



Zoonoses

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Disclosures of Financial Relationships with Relevant Commercial Interests

- List of disclosures or “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

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

Question #1

- A previously healthy 42-year-old man presents to a district hospital in rural northwestern Bangladesh in late January. He developed fever, headache, & myalgias 5 days ago.
- Over the past 2 days he has become progressively confused & drowsy, & today he developed a cough & shortness of breath.
- On arrival, temperature is 39.4°C, blood pressure 138/86 mm Hg, pulse 112/min, and respiratory rate 28/min. He is somnolent & disoriented. Neurologic examination shows a depressed level of consciousness & brief, repetitive jerking movements of the limbs.
- Cerebrospinal fluid analysis reveals a lymphocyte-predominant pleocytosis with mildly elevated protein & normal glucose.
- Two other residents of his village have been hospitalized during the same period with a similar rapidly progressive febrile encephalitis.

Question #1

Which of the following is the most likely source of this patient's infection?

- A. Consuming unpasteurized dairy products
- B. Drinking raw date palm sap
- C. Receiving a bite from a stray dog
- D. Receiving a mosquito bite
- E. Swimming in a stagnant freshwater pond

Question #2

The patient's serum is positive for IgM antibodies against Nipah virus.

Which of the following is the natural reservoir of this virus?

- A. Domestic pigs
- B. Fruit bats of the genus *Pteropus*
- C. Palm civets
- D. Rhesus macaques
- E. Rodents of the genus *Rattus*

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)
<i>Yersinia pestis</i>	Rats/Fleas	Plague (sepsis, pneumonia)	Madagascar (2017)
<i>Brucella</i> spp.	Cattle, sheep, goats	Brucellosis (undulant fever, endocarditis)	China (2020)
<i>Coxiella burnetii</i>	Cattle, sheep, goats	Q fever (pneumonia, hepatitis)	Netherlands (2007)

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

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

There Are Many

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

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

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

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

 CATS • <i>Bartonella henselae</i> • <i>Pasteurella multocida</i> • <i>Yersinia pestis</i> • <i>Francisella tularensis</i>	 BIRDS • <i>Chlamydophila psittaci</i> • <i>Chlamydia</i>	 FARM ANIMALS (sheep, cows, horses, goats, chicken, etc.) • <i>Bacillus anthracis</i> • <i>Brucella</i> • <i>Coxiella burnetii</i> • <i>Campylobacter</i> • <i>E. coli</i> (Shiga toxin+) • <i>Erysipelothrix rhusiopathiae</i> • <i>Hepatitis E</i> • <i>Leptospira</i> • <i>Parapoxviruses</i> (orf, etc.) • <i>Rhodococcus</i> • <i>Salmonella</i> • <i>Trichinella</i>
 FISH • <i>Erysipelothrix rhusiopathiae</i> • <i>Mycobacterium marinum</i> • <i>Streptococcus iniae</i> • <i>Vibrio</i>	 DOGS • <i>Pasteurella multocida</i> • <i>Capnocytophaga canimorsus</i> • <i>Campylobacter</i> • <i>Leptospira</i> • <i>Staph. intermedius/pseudintermedius</i>	

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Adapted from Comprehensive Review of Infectious Diseases (2020), Elsevier.

 LEECHES • <i>Aeromonas hydrophila</i>	 RABBITS • <i>Francisella tularensis</i>	 REPTILES • <i>Salmonella</i>
 BEARS • <i>Trichinella spiralis</i>	 RODENTS • <i>Leptospira</i> • <i>Mpox</i> • <i>Salmonella</i> • <i>Spirillum minus</i> • <i>Streptobacillus moniliformis</i> • <i>Yersinia pestis</i>	 CAMELS • MERS-CoV
 BATS • <i>Rabies</i> • <i>Nipah virus</i>		

Adapted from Comprehensive Review of Infectious Diseases (2020), Elsevier.

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

Direct Contact with Animal or Animal Tissue

Question #3

- 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 mid-inguinal 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 #3

What is the most likely diagnosis?

- 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



Image from <https://www.skindsight.com/skin-conditions/adult/lymphogranuloma-venereum-lgv>

Cat Scratch Disease



- *B. henselae* causes most cases
- >13,000 cases in the USA per year¹
- 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, et al. *Emerging Infectious Diseases* 22 (2016)
Cat photo from <http://www.catscratchmed.com>
Cartoon from CDC.gov

Diagnosis

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

Symptoms of Cat Scratch Fever

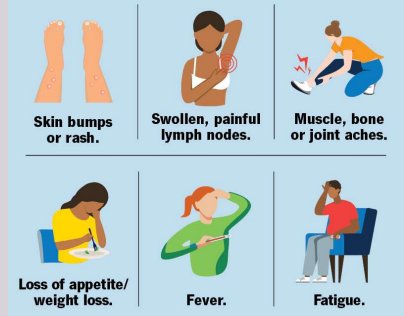
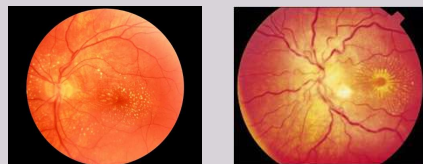


Image adapted from <https://my.clevelandclinic.org/health/diseases/23537-cat-scratch-fever>
Diagnostic info <https://www.cdc.gov/bartonella/bartonella-henselae/>

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.aars.org/file/1173/cat-scratch-retinitis-with-macular-lipid>,
<http://www.nejm.org/doi/full/10.1056/NEJMc010038#article>
Encephalitis reference: Fan J & Ali H. *Proc Bayl Univ Med Cent*. 2020 Jul; 33(3): 440–441.

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

Spach DH & Kaplan SL. UpToDate (2025)

Warthin Starry Silver Stain

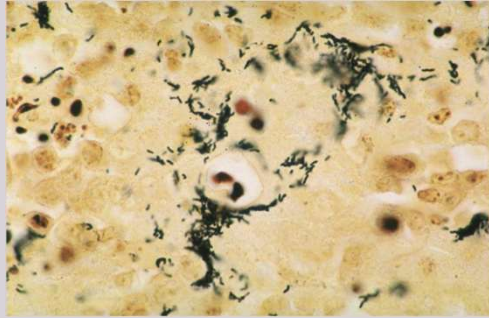


Photo by Andrew Margileth, MD.
from <http://emedicine.medscape.com/article/214100-workup#c8>

Cat Scratch Lymphadenopathy

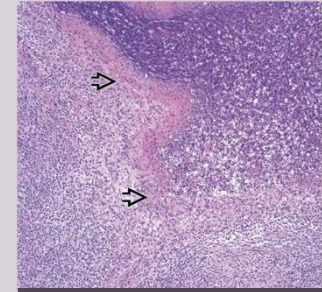
Stellate abscesses, necrotizing granulomas

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/>

Disseminated Bartonellosis

- Disseminated *Bartonella henselae* infection presents with a spectrum of severe manifestations, including persistent bacteremia, endocarditis, bacillary angiomatosis, peliosis hepatis, & multi-organ involvement

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

Anthrax

Cutaneous anthrax treated with doxycycline



At diagnosis

6 Days Later

4 Weeks After Diagnosis

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

Anthrax

- *Bacillus anthracis*: Aerobic, encapsulated, sporulating Gram-positive bacillus



- Usually infects cattle & sheep
- Human exposure may be through agriculture, or from related industry
- Those at highest risk are shepherds, farmers, & workers in facilities that use animal products, esp. contaminated goat hair, wool, or bone
- Incubation period about a week
- 20 meningitis reported in ~10% of pts hospitalized w/ cutaneous anthrax

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

Anthrax

- Skin (95%): pruritic papule on skin exposed to goat hair, animal hides. Small vesicles around an ulcer. +/- pain. Edema. Mild systemic symptoms usually
- Inhalation anthrax results from the inhalation of spores when aerosolized while working with contaminated animal products (wool, hair, hides)
- DX: Can be seen on smear, culture of vesicle fluid (alert the lab!)
- Inhalation (5%), ingestion (<1%)
- Anthrax rare in USA

<https://www.pcds.org.uk/clinical-guidance/anthrax>
Wilson KH, UpToDate (2025)

Anthrax

- Systemic anthrax:
- Pt. suspected of having inhalational, GI, injection anthrax, or anthrax meningitis should be treated urgently with intravenous antimicrobial combination therapy & antitoxin (raxibacumab, obiltoximab, or anthrax immunoglobulin) from CDC
- Empiric regimen = combination of 2 bactericidal agents + 1 protein-synthesis inhibitor
 - MEROPENEM + FQ (cipro/levo) + TCN (mino/doxy)
 - 2 weeks (>3 weeks for meningitis)
- Cutaneous anthrax: FQ (cipro/levo) or TCN (mino/doxy) x 7-10 days

Wilson KH, UpToDate (2025)



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

Edema
Vesicles
Necrotic Ulcer



Painless

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

Tularemia



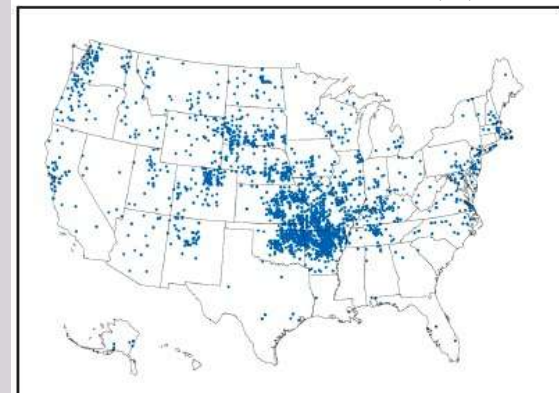
Image from cdc.gov

Tularemia

- Highly infectious gram-negative **coccobacillus** *Francisella tularensis*
- Tier 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 bio-weaponization

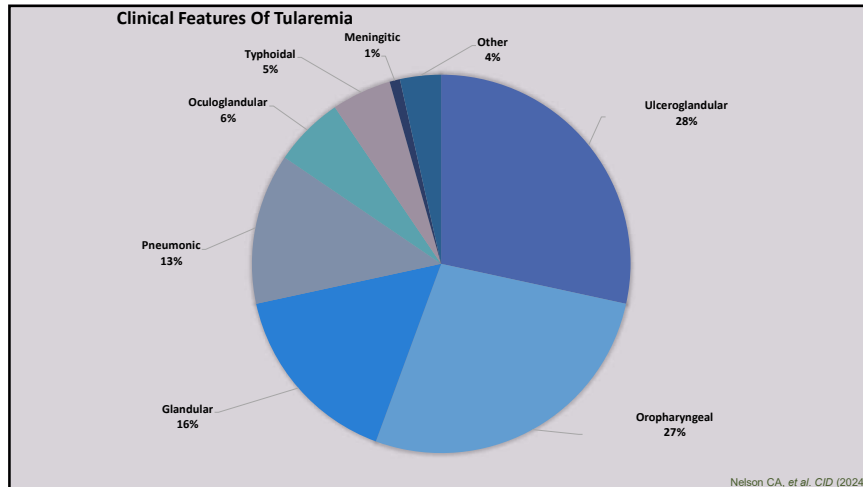
FIGURE 1. Reported tularemia cases, by county of residence* — United States, 2011–2022

Rich SN, et al. MMWR (2025)



~200 cases
per year in
the USA

* Cases are indicated randomly within county of residence.



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 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 *F. tularensis* spores.

Lawn Mowing & Brush Cutting

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

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

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

Rabbit Skinner



Glandular Tularemia

- 68-year-old with 1 week fever then 2-month progressive, painful swelling on R. side of neck
- Exposure to a sick cat
- Diagnosis made by + IgM (1:1280)
- Improved with 4 weeks doxycycline



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

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



Volume 78, Issue Supplement_1
15 February 2024

Contact with Insect Vector

Plague



www.plaquedoctormasks.com

Plague

- *Yersinia pestis*
- Endemic in **MADAGASCAR** & DRC
- 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)

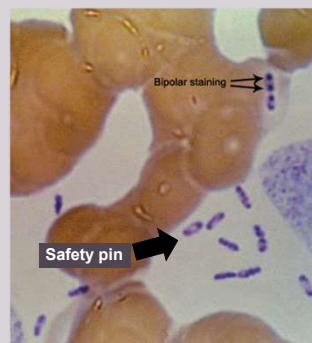
Why Madagascar & Plague?

Factor	Madagascar	Other Endemic Regions (e.g., U.S. Southwest, Central Asia)
Primary Reservoirs	Black rats (<i>Rattus rattus</i>) living in close contact with humans	Wild rodents (prairie dogs, ground squirrels, gerbils) usually far from people
Main Flea Vector	<i>Xenopsylla cheopis</i> (oriental rat flea) — highly efficient at transmitting plague	Other flea species, generally less efficient or less abundant
Transmission Cycle	Domestic rat → flea → human cycle well established	Mostly sylvatic (wild animal → flea → wild animal), rare human involvement
Climate	Highland climate (mild, rainy season supports flea survival and population growth)	Often arid/desert climates, less favorable for flea proliferation
Housing & Sanitation	Many homes allow rodent entry; poverty limits rodent/flea control	Better housing quality and vector control reduce contact with rodents
Healthcare Access	Limited, especially in rural areas → delays in diagnosis and treatment	Faster access to medical care and antibiotics prevents outbreaks
Burden of Disease	Several hundred cases annually; occasional large outbreaks (e.g., 2017 urban outbreak)	Sporadic cases (dozens or fewer per year) with rare local outbreaks

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Plague

- Gram negative coccobacillus
- **Bipolar-staining** bacilli
- **Safety pin** appearance
 - *Yersinia pestis*: lab hazard
- Dx: PCR, Ag assay, culture
- Treatment: **Streptomycin or FQs** >> doxy



Notes from the Field

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

Adam B. McQuinn, MD, MPH, Assistant Professor, University of Wyoming, Laramie, WY; Alan H. Hens, MD, PhD, University of Wyoming, Laramie, WY

In September 2021, the Wyoming Department of Health (WDH) was notified of a suspected case of pneumonic plague in an adult who was admitted to a Wyoming hospital following a 48-hour history of increasing cough, dyspnea, and absence of hemoptysis. The patient reported no recent travel history or contact with wild animals with any cases that were ill.

Upon admission, the patient was found to have a high fever, tachypnea, and hypoxemia. Initial chest radiograph showed bilateral infiltrates. Sputum and blood cultures were positive for *Yersinia pestis*. The patient was treated with intravenous streptomycin and recovered fully.

This case highlights the importance of maintaining a high index of suspicion for pneumonic plague in patients with severe respiratory illness, even in the absence of travel history or contact with wild animals. Prompt diagnosis and treatment are critical for survival.

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

The cat's owner later learned the cat had been in contact with a dead rodent in a field near the cat's house.

February 9, 2024

Wyoming woman catches rare pneumonic plague from cats

A woman from Wyoming caught the rare and serious form of the disease after being bitten by a cat.

February 9, 2024

• <10 cases of human plague per year in USA, mostly rural West

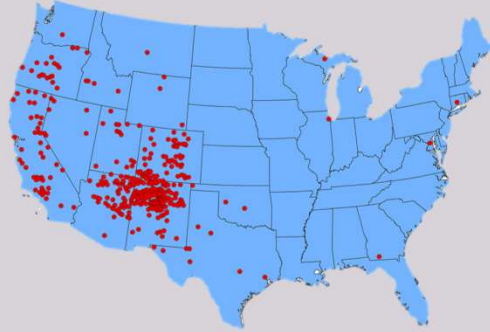
• Typically, in northern New Mexico, northern Arizona, southern Colorado, California, southern Oregon & western Nevada

• 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

Plague Map USA

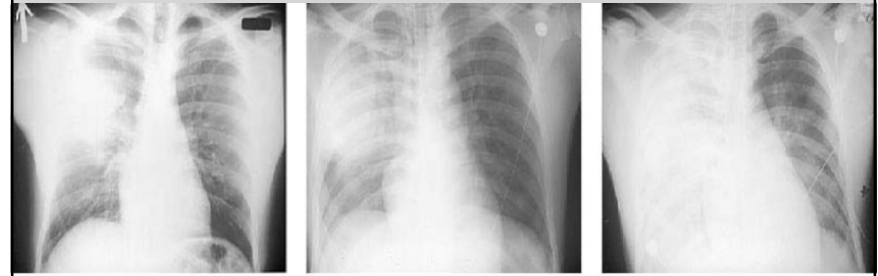


1970-2020

<https://www.cdc.gov/plague/maps/index.html>

Pneumonic Form

Rapid Progression of Pneumonic Plague on CXR over 13 Hours



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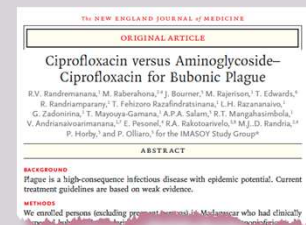
Image from Canyon, Deon V. "Environmental Change and Human Health Case Studies I." (2008).

Bubonic Form



Wikipedia image

Treatment



RCT aminoglycoside (SM) x 3d -> FQ (cipro) x 7d vs FQ alone x 10 days

Cipro alone was non-inferior

Randremanana RV, et al. NEJM (2025)

Intact Skin Contact with Animal Urine

Question #4

- 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

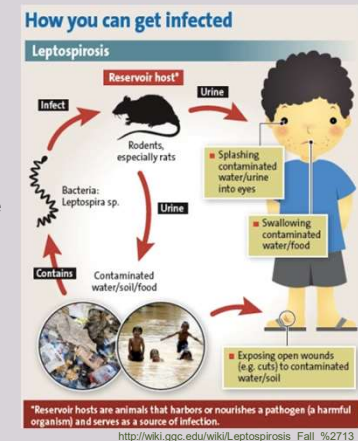
Question #4

What is the most likely diagnosis?

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

Leptospirosis

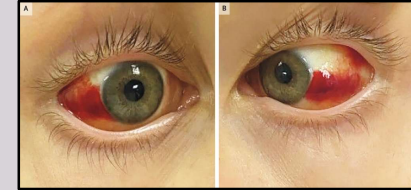
- Spirochetes excreted in urine of infected host & able to survive in wet environment
- Exposed intact skin to animal urine in water: veterinarians, farmers, loggers, triathletes, white water rafting, trapping
- Urine from cows, pigs, dogs, raccoons, rats, mice.
 - Summer & early Fall



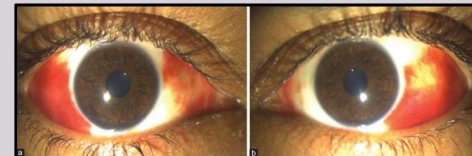
Leptospirosis

- 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 (Ciurariu E, et al. *Microorganisms* 2025)
- Rx: **doxycycline** for outpatients, IV penicillin for inpatients
 - Jarisch-Herxheimer in first 2 hr

Conjunctival Suffusion & Leptospirosis



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



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

Ingestion of Animal Products

Question #5

- 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 #5

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

Brucellosis

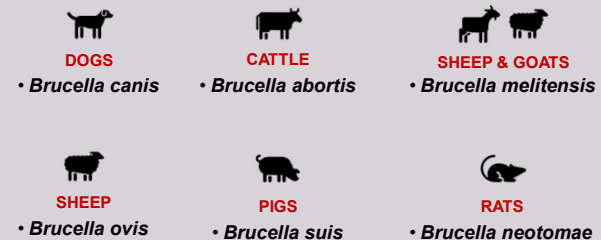
- Brucellosis is most often transmitted through the ingestion of raw or unpasteurized dairy products from infected animals, including milk & cheese (unpasteurized)
- Brucellosis can be transmitted through direct contact with infected animals or their bodily fluids, including vaginal discharges, aborted materials & semen
- 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

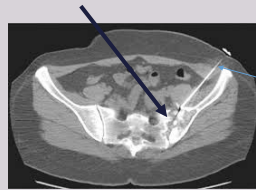
Animal Sources of *Brucella*



Qureshi KA, et al. Ann Med (2023)

Brucellosis

Later onset lesions in bone, liver
Epididymo-orchitis¹, 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. 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)

Question #6

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

Inhalation of Animal Products

Question #7

- 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, non-radiating 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.

Question #7

- 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 X-ray was normal
- Ceftriaxone was begun but the patient remained febrile & had the chest CT shown on the next slide

Question #7

Which of the following is the most likely diagnosis?

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

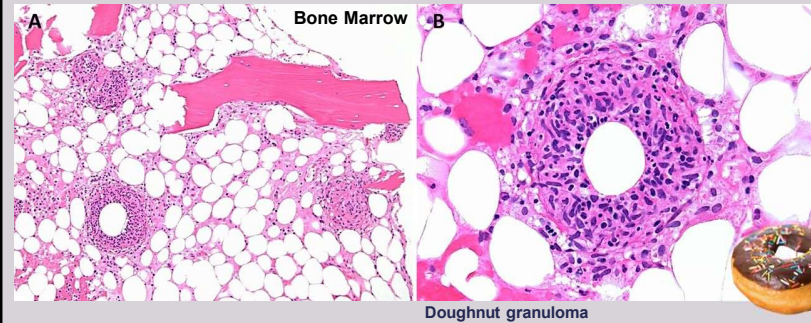
Question #7



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



Grant Herndon, and Heesun J. Rogers, Blood 2013;122:3098

The End

Thank you!
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@DMAronoff (Bluesky)
 david.aronoff (Insta, Threads)