UPDATES IN CANINE INFLUENZA VIRUS: MANAGEMENT, DIAGNOSIS, TREATMENT, PREVENTION AND VACCINATION

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THANK YOU!

MERCK
Animal Health

Nobivac
Essential protection for essential bonds

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Canine Influenza: Influenza A in Companion Animal Species

- Canine influenza virus
  - Family: Orthomyxoviridae
  - Negative sense, single-stranded RNA virus
  - Diameter: 80-120nm (0.08-0.12um)

- Species affected: dogs, cats, ferrets, guinea pigs
  - The influenza triad: humans/birds/swine
  - The mammalian/avian mixing pot

Current Canine Influenza Subtypes

- Hemagglutinin: H
  - 1-18
  - 17/18 seen only in bats

- Neuraminidase: N
  - 1-11
  - 10/11 seen only in bats

H3N8 and H3N2 are the primary subtypes affecting dogs

- Other strains: H1N1, H3N1, H3N2 (cats), H5N1, H5N2, H5N6, H6N1, H7N2 (cats), H9N2, likely H7N9
- huH1N1 in dogs/cats during the 2009 huH1N1 human pandemic
Influenza in Dogs and Cats: 2005-Present

- 438 total isolates
- 423 from dogs
- 15 from cats

Lack of surveillance:
- Influenza surveillance in companion animals is abysmal compared to humans, pigs, or poultry

How did we go from no flu in dogs to this?

- Viral Mutations
- Shift
  - Major changes in H or N types: leads to new viral phenotype unrecognized by the immune system
  - Current canine H3N2 virus contains avian segments
  - Requires 2 viruses to infect the same patient
- Drift
  - Viral RNA polymerase lacks a proofreading mechanism
  - High error rate leads to “new” viruses during every infection
  - Sufficient drift leads to:
    - Renewed susceptibility
    - Crossover to new species
- Global population movements

Influenza Strains: a Historical Selection

A Closer Look at H3N2 Evolution in Dogs/Cats

Divergence Occurred Quickly in the US

H3N2 Origin and Endemicity

- How did a Korean virus get to the US?
  - Imported shelter dogs
  - Imported pets
- Epidemic or Endemic?
  - Repeated reintroductions of the virus from Asia
  - Environmental: virus desiccates and dies outside host
  - Animal reservoir: feral dogs/cats
  - Endemic: circulating in the canine +/- feline population
    - Dog shows
    - Shelters
    - Doggie daycares
    - Grooming facilities
**Paradoxical Reverse Seasonal Pattern**

- Human seasonal flu: fall into late spring
- Prolonged virus survival time (cold/less sunlight)
- People spend more time indoors in close proximity
- Canine: spring into fall
- More time spent in canine social settings: dog parks
- More travel with pets: more opportunity to transport virus
- Summer: boarding season
- March-July: >80% of H3N2 canine flu reports (data from ProMED-mail) in 2016 and 2017

The virus is spreading when environmental conditions are least favorable...

**Canine Influenza Transmission**

- **Secretions**
  - Direct Contact
  - Liquids/Droplets (>5um diameter)
  - Eyes, upper respiratory tract
  - Aerosols (<5um diameter, but greater virus content)
  - 20 feet in an air space
  - Lower respiratory tract
  - Mechanical Ventilation
- **Fomites**
  - Contaminated surfaces, gloves, stethoscopes, laryngoscopes, etc.

**Canine Influenza Diagnostics**

- **Acute phase**
  - Serology: the "PRE" sample
  - Requires "POST" sample several weeks later
  - Easy and part of routine workup
  - May not be useful if virus doesn’t match serology antibodies
  - Initial sample should have no/few antibodies in acute presentation
- **Nasal, Oropharyngeal, and/or Conjunctival Swabs**
  - Nasal swabs are 2-3 times more likely to find a positive than OP swabs
  - Conjunctival swabs are highly dependent on the virus present
  - Tissue samples: fresh lung tissue or swabs
- **Chronic phase**
  - Serology: the "POST" sample

**Appropriate Swabs**

- Polyester/Dacron
- Flock swabs
- Bacterial culture swabs
- Plastic handles
- Avoid:
  - Wooden handles
  - Cotton swabs (limited to no virus recovery)

**Follow the Diagnostic Lab’s Recommendations, but Beware of the Consequences...**

Dessication kills the virus!!!

**Diagnostic Labs and Testing**

- Where to send: multiple commercial and academic labs with many test options
- What to order:
  - At a minimum:
    - H3N8 and H3N2 PCR
  - Some labs will run a matrix PCR first (screening test) then subtype the positives
  - Labs requesting dry swabs are typically not doing virus isolation
  - Ideally:
    - A respiratory panel: suspected flu is often something else
    - Matrix PCR, or multiple PCR for H3N8, H3N2, H7N2, H3N1 +/- H5N1
    - Virus isolation on any matrix PCR positives (most important on PCR-untypable strains)
Enhancing Virus Recovery and Survival

- Don’t use cotton swabs
- Don’t pre-moisten the swabs
- Don’t freeze the sample, even over a long weekend
- Moisten the swab with saline or viral transport media
  - Virus on properly moistened and refrigerated swabs can survive for more than a week
- Ensure tubes do not leak or dessicate during shipment (parafilm or tape the cap to the tube)
- Ship samples overnight on ice packs

What we know...CIV outbreaks typically result from:

- Direct dog-to-dog contact
- Fomite and aerosol transmission in stressful environments with high population densities such as:
  - Boarding
  - Daycare
  - Grooming
  - Veterinary medical facilities
  - Animal shelters
  - Pet stores
  - Canine sports or other competitions

Isolation? Quarantine?

- **Isolation** = used to separate ill animals who have a communicable disease from healthy animals
- **Quarantine** = used to separate and restrict the movement of well animals who may have been exposed to a communicable disease to see if they become ill. These animals may have been exposed to a disease, or they may have the disease but do not show signs

Goal of both = stop disease transmission!

Is isolation of CIV patients **REALLY** necessary?

- Existing population is largely immunologically naive
- Morbidity rate associated with canine influenza is estimated at 80%
- CIV H3N2 is much more contagious (or readily transmissible) than H3N8
- Is it CIV? Or CIV + bacterial infection? Or a new CIV strain?

How do we isolate?

- Exterior entry directly into rarely used exam room, if possible
- Separate air-handling for treatment area/cage area
- Dedicated/limited personnel
- Remove waste (excrement, exudate, etc.) as soon as possible from cage
- NO contact with other animals

Best practices for sanitation and isolation and lessons learned from previous outbreaks

Jennifer Chatfield, DVM, DACZM
Estimate appropriate isolation period for dogs infected with CIV H3N2 virus on the basis of the duration of virus shedding.

PCR assay results ranged from 13 to 24 days
- Dogs infected with H3N2 virus should be isolated for a period of ≥ 21 days following onset of illness.
- Even when resolution of clinical signs occurs sooner than 21 days, shedding of H3N2 virus may persist.

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Disinfect hard surfaces
- Disinfecting kills germs on surfaces
- Use products according to label instructions – including allowing for contact time
- Soft items (towels, blankets, etc.) can be washed as routine (recommend hot water, detergent, and bleach)
- Items that cannot be washed should be discarded appropriately

Disinfection following suspected CIV case
- Quaternary ammonium compounds (i.e. benzalkonium chloride)
- Aldehydes
- Potassium peroxymonosulfate
- Phenols
- Bleach (1:30) solutions

Be sure to allow sufficient contact time!

Washing hands is CRITICAL
- Handwashing reduces transmission of respiratory illness

Meanwhile, back in the exam room...

...disinfection following suspected CIV case!
Staff

- Limited personnel in contact with affected dogs
- Personnel contact patients in this order:
  1. Healthy
  2. Young
  3. Oldest
  4. Sickest
- If possible, only staff with no dogs at home handle potential CIV cases
- Consider changing scrub tops, foot baths, etc.

Disease Prevention with Dogs in Group Settings

Jason Stull, VMD, MPVM, PhD, DACVP

The Canine Group Setting

- Come together
  - Shared environment
  - Temporary
  - Many dogs
  - Local/International
- Shows
  - Sporting events
  - Dog parks
  - Training classes
  - Dog daycare
  - Boarding

Multiple Factors Influence Infection Risks

Recommendation Areas

1. General: no sick dogs
2. Vaccination: core + lifestyle
3. Insect and Wildlife Control
4. Vector and vector-borne disease
5. Enteric disease
6. Environmental disinfection/hygiene
7. Facility design and traffic control
8. Disease recognition/response: exposed dogs

Key for canine flu prevention
Vaccination

• Core for group settings
  • Distemper
  • Adenovirus
  • Parvovirus
  • Rabies
  • Bordetella
  • Parainfluenza

• Time for immunity and boosters

Non-Core Vaccination

• Based on risk
• Canine flu H3N8 and H3N2
  • 2 doses, 2-4 weeks apart
  • Annual booster
• Lyme
• Leptospirosis

Environmental Disinfection & Hygiene

• Staff & owners perform hand hygiene
  • Entry and exit to event
  • Between dog contacts (groups)

Environmental Disinfection & Hygiene

• Reduce multi-dog contact to items
  • Bring (and use) own items
  • Single dog use provided by setting

Facility Design and Traffic Control

• Unnecessary dog-dog and person-dog contact

• During an outbreak avoid highly populated dog areas

Pet Owner Communication

• Ask the right questions
• Help to understand and alter risk
• Open, two-way exchange of information and opinion
• Empower to make informed decisions
Available Resources

http://go.osu.edu/IDk9risk

Risk Calculator

- Audience: Public
- 5-10 min
- Immediate personalized feedback on risk reduction

Checklist

http://go.osu.edu/IDk9risk

Clinical signs and transmission

Justine Lee, DVM, DACVECC, DABT

Clinical signs of CIV

- Coughing (95%)
- Lethargy/weak (70%)
- Inappetance (63%)
- Fever (58%)
- Nasal/ocular discharge (49%)
- GI signs (27%)
- Pneumonia (20%)
- Tachypnea (at rest)
- Tachycardia
- Coupage → cough
- Constant panting
- Dyspnea
- Exercise intolerance
- Cyanosis
- Collapse

Physical examination

- Coughing
- Lethargic
- Nasal/ocular discharge
- Dehydration
- Fever (T>103°F/39.4°C)
- Abnormal auscultation
Canine Influenza

• Mild form:
  • Cough – can be very persistent, 30-60 days
  • Fever
  • Nasal discharge

• Severe form:
  • Pneumonia with hypoxia in ~ 10% of dogs
  • Mortality rate up to 8%

• Secondary bacterial infections are common and worsen clinical signs
  • Nasal: Staphs and Streps
  • Pulmonary: Bordetella and Mycoplasma
  • Strep zooepidemicus (hemorrhagic pneumonia)

Primary survey

• Immediate assessment

• Stabilization of the ABCDs!
  • Airway
  • Breathing
  • Circulation
  • Dysfunction

Goals of Treatment

• Hydration
• Oxygenation
• Antibiotic therapy
• Nebulization and coupleage
• Supportive care
• Anti-emetic therapy

Treatment

Justine Lee, DVM, DACVECC, DABT

Treatment protocols: IV fluid therapy

• Ensure hydration
  • Prevent dehydration of airway secretions which worsen ability to be expectorate

• Replace hydration over several hours
  • Crystalloid
Oxygen Therapy

• Oxygen
  • Pulse ox < 92%? NEEDS O₂!
• Establish Airway
• IV access

Antibiotic therapy

• Viral infection but concern about secondary septic hemorrhagic syndrome in severe cases

• Mixed bacterial flora
  • Gram +/-

• Combination broad-spectrum antibiotic therapy

• Route of delivery
  • IV or IM
  • If stable, switch to oral after initial IV/IM dose

Antibiotic therapy

• Broad spectrum antibiotics if secondary bacterial infection suspected
  • Doxycycline
  • Amoxicillin/clavulanic acid
  • Enrofloxacin + amoxicillin/clavulanic acid
  • Enrofloxacin + cefazolin or ampicillin
  • Amikacin in hydrated patients only

Nebulization and coupage

• Goals:
  • Hydrate
  • Loosen/expectorate secretions

• Promote expectoration

• Coupage q. 4-6 hours

Miscellaneous treatment

• Cooling measures?
  • If very elevated T → DIC
  • Stop cooling at T>103°F/39.4°C

• Analgesics
  • If painful, treat.
  • Be aware of respiratory depression and cough suppression w/ opioids

• One-time, anti-inflammatory dose of DexSP?
  • Viral?

Treatment

• Tamiflu- not recommended
• Antibiotics- secondary infections
  • Should be based on C&S
    • B. bronchiseptica
    • Doxycycline, TMS
    • Always resistant to Cephalexin
    • Strep. Zooepidemicus or other secondary bacterial infections
    • Clavamox, cephalosporins, fluoroquinolones
  • Only use steroids and anti-tussives if absolutely necessary
  • Rest
  • +/- nebulizers and coughers
  • May include aerosolized antibiotics
Further diagnostics
• Physical examination (PE)
• Chest radiographs
• Pulse oximeter
• Arterial blood gas

Summary of treatment recommendations
• Cough suppressants only if bacterial pneumonia is ruled out.
• Immediate isolation
• Low stress environment

Further diagnostics
• Oral antibiotic therapy for 2-6 weeks
• Recheck serial radiographs
• Continue antibiotics 1-2 weeks past resolution of radiographic disease

Appropriate client communication
• Educate owners appropriately
• Discuss preventative care
  • No doggy daycares
  • Minimize dog exposure
  • Vaccination?
• Recognize and treat appropriately

So how do we protect our canine patients?

Tools for Prevention of CIRD complex: Vaccines
Vaccination is key to controlling CIRD complex
THE DOG BEING IMMUNIZED by reducing disease signs and severity
SURROUNDING DOGS by reducing shedding and spread of disease
Conclusion

• Rapid recognition
• Appropriate history (e.g., travel, boarding)
• Appropriate education
• Re-evaluate your boarding policy
• Appropriate disinfection
• Minimize nose-to-nose contact during outbreaks
• Vaccination when appropriate

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