Zoonoses: What can we get from our pets?

Zoonosis

- Infectious disease that occurs principally in animals but which may spread to humans
- Bacteria, viruses, fungi, protozoans, helminths

Case 1

- A 5yr.old autistic male, was brought to the ER due to seizures. On auscultation, you hear crackles and wheezing and physical examination revealed hepatomegaly.
- CBC revealed leukocytosis (14.2/cu mm with 20 % eosinophils). The caregiver tells you that the patient is fond of playing in the garden with soil where their pet dog runs and plays.

Toxocariasis (Visceral and Ocular Larva Migrans)

- Develops when human ingest the eggs of canine ascarid *Toxocara canis* or, less commonly, the feline ascarid *Toxocara cati*
- Almost all puppies are naturally infected with *T.canis*
- Infected animals shed millions of eggs per day that can survive for months in the soil

Toxocariasis: Epidemiology

- Small children are especially prone to acquire VLM
  - from intimate contact with a family pet
  - from contaminated sandboxes or playgrounds
  - (+) history of geophagia (pica)
  - exposure to puppies

Toxocariasis: Pathogenesis

Eggs in feces → Ingested in GIT → Larva hatches in GIT

circulation

Larva migrates in liver, lung, brain, other organs

Toxocariasis: Clinical Manifestations (VLM)

- Classic description involves a child (usually between 1-5 yrs.old) who has:
  - Fever
  - Leukocytosis
  - Eosinophilia
  - Hepatomegaly
  - Pneumonitis with wheezing and hypergammaglobulinemia

Toxocariasis: Clinical Manifestations (VLM)

- Larvae migrating during a primary infection may be better able to damage host viscera without being impeded by the host inflammatory response
  - therefore, more likely to reach the CNS
- Children with CNS involvement: frequently have either neuropsychiatric disturbances or seizures

Toxocariasis: Clinical Manifestations (Ocular Larva Migrans- OLM)

- Typically occurs in older children
- Often *do not have eosinophilia or elevated antibody titers*
- Larvae probably enter the anterior vitreous of the eye from the peripheral branch of the retinal artery
- Common features: Unilateral vision loss and strabismus, diffuse endophthalmitis

Toxocariasis: Diagnosis

- VLM: usually established by clinical symptoms
  - EIA measures serum antibody against antigens from T.canis
  - High degree of sensitivity (78%) and specificity (92%) at a titer > 1:32
- OLM: diagnosed on fundoscopy by characteristic migratory tracts and granulomata on the retina; larvae occasionally seen

Toxocariasis: Treatment

- VLM: usually self-limiting
  - Anthelminthic of choice: *albendazole (10 mg/kg/day in 2 divided doses x 5 days)*
  - For severe symptoms, or for CNS and eye involvement: *add corticosteroids*
- OLM: antihelminthic + corticosteroid therapy
  - *albendazole, mebendazole, thiabendazole, levamisole*, and *ivermectin*
  - With surgery when appropriate (e.g., vitrectomy, membrane peeling)

Toxocariasis

- Prognosis: excellent in children
- Prevention: control and anthelminthic treatment of animal reservoirs; elimination of dog feces from environment

Other Major Helminthic Zoonotic Infections

Disease	Causative agent	Common Animal Reservoir	Modes of transmission
Cutaneous larva migrans	*Ancylostoma braziliense, A. caninum*	Cats, dogs	Direct contact
Echinococcosis	*Echinococcus granulosus, Echinococcus multilocularis*	Dogs, carnivores, livestock (especially sheep)	Ingestion of eggs or food contaminated with fecal material
Cysticercosis	*Taenia solium*	pigs	Ingestion of uncooked or partially cooked pork

Case 2

- A 12 yr.old female was brought to your clinic with complaints of fever for 5 days, associated with arthralgia, calf muscle pain, headache, chills, nausea and vomiting. The patient recently came from the province for the summer and spent her vacation lounging in the town's pond.

Leptospirosis

- A disease of wild and domestic animals
- Caused by *Leptospira interrogans*
- Leptospires live for years in renal tubules of infected mammals (rats, dogs, cattle, swine, goats, mice)
- Become infected when on contact with leptospiruric animals, contaminated soil, or bodies of water

Leptospirosis: Clinical manifestations

Leptospires penetrate the skin, mucous membranes → (circulation) → Localized ischemia of infected blood vessels of renal tubules, liver, meninges, muscles, eyes, placenta

Incubation period of 1-2weeks:

Initial or Leptospiremic Phase (4-7days):

- profound myalgias
- Conjunctival suffusion
- Nausea/vomiting
- Abdominal pain
- Fever, headache, chills
- Neck stiffness
- Leptospires isolated from blood & CSF

1-5 days asymptomatic

Secondary LEPTOSPIRURIC or Immune Phase (>4-30 days):

- Aseptic meningitis
- Fever, headache, vomiting
- Isolated from the urine
- Anti-leptospira agglutinating antibodies are present
- Disappearance of leptospires from blood

Leptospirosis: Clinical manifestations

- Anicteric leptospirosis
- Aseptic meningitis
- Weil's disease:
  - Classic hepatorenal disease occuring in 5-10% of cases
  - More severe illness
  - consisting of an initial phase of fever + azotemia, jaundice, hemorrhage, anemia, mental status changes, and shock

Leptospirosis: Diagnosis

- Suspected from the clinical manifestations + history of possible exposure
- Confirmed by serologic testing: MAT; ELISA
- During 1st week:
  - leptospires can be isolated from blood and CSF
- During Leptospiruric phase:
  - Urine is source of positive cultures and dark-field examinations
  - Mild proteinuira, granular casts, microscopic hematuria
  - CSF analysis

Leptospirosis: Treatment

- Self-limiting in >90% of untreated patients
- High-dose penicillin G 300,000 U/kg/day (max 12-24 MU) q4 IV for 7 days is recommended for serious infection
- doxycycline 4mg/kg/day (max 200mg/day) q12 PO x 7days for those >9 y/o

Leptospirosis: Prevention

- Avoidance of potentially infected areas near streams and ponds
- Vaccinated domestic animals and livestock may still excrete the organism in the urine
- Doxycycline: prophylaxis for persons working in highly endemic areas; long-term use is not advised

Kung Hei Fat Choy!

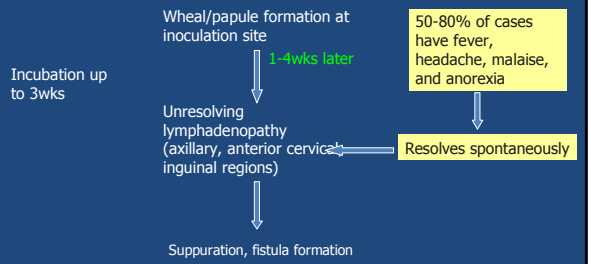
Case 3

- An 8 yr.old female was brought to you because of enlarged right axillary lymph nodes of 3 weeks duration. You noticed a suppurative papule along her right forearm.

Cat Scratch Disease

- Caused by *Bartonella henselae* spread by either a cat bite or scratch
- Transmission from cat to cat is believed to be from fleas, *Ctenocephalides felis*
- Worldwide, most common in 5-10 yrs. of age
- Symptoms: local swelling and swelling of the lymphatic system and flu like malaise

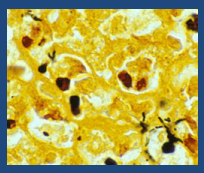
CSD: Clinical Manifestations



CSD: Other Clinical Manifestations

- Hepatosplenic CSD
- CNS: seizures, encephalopathy in 2% of patients
  - Onset: few days to months after lymphadenopathy formation
  - Abnormal EEG
  - CSF: lymphocytic pleocytosis
- Parinaud's syndrome
  - Bulbar conjunctivitis, conjunctival granuloma
  - Preauricular lymphadenopathy
- In AIDS and cancer patients, bacillary angiomatosis, peliosis

CSD: Diagnosis



- Suspected on the basis of:
  - clinical presentation
  - regional lymphadenopathy
  - (+) recent direct contact with a cat
  - confirmed by serologic test
- Antibody titers (IFA, ELISA >1:64) usually peaks at 4-6 wks after development of lymphadenopathy, persists for 4-5 months
- Organism grows slowly, takes 10-40 days

CSD: Diagnosis

- PCR: highly sensitive and specific diagnostic tool
  - Detects *Bartonella* at sites of skin inoculation, lymph nodes, bone, eye, conjunctivae, paraspinal lesions, liver, spleen, brain
- Majority of cases resolves in 1-2 months without any antimicrobial therapy

CSD: Treatment

- Antimicrobial therapy should be considered for patients with:
  - Lymphadenopathy that does not resolve within 6-8weeks
  - Lymphadenopathy associated with significant pain, limitation of movement, or persistence of debilitating symptoms
  - Severe systemic disease: encephalopathy, osteomyelitis, neuroretinitis;
  - Underlying medical disorder complicated by CSD

CSD: Treatment

- Some clinical response may be achieved with
  - rifampin (20 mg/kg/day in 2 divided doses x 14 days), azithromycin, cotrimoxazole, gentamicin, and ciprofloxacin
- Proposed treatments regimens for bacteremia and endocarditis includes
  - combinations of gentamicin + ceftriaxone, erythromycin or a macrolide, and a quinolone

CSD: Prognosis and Prevention

- Completely resolves in 1-2months even without antimicrobial therapy
- No deaths have been directly attributed to CSD
- Attentiveness towards avoidance of scratches and bites from cats & kittens

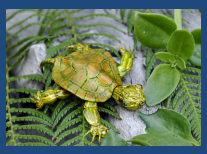
CSD: Prognosis and Prevention

- No data exist to support usefulness of antimicrobial prophylaxis for persons after cat contact OR use of flea eradication measures
- Declawing is unnecessary

Case 4

- A 10 yr.old male was brought to your clinic because of diarrhea and abdominal pain. There was associated low-grade fever. On PE the abdomen was tympanitic with increased bowel sounds. According to the mother, the child was often seen playing with his older brother's pet iguana.

Nontyphoidal Salmonella



- Associated with pet reptile or amphibian contact
- Many reptiles are colonized with *Salmonella*, intermittently shed in their feces
- Infected by ingesting *Salmonella* after handling a reptile or objects contaminated by reptiles → failing to wash their hands properly

Salmonella: Clinical Manifestations

- Most Salmonella infections are asymptomatic or mild
- Oral ingestion of at least 100,000 viable organisms is required to cause enteritis
- Short incubation period of < 1 week, usually 24-48 hours
- Self-limited symptoms
  - colicky abdominal pain, nausea, vomiting, loose stools, low-grade fever
  - Diarrhea is often green and foul-smelling

Salmonella:Diagnosis

- Occult blood is reported in 83%
- WBC is more commonly increased
- Stool cultures ae positive in >90% of cases
- Serologic testing with *febrile agglutinins* or the *Widal test is not recommended*

Salmonella:
Complications and Prognosis

- High rate of sepsis among infants, with 20% mortality rate
- Meningitis, liver abscess, or pulmonary involvement
- Because of increased risk of bacteremia, blood cultures are recommended for:
  - children <3 months, regardless of presence or absence of fever
  - for children 3-12 months of age with fever $\geq$39ºC
  - for children who appear lethargic or moderately ill

Salmonella: Treatment

- Generally supportive treatment
- Specific antimicrobial therapy is indicated for
  - patients with bacteremia or extraintestinal dissemination
  - high-risk patients with noninvasive gastroenteritis including
    - <3months of age, immunocompromised, persons with hemoglobinopathies or chronic GIT disease
- Third-gen cephalosporins, ciprofloxacin

Salmonella: Prevention

- Thorough hand washing with soap and water after handling reptiles or reptile cages
  - Children <5 years of age and immunocompromised persons should avoid contact
- Reptiles should not be allowed to roam freely in homes or living areas and should be kept out of kitchens and food areas to prevent contamination
- Sinks or bathtubs used to bathe reptiles or to wash their dishes should be thoroughly disinfected
- Reptiles should not be kept in childcare centers

Pasteurella multocida

- oral flora of dogs & cats
- Isolated after an infected animal bite
- Often remain localized to the wound

Pasteurella: Signs & Symptoms

- Erythema, swelling, tenderness & drainage at bite wond site
- Direct extension may occur to surrounding tissues
  - Lymphangitis
  - Regional lymphadenopathy
  - Bacteremia
- Complications:
  Osteomyelitis
  - Arthritis
  - Tenosynovitis
  - Sepsis
  - Meningitis
  - Brain abscess
  - Pneumonia
  - Endocarditis

Pasteurella: Management

- Local wound care
  - Aggressive irrigation with NSS
- Removal of devitalized tissue
  - to prevent nidus of infection for inoculated organism
- Penicillin G is the drug of choice
- Alternatives: Ampicillin-Sulbactam, Ceftriaxone or Cefotaxime

Other Major Bacterial Zoonotic Infections

Disease *Bacterial Diseases*	**Causative agent**	**Common Animal Reservoir**	**Modes of transmission**
Plague: bubonic, pneumonic, septicemic	*Yersinia pestis*	Rats and other rodents	Flea bite; Human to human: respiratory droplets
Anthrax: pneumonic, malignant pustule	*Bacillus anthracis*	Cattle, sheep and goats	Direct contact with infected animals or their products
Relapsing fever	*Borrelia sp.*	rodents	Tick bite; human to human: body louse

Other Major Bacterial Zoonotic Infections

Disease *Bacterial Diseases*	**Causative agent**	**Common Animal Reservoir**	**Modes of transmission**
Rat-bite Fever	*Streptobacillus moniliformis;* *Spirillum minus*	Mice, rats, hamsters	Bites, ingestion of contaminated food or water
Campylobacteriosis	*Campylobacter jejuni*	Rodents, dogs (puppies), cats, chicken, swine	Direct contact. Ingestion of contaminated food or water
Tularemia : pneumonia, skin lesion, adenitis	*Francisells tularensis*	Rabbits, squirrels, dogs, cats	Aerosol ingestion, direct contact, ingestion of contaminated meat, bite of fleas, deer flies. mosquitoes

Other Major Bacterial Zoonotic Infections

Disease *Bacterial Diseases*	**Causative agent**	**Common Animal Reservoir**	**Modes of transmission**
Lyme disease: erythema chronicum migrans, arthritis, carditis, neuropathy	*Borrelia burgdorferi*	White-footed mouse	Bite of deer tick (Ixodes) nymphs
Melioidosis: pneumonia, lung abscess, sepsis	*Burkholderia psudomallei*	Rats, mice, rabbits, ruminants, primates	Inhalation or direct inoculation

Other Major Bacterial Zoonotic Infections

Disease ***Bacterial Diseases***	**Causative agent**	**Common Animal Reservoir**	**Modes of transmission**
Yersiniosis	*Yersinia enterolitica, Yersinia pseudotuberculosis*	Rodents, cattle, goats, sheep, swine, fowl, dogs	Direct contact, ingestion of contaminated foof or water
Whooping cough	*Bordetella bronchiseptica*	Cats, dogs, pigs, rabbits	Direct contact
Erysipeloid	*Erysipelothrix rhusiopathiae*	Sheep, swine, turkeys, ducks, fish	Direct contact

Other Major Bacterial Zoonotic Infections

Disease ***Mycobacterial Diseases***	**Causative agent**	**Common Animal Reservoir**	**Modes of transmission**
Wound infection	*Mycobacterium marinum, Mycobacterium fortuitum, Mycobacterium kansasii*	Fish, aquarium	Direct contact, scratches
Chlamydial Diseases			
Psittacosis	*Chlamydia psittaci*	Birds	Aerosol inhalation

Major Viral Zoonotic Infections

Disease ***Viral Diseases***	**Causative agent**	**Common Animal Reservoir**	**Modes of transmission**
Rabies	*Rabies virus*	Dogs, skunks, bats raccons, foxes, cats	Bites, scratches

Cryptococcosis

- *Cryptococcus neoformans*, ubiquitous monomorphic fungus resident in soil & bird feces
- infected by inhalation of contaminated aerosols
- In normal hosts, infection is subclinical or minor localized pulmonary disease

Cryptococcosis: Clinical Manifestations

Central Nervous involvement (75%)

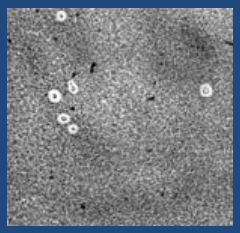
- Headache. Fever
- Nausea, vomiting
- Stiff neck
- Altered consciousness, impaired mental functions, cranial nerve lesions, visual deficits
- Duration: < 1week - 18 months

Pulmonary Involvement

- Not well described in children, most cases are disseminated at time of diagnosis
- Cough, chest pain
- Sputum production (32%)
- Weight loss (26%)
- Fever (26%)
- Hemoptysis (18%)

Diagnosis

- India ink or mucicarmine stain
- Culture
- Antigen test (latex agglutination titers 1:4 or >)



Cryptococcosis: Treatment In the Immunocompetent Host

Pulmonary and Non-CNS Disease

- Most infants & children, treatment is warranted
- Performing LP is essential in all cases
- Asymptomatic & mild-moderate symptoms: fluconazole 3-6mkday for 6 to12 weeks
- Alternative: itraconazole
- If azoles cannot be tolerated or progression occurs:

  amphotericin B 0.4 to 0.7 mg/kg/day
- Severe infections, treated like CNS disease

Cryptococcosis: Treatment In the Immunocompetent Host (CNS Disease)

- Combination of amphotericin B (0.7 to 1.0 mg/kg/day) + flucytosine 100mg/day for 2 weeks followed by
- fluconazole 100 mg/kg/day for 10 weeks

OR

amphotericin + flucytosine for 6-10 weeks

- Spinal tap should be done after 2 weeks of therapy (60-70% will have sterile spinal fluid)
- (+) CSF CS: require more prolonged treatment course
- Intraventricular and intrathecal amphotericin B for refractory cases

Cryptococcosis: Treatment In the *Immunocompromised* Host

- Cryptococcal Pneumonia
- fluconazole 100mg/kg/day for life
- Alternative: itraconazole
- Severe infections: amphotericin B until the patient is asymptomatic
  → fluconazole may be substituted for maintenance
- Cryptococcal Meningitis
- amphoterin B + flucytosine for 2 weeks → fluconazole for minimum of 10weeks

Other Major Fungal and Protozoal Zoonotic Infections

Disease	Causative agent	Common Animal Reservoir	Modes of transmission
Dermatophytoses	*Microsporum* *Trichophyton* *Epidermophyton*	Dogs, cats, rabbits	Direct contact, scratches
Protozoan Diseases Toxoplasmosis	*Toxoplasma gondii*	Cats, livestock	Ingestion of oocysts in fecally contaminated material of ingestion of tissue cysts in poorly cooked meat

Black Death

The victims "ate lunch with their relatives and dinner with their ancestors in paradise." - Giovanni Boccaccio

Thank you very much!