Canine and Feline Influenza: Risks, Management, and Prevention

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Emerging Issues

- Evolving viruses
- Species jumps
- Newer, highly sensitive diagnostic testing methods
- Unknown/unrecognized agents
- More animal movement
  - Shelters
  - Owners
- Anti-vaccination movement
Epidemiologic Triad

- Host
- Agent
- Disease
- Environment
Host

- Age
- Concurrent conditions
- Stress!

Agent

- Virulence
- Transmission routes
- Carrier state
- Incubation period
- Shedding
- Vaccine and treatment coverage

Disease

- Immune status
- Vaccine status
- Nutritional status

Environment

- Capacity
- Housing
- Sanitation
- Ventilation
- Staff training and communication
URI Prevention & Management

- Control the Environment
- Prepare and support the Host
- Minimize Exposure to the Agent
Canine URI Agents

**VIRAL**

Classics
- Canine distemper
- Canine parainfluenza (CPiV)
- Canine adenovirus (CAV2)
- Canine respiratory coronavirus (CRCoV)

Emerging
- Canine pneumovirus
- Canine Influenza (CIV)
- H3N8
- H3N2

**BACTERIAL**

*Bordetella bronchiseptica*

*Mycoplasma spp.*

*Strep zoo*
Agents

INCUBATION

Exposure → clinical signs
Most often < 1 week
- Between 2-14 days

Shedding

Clinical Signs/Shedding
- Shedding variable: some BEFORE CLINICAL SIGNS
- Variable length but most < 2 weeks

TRANSMISSION

Direct contact: sick → susceptible
Aerosolization
Environmental contamination
- FOMITES!

Secretions
Feline URI Agents

CLASSIC AGENTS

- Viral
  - Feline Herpes Virus (FHV-1)
  - Feline Calicivirus (FCV)

- Bacterial
  - *Bordetella bronchiseptica*
  - *Chlamydophilia felis*
  - *Mycoplasma* spp.
  - Others

EMERGING AGENTS

- Feline influenza
  - H5N1
  - H1N1
  - H3N2
  - H7N2

- Feline pneumovirus?
Feline URI Agents

**INCUBATION**

Exposure → clinical signs

Often < 1 week
- Between 2-14 days

**Shedding**

Clinical Signs/Shedding most efficient when clinical signs are present
- Variable length Weeks to months

**TRANSMISSION**

Direct contact: sick → susceptible

Droplet

Environmental contamination
- FOMITES!
Influenza viruses

Orthomyxovirus
  ◦ Enveloped RNA virus
  ◦ Three families
    ◦ A – avian, human pandemic, highly virulent and mutable
    ◦ B – humans, seals, ferrets, less mutable
    ◦ C – humans, dogs, pigs; rare

◦ Influenza A is the one we are most worried about
Influenza A viruses – relevant factors

Antigenic protein = classification
- H1-H18 Hemagglutin receptors
- N1-N11 Neurominidase receptors

H antigen is responsible for viral attachment to host cells

N antigen is responsible for the exit strategy to continue infection

Lots of recombination events, highly mutable
Influenza viruses – relevant factors

Transmission
- Droplet, aerosolization
- Direct contact
- Fomites
- For H5N1, consumption or droppings
- No reports of transmission from dogs/cats to people
- Ferrets are susceptible to H1N1
Canine influenza (H3N8 and H3N2)

H3N8 (2004)
- Equine to dog
- Periodic outbreaks
  - Endemic areas: NY, PA, CO, FL

H3N2 (2015)
- 2015 Outbreak in Chicago
- Avian to dog transmission
- first reported in owned dogs
- Longer shedding periods (21 days?)
- More severe disease
Canine Influenza

Mild forms
- Soft cough, 10-30 days
- Lethargy, fever, inappetance, nasal discharge

Severe forms
- High fevers
- Pneumonia – secondary agents
- 1 in 5 require hospitalization H3N2

Morbidity: virtually all dogs become infected; 80% show clinical signs

Mortality: low (less than 10%)
Feline Influenza

**Strains**
- H5N1: highly pathogenic avian influenza
- H1N1
  - single cat in 2009, Iowa household members had respiratory disease
- H3N2: Canine flu
  - S Korea in 2006; birds to dogs
  - Dog to dog (US 2015)
  - Dog to Cats
    - Relatively rare
    - Does not affect humans
Feline influenza (H7N2)

- H7N2: Low Pathogenic Avian Influenza
  - Cats in NYC shelters (2016)
  - Found by accident – sent as a canine sample for PCR (specific to H3N2 and H3N8)

- History
  - Had circulated in NYC live bird markets early 2000s
  - Thought to be eradicated (2006)

- Only 2 previous human cases reported
  - Considered “low risk for transmission”

- 1 investigator tested positive one day, negative the next, but risk was raised
PCR Testing for respiratory disease

Canine and feline respiratory panels
- PCR technology – can identify based on small amounts of agent
- Oropharyngeal and conjunctival swabs – 2-3 per animal, pooled in dry sterile tube
- For complete instructions, see https://vetmed-maddie.sites.medinfo.ufl.edu/files/2014/10/Collection-of-Swabs-for-Diagnosis-of-Respiratory-Pathogens-by-PCR.pdf
- Remember short shedding period for H3N8 (7 days); longer for H3N2 (21-28 days)

- Antech/Idexx: H3N8, H3N2
- Cornell AHDC: Testing for Influenza A matrix, then follow with strain details
PCR testing in shelters

Benefits
- Management
- Prognosis

Why not do it on everyone?

How does it change what you do?

Unusual clinical signs: type or severity
Unusual numbers of cases
Disease in vaccinated, healthy animals
Unclear source
ELISA for Influenza A testing in shelters

Human point of care test
Can be used to test dogs with less than 4 days of clinical signs
Influenza A nucleoprotein
False negatives due to low amounts of virus
Paired serology is definitive

Acute serum sample < 7 days of signs, followed by another sample 2 weeks later
- Measures IgG levels
- 2 to 4 fold increase verifies acute disease

CIV is novel in many settings
- Positive titer at the start can be significant
URI Prevention & Management

- Control the Environment
- Prepare and support the Host
- Minimize Exposure to the Agent
VACCINES AVAILABLE?

CLASSICAL AGENTS

- Viral
  - Canine Distemper (CDV)
  - Canine Parainfluenza (CPiV)
  - Canine Adenovirus (CAV2)
  - Canine respiratory coronavirus (CrCoV) No

- Bacterial
  - Bordetella bronchiseptica
  - Mycoplasma spp. No

EMERGING AGENTS

- Canine pneumovirus - No
- *Strep zoo* - No
- Canine Influenza (CIV)
  - H3N8 (2009)
  - H3N2 (2015)
  - Bivalent 2016
  - Ongoing research
Current research (2017)

A bivalent live-attenuated influenza vaccine for the control and prevention of H3N8 and H3N2 canine influenza viruses

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VACCINES AVAILABLE?

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  - *Chlamydophilia felis*
  - *Mycoplasma* spp. No
  - Others

EMERGING AGENTS

Feline influenza? No
- H5N1
- H1N1
- H3N2
- H7N2

Feline pneumovirus? No
Vaccine principles

Protective
  ◦ Canine distemper

vs partially protective
  ◦ Herpes, calici
  ◦ Bordetella
  ◦ CIV too

Vast majority of URI, protection is PARTIAL
  ◦ Minimize signs, severity, shedding
Vaccine principles in shelters

AT INTAKE

Correct products, modified live agents
- DOGS: DHPP SQ, Bordetella/Parainfluenza IN (+/-CAV2)
- CATS: FVRCP SQ, IN?

Limitations of killed products

Benefits of intranasal products for cell mediated immunity

Correct handling of products
- Trained staff
- Refrigeration
- Mixing just prior to use
Table 10.2. Anti-microbial treatment options for URI
Sources: Lappin et al. 2017; Plumb 2015; Sykes 2013

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>First line antibiotics</td>
<td></td>
<td>Uncomplicated URI</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>5mg/kg PO q12 or 10 mg/kg PO q24h</td>
<td>Effective against CIRD associated B bronchiseptica or Mycoplasma spp. Much preferred over other options in shelters.</td>
</tr>
<tr>
<td>Minocycline</td>
<td>5mg/kg PO q12h</td>
<td>Similar to doxycycline</td>
</tr>
<tr>
<td>Amoxicillin-clavulanate</td>
<td>11 mg/kg PO q12h</td>
<td>Effective against CIRD caused by secondary commensals, including Pasturella, Staphylococcus, and Streptococcus species. Ineffective against beta-lactamase bacteria, including most B. bronchiseptica isolates. Ineffective against Mycoplasma spp.</td>
</tr>
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<td>Second line antibiotics</td>
<td></td>
<td>For use in non-responsive or cases progressing to pneumonia. Preferably based on culture and sensitivity of endotracheal wash or bronchoalvelolar lavage samples. Culturing nasal swabs not recommended.</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>5-10mg/kg PO q 24 h for 3-7 days; 10mg kg PO q 24-72 hours (cats)</td>
<td>Primary bacterial pneumonia including Mycoplasma spp.</td>
</tr>
<tr>
<td>Enrofloxacin</td>
<td>5-20mg/kg PO, IM, IV q24h</td>
<td>Effective against most isolates of B. bronchiseptica and Mycoplasma spp</td>
</tr>
<tr>
<td>Marbofloxacin</td>
<td>2.7-5.5 mg/kg PO q 24h</td>
<td>Effective for B. bronchiseptica and Mycoplasma spp and many secondary Gram-positive and Gram negative organisms.</td>
</tr>
<tr>
<td>Pradofloxacin (cats)</td>
<td>5mg/kg</td>
<td>Only quinolone with effects against anaerobes; good for bacterial rhinitis/ osteomyelitis; good for P. multocida, Mycoplasma spp, C. felis.</td>
</tr>
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URI Treatment: Anti-tussives

DOGS

- All extra-label, except Butorphanol (0.55mg/kg q 6-8)
- Can compromise clearance mechanisms
- Options: controlled drug management
  - Hydrocodone bitartrate/homatropine MBr (0.2-0.5mg/kg PO q 12 h),
  - Maroparitant (0.5mg -1mg/kg q 24 h)
  - Cough suppression in cats, dogs and humans through its inhibition of the tachykinin NK1 receptor and Substance P (this is extra-label usage)

Patient selection, not protocol typically
Not recommended with CIV due to risk of pneumonia
Pneumonia in cats


Tachypnea and dyspnea
- Varying degrees, can be missed

Fever
- Only about 50% of the time. Not reliable

Cough
- *Bordetella*, parasites such as lungworm, toxoplasmosis

Tachycardia
- Secondary to hypoxia, sepsis, fever, progression

Crackles and wheezes on auscultation
- Must distinguish from referred upper respiratory sounds
Shelter specific concerns

Must separate ill animals from healthy animals
  ◦ “clean break” is ESSENTIAL

Disaster comes when dogs are presumed to have standard kennel cough and left in the population

Environmental measures are critical
URI Prevention & Management

Control the Environment

Prepare and support the Host

Minimize Exposure to the Agent
The Shelter as a System

- Owner surrender
- Stray intake
- Return to owner or field
- Foster
- Adoption
- Transfer
- Euthanasia

Intake → In shelter → Outcomes
Capacity for Care = healthy humane care
Risk management and Pathway Planning

Farm animal herd health = “all in, all out”

What can we do in shelter medicine?
  ◦ Who are at greatest risk for introducing Influenza into our shelters?
  ◦ What can we do to minimize the risk?

Should we quarantine everyone for 14 days?
The longer they stay, the greater the risk

Dinnage, JD, Scarlett JM, Richards JR. 2009
Shelter Principles in Herd Health: basics

Assessment on arrival (trained medical staff member)
  ◦ Physical exam and behavioral assessment

Vaccinate everyone, and more commonly
  ◦ MLV vaccines for common diseases: DHPP, FVRCP, Bb/CPIV IN

Treat the treatable
  ◦ Anti-parasitics, other potentially infectious diseases

Protect the vulnerable
  ◦ Age and species specific housing
  ◦ Risk assessment based on source

Remove infected animals
  ◦ Isolation, foster care, euthanasia

Pathway planning

Biosecurity, surveillance, and humane handling
Controlling ClV Transmission: Fomite control

- On surfaces = 48 hours
- On clothes = 24 hours
- Hands = 12 hours

- Hand hygiene
  - Hand-washing
  - Gloves
  - Hand sanitizer
    - >65% alcohol

- PPE
  - Garments, footwear, gloves
Limit Agent in the Environment

- **Cleaning and disinfection**
  - Role of everyone
  - Spot cleaning better than daily deep cleaning (*in general*)
  - Clean prior to disinfection
  - Identify and troubleshoot all fomites!

- **Products:**
  - Accelerated hydrogen peroxide (Accel) 😊
  - Sodium hypochlorite (Bleach) 😊
    - 1:32 dilution, 10 minutes
  - Potassium peroxymonosulfate (Trifectant) 😊
  - QUATS (Triple Two, Rocal) 😞 for calicivirus
Controlling Transmission: Early ID of signs

**DOGS**

- Cough
- Nasal discharge
- Ocular discharge
- Retching
- Lethargy

**CATS**

- Conjunctivitis
- Sneezing
- Nasal discharge
- Lethargy
- Fever
Health Surveillance

Daily monitoring

Staff training
- What to look for, how to report, what to submit

Data collection, recording, access
- Clipboards, software systems, using medical tracking data

Pre-existing protocols
- Empower staff to enact isolation, early treatment
- Communicate sooner rather than later
What should we be doing, as shelters, regarding vaccination for CIV?
Additional Resources


Consultation Service, Cornell University Maddie’s Shelter Medicine Program
  ◦ Consultation hotline 607- 882 – 0179
  ◦ Email sheltermedicine@cornell.edu