Queries and Quarantines: Emerging Respiratory Infections

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Background (Dogs)

Upper respiratory infections are common in small animal veterinary practice. Clinical signs include coughing, nasal discharge and dyspnea. The vast majority of cases in dogs are caused by members of the "Canine Infectious Respiratory Disease Complex." This complex classically includes viral (canine parainfluenza virus, canine adenovirus 2 and canine herpesvirus 1) agents and one bacterial agent (*Bordetella bronchiseptica)*. Pathogenesis is likely complex since co-infections with multiple organisms are common especially in clinically ill animals. Clinical disease can vary from mild to severe and outbreaks can be very dangerous in large dog populations. In recent years several new "players" have begun to be recognized and tested for including canine respiratory coronavirus, canine pneumovirus, canine influenza virus, *Streptococcus zooepidemicus* and *Mycoplasma cynos)*. It is likely that many of these pathogens are not "new" but more likely that they have just not been recognized.

Emerging Viral Infections (Dogs)

Canine Respiratory Coronavirus (CRCOV)

First it is important to note that CRCoV is a distinct betacoronavirus from Canine Coronavirus (an alphacoronavirus) which is typically associated with enteritis in canine patients. It was first described in the UK in 2003. Experimental infections have shown that the agent typically, but consistently, leads to mild disease in dogs. It can also be recovered from dogs in challenge studies. The organism can also occasionally be detected in fecal samples and may show "dual tropism." It is unclear if it may play a role in enteric disease.

Infection mainly leads to inflammation in the nares and trachea and leads to moderate reduction of mucociliary clearance. Clinicopathologic changes in dogs challenged with the virus include lymphocytosis and possible neutropenia with mild left shift/toxicity. It is currently unknown but suspected that infection with CRCoV predisposes to more serious secondary infections. Many coronaviruses suppress the activation of important pro-inflammatory responses that are important for protecting against infection.

Diagnosis is typically done by reverse-transcriptase (RT) PCR from oropharyngeal or nasal swabs. Antiviral therapy has not been investigated for CRCoV. Prophylactic antibiotic therapy may be warranted in animals with compromised immune systems or protracted clinical signs.

References:

Erles K, Toomey C, Brooks HW, . Detection of a group 2 coronavirus in dogs with canine infectious respiratory disease. Virology. 2003;310:216–223.

Erles K, Brownlie J. Investigation into the causes of canine infectious respiratory disease: antibody responses to canine respiratory coronavirus and canine herpesvirus in two kenneled dog populations. Arch Virol. 2005;150:1493–1504.
Mitchell JA, Brooks HW, Szladovits B, . Tropism and pathological findings associated with canine respiratory coronavirus (CRCoV). Vet Microbiol. 2013;162:582–594.

Canine Influenza Virus (CIV)

First detected in Greyhounds in 2004, the virus was determined to be most closely related to influenza of equine origin (H3N8). Direct transmission from a horse to a dog is suspected initially but the virus gained the ability to transmit from dog to dog and has established itself as an important respiratory pathogen. Seroprevalence is highest among "at-risk populations" (i.e. kenneled dogs) and incidence may be highest in the NE USA. In 2015, an outbreak in Chicago of H3N2 in dogs (believed to be of avian origin) was caused by a virus identical to strains only previously reported in Asia. It has since been diagnosed in dogs from Florida, Georgia, North Carolina, South Carolina, Texas, Kentucky, Tennessee, Missouri and Louisiana.

Influenza, like most respiratory pathogens, is spread by droplet, aerosol or indirect contact. In dogs it is not considered a seasonal disease. It remains viable on clothing for approximately 24 hours and surfaces for about 48 hours. The incubation period is slightly different for H3N8 (1-5 days) and H3N2 (2-8 days). Most virus is shed prior to clinical signs. Virtually all dogs exposed become infected and 80% display clinical signs. Non-clinical dogs can spread infection. Typically disease is mild but in some individuals it can manifest as a severe pneumonia (+/- bacterial component). Severe forms may involve hemorrhage in the lungs and thoracic cavity. Treatment is mainly supportive care. Very little research has been done in the use of oseltamivir (TamiFlu) in dogs. Use is off label and should be done in accordance with AMDUCA. Diagnosis is typically performed by reverse-transcriptase (RT) PCR from oropharyngeal or nasal swabs. Serologic studies may also be helpful in outbreak scenarios. There is no evidence that either H3N8 or H3N2 are zoonotic. Sporadic reports of dogs infected wth H1N1, H5N1 and other strains have been reported.

References

Castleman WL, Powe JR, Crawford PC, . Canine H3N8 influenza virus infection in dogs and mice. Vet Pathol. 010;47:507–517.
Song D, Kang B, Lee C, . Transmission of avian influenza virus (H3N2) to dogs. Emerg Infect Dis. 2008;14:741–746.
Anderson TC, Crawford PC, Dubovi EJ, . Prevalence of and exposure factors for seropositivity to H3N8 canine influenza virus in dogs with influenza-like illness in the United States. J Am Vet Med Assoc. 2013;242:209–216.

Canine Pneumovirus

First described in 2010 this virus still requires much more study to undertand its role in CIRD. It is a parmyxovirus most colosely related to murine pneumovirus. Penumoviruses typically replicate in bronchiolar tissue and sampling of the lower respiratory tract may be required for diagnosis.

Other viruses

CCoV (the one associated with enteric disease) was linked to a severe, fatal outreak of respiratory disease in dogs in Italy in 2005 and Brazil in 2014. Dogs also had enteric an d neurologic disease.

Canine Bocavirus has been identified in metagenomics studies of healthy dogs and dogs with respiratory disease. There are 3 genetic groups of CBoV. Group A is associated with healthy dogs and Group B and C are associated with dogs with clinical respiratory disease.

Canine Hepacivirus is the first non-primate hepacivirus to be described. As the name suggests, the organism can also be detected in liver tissue as well as respiratory specimens. Its role in respiratory disease is NOT well understood.

References:

New and Emerging Pathogens in Canine Infectious Respiratory Disease S. L. Priestnall, J. A. Mitchell, C. A. Walker, K. Erles, and J. Brownling, Veterinary Pathogology Vol 51, Issue 2, pp. 492 - 504

Emerging Bacterial Infections (Dogs)

Streptococcus zooepidemicus

Sporadic cases of infection have been reported in dogs since the 1970's but there is increased reports including some high profile outbreaks in Miami, Milawaukee and Las Vegas. Initially the disease presents similarly to classic "kennel cough" but it quickly progresses to severe pyrexia, dyspnea and lethargy. Commonly the animals present with hemorrhagic nasal discharge or hematemesis secondary to severe pulmonary hemorrhage. The full pathogenesis is poorly understood however exotoxin production and superantigen activity is likely. Challenge studies with the bacterium alone have failed to produce clinical signs but co-infection with CIV leads to very severe disease. Therapy is often unsuccessful and prophylactic administration of antibiotics (penicillins) should be instituted for any exposed animals.

Mycoplasma cynos

M. cynos is the only canine *Mycoplasma* to be associated with clinical respiratory disease; however, it can also be found in clinically unaffected animals. In addition, it is very commonly present with other respiratory pathogens. It is unclear whether this is a primary or secondary pathogen. It is thought that in some animals infection can lead to pathologic changes such as lung consolidation and cilia-loss. Transmission is by droplet aerosolization and diagnosis is typically by PCR detection. Doxycycline is considered the drug of choice to treat canine mycoplasmosis.

References:

New and Emerging Pathogens in Canine Infectious Respiratory Disease S. L. Priestnall, J. A. Mitchell, C. A. Walker, K. Erles, and J. Brownling, Veterinary Pathogology Vol 51, Issue 2, pp. 492 - 504

Background (Cats)

Feline upper respiratory tract infections (URI) can be frustrating infections with complex etiology. Bacterial and viral organisms can lead to clinical signs but co-infection is common. The most important viral pathogens are Feline Herpes Virus (FHV-1) and Feline Calicivirus (FCV). Bacterial agents include *Chlamydia felis*, *Mycoplasma spp.,*and *Bordetella bronchiseptica.* Antimicrobial therapy is only suggested when mucopurulent nasal discharge is detected which is suggestive of a bacterial etiology.

Emerging Infections (Cats)

Influenza

Influenza A infections have rarely been reported in cats. A unique report of an outbreak (H1N1) in an Italian cat colony was reported in 2009. In 2016 in New York City there was a large outbreak of low-pathogenic avian influenza (LPAI/H7N2) . Over the course of 3 months 500 animals were reported to have been diagnosed with infection. Infection was mild in healthy cats and consisted of coughing, sneezing and nasal discharge. Pneumonia in an elderly cat was reported and it was euthanized. A veterinarian treating the cats also came down with mild respiratory disease and the same virus was isolated from the person. It is unclear what role influenza has previously played in feline respiratory disease since it is not routinely tested.

Reference:

Hatta M, Zhong G, Gao Y, et al. Characterization of a Feline Influenza A(H7N2) Virus. *Emerging Infectious Diseases*. 2018;24(1):75-86. doi:10.3201/eid2401.171240.

Aspergillosis

Nasal infection with *Aspergillus* is most commonly associated with dolicephalic breeds of dogs, but recently reports of *Aspergillus felis* in Australia and the UK may suggest that it is an emerging disease in cats with fungal rhinosinusitis. Diagnosis requires histopathologic examination of nasal tissue and with concurrent fungal isolation and identification. Human and canine cases have also been reported.

Barrs VR, van Doorn TM, Houbraken J, et al. *Aspergillus felis* sp. nov., an Emerging Agent of Invasive Aspergillosis in Humans, Cats, and Dogs. Goldman GH, ed. *PLoS ONE*. 2013;8(6):e64871. doi:10.1371/journal.pone.0064871.