

INFECTIOUS CANINE RESPIRATORY DISEASE FROM A TO Z: Adenovirus, Bordetella...influenza

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In dogs there are a number of common and important infectious causes of acute respiratory signs. Cough is one of the most common of these. There are many different schemes to use in determining the cause of cough: two of the most useful broad schemes relate to duration of signs and to anatomic location. Once it has been determined if cough is acute or chronic and where within the cardiac or pulmonary system the cough is likely originating, more specific differential lists can be generated, allowing for a more focused diagnostic work up. Similarly, the diagnostic approach to respiratory distress involves identifying the anatomic localization of disease. This lecture will provide an overview of the different infectious causes of acute cough and respiratory distress that occur as part of the spectrum of canine infectious respiratory disease complex (CIRDC). Different bacteria and viruses including emerging pathogens like H3N2 influenza causing outbreaks will be reviewed, followed by preventative strategies and diagnostic and therapeutic approaches.

The etiology of cough can be broadly broken down into cardiogenic and non-cardiogenic (i.e., respiratory) causes. Cardiogenic causes of cough include left-sided or biventricular congestive heart failure which induces pulmonary edema, or left atrial enlargement that can cause compression of the left mainstem bronchus. Non-cardiogenic causes of cough can be subdivided according to the anatomic location within the respiratory tract that is affected: i.e., upper respiratory tract, lower respiratory tract, pulmonary parenchyma, or pleural cavity. Knowing that a dog presents with an acute cough will help to narrow the list of differentials. Acute cardiac causes of cough include rupture of a chordae tendineae; acute respiratory causes of cough include CIRDC, sterile tracheobronchitis, inhalation of a foreign body, aspiration, and other types of bronchopneumonia. The caveat to this is if there is an acute exacerbation of a chronic condition leading to the “current” cough, many of the differentials of chronic compensated cough must still be considered. Radiography is an important next diagnostic step to discriminate between cardiac and respiratory causes of cough and will guide further diagnostics.

Understanding the causes of respiratory distress in cats is critical for prompt and effective treatment. Respiratory distress can be broadly classified into one of eight causes:

- upper airway obstruction
- lower airway obstruction

- flail chest
- abdominal enlargement
- pulmonary parenchymal disease
- pleural cavity disorders
- pulmonary thromboembolism
- “look-alike” syndromes (i.e., causing labored breathing but not being a true disorder of the respiratory system)

This scheme allows for prompt recognition of the first four causes listed above after initial examination of the patient. In particular, emphasis should be placed on the pattern of respiration (inspiratory distress, expiratory distress, or both; paradoxical respiration), audible noises (stridor or wheezing) or the absence thereof, obvious physical abnormalities (eg, trauma associated with flail chest, distended abdomen) and other findings on thoracic auscultation (adventitious lung sounds, diminished heart or lung sounds, arrhythmias, murmurs).

In dogs in particular, there are important infectious and contagious causes of acute cough. While not all kennel dogs have kennel cough, it is still critical that, until proven otherwise, all dogs with acute cough should be handled as if infectious until proven otherwise. This is essential so that your veterinary practice does not contribute to spread of respiratory infectious disease.

Canine kennel cough or infectious tracheobronchitis is now referred to as Canine Infectious Respiratory Disease Complex (CIRDC) to reflect involvement of not just the trachea and bronchi, but also nasal passages and pulmonary parenchyma. There are several major and several minor bacterial and viral pathogens which have been implicated in this disease complex. The major pathogens include *Bordetella bronchiseptica*, influenza, distemper, parainfluenza and adenovirus. The minor pathogens include *Mycoplasma spp*, respiratory coronavirus, *Streptococcus zooepidemicus*, herpes virus, pneumovirus and secondary bacterial pathogens. New pathogens are emerging, for example H3N2 is a new strain of influenza virus responsible for large outbreaks of respiratory disease and there is minimal immunity against influenza in the dog population as a whole. Susceptibility to disease depends on a variety of different factors. This includes the pathogens themselves: are they viral or bacterial? One or many? What virulence factors do they possess? It also includes the individual host immune status, including age (very young or old), vaccination status and presence of immunodeficiencies or immunosuppression. Finally, husbandry practices contribute to manifestation of disease and include factors such as stress, overcrowding, quarantine practices,

air quality and sanitation practices. Any dog coming into contact with other dogs (shelters, kennels, groomers, doggie day care, dog parks, etc) is at risk.

Because there is such a large array of pathogens implicated in CIRDC, there is a desire to try to determine which of the pathogens are involved in any particular case or outbreak. Clinical signs of nasal discharge/sneezing, cough and signs of systemic illness (fever, lethargy, anorexia) can be seen with any of the pathogens and by themselves are not discriminatory. However, there are some suggestive findings which may make particular pathogens more likely. For example, with *Bordetella bronchiseptica*, dogs of any age are affected (with more severe disease in young and old dogs) and may lack recent vaccination; additionally, they are more likely to have a harsh, honking cough (reflective of tracheobronchitis). In comparison, dogs affected with influenza are of any age and immune status, may have an excellent vaccination status (with the exception of influenza vaccine) and are more likely to have a soft cough (reflective of pulmonary parenchyma involvement). Dogs with distemper are often young and unvaccinated and may have gastrointestinal or neurologic signs.

While some of the aforementioned features may be suggestive of a particular pathogen, ultimately definitive diagnosis relies on identification of the pathogen through bacterial culture, viral isolation or polymerase chain reaction (PCR). This is more critical in large outbreaks than for single pet infections as it can affect husbandry practices to minimize the spread of the organisms. It is critical to remember that presence of a positive result on a PCR test does not imply causation of disease (eg false positives with recent vaccinates), and a negative result may not definitively rule out a pathogen (eg, H3N8 influenza has a comparatively short shedding period). In individual pets affected with CIRDC, if clinical signs are mild and localized to the upper respiratory tract, diagnostics may not be indicated. If clinical signs are more severe and reflective of pneumonia, bacterial cultures focusing on *Bordetella*, *Mycoplasma* and secondary pathogens can help guide appropriate therapeutic intervention. For canine influenza (H3N8 or H3N2) it is critical to remember that shedding occurs early and declines relatively quickly (especially H3N8): antigen based testing may result in a false negative result. The optimal testing time for antigen based tests (eg PCR, ELISA or viral isolation) are in dogs exposed to other dogs that are not yet symptomatic or those symptomatic for just a short period of time. Antibody based tests are the gold standard because dogs consistently seroconvert and these are sensitive tests; however, paired titers are generally required and there is a delay in diagnosis.

Preventative measures are a critical step in diminishing the number of and severity of outbreaks. Husbandry practices play an important role in settings where large number of dogs

will come in contact with each other. Vaccination is another key step to boost individual host immunity. While it is not possible nor even reasonable to vaccinate against every single bacteria and virus implicated in CIRDC, the strategy would be to select pathogens known to be contagious, virulent, common and in which there are good vaccines. Another consideration is the optimal route of vaccination. For mucosal pathogens like *Bordetella*, the mucosal route of vaccination has important advantages over injectable vaccines.

Treatment depends on the scenario. If a single dog presents with cough but no signs of pneumonia, supportive care, cough suppressants and client education and the primary means of treatment. If a single dog present with pneumonia, broad-spectrum antibiotics (ideally based on culture and sensitivity to be de-escalated once sensitivity results return), supplemental oxygen, iv and nebulized fluids, and coupage may be indicated. In a large scale outbreak, both the environment (optimizing husbandry factors and revisiting vaccination protocols for the future) and individual animals (following guidelines of the scenarios in pet dogs above) must be addressed.