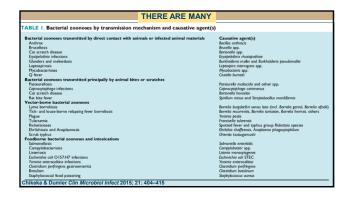
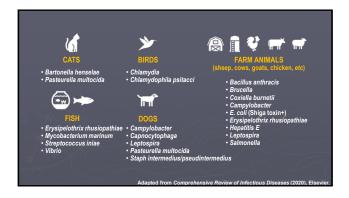


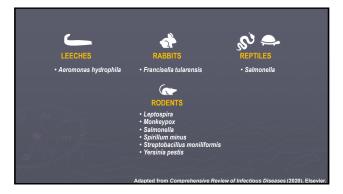
Disclosures of Financial Relationships with Relevant Commercial Interests None

Zoonoses: major infection route from animals in USA

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







Direct contact with animal or animal tissue

Question #1

19 yr woman presented with several days of headache, fever, chills, myalgias, cough & a rash

On exam she had generalized adenopathy & a vesiculopustular rash with focal areas of hemorrhage progressing in a uniform manner including the entire body, most prominently on the trunk, palms & soles

She reported her new pet prairie dog was also ill (lethargy, wasting, not eating)

Question #1 Sejvar JJ, JID 2004:190

Ouestion #1

What is the most likely infection?

- A. Erysipelothrix rhusiopathiae
- **B.** Smallpox
- c. Gambian cutaneous ulcerans
- D. Monkeypox
- E. Yaws (*Treponema pallidum pertenue*)

Question #2

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.

Ouestion #2

Most likely dx:

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

Suppurative inguinal lymph nodes (continued)

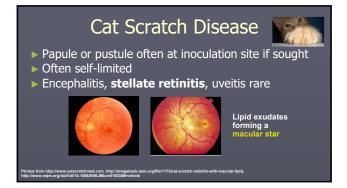
- ➤ Staphylococcus aureus. Gram stain of pus & culture positive. Distal lesion may be present.
- ▶ Lymphogranuloma venereum (LGV)-
 - Sexually transmitted
 - Chlamydia trachomatis L1-L3: genital lesion usually inapparent
 - "Stellate abscesses" on bx
 - (+) Nucleic acid amplification test on urine or wound

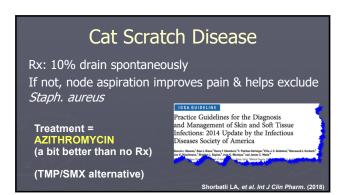
Cat Scratch Disease



- ▶ *B. henselae* causes most cases
- >13,000 cases in the USA per year¹
- ► Clinical findings:
 - 80% <21 yrs old, acute suppurative lymphadenitis proximal to bite, scratch, lick of young cat
 - Cats have chronic bacteremia but seem healthy
- ▶ Cat fleas may transmit between cats & occasionally to humans

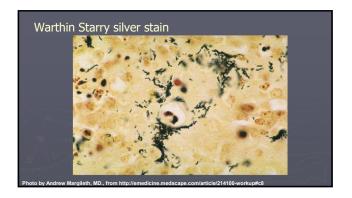
1. Nelson CA, at al. Emerging Infectious Diseases 22 (2016); Photo from http://www.catscratchmed.com

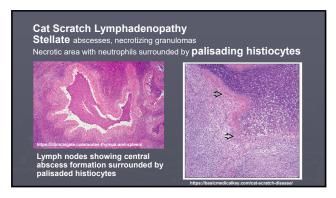










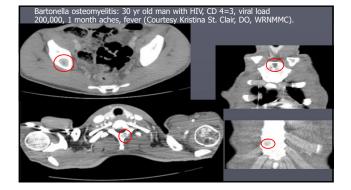


Major Syndromes due to Bartonella species

- ▶ Bartonella: Slow growing weakly Gram (-) rod
- B. henselae- cat scratch disease, peliosis
 B. bacilliformis- the Andes, Peru & sand fly bite; Carrion's disease
- Oroya fever (acute phase: fever + anemia) \rightarrow verruga peruana (later; hemangioma-like nodules in the skin & mucous membranes); Treatment = ciprofloxacin (Oroya); azithromycin (vp)
- - Human **body louse** *Pediculus humanus var. corporis* = vector
 - Bacteremia in persons experiencing **homelessness**, trench fever
 - **Endocarditis**

Major Syndromes due to Bartonella species

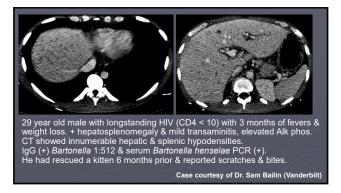
- HIV-associated (CD4<<100)
 - Bacillary angiomatosis (cutaneous)
 - ► Caused by either *B. henselae* or *B. quintana*
 - Lesions bleed easily
 - ▶ Biopsy: vascular proliferation, plump endothelial cells, bacill
 - DDx = Kaposi sarcoma
 - Bacillary **peliosis** (*B. henselae*)
 - Osteomyelitis (lytic; B. quintana)
 - Chronic bacteremia/endocarditis



Bacillary peliosis

- ▶ B. henselae
- ► Hepatosplenic bacillary peliosis
- ▶ Fever, chills, hepatosplenomegaly
- ▶ CT: Hypodense dense center +/- contrast enhancing rim
- ▶ Ultrasound, MRI = masses
- ▶ Blood filled spaces. Numerous bacilli on Warthin Starry stain or immunostaining





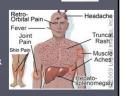
Solid Organ Transplantation

- SOT, like AIDS, can predispose to ALL the manifestations of bartonellosis
 - Lymphadenitis
 - Skin lesions (bacillary angiomatosis)
 - Bone lesions
 - Liver lesions

Bartonella quintana



- ▶ Transmitted by human body lice
- Crowded, unsanitary conditions: "trench fever" in WW1
- Splenomegaly, fever, arthropathy & arthritis, leg pains, rash, & severe weakness, thrombocytopenia
- Bacteremia, endocarditis in AIDS, homelessness +/- alcoholics



Brougui P. et al. NEJM (1999

Bartonella endocarditis

- <5% of all bacterial endocarditis</p>
- ► Consider *B. quintana* or *B. henselae* in **homelessness** & with **culture negative** endocarditis
- ▶ Insidious or acute onset of fever, weight loss, anorexia.
- ► Serology: IgG>1:800 highly suggestive (not species specific)
- ▶ **PCR** of serum, valve tissue
- Lysis-centrifugation blood cult.
 - 35°C, fresh chocolate agar, hold 2-4 weeks
- ▶ Rx: gentamicin + doxycycline x 6 weeks

ANTHRAX Cutaneous anthrax treated with dosycycline At diagnosis 6 days later 4 weeks after diagnosis

ANTHRAX

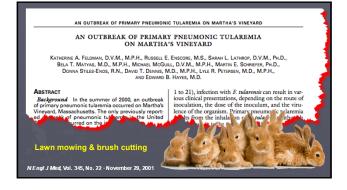
- ➤ Skin (95%): pruritic papule on skin exposed to goat hair, animal hides. Small **vesicles around an ulcer**. +/- pain. **Edema**. Mild systemic symptoms.
- ▶ DX: Aerobic, encapsulated, sporulating Gram positive bacillus seen on smear, culture of vesicle fluid
- RX: Penicillin but "weaponized" strains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





TULAREMIA

- Highly infectious gram-negative coccobacillus Francisella tularensis
- Vectors = Ticks (Dermacentor variabilis > Amblyomma americanum) & Deerflies
- ▶ Direct inoculation = rabbits, squirrels, muskrats, beavers, cats
- ▶ Hunters **skinning animals** (old days); farmers, veterinarians
- ▶ Red tender local lymph node inoculation site may form ulcer
- Ulceroglandular > glandular >> oculoglandular, pharyngeal, typhoidal, pneumonic = Bioterrorism, landscapers, mowers

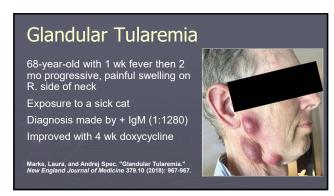


TULAREMIA

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

Maurin & Gyuranecz. Lancet (2016)

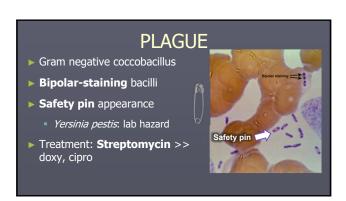








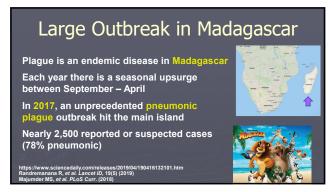


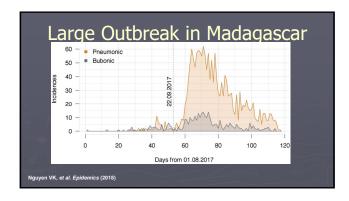














Intact skin contact with animal urine

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

Ouestion #3

Most likely diagnosis:

- A. malaria
- B. dengue
- c. ehrlichiosis
- D. leptospirosis
- E. Zika

Ingestion of animal products

Question #4

A 41 year old car salesman from Baltimore was admitted for a febrile illness & found to have *Brucella melitensis* in his blood culture. He 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, he had bought some lamb & beef at a farmer's market outside Baltimore.

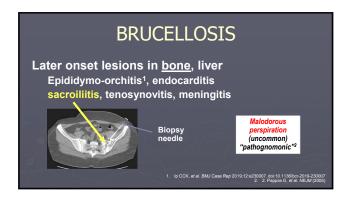
Question #4

The most likely source of his 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

- ► Exposure to non-USA dairy or meat, unpasteurized cheese, uncooked meat,
- ▶ Slaughterhouse worker, meat packer, veterinarian
- ▶ Acute or indolent onset fever, aches
- ▶ Nodes, liver, spleen may be enlarged



BRUCELLOSIS (con't)

- ▶ WBC normal or low, anemia, plt can be low
- ► DX: Blood culture, serology
- ▶ RX: Doxy plus rifampin or strep/gent
 - TMP-SMX in pregnant or young children

Inhalation of animal products

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 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.

Case

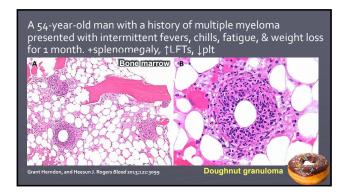
- ➤ Examination was normal except for a variable temperature up to 102°F
- ▶ WBC **3.3**K, platelets **121**K, creatinine 1.2, AST **144**, ALT **154**, alk phos 88, total bilirubin 0.6
- ► Admission chest Xray was normal
- Ceftriaxone was begun but the patient remained febrile & had the chest CT shown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



Question #5

Which of the following is the most likely diagnosis?

- A. brucellosis
- anthrax
- c. leptospirosis
- D. Q fever
- E. Visceral leishmaniasis



Rat Bite Fever

- ▶ Rat-bite fever (RBF): infection caused by 2 different bacteria:
 - Streptobacillus moniliformis, the only reported bacteria that causes RBF in North America (streptobacillary RBF): fever, chills, myalgia, headache, & vomiting; rash
 - ▶ Gram negative; can culture
 - Spirillum minus, common in Asia: fever, ulceration at the bite site, lymphangitis, lymphadenopathy, distinct rash of purple or red plaques
 - ▶ Darkfield needed to diagnose; culture negative
- Most infected after contact with rodents carrying the bacteria
 - Consumption of food or water contaminated with the urine & droppings of rodents carrying the bacteria.
- Penicillin treatment

https://www.cdc.gov/rat-bite-fever/index.html



Summary of Key Exposures

- Flea bites from rodents or outdoor cats in contact with wild rodents:
 - Yersina pestis PLAGUE (New Mexico, Colorado, Arizona)
- ➤ Wild game or their ticks: handling, cleaning muskrats, beavers, rabbits, squirrels
 - TULAREMIA

Summary of Key Exposures

- ► Eating unpasteurized cheese from overseas, including goat cheese:
 - BRUCELLOSIS
 - Unpasteurized queso could suggest Listeria
 - ▶ Stem likely to include pregnant patient

Summary of Key Exposures

- ➤ Animal **urine** on intact skin: hiker, farmer, forestry, veterinarian, swimming, falling in water or rafting in contaminated water
 - Leptospirosis
- ▶ Handling overseas animal hair, hides
 - Anthrax
- Slaughterhouses, veterinarians, parturient cat exposure, sheep handlers, living downwind of sheep/cattle farms
 - Q Fever

Key Clinical Syndromes

Culture negative endocarditis

Homelessness: Bartonella quintana Animal exposure: Coxiella burnetii Kaposi-like skin lesions: Bartonella henselae Tender lymph node: bartonellosis, tularemia, plague

Fever + jaundice: leptospirosis

Sacroiliitis or chronic illness w/ stinky sweat: brucellosis

Rat bite in US: $Streptobacillus\ moniliformis$

Rat bite in Asia: Spirillum minus

Other Zoonoses

- ▶ There are many zoonoses
- ▶ Be sure to review them before the boards

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

The End

Thank you!

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