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### Diagnosis and Therapy of Canine Chronic Bronchitis

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#### INTRODUCTION

Chronic bronchitis (CB) is an inflammatory airway disease, which, in association with tracheobronchial collapse, is probably the most common chronic canine airway disorder. Inflammation within airways causes chronic cough and excessive mucus production. Because, dogs can't expectorate (spit), it is not always easy to know if the dog is making increased airway mucus. Therefore, the diagnosis of CB is usually based on chronic cough alone.

Because we diagnose CB on the basis of a daily cough, we need to be sure that other causes of chronic cough such as heart failure, heartworm infestation, pneumonia, lung tumor, etc., have been ruled out. This can be complicated, in part, because CB is a disease of older dogs, and these animals may have any of these other, co-existing disorders, which can by themselves, cause cough. Additionally, certain drugs used to treat CB in dogs may be inappropriate and even contraindicated for disorders other than CB. Importantly then, the diagnosis of CB must be made with some degree of certainty to avoid potential complications related to therapy.

#### CLINICAL FINDINGS IN DOGS WITH CHRONIC BRONCHITIS

##### Signalment

Dogs diagnosed with CB are generally  $\geq 6$  years of age. There does not seem to be a clear sex or breed predilection although lots of small and toy breeds such as Poodles and Pomeranians have been clinically diagnosed with CB.

##### History

By definition, dogs with CB have a chronic cough. This cough is generally deeper and "throatier" than the high pitched "honking" cough caused by extrathoracic tracheal collapse, and yet harsher than the "soft moist" cough caused by pneumonia. To figure out if increased mucus production is associated with the cough, ask the client if the cough terminates in gagging, swallowing or choking. If so, the dog is coughing up and then swallowing the mucus.

Some dogs with CB may be otherwise absolutely normal while others will be severely exercise-limited by their disease. The difference is probably due to the amount of cartilage weakening that is present, and the resulting airway collapse that occurs when the easily fatigued dog begins to exercise. These animals are otherwise bright, alert, and in all other respects, systemically well. Chronic bronchitis in dogs does not cause depression, lethargy, anorexia, etc. If these signs are present, you should consider other disorders that cause cough.

##### Physical Examination

The only consistent auscultable finding in dogs with CB is inspiratory and expiratory crackles. Heart rate is generally normal for the breed and age, and may be a bit slower than anticipated. A sinus arrhythmia is very common and can be appreciated by palpating the femoral pulse in time

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with the breathing pattern of the dog.

### **Diagnostic Tests**

Because the diagnosis of CB is based on a history of chronic cough, it is only necessary to perform those diagnostic tests that help to determine the presence of other disorders that cause cough.

**Thoracic Radiographs.** Thoracic radiographs of dogs with CB may appear normal. This finding does not rule out CB! More commonly however, thoracic radiographs reveal the presence of "doughnuts" and/or "tram lines" which are prominent and thickened bronchial walls seen on end or in parallel, respectively.

**Bronchopulmonary Cytology.** Neutrophils are usually the predominant cell recovered from specimens taken by tracheal wash; these cells do not independently indicate current or past infection. Intracellular bacteria and/or a toxic appearance of neutrophils would of course suggest the presence of bacterial infection. Mucus is generally abundant even when a relatively small volume of fluid is recovered. Small numbers of lymphocytes, eosinophils, and epithelial cells are recovered in most samples.

Alveolar macrophages may be found in various morphologic stages, from relatively quiescent to "activated" in all normal animals as well as in dogs with CB. Techniques such as bronchoalveolar lavage allow the wash fluid to come into contact with the lung surface and result in retrieval of a higher percentage of alveolar macrophages compared to tracheal washing. Regardless of the techniques used, the alveolar macrophage is an absolutely normal finding and should not be interpreted as a sign of bronchopulmonary inflammation or pathology.

CB may sometimes be associated with airway eosophilia in dogs. In my experience, this is more common in "snow dogs" (Malamutes, Huskies etc). These pets commonly are symptomatic on a seasonal basis only (suggesting an environmental source of the offending antigen and cause for the subsequent cough). These cases also seem to respond most dramatically to anti-inflammatory therapy (see Glucocorticoid Therapy below).

**Tracheobronchial Culture.** A presumptive diagnosis of "bacterial" bronchitis is most commonly made when cultured airway samples grow a mixed population of aerobic bacteria. Remember though, airways of all species studied, including dogs, cats and people, retain small numbers of bacteria throughout the day. That is one of the reasons we cough and clear our throat. In my experience, bacteria recovered from the airways of bronchitic dogs reflect innocuous colonization rather than infection.

**Bronchoscopy.** The airways of dogs with CB are universally erythematous and usually have a roughened or granular appearance. The mucosa is often thickened, irregular and edematous. Excessive and thick mucus may span the lumen of an airway or gather as a mucus plug, which can occlude smaller airways.

Collapse of the dorsal tracheal membrane into the lumen of the airway is common in dogs with CB. This finding does not rule out CB, but instead reflects concurrent tracheal collapse in association with CB. A striking finding in some dogs with CB is the collapse of intrathoracic airways during passive exhalation. This may not be apparent on thoracic radiographs and in any case is much more dramatic when visualized endoscopically in dynamic motion. In my experience, dogs with intrathoracic airway collapse

respond only marginally to therapy, and in general, have a less fortunate prognosis.

**Biopsy and Histopathology.** Chronic bronchitis is a clinical diagnosis and does not require tissue biopsy for confirmation. Nevertheless, certain histologic features of chronic bronchial disease are characteristic and include goblet cell hypertrophy and hyperplasia, mononuclear cell infiltration, and increased connective tissue within the lamina propria.

## THERAPEUTIC OPTIONS

Chronic bronchial inflammation, regardless of cause, causes mucosal and airway wall thickening, mucus hypersecretion, and some degree of airway smooth muscle constriction. The resulting signs are the defining features of canine CB and include cough and exercise intolerance. *The primary treatment of CB is based entirely on controlling airway inflammation.* The guiding principle of any therapy must always be "if in doubt, do no harm."

### Corticosteroids

Glucocorticoids have been used to treat humans with bronchial disease for over 50 years. They are clearly the most effective treatment for this disorder, although potentially debilitating side effects limit their use in this clinical setting. Even though steroids are not primary antitussives, by decreasing inflammation they may decrease stimulation of airway sensory nerves that are responsible for initiating cough in canine CB. Additionally, steroids decrease the volume of mucus produced by bronchitic airways. In my experience, steroids are the most effective drugs available to treat dogs with CB, and should be considered the mainstay of chronic therapy. I generally begin treatment with prednisone 1 mg/kg q12h PO for one week, then 0.5 mg/kg q12h PO for an additional week. The first week or two of treatment will cause the most dramatic decrease in clinical signs and this is usually as good as the dog will ever get on prednisone. Tapering continues to the lowest effective dose that controls > 75% of the cough. If the cough returns using a dose of prednisone that causes significant side effects (as determined by you and the owner), I introduce inhaled steroids (flovent, 220 mcg q12h; see article on inhaled medications elsewhere in these Proceedings).

### Bronchodilators

It would make sense to use bronchodilators to treat dogs with CB if some degree of bronchoconstriction existed which led to clinical signs. There is very little reason to believe that this is true for most dogs with CB. Only one non-anecdotal study has collected objective data to determine the effect of bronchodilator therapy in dogs with CB. In that report, and in our later experience, only about one in seven dogs had a positive therapeutic response. On the other hand, bronchodilator therapy by inhalation is safe and easy to administer (see article on inhaled medications elsewhere in these Proceedings). Because it is not clear which dogs with CB will benefit from bronchodilator therapy, it can be attempted in any dog with CB that does not have a great response to steroids.

### Antibiotics

Bacterial infection probably doesn't play a significant role in most cases of canine CB. A positive culture result obtained from a tracheobronchial wash does not necessarily imply the presence of a clinically significant airway infection and should not lead to antibiotic therapy, unless there was a pure bacterial culture on a primary culture plate. This is because aerobic bacteria recovered from the airways of healthy cats, dogs, and humans, does not exceed  $5 \times 10^3$  organisms/ml. In contrast, growth of a single organism recovered without the use of enrichment broth implies  $>10^5$

organisms/ml; this is consistent with an "infected" airway. Of course, if a primary culture is returned, antibiotic treatment should begin based on culture and sensitivity data.

### Cough Suppressants

Chronic airway inflammation causes production of lots of thick mucus, probably as a protective mechanism to trap the offending irritant from reaching the lung. Coughing is very important to clear this mucus and should be thought of as a protective physiologic reflex. However, there are many cases in which the cough is dry and non-productive. In these situations, the cough is not protective and serves to further irritate the airway, leading to a vicious cycle of cough-irritation-cough. In addition, some dogs with chronic cough are unable to sleep and may awaken their owners at night. Occasionally, some dogs with chronic cough may become syncopal. In each of these clinical settings, cough suppression may be indicated. I use hydrocodone bitartrate, 0.22 mg/kg PO q6-12h as needed. This is a starting dose, and I increase the dose and the frequency until the cough is greatly reduced or the dog is asleep. Literally!

In practice, the most common side effects of high doses of hydrocodone in dogs are drowsiness and constipation. I use 1 teaspoon of metamucil for the constipation and I reduce the dose of hydrocodone during the day to decrease the somnolence.

### Other Drugs

Mucolytics have been suggested as a form of therapy for dogs with airway disease associated with excessive secretion of mucus. While drugs such as acetylcysteine are capable of breaking the disulphide bonds that are partially responsible for the particularly viscid nature of airway mucus, in practice, aerosolized acetylcysteine is irritating to airway epithelium and can promote significant bronchoconstriction.

### PROGNOSIS AND CONCLUSIONS

Canine CB is a common, progressive, and chronic airway disorder. Signs can be greatly improved but the disease is not curable. Establishment of excellent client communications is critical so that client expectations are realistic and so that the therapeutic regime established by the clinician is adhered to.



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