Infections We Get From Our Pets

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August 5, 2017

Disclosures
The planner and speakers of this conference have no relevant financial relationships with any commercial interests to be disclosed. There is no external financial support for this activity.
Objectives

- Recognize, identify, and treat human infections associated with pets in the United States
- Discuss preventive measures regarding human infections linked to pets in the United States

U.S. Pet Ownership Statistics

<table>
<thead>
<tr>
<th>Companion animals</th>
<th>Dogs</th>
<th>Cats</th>
<th>Birds</th>
<th>Horses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of households owning</td>
<td>30.5%</td>
<td>30.4%</td>
<td>3.1%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Number of households owning</td>
<td>43,346,800</td>
<td>35,117,060</td>
<td>5,671,000</td>
<td>1,750,060</td>
</tr>
<tr>
<td>Average number owned per household</td>
<td>1.6</td>
<td>2.1</td>
<td>2.3</td>
<td>2.7</td>
</tr>
<tr>
<td>Total number in United States</td>
<td>69,926,800</td>
<td>74,659,060</td>
<td>6,300,060</td>
<td>4,856,000</td>
</tr>
<tr>
<td>Veterinary visits per household per year (mean)</td>
<td>2.5</td>
<td>1.5</td>
<td>0.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Veterinary expenditure per household per year (mean)</td>
<td>$578</td>
<td>$519</td>
<td>$53</td>
<td>$573</td>
</tr>
<tr>
<td>Veterinary expenditure per animal (mean)</td>
<td>$227</td>
<td>$399</td>
<td>$514</td>
<td>$513</td>
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</tbody>
</table>

Specialty and Exotic Animals

<table>
<thead>
<tr>
<th>Households (in 1,000)</th>
<th>Population (in 1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>7,734</td>
</tr>
<tr>
<td>Ferrets</td>
<td>334</td>
</tr>
<tr>
<td>Rabbits</td>
<td>1,403</td>
</tr>
<tr>
<td>Hamsters</td>
<td>877</td>
</tr>
<tr>
<td>Guinea Pigs</td>
<td>847</td>
</tr>
<tr>
<td>Gerbils</td>
<td>234</td>
</tr>
<tr>
<td>Other Rodents</td>
<td>391</td>
</tr>
<tr>
<td>Turtles</td>
<td>1,320</td>
</tr>
<tr>
<td>Snakes</td>
<td>555</td>
</tr>
<tr>
<td>Lizards</td>
<td>726</td>
</tr>
<tr>
<td>Other Reptiles</td>
<td>365</td>
</tr>
<tr>
<td>Poultry</td>
<td>1,020</td>
</tr>
<tr>
<td>Livestock</td>
<td>661</td>
</tr>
<tr>
<td>All others</td>
<td>246</td>
</tr>
</tbody>
</table>

Outline

- Dog and Cat Bites
- Dog Related Illness
- Cat Related Illness
- Bird Related Illness
- Fish, Rodents
- Summary
- Questions
Dog Bites

- 60% of animal bites are related to dogs
- Over 350,000 people were treated for dog bites in 2001
- Most bites occur in young children
- Facial bites seen in children
- Hand bites seen in adults
- Mixed infections
  - Human skin flora
  - Animal mouth flora

Cat Bites

- 10-20% of animal bites are related to cats
- Most bites occur in women and in the elderly
- Bites occur on upper extremity and face
  - Less often life threatening than dog bites
  - Higher infection risk than dog bites
- Mixed infections
  - Human skin flora
  - Animal mouth flora
Evaluation of a Dog or Cat Bite

1. Wound Assessment
   - Location of injury
   - Type of injury
2. Culture Data
3. Imaging
4. Surgical Intervention/Wound Care
5. Preventive Care
   - Vaccines
   - Rabies Assessment

Bite Wound Assessment

- Evaluate Location of the Wound
  - Face
  - Hands
- Evaluate Type of Wound
  - Crush injury
  - Puncture wound
Dog Bite of the Face

Figure 1: Dog bite patient with extensive facial injuries

Cat Bite of the Finger

Figure 2: Septic arthritis of left first proximal interphalangeal joint
Culture Data

- Obtain deep swab of infected wounds
  - Identify infectious agent
  - Direct antibiotic therapy
- Avoid superficial wound swabs
  - Normal skin flora

Up to 20% of bites will be complicated by serious infection.

Dog Bite Pathogens

Aerobes
- *Pasteurella* species
- *Streptococcus* species
- *Staphylococcus* species
- *Neisseria* species

Anaerobes
- *Fusobacterium* species
- *Bacteroides* species
- *Porphyromonas* species
- *Prevotella* species
- *Capnocytophaga* species
### Cat Bite Pathogens

**Aerobes**
- *Pasteurella* species
- *Streptococcus* species
- *Staphylococcus* species
- *Moraxella* species

**Anaerobes**
- *Fusobacterium* species
- *Bacteroides* species
- *Porphyromonas* species

### Imaging
- **Plain radiograph**
  - Evaluate for fracture
  - Rule out foreign body
- **CT scan, MRI**
  - Skull fracture
  - Joint involvement
Wound Care and Surgical Intervention

- Irrigation and debridement
  - Avoid closure of wounds
- Surgical consultation
  - Plastic Surgery for facial wounds
    - Potential for closure
  - Orthopedic Surgery for hand wounds

Empiric Treatment of Bites

Amoxicillin + Clavulanate for 7 days

Penicillin Allergy

   - Adult: Doxycycline + metronidazole
   - Children: Clindamycin + TMP-SMX
Animal Bite Treatment Failure

- Inappropriate Antibiotic Choice
- Patient nonadherence
- Infectious Complications
  - Septic Arthritis
  - Osteomyelitis

*Pasteurella species*

- Aerobic, facultative anaerobic gram negative bacilli
- Most human infections are caused by dog or cat bites
- Infectious complications
  - Necrotizing fasciitis
  - Septic arthritis, osteomyelitis
  - Meningitis
**Pasteurella species Treatment**

**Amoxicillin + Clavulanate**

Alternative Therapies:
- Ampicillin + sulbactam
- Ciprofloxacin or Levofloxacin
- Doxycycline
- TMP-SMX

Avoid:
- Cephalexin
- Clindamycin
- Penicillin without a beta lactamase inhibitor

**Capnocytophaga canimorsus**

- Facultative anaerobic gram negative rods
- “dog-bite organism”
- Associated with
  - Chronic alcohol use
  - Asplenia
  - Immunosuppression
- Infectious complications
  - Cellulitis
  - Meningitis
  - Endocarditis
Clinical Scenario

60 year old male with new onset abdominal pain, fatigue and a petechial rash. He reports being bitten by a neighborhood dog one week prior. He drinks six beers daily.

His clinical condition rapidly deteriorates and he requires ventilator and vasopressor support.

C. canimorsus

Amoxicillin + Clavulanate

Alternative Therapies:
- Doxycycline
- Clindamycin
- Moxifloxacin

Severe Infection (sepsis, severe cellulitis):
- Ampicillin + Sulbactam
- Ceftriaxone
- Meropenem
Tetanus Prophylaxis

- **Minor Wounds**
  - Td if < 3 doses per history, >10 years since vaccine

- **Contaminated Wounds**
  - Td + TIG if < 3 doses, Td if > 5 years since vaccine

- **Tetanus Immune globulin indicated if:**
  - Contaminated wound, with incomplete or unknown vaccine series

ACIP Recommendation
Human Rabies

- 55,000 people die annually from rabies
- Approximately 3 human cases/year in the US
- Bat rabies causes most cases in the US
- Major risk groups
  - bats, raccoons, skunks, foxes

As of 2006, major canine variants were eliminated due to vaccinations

Rabies Prevention

- Vaccinate Pets
- Healthy dog or cat bite
  - Observe pet for symptoms
  - Sacrifice pet and treat human if DFA positive
- Skunk/Bat/Raccoon Bites
  - treat pending animal testing

Treatment: HRIG then 4 dose vaccine schedule (Days 0,3,7,14)
What about worms?

Toxocara spp.

- Nematodes
  - *Toxocara canis, Toxocara cati*
- Pet Infection
  - Definitive Host
  - Infections acquired at any age
  - Reinfection possible
- Human Infection
  - Accidental Host
  - Frequent in young children
  - Ingestion of contaminated soil
**T. canis**

- Often asymptomatic
- Visceral larva migrans
  - Fever, hepatomegaly, bronchospasm, myalgias, arthralgias
- Ocular larva migrans
  - Unilateral eye pain, vision loss, leukocoria
- “Covert toxocariosis”
  - Fatigue, abdominal complaints, allergic symptoms

**Human Toxocariosis**
Diagnosis

- Visceral larva migrans
  - Serologies
  - Presume in a child with fever and eosinophilia
- Ocular larva migrans
  - Eye exam
  - Larvae in tissue

Do not test stool for ova and parasites

Treatment

- **Visceral Larva Migrans**
  Albendazole twice daily for 5 days

- **Ocular Larva Migrans**
  Albendazole (often longer course)
  Corticosteroids
  Vitrectomy and destruction of retinal larvae
Prevention of *Toxocara* Infections

- Hand washing after outdoor exposures
- Cover sandboxes
- Avoidance of “Pet Parks”
- Fecal examination and antihelminthic treatment for pets
- Routine de-worming for puppies and kittens

Clinical Scenario

45 year old female presents to her primary care physician with 2 months of cough, pleuritic chest pain, and hemoptysis. She has had low grade fevers, but no weight loss. She smokes one pack of cigarettes per day. She denies recent travel, incarceration, or history of positive TB test. She lives at home with her dog that she states has “skin irritation.”
Imaging

Differential Diagnosis

- Lung Malignancy
- Pulmonary Embolism
- Tuberculosis
- Pulmonary Fungal Infection
- Human Pulmonary Dirofilariasis (Canine Heartworm)
**Dirofilaria immitis**

- Nematode
- Arthropod-borne parasite of domestic and wild animals
- Mosquito vector transmits between dogs and between dogs and humans
- Vascular infection
  - Larvae enter pulmonary vessels and die
  - Death and disintegration causes inflammation and formation of granulomas

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### Human dirofilariasis

**Table 3** Human dirofilariasis cases: United States and Europe, 1999 and 2012

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Dirofilaria immitis</th>
<th>Dirofilaria repens</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>97</td>
<td>120</td>
</tr>
<tr>
<td>France</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Italy</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Greece</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Spain</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Germany</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Russia</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><em>Human case totals</em></td>
<td><em>114</em></td>
<td><em>160</em></td>
</tr>
<tr>
<td>World reported case totals up to 2012</td>
<td>372</td>
<td>1,410</td>
</tr>
</tbody>
</table>

NR, not reported.
Diagnosis

- No laboratory tests
- “Coin lesions” on chest x ray
- Adult worm identified on excisional biopsy
- Peripheral eosinophilia rare
  - less than 15% of cases
- Extra pulmonary granulomas

Treatment

- Excision of nodules from the lungs
- Extraction of live worm

No antibiotic or antihelminthic therapy
Prevention of Human dirofilariasis

- Canine chemoprophylaxis
- Mosquito Control

Cat Scratch Disease (CSD)

- *Bartonella henselae*
- 50% of cats are seropositive
- Pustule forms at site of cat scratch within a few days, followed by painful lymphadenopathy that can last 2-3 months
- Ophthalmologic complications are seen in up to 13% of cases
**Bartonella henselae**

- Gram negative, intracellular bacilli
- Identified as the etiologic agent of Cat Scratch Disease in 1993
- Cats are reservoir host, transmitted between cats by the cat flea

**Diagnosis**

- Three of the following are required
  1. Lymphadenopathy without other etiology
  2. Positive *B. henselae* titer
  3. Known cat contact
  4. Lymph node with bacilli or necrosis on histopathology
Ocular Bartonellosis

- Symptoms
  - Decreased visual field
  - Unilateral blurry vision
  - Lymphadenopathy
  - Flu-like illness

Macular Star

Photo courtesy of Dr. Hans Schlecht
# Treatment

**Cat Scratch Disease**
Azithromycin 500mg once, then 250mg daily x4

**Retinitis**
Doxycycline + rifampin for 4-6 weeks

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# Bacillary Angiomatosis

- HIV/AIDS
- Caused by *B. henselae*
- Presents as red papules or subcutaneous nodules
- Diagnosis made from lymph node tissue positive for many bacilli on Warthin Starry Stain
- Treatment:
  - Doxycycline for 3 months
  - Consider addition of rifampin
Warthin Starry Stain

http://pathologyoutlines.com/images/lymph/21_080.jpg

Toxoplasma gondii
Toxoplasma gondii

- Infection types
  - Primary Infection
    - Asymptomatic
    - Symptomatic
  - Secondary Infection
  - Congenital Infection

Primary Infection

- Most are asymptomatic
- Symptoms can include fever, malaise, and lymphadenopathy
- Disseminated or cerebral disease is rare
Secondary Infection

- Reactivation of latent infection
  - HIV/AIDS
  - Chemotherapy
  - Organ Transplantation
  - Immunosuppression

Secondary Infection

- Presents as encephalitis
  - Headache, fever, confusion
  - Ring enhancing lesions on imaging (CD4 <50)
- Presents as pulmonary disease
Congenital Infection

- Transplacental infection
  - Miscarriage, stillbirth
  - Ocular disease
  - Cerebral involvement
- 22% of infected infants have clinical disease
- “TORCH” infection

Diagnosis

- Serum Testing
  - Seroconversion
  - 4-fold increase in titer
    - IgM can remain positive for > 2 years
- Histopathology
Treatment

- Primary infection
  - usually requires no treatment
- Secondary infection (reactivation)
  - Pyrimethamine + sulfadiazine + leucovorin for 6 weeks
- Secondary Prophylaxis
  - TMP-SMX
- Pregnancy
  - 1st trimester: Spiramycin
  - Pyrimethamine + sulfadiazine + leucovorin

Prevention

- Pregnant women should avoid litter boxes and cats that forage outdoors
- Avoid undercooked meats
**Chlamydophila psittaci**

- Gram negative, intracellular bacteria
- 80 cases/year
- Birds are host
  - Fluids from beaks, eyes, excrement
- Symptoms
  - Headache, fever, malaise, cough
  - Mimic influenza and other atypical pneumonias
- Fatal in up to 20% of cases if untreated

**Exam Findings**

- Enlarged spleen
- Relative bradycardia
- Pink, blanching rash (Horder’s spots)
- Chest radiograph shows lobar or interstitial infiltrates
Treatment

Doxycycline for 10-21 days
Azithromycin for 7 days

Salmonella (non-typhoidal)

- 1-3 million cases/year in the United States
- 2016
  - Largest number of infections linked to backyard poultry
  - 895 cases, 48 states, 3 deaths
- 2017
  - 790 cases, 48 states
- Diagnosed by culture of blood, stool, urine
Salmonella

- Ingestion of bacteria in food or water from multiple animal reservoirs
- Symptoms
  - Develop 12-72 hours after exposure
  - Fever, abdominal pain, non-bloody diarrhea
- Self limited
  - 4-7 days

At Risk Populations

- Individuals > 65 years of age
- Individuals < 5 years of age
- Immunosuppressed or immunocompromised
Salmonella Treatment

Most cases do not require treatment.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMP-SMX, Ciprofloxacin, or Ceftriaxone</td>
<td>5-7 days</td>
</tr>
</tbody>
</table>

Immunocompromised: treat for 14 days

Human Salmonella infections linked to Backyard Flocks (2016)
Human Salmonella infections linked to Backyard Flocks (2017)

Backyard Poultry

FIND OUT WHY

Poultry belong outside. Handwashing protects you from germs.
**Mycobacterium marinum**

- “fish tuberculosis”
- Present with singular papular lesion
  - May have proximal (sporotrichoid) spread
- History positive for trauma or chronic wound with fish tank exposure
- Causes soft tissue, bone infections

**M. marinum Diagnosis**

The diagnosis is made by AFB smear/culture from an active lesion.

Tuberculin skin testing can be positive from *M. marinum* infections.
**M. Marinum Treatment**

- Treatment
  - Clarithromycin and ethambutol
  - Clarithromycin and rifampin
- Alternative Therapy
  - Minocycline
  - Doxycycline
  - TMP-SMX

Treatment duration: 2-3 months, or 4-6 weeks after resolution of symptoms

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**Rat Bite Fever**

- Caused by *Streptobacillus moniliformis*
- Non-encapsulated Gram negative bacilli
- Symptoms
  - 10 day incubation period, followed by fevers, chills, headache, nausea and vomiting
  - 2-4 days after symptom onset, rash on palms and soles can develop
  - Nearly half of patients will develop polyarthritis
- Most symptoms resolve with or without treatment in 2 weeks, but arthritis can persist
- 10% mortality if untreated
Rat Bite Fever

http://www.cmaj.ca/content/185/15/1346.full.pdf

Differential Diagnosis for Rash

- Secondary Syphilis
- Rocky Mountain Spotted Fever
- Hand Foot Mouth Disease
Infection Sites

- Joints
- Skin
- Recurrent Fever
- Diarrhea
- Endocarditis
- Meningitis/Brain Abscess
- Pneumonia

Treatment

Uncomplicated: Penicillin G or Amoxicillin (14 days)
Complicated: Penicillin G (28 days minimum)
Alternative Therapy: Doxycycline, Ceftriaxone
**Prevention**

- Avoid contact with rats, rodents, ferrets
- Avoid non-zoonotic transmission by avoiding infected food products

**Summary**

- Discussion of a systematic approach to the assessment and treatment of dog and cat bites
- Discussion of identification, treatment, and prevention of human infections related to household pets
- Reviewed Tetanus and Rabies vaccine indications
“I tell you, that dragon’s the most horrible animal I’ve ever met, but the way Hagrid goes on about it, you’d think it was a fluffy little bunny rabbit.”

— J.K. Rowling, Harry Potter and the Sorcerer’s Stone

Questions


https://www.cdc.gov/parasites/dirofilariasis/

https://www.cdc.gov/parasites/toxocariasis/index.html


http://pathologyoutlines.com/images/lymph/21_060.jpg