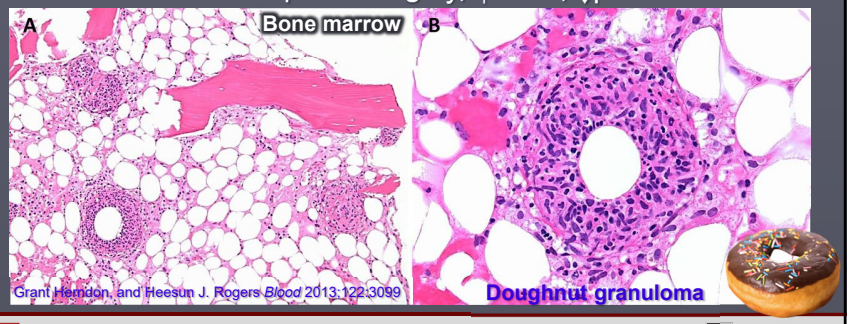
A 54-year-old man with a history of multiple myeloma presented with intermittent fevers, chills, fatigue, & weight loss for 1 month. +splenomegaly, ↑LFTs, ↓plt



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66

The End

Thank you!

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

67