

**SA283**

**EMERGING CANINE INFECTIOUS RESPIRATORY DISEASES**

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Management of infectious respiratory disease in dogs housed in close proximity to one another remains a particular challenge and it is critical that veterinarians working in and with animal shelters be familiar with the various causes of the canine infectious respiratory disease complex (CIRDC), commonly known as “kennel cough.” Numerous pathogens are included in the CIRDC, including *Bordetella bronchiseptica*, canine influenza virus (CIV), canine distemper virus (CDV), canine parainfluenza virus (CPiV), canine adenovirus type 2 (CAV-2), canine respiratory coronavirus (CRCoV), canine herpesvirus (CHV), *Streptococcus equi* subsp. *zooepidemicus*, *Mycoplasma* spp, and still others. In general these various pathogens can produce clinical signs alone or in combination that are virtually indistinguishable from one another, requiring that diagnostic testing be performed in order to identify the specific cause(s). Typical clinical signs include coughing, nasal discharge, and mild pyrexia with more severe clinical signs, lower respiratory involvement, and even death possible. Disease caused by various etiologic agents in the CIRDC is typically mild with low mortality rates, but severe and even fatal disease can occur with some pathogens and in certain situations. Treatment is usually supportive in nature with antibiotic therapy indicated for primary bacterial infections as well as secondary bacterial infections. More severely affected dogs require more aggressive treatment, which may include hospitalization, intravenous fluid therapy, oxygen support, nebulization and coupage. Despite the relatively mild disease that is typically seen, CIRDC remains a particular concern for shelters (as well as other facilities where large numbers of dogs are housed in close proximity to one another, such as boarding facilities) because of the significant morbidity and ease of transmission. Vaccination is available for some etiologic agents but not others, and many of the available vaccines limit severity but not infection – creating a situation where respiratory disease can still be frequently seen despite adherence to recommended vaccination protocols appropriate for dogs in animal shelter settings. This session will focus on several emerging and re-emerging causes of infectious respiratory disease in dogs.

**CANINE RESPIRATORY CORONAVIRUS**

Infection with a group 2 coronavirus, known as canine respiratory coronavirus (CRCoV) has been shown to produce typically mild upper respiratory symptoms. Initial reports the virus using a reverse transcriptase polymerase chain reaction (RT-PCR) on tracheal and lung samples collected from dogs with clinical signs of respiratory disease that were housed in a shelter setting in the United Kingdom in 2003. Subsequent work demonstrated the presence of the virus in samples of canine lung collected from Canada in 1996. This virus is distinct from that which has been found in dogs with gastrointestinal signs, which is a type 1 coronavirus similar to that which causes transmissible gastroenteritis (TGE) in pigs.

Most of the dogs reported to be infected with CRCoV have had signs of mild respiratory disease, but there have been less frequent reports of isolation of the virus from dogs with a variety of clinical signs that ranged from none to severe disease. As with most causes of CIRDC, infected dogs presented with a cough and nasal discharge and co-infection with other pathogens was common. High rates of seroconversion over relatively short (e.g. 21 days) periods of time suggest that the virus is easily transmitted in at least certain settings or under certain conditions, and seroprevalence studies have shown that more than half of the dogs tested in the United States have evidence of prior exposure. There is some evidence that CRCoV is not limited to infection of respiratory tissues, as the virus has been detected in dogs without respiratory symptoms, although in many such cases other co-infections (e.g. canine parvovirus, canine coronavirus) were also present. Thus, concern remains that there is at least a theoretical possibility that viral shedding and transmission may not be solely through the respiratory tract and that some fecal-oral transmission might occur, which has important implications for control and prevention strategies.

Treatment is supportive and aimed at preventing secondary bacterial infections as well as providing definitive treatment, if appropriate, for any additional primary pathogens. Paired convalescent samples can be used to diagnose recent infection with CRCoV but more commonly RT-PCR is used on nasal swabs for definite diagnosis. Because many assays detect canine coronavirus rather than canine respiratory coronavirus it is critical that the specificity for the virus in question is established with the diagnostic laboratory as the antibodies for the two viruses do not cross react.

Strategies for the prevention of CRCoV infection in dogs are non-specific and similar to those utilized for other causes of CIRDC in general, including stress reduction, prompt identification and isolation of any symptomatic dogs, adequate ventilation, appropriate cleaning and disinfection, and minimization of fomite spread. The virus is an enveloped RNA virus and has not been shown to persist in the environment for extended periods of time, so routine sanitation procedures are likely to be sufficient. Vaccination against CRCoV is not currently available so prompt administration of core vaccines for dogs in animal shelters is important to limit co-infections with other pathogens that can be prevented or minimized through vaccination.

### **CANINE INFLUENZA VIRUS**

Canine influenza virus is a highly contagious cause of respiratory infection in dogs resulting in clinical signs that are similar to other causes of CIRDC. The virus was first isolated in 2004 from racing greyhounds and later determined to be an H3N8 virus that came from interspecies transmission from horses, although recent work has shown that virus was circulating in dogs (based on serologic evidence) since at least 1999. Despite the duration that the virus has been a canine pathogen it remains a relatively new virus to which the vast majority of dogs have not been previously exposed and to which there is little to no immunity against infection. The virus has become well-established in certain populations of dogs in various geographic areas across the country (e.g. Florida, New York City, Colorado) and continues to be introduced to new areas, but is rarely identified in others; continual changes in the geographical areas of activity and spread of the virus are evident.

Clinical signs caused by infection with canine influenza virus are indistinguishable from those caused by other pathogens in the CIRDC, including cough and nasal discharge. Most infected dogs develop a mild form of the disease and treatment is largely supportive. However, severe signs, lower respiratory involvement, and even fatalities can occur in a small percentage of dogs; aggressive treatment is necessary to limit mortality. Laboratory testing is required to confirm a diagnosis. PCR testing (frequently performed on nasal swabs) is readily available and serology on paired samples or virus isolation can also be performed.

Recent approval of a vaccine against canine influenza has added a new tool for control of CIV infection in some facilities, and it is currently considered in the American Animal Hospital Association's 2011 Canine Vaccination Guidelines as a non-core vaccine recommended for use in certain populations of shelter-housed dogs. The vaccine limits the severity and duration of clinical signs but does not prevent infection. Because it is a killed product immunity should not be expected until approximately one week following the second dose (e.g. three weeks following initial vaccination) and thus is of limited benefit unless exposure can be prevented during this time.

### **STREPTOCOCCUS EQUI SUBSP ZOOEPIDEMICUS**

Outbreaks of severe respiratory disease characterized by hemorrhagic pneumonia, high mortality rates, and acute death in dogs housed in high-density populations have been identified in the last several years and attributed to infection with *Streptococcus equi* subsp. *zooepidemicus*. Infection with *Streptococcus equi* subsp. *zooepidemicus* is typically associated with horses, where it can be found as a commensal organization in the respiratory tract as well as acting as an opportunistic pathogen resulting in a variety of clinical signs. How and when *Streptococcus equi* subsp. *zooepidemicus* came to be introduced into populations of dogs remains unknown, as does much of the basic epidemiology of canine infections. Isolates causing outbreaks in populations of dogs tend to be the same genetically and the outbreaks appear to be the result of direct or indirect transmission between dogs, possibly resulting from the introduction of asymptomatic carriers. The role of *Streptococcus equi* subsp. *zooepidemicus* as a commensal organism in dogs is not well understood, however, and appears to be less common in this species than it is in horses. *Streptococcus* spp. can frequently be isolated from the upper respiratory tract of healthy dogs, but such isolates typically belong to Lancefield group G, while *Streptococcus equi* subsp. *zooepidemicus* belongs to Lancefield group C.

The pathogenic mechanism(s) by which *Streptococcus equi* subsp. *zooepidemicus* causes such severe disease in dogs remains poorly understood. Co-infection with other pathogens implicated in CIRDC is possible and may play a role in the development of severe disease. Dogs infected with *Streptococcus equi* subsp. *zooepidemicus* have also been found to have canine adenovirus type 2, canine herpesvirus, canine distemper virus, and *Bordetella bronchiseptica* infections (all of which have been reported in the literature); in the author's experience with co-infection with canine influenza virus is common as well.

Clinical signs in dogs infected with *Streptococcus equi* subsp. *zooepidemicus* may include non-descript signs seen with other causes of CIRDC, including nasal discharge, coughing, and fever. However, clinical signs often progress rapidly and dramatically, and can include severe pyrexia, lethargy, respiratory distress, hemorrhagic nasal discharge (which may be profuse), and sudden death, sometimes in the absence of any noted antemortem symptoms. Large numbers of dogs may be affected and transmission to other dogs can occur rapidly. Clinical findings and history are not, however, pathognomonic and causative agents associated with CIRDC can also cause similar severe clinical signs. Necropsy of infected dogs frequently reveals the presence of large amounts of hemorrhagic fluid within the thorax as well as the presence of dark red, rubbery (consolidated) lung lobes, consistent with the severe acute pneumonia or pleuropneumonia that can be confirmed with histopathology. Impression smears of the lungs and/or smears of the pleural fluid can be very helpful in establishing a preliminary diagnosis in house while confirmatory testing is pending, as gram-positive cocci that appear in clusters or small chains can often be readily identified with cytology. Lung samples should be collected during necropsy and submitted for bacterial culture and definitive identification; PCR testing is also commercially available.

Prompt identification of cases, treatment of infected dogs, and implementation of control measures is critical. Special care should be taken to protect the health of other dogs in the facility as well as that of other species, including humans; there has been at least one report of clinical disease in cats in a cattery setting as well as transmission from an infected dog to his handler. *Streptococcus equi* subsp. *zooepidemicus* isolates are reported to be susceptible to a variety of antibiotics, including penicillins and fluoroquinolones. In some outbreaks response to treatment has been dramatic while in other causes fatalities resulted despite treatment, perhaps because of advanced or rapid progression of the disease or antimicrobial resistance. Aggressive supportive therapy including oxygen support and intravenous fluids may be necessary for some dogs.

### **CANINE PNEUMOVIRUS**

Recent work investigating the etiologic cause(s) of acute respiratory disease in shelter dogs led to the identification of a novel virus circulating within the population. Samples from 200 dogs collected over a 2 year period were analyzed, with 13 isolates of what was subsequently determined to be a pneumovirus detected in cell culture. Because most dogs from which the virus was isolated were also co-infected with other causes of CIRDC (most frequently canine influenza virus and canine parainfluenza virus) it is difficult to determine what, if any, pathogenic potential the virus has and what, if any, role it plays in CIRDC. Theoretically there appears to be at least the potential for disease causation, as the virus in dogs is very closely related to the murine pneumovirus (MPV); MPV is known to cause by clinical and subclinical disease in laboratory and wild rodents. Unfortunately little is known about the epidemiology of MPV that could provide additional insight into the epidemiology of the infection in dogs and further work is needed to elucidate the clinical significance of this virus.

## REFERENCES

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