LOGICAL APPROACH TO COUGH
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Cough is one of the body’s defense mechanisms to prevent the entry of noxious materials into the respiratory system, and to clear potentially harmful debris from the lungs and respiratory tract. It is normally associated with other protective processes such as bronchoconstriction and mucus secretion, both of which may aid in the effectiveness of the cough. Cough is an indicator of airway or pulmonary disease, although it also may occur as a primary sign of other thoracic disorders. Cough receptors are located in the larynx, pharynx and large airways. They are absent in the alveoli and alveolar sacs. As a result, diseases of the lung parenchyma may not stimulate the cough reflex to the degree that disorders within the airways do. This is teleologically understandable because even a vigorous cough would not move gas fast enough to cause turbulence and shearing forces at the airway wall in the smaller airways. Cough at this level therefore, would be ineffective. Cough is not a localizing sign being associated mostly with diseases of the lower respiratory tract (trachea, bronchi and lungs). Patients with upper respiratory tract disease may, however, cough if secretions are being drained into the larynx and trachea.

What is causing this cough?
Cough in dogs is usually caused by tracheal collapse, chronic bronchitis, compression of the left main stem bronchus by a large left atrium, congestive heart failure or pneumonia. Other causes of cough include: tracheitis, traumatic or mechanical problems (e.g. foreign body, irritating gases), parasitic disorders (e.g. lungworms, heartworm), and neoplasia. As rule, loud cough originates in large airways, whereas soft, discrete cough is associated with small airway disease (Table 1). In cats, cough is usually a sign of pneumonia, heartworm disease, chronic bronchitis, asthma or lungworms. The history may help establish the etiology for the cough. In dogs, nocturnal coughing is generally associated with cardiac disease, psychogenic causes, or tracheal collapse. Patients with tracheal collapse also may start coughing after drinking water. Cough due to respiratory disease is more likely to occur during the day. Tracheal diseases usually have a goose-honk cough that can be initiated by excitement or by pulling on the collar and leash. The physical examination assists in identifying the reason for the cough and is particularly helpful in differentiating if the cough is due to lung or heart disease in dogs. Canine patients with heart failure usually have fast heart rates with soft crackles, whereas dogs with primary lung disease tend to have pronounced sinus arrhythmia with crackles that are usually louder and of higher-pitch than the ones resulting from heart failure. Wheezes also can be present, particularly in patients with respiratory disease. Crackles are a non-specific sign of small airway disease. Wheezes are continuous musical sounds generated by air forced to pass through a narrow region abruptly into a wider region. Wheezes usually indicate disease in the larger airways. Maneuvers that stimulate the patient to take deep breaths may help in lung auscultation because abnormal lung sounds (especially crackles) may be missed if the lung is not adequately expanded. Closing the nostrils for 10 to 15 seconds usually will force the patient to inspire deeply.

Table 1. Common causes of cough in dogs

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<th>Loud Cough</th>
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<tr>
<td>Tracheal collapse</td>
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<td>Infectious tracheobronchitis</td>
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<td>Chronic bronchitis</td>
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<td>Left main stem bronchial compression</td>
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<td>Lungworms</td>
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<th>Soft Cough</th>
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<td>Pneumonia</td>
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Left-sided congestive heart failure  
Non-cardiogenic pulmonary edema  
Lungworms

Good quality chest radiographs are of paramount importance in evaluating a patient with cough. In many occasions, the diagnosis can be made by visualization of a tracheal collapse, large left atrium, pulmonary masses, or radiographic patterns suggestive of pulmonary edema, pneumonia, bronchial disease or heartworm disease. There is a limited number of ways that the heart and lungs can respond to injury and produce radiographic patterns. Even when radiographs do not reveal the diagnosis they help in narrowing the differentials, and determining the next diagnostic step (e.g. cytologic diagnosis in a patient with bronchial pattern is more likely to be obtained performing a tracheal wash, whereas in a patient with pulmonary masses a fine needle aspiration may be more helpful).

Direct inspection of trachea and bronchial tree can be obtained by bronchoscopy. General anesthesia is required but the risks involved with the technique are outgained by the valuable information that can be obtained. Abnormalities in the lumen (e.g. tracheal or bronchial collapse, external compression), mucosa (e.g. edema, inflammation, excessive mucus), or submucosa (e.g. hyperemia, nodules) can be directly seen with the bronchoscope. Additional advantages of bronchoscopy include the ability to perform bronchoalveolar lavage and removal of foreign bodies during the procedure. Although imaging techniques and direct visualization are useful in identifying and localizing the disease process responsible for the coughing, they do not always provide an etiologic diagnosis and biopsies are not routinely performed. For these reasons, cytologic evaluation is often necessary to establish an etiologic diagnosis. Three techniques are commonly used to obtain samples for cytology in patients with cough: 1) tracheal wash, 2) bronchoalveolar lavage, and 3) fine needle aspiration of the lung. Samples obtained by tracheal wash and bronchoalveolar lavage can also be used for bacterial and fungal culture in case of a suspected primary or secondary infection. Tracheal wash fluid can be collected transtracheally or through a sterile endotracheal tube (the method of choice in small dogs and cats). Tracheal wash is indicated for patients with tracheobronchial disease. Tracheal wash is rarely diagnostic in patients with lung parenchymal disease or diseases that involve only the pulmonary interstitium. The latter patients, however, are usually presented with dyspnea and not cough, although minimal or nonproductive cough may occasionally occur. Bronchoalveolar lavage is the injection and removal of saline into the airway in a volume large enough to flood the alveoli dependent on that airway. General anesthesia and bronchoscopy are required to properly perform bronchoalveolar lavage in small animals. The fluid recovered by this technique is representative of processes involving the deep lung tissues (bronchioles, alveoli, and some times the interstitium). Fine needle aspiration of the lungs is usually indicated for the diagnosis of masses that are causing cough by compressing the airways. It can also be used in patients with disease of the deep lung tissues, but it provides a small sample which is representative of a small area of the lungs. Based on the cytologic examination, the nature of inflammatory process (e.g. eosinophilic, neutrophilic) can be determined. In some occasions, a specific diagnosis can be obtained (e.g. when etiologic agents can be recovered or specific neoplastic cells identified).

**Is a dog with heart murmur coughing due to heart or lung disease?**

Coughing dogs with heart murmur constitute a diagnostic and therapeutic challenge. Old dogs, particularly of small breeds, are commonly affected by chronic respiratory diseases and mitral regurgitation, both of which can result in coughing. Dogs with heart disease may cough due to left-sided congestive heart failure or due to compression of the left main stem bronchus. Patients that are coughing because of compression of the left main stem bronchus and are not in heart failure have history and clinical signs similar to patients with chronic respiratory disease. The history and physical examination are very helpful in the determining the reason for the cough in many cases. Dry, hacking coughs are usually associated with large airway disease (e.g. tracheobronchial collapse, tracheobronchitis, or compression of the left main stem bronchus). More subtle coughs may result from parenchymal injury (e.g. pulmonary edema, pneumonia). Cough in heart failure patients tends to be worse at night and the cough may be accompanied by pink nasal discharge or sputum. Cough in patients with respiratory disease is usually worse during the day and...
may be accompanied by mucopurulent nasal discharge. Dogs with heart failure are frequently thin with severe weight loss (a notable exception are some Dobermans with dilated cardiomyopathy). Patients with primary chronic respiratory disease, on the other hand, tend to be overweight. On physical examination, dogs with left-sided congestive heart failure usually have a tachycardia, whereas dogs with respiratory disease or left main stem bronchus compression have normal heart rate with pronounced sinus arrhythmia. Presence of a gallop rhythm suggests diastolic dysfunction and potentially heart failure. Crackles may be presented in patients with heart or lung disease, although dogs with primary lung disease tend to have louder, high-pitched crackles. Cyanosis can be observed in both primary lung disease and congestive heart failure. Cyanosis in an old dog that is not ill strongly suggests that the cyanosis is caused by a respiratory problem. Dogs cyanotic from pulmonary edema usually dye or recover with therapy in a short period of time. Long term cyanosis will be accompanied by polycythemia. Dogs with chronic respiratory disease therefore, have increased hematocrit, whereas dogs with congestive heart failure have low-normal to low hematocrit due to fluid retention. Further diagnostic tests such as chest radiographs, echocardiogram, and tracheal wash may be necessary to establish if the cough is due to pulmonary or heart problem. Careful interpretation of the information obtained in the history and physical examination, however, will allow the veterinary practitioner to arrive at the correct diagnosis with reasonable assurance in most cases.

References: