

CANINE INFECTIOUS RESPIRATORY DISEASE (CIRD) COMPLEX

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CIRDC INFECTIOUS AGENTS

Commonly identified CIRDC pathogens include -

- Canine Parainfluenza virus (CPIV)
- Canine Adenovirus type 2 (CAV2)
- Canine Distemper virus (CDV)
- Canine Herpes virus (CHV)
- Canine Influenza virus H3N8 (H3N8 CIV)
- Canine Influenza virus H3N2 (H3N2 CIV)
- Canine Respiratory coronavirus (CRCoV)
- Canine Pneumovirus (CnPnV)
- *Bordetella bronchiseptica* bacteria (*Bordetella*)
- *Streptococcus zooepidemicus* bacteria (*Strep zoo*)
- *Mycoplasma cynos* bacteria (*Mycoplasma*)

Prevalence varies between localities and over time; e.g. the most commonly isolated agent from one commercial laboratory in the Chicago outbreak was canine influenza virus (CIV – H3N2). Often multiple agents act sequentially or synergistically to cause disease; co-morbid infections are likely to be more severe.

CIRD TRANSMISSION

The most common mode of transmission is dog-to-dog contact and outbreaks are most common in high-stress, high-density environments such as pet shops, boarding and grooming facilities, commercial kennels, sporting events, daycare, animal shelters and veterinary hospitals. Oronasal contact with aerosolized respiratory secretions and fomite spread are also important, depending on the pathogen.

Clinical signs usually develop 1-3 days post-exposure (up to 10 days), although this is pathogen-specific.

Pathogen shedding varies with infectious agent -

- **Preclinical** shedding occurs for all pathogens – infected dogs are contagious before clinical signs occur
- Most viral agents shed for 10 days post-infection
- CIV – Viral shedding ceases after approximately 7 days in most dogs; intermittent shedding of H3N2 for a further 2-3 weeks in some dogs
- Canine distemper virus (CDV), canine adenovirus 1 (CAV-1), *B. bronchiseptica*, *Mycoplasma* and *Strep. zooepidemicus* can be shed for weeks to months

CLINICAL SIGNS OF CIRDC

Typically, CIRDC presents with mild upper respiratory signs such as -

- Paroxysmal coughing
- An elicitable tracheal cough
- Laryngitis, sometimes with hoarse/high pitched ‘honking’
- Rhinitis – Nasal discharge
- Ocular discharge
- Retching, hacking cough with gagging

Otherwise, physical examination findings are unremarkable and the duration of clinical signs is typically 1–2 weeks. Importantly, CIRDC is a clinical description rather than a diagnosis. The outcome of exposure depends on a complex mix of host factors, pathogen factors and husbandry factors. For this reason, *the pathogen causing the infection cannot be diagnosed based on clinical signs, so diagnostic testing is necessary so that appropriate treatment and quarantine/isolation recommendations can be made.*

More severe disease is more likely in puppies and unvaccinated dogs, and dogs are presented with signs of the typical presentation, plus -

- Fever, lethargy, anorexia
- Dyspnea, clinical signs of lower respiratory tract infection
- A prolonged clinical course

CANINE INFLUENZA VIRUS (CIV): H3N8 and H3N2

Canine influenza virus H3N8 originated as a mutated form of equine influenza virus. It was first identified in the USA over a decade ago, and is now widespread across the continental USA. A second strain of CIV (H3N2) was isolated from Chicago in early 2015. It originated from an avian influenza strain and is closely related to H3N2 Asian influenza strains. It can infect both dogs and cats, but feline cases in the USA have been rare to date. PCR and serological testing for H3N2 and H3N8 are available from commercial veterinary labs.

CIRDC DIAGNOSTICS

Antigen Testing

CIRDC - PCR

Commercially available Canine Respiratory PCR panels can detect a wide range of CIRDC pathogens from nasal or oropharyngeal swabs. There is usually a 1–3 day turnaround time for test results. Swabs are transported in a sterile tube, with no transport medium/saline. Pathogens detected can include –

- *Bordetella bronchiseptica*, CAV2, CDV, canine herpesvirus, H3N8 canine influenza virus, H3N2 CIV, CPiV, canine pneumovirus, CRCoV, H1N1 pandemic influenza virus, *Mycoplasma cynos*, *Streptococcus equi* subsp. *zooepidemicus*

Some labs require an extra box to be checked for CIV PCR to be performed, so accession forms should be checked carefully. Subclinical infections can occur, so a positive result does not necessarily mean that the pathogen identified is causing the clinical signs; however, sampling multiple clinically affected dogs provides more reliable information. Additionally, false positive results can occur after modified live intranasal vaccination against *B. bronchiseptica*, CAV-2 and CPiV. Importantly, timing is critical for diagnostic accuracy - most pathogens are shed at peak levels in the first 4 - 7 days of clinical signs, so sampling is preferred from early clinical cases (first 4 days).

Plastic-stemmed (not wooden-stemmed) swabs should be used and swabs should be placed in dry, sterile tubes (no transport medium should be used).

CIV – Virus Isolation

The Cornell Animal Health Diagnostic Center offers virus isolation testing for both H3N8 and H3N2 CIV. Oropharyngeal and/or nasal swabs should be placed in sterile tubes containing transport medium for virus isolation testing.

Antibody Testing

CIV – Hemagglutination Inhibition (HI) testing for anti-CIV antibodies

This test relies on submission of paired serum specimens to demonstrate a rising convalescent titer 2-3 weeks after the initial titer. Results are as follows -

- Vaccination can produce low titer – 1:16 – 1:64
- Active infection titer – 1:512 – 1:2048

Putting serological results into context with the history and clinical signs is important. Since there are low seroprevalence rates and low vaccination rates in many regions of the USA, in an individual dog, a moderate titer with clinical signs of respiratory disease and an appropriate history of exposure to CIV could be considered significant. Timing is important – the antibody titer is starting to rise 10 days after infection; this is too late for positive PCR results to be obtained since viral shedding has ceased by that time.

The Cornell Animal Health Diagnostic Center offers HI testing for both H3N8 and H3N2 CIV antibodies.

CIRDC - Bacterial culture and sensitivity

Bordetella bronchiseptica, *Mycoplasma cynos*, *Streptococcus equi* subsp. *zooepidemicus* are the major bacterial pathogens of the canine respiratory tract that can be identified on culture. Additionally, *E. coli*, *Klebsiella*, *Pasteurella*, and *Enterobacter* are common secondary infectious agents. Bacterial culture of the nasal and oropharyngeal tract often yields multiple opportunistic isolates rather than the primary pathogen, limiting its usefulness for diagnosis. However, if a heavy pure growth of a single isolate does occur, there is a susceptibility profile to guide antimicrobial choices.

CIRDC – Other Diagnostic Support

Diagnostic support that can provide relevant information in dogs suspect for CIRDC includes –

- History – Exposure to infected dogs; compatible clinical signs.
- Clinical signs – Usually upper respiratory tract signs, but occasionally severe lower respiratory signs
- Leukogram
 - Stress response in uncomplicated cases
 - Inflammatory leukogram with leukocytosis and left shift in severe cases
- Thoracic radiographs
 - Unremarkable in uncomplicated cases
 - Severe cases – Hyperinflation, atelectasis, consolidation

CIRDC THERAPEUTIC OPTIONS

Antimicrobials

Doxycycline is a good first choice in the absence of antimicrobial susceptibility results because of its efficacy against *Bordetella bronchiseptica* and its good penetration of lung tissue. However, it should be borne in mind that doxycycline is bacteriostatic and that bactericidal antibiotics could be required for bacterial pneumonia due to other bacterial species. Intravenous antibiotics could be indicated in lower respiratory tract infections or if sepsis is suspected.

Glucocorticoids

Oral glucocorticoids can be administered at anti-inflammatory doses for up to 5 days to relieve coughing, but this will not shorten the clinical course of disease. Intratracheal glucocorticoids appear to offer no therapeutic advantage.

Cough Suppressants

Over the counter antitussives are unlikely to offer relief. Trimeprazine tartrate with prednisolone (Temaril P[®]) has been used with some success to relieve coughing (Dose rate - Up to 10lb - 0.5 tab q12h; 11-20lb - 1 tab q12h; 21-40lb - 2 tabs q12h; >40lb - 3 tabs q12h). Hydrocodone or oral butorphanol (Torbutrol[®]) suppress cough frequency and intensity, but can lead to reduced expectoration and reduced clearance of respiratory secretions if used on a prolonged basis, resulting in compromised ventilation. These drugs are not recommended if secondary bacterial infection is present.

Bronchodilators

Methylxanthine drugs such as aminophylline prevent bronchospasm, but are likely to have limited if any effect, as bronchospasm is not usually a major pathogenic feature of CIRDC.

Aerosol therapy/Nebulization

These therapeutic modalities can be especially useful if secondary infection or excessive respiratory secretions are present. Therapy is administered q24h – q6h.

Nebulized Glucocorticoids -

- These can provide short-term relief if paroxysmal coughing is present.

Nebulized Antibacterials -

- If there is no response to oral or parenteral antibiotics, kanamycin, gentamicin, polymyxin B can be nebulized to reduce the severity of clinical signs of *Bordetella bronchiseptica* infection in the trachea and bronchi.
- These should be used for short periods in refractory, severe or persistent cases, as they can cause airway irritation.
- Nebulized gentamicin – 6-10mg/kg diluted in 5-10mL sterile saline delivered by face mask over 5-10 minutes

Mucolytic Agents -

- There appears to be no value in nebulizing mucolytic agents, and these could be contraindicated as they can sometimes exacerbate excessive respiratory secretions.

General care for less severe cases

To prevent unnecessary stimulation of the cough reflex, collars should be changed for gentle leaders and stimulation should be minimized to reduce barking. Potential irritants such as cigarette smoke, smog etc. should be avoided.

Supportive care for more severe cases

Supportive care, including fluid support and caloric intake, should be provided. Supplemental oxygen might be needed in severe cases. Outdoor time can be beneficial when the weather is suitable so that dogs have time in the fresh air. Dog housing should have appropriate ventilation and temperature control.

OUTBREAK MANAGEMENT – DOG KENNELS AND SHELTERS

The following 5 steps form the core components of an infectious disease outbreak protocol -

1. Diagnosis and isolation – The outbreak pathogen should be identified using the appropriate tests. All clinically affected animals should be kept in an isolation area. An external entrance to the isolation area is ideal to prevent fomite transmission when infected animals enter the building. Personal protective equipment such as gloves, gowns, masks etc. should be worn.
2. Identification and management of exposed dogs - Daily rounds should be performed to assess all dogs and a quarantine area should be set up for exposed dogs. To reduce fomite transmission, assess lower risk animals first and have separate equipment in each area. The area where quarantined animals are kept should be large. Personal protective equipment such as gloves, gowns, masks etc. should be worn. If possible, reduce the number of dogs housed during the outbreak to reduce exposure risk, barking and stress. The longer a dog stays in the outbreak environment, the higher the risk that infection will occur.
3. Environmental decontamination - All CIRDC viruses except CAV-2 are enveloped, so routine disinfectants should be effective for CIRDC outbreaks. Decontamination is a two-step process consisting of –
 1. Thorough cleaning to remove organic matter
 2. Disinfect with appropriate product for pathogens involved, contact time, dry
 Concentrate on deep cleaning after the dog has permanently vacated the cage and on cleaning high contact surfaces.
4. Protection of newly admitted animals - House newly admitted dogs separately to create a ‘clean break’. Each team member should only be allowed on one side of the clean break. All incoming dogs should be vaccinated as early as possible and puppies should be vaccinated as young as possible. Booster vaccinations should be administered after 2 weeks as appropriate. Ideally there should be a physical separation of 25 feet between newly admitted dogs and the rest of the population.
5. Documentation and communication – A written CIRDC protocol should be prepared and updated as necessary. The protocol should include information on housing and vaccination protocols, treatment recommendations, decontamination protocols etc., individualized to the facility and the animals it serves.

CIRDC VACCINES

Core CIRDC Vaccines

According to the 2011 AAHA Canine Vaccination Guidelines, CDV and CAV-2 vaccines (along with canine parvovirus) are core vaccines.

Noncore CIRDC Vaccines

The CIRDC vaccines listed in the 2011 AAHA Canine Vaccination Guidelines as noncore are -

- Canine parainfluenza virus (CPiV) – Available in combination with core vaccines as part of a multivalent product
- *Bordetella bronchiseptica* (Bb) – Parenteral (inactivated) or intranasal/oral (live avirulent) vaccines
- Canine influenza virus – Parenteral inactivated vaccines against H3N8 and H3N2
- Bb+CPiV±CAV-2 – Combination intranasal vaccine

The decision regarding which vaccines are core or non-core is for the individual practitioner to decide, based on her/his extensive local knowledge. Widespread vaccination provides herd immunity which protects the canine patient population when exposure to CIRDC pathogens occurs.

KEY MESSAGES

1. CIRDC Etiology: CIRDC can be caused by a variety of viral or bacterial pathogens, acting alone or as co-infections.
2. CIRDC Transmission: Infection is readily transmitted by direct contact between infected and susceptible dogs; aerosol and fomite transmission are also possible.
3. Epidemiology – Canine Influenza Virus: In CIV infections, viral shedding can occur before clinical signs commence.
4. Diagnosis - Canine Influenza Virus: Diagnosis of CIV can be made by PCR or virus isolation only in the early stages of infection before viral shedding ceases; antibody testing is required after viral shedding stops.
5. CIRDC Prevention: Vaccination works with the immune system to moderate infection and clinical disease. Set reasonable and educated expectations with dog owners.
6. Preventing Transmission of Canine Influenza Virus: Widespread vaccination is the best strategy for mitigating transmission. Plan ahead so all dogs are fully vaccinated because outbreaks are unpredictable.

SUGGESTED READING

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