Chronic bronchial disease in cats occurs most commonly in two forms, including chronic bronchitis and asthma. *Chronic bronchitis* is defined as an inflammatory disorder of the lower airways that causes a daily cough, for which other causes of cough (including heart failure, pneumonia, neoplasia etc) have been excluded. *Asthma* is more loosely defined as that disorder of the lower airways that causes airflow limitation, “that may resolve spontaneously or in response to medical treatment”. The symptoms of asthma can be dramatic, including acute wheeze and respiratory distress. Sometimes however, the only symptom of asthma is a daily cough, and in human patients this is referred to as “cough-variant” asthma.

Chronic bronchitis is diagnosed by excluding other disorders that cause daily cough. Definitive diagnosis of asthma is usually based on specific pulmonary function studies that require patient cooperation. Because both disorders, bronchitis and asthma, can cause a daily cough as the only clinical sign, there are many times when it is not possible to distinguish one from the other in an individual feline patient. Nevertheless, the diagnosis, prognosis and treatment options for both diseases overlap with great frequency.

**Diagnosis**

There are no specific tests in general practice that can be used to definitively diagnose asthma or bronchitis in cats. Therefore we rely upon clinical criteria, including:
1. A history of (some or all of these clinical signs) cough, acute wheeze, tachypnea and respiratory distress including labored, open mouth breathing. This is usually quickly relieved with some combination of oxygen, bronchodilators, and corticosteroids.

2. Radiographic evidence of bronchial wall thickening, which is usually described as "doughnuts" and "tramlines." Radiographs may also demonstrate atelectasis, most commonly of the right middle lung lobe. It is usually easier to see this pattern on a DV or VD exposure because the right middle lung lobe silhouettes with the base of the heart on the lateral view. Atelectasis most commonly occurs in the right middle lung lobe because of mucus accumulation within the bronchus, and this airway is most commonly involved because it is the only airway that has a dorsal/ventral orientation within the bronchial tree, and therefore subject to the effects of gravity. Air trapping may also be demonstrated by hyperinflated airways. This is seen most prominently on the lateral view and can be appreciated by recognizing the position of the diaphragmatic crus at approximately the level of L1-L2.

3. Response to therapy is an important diagnostic measure. Cats with asthma may stop coughing or wheezing within 10 minutes after administration of a bronchodilator. The great majority of cats with bronchitis or asthma respond to high dose corticosteroid therapy within 5-7 days (see below under treatment). If your patient with bronchitis or asthma does not respond in this manner it is time to reevaluate the diagnosis.

PATHOPHYSIOLOGY

In the simplest terms, airways are tubes. They may be thought of as the plumbing system of the lung, and the primary purpose of the airway tree is to bring air from the environment into the lung for gas exchange. Although the potential causes of bronchitis and asthma are numerous, the airways are capable of responding to noxious stimuli in only a limited number of ways. Airway
epithelium may hypertrophy, undergo metaplastic change, erode, or ulcerate. Airway goblet cells and submucosal glands may hypertrophy and produce excessive amounts of viscid mucus. Bronchial mucosa and submucosa are usually infiltrated with variable numbers and types of inflammatory cells and may become edematous. Bronchial smooth muscle may remain unaffected, become hypertrophied, or spasm. In almost all cases, the unifying and underlying problem is chronic inflammation, whereas the exact cause remains unproved.

The resulting clinical signs of cough, wheeze, and lethargy are due to limitation of air flow from excessive mucus secretions, airway edema and airway narrowing from cellular infiltrates. Cats with asthma may additionally suffer acute airway narrowing from airway smooth muscle constriction. A 50% reduction in the luminal size of an airway results in a 16-fold reduction in the amount of air that flows through that airway. Clearly then, small changes in the size of the airway result in dramatic changes in air flow. The clinical implications of this finding are twofold. First, relatively small amounts of mucus, edema, or bronchoconstriction can partially occlude airways and cause a dramatic fall in air flow. Conversely, therapy that results in relatively small increases in airway size may cause a dramatic improvement in clinical signs.

CLINICAL FINDINGS

**Clinical Signs**

Clinical signs are variable. Bronchitic cats have a daily cough, and may be absolutely symptom free in between episodes of cough. Alternatively, cats with bronchitis may be tachypneic at rest. Asthmatic cats may cough, wheeze, and struggle to breath on a daily basis. In mild cases, symptoms may be limited to occasional and brief coughing. Some cats with asthma may be asymptomatic between occasional episodes of acute airway obstruction. Severely affected cats may
have a persistent daily cough and experience many episodes of life-threatening acute bronchoconstriction.

As previously outlined, a common problem for the practitioner is to distinguish between chronic bronchitis and asthma as the cause of a chronic cough in cats. Although these two disorders are frequently lumped together under the title of *chronic bronchial disease* or *lower airway disease*, the two disorders may require different therapeutic approaches and often have different prognoses. All cats with chronic bronchitis, by definition, have daily cough. Some cats with asthma may be asymptomatic between occasional episodes of acute airway obstruction. Other asthmatic cats may cough occasionally and demonstrate frequent tachypnea. Importantly, asthmatic cats, but not bronchitic cats, may benefit from bronchodilator treatment (see the section on therapy).

**DIAGNOSTIC TEST FINDINGS**

**Physical Examination**

There are no physical examination findings that can be relied on to make the diagnosis of asthma. In fact, cats with bronchitis or asthma may have a normal physical examination at rest. Conversely, respiratory distress primarily during the expiratory phase of breathing is the hallmark of these disorders in cats. Adventitious sounds, including crackles are often heard. Wheezes are more characteristic of feline asthma.

**Thoracic Radiographs**

Routine survey chest radiographs may be normal and should not cause the practitioner to abandon the diagnosis of asthma. Frequently, however, radiographs may demonstrate diffuse prominent bronchial markings consistent with inflammatory airways. Radiographic signs of increased lung lucency and flattening and caudal displacement of the diaphragm represent
hyperinflation and suggest air trapping. In the author's experience, approximately 10% of chest radiographs of cats with bronchial disease have increased density within the right middle lung lobe associated with a mediastinal shift to the right. This is evidence of atelectasis. In more extreme cases, you may appreciate fluffy ill defined heavy interstitial infiltrates in multiple lung lobes. The cause of these changes in cats with lower airway disease may be multiple small areas of atelectasis in multiple lung lobes resulting from multiple diffuse small mucus plugs. This presents a diagnostic challenge because this radiographic change is consistent with a number of disorders including neoplasia and diffuse interstitial pneumonitis.

THERAPY

Treatment of bronchial disease in cats is multifactorial, and includes environmental changes as well as drug therapy. Because there are limitations on the length of this manuscript, we will limit our discussion to newer inhaled medications. A thorough review of treatment options will be presented in lecture.

INHALED MEDICATIONS

Aerosol delivery

Aerosol administration relies upon the delivery of drug to distal airways, which in turn depends on the size of the aerosol particles and various respiratory parameters such as tidal volume and inspiratory flow rate. Even in such co-operative patients as humans, only approximately 10-30% of the inhaled dose enters the lungs. Recent studies in cats have demonstrated that passive inhalation thru a mask and spacer combination (aerokat) is an effective method of delivering sufficient medication to be clinically effective.

Delivery Technique
Drugs for inhalation typically come in a rectangular metered dose inhaler (MDI) or a round “diskus” form. At the present time, only the MDI form is practical for use in animals.

The most effective means of using an MDI requires that inhalation be purposefully coordinated with actuation of the device. This coordination cannot be reliably done in most infants, small children, or animals. An alternative method was developed to allow children and animals to use MDI's without the need to coordinate their breathing patterns. In dogs and cats, this method involves the use of a spacer device and a mask specifically designed for them. Small, aerosol-holding chambers are attached to an MDI and a mask. The spacer is approximately the size of the inner cardboard roll used with toilet paper. The MDI fits on one end of the spacer, and the other end of the spacer has an attachment for the face mask. The MDI supplies precise doses of the aerosol drug, and the holding chamber contains the aerosol so it can be inhaled when the patient breathes. The mask is designed to cover the nose of the cat.

The MDI is first shaken to open an internal valve within the canister, and then it is attached to the spacer. The mask attached to the other end of the spacer is placed snugly on the animal’s nose.

**Inhaled Corticosteroids**

*Fluticasone propionate* (Flovent)

The most commonly used inhaled corticosteroid is fluticasone propionate. Fluticasone propionate is a synthetic corticosteroid that has 18-fold greater affinity for the corticosteroid receptor compared with dexamethasone, the reference standard for corticosteroid potency.

Flovent is a large molecule and acts topically within the airway mucosa. Because there is poor absorption across gut epithelium there is minimal oral systemic bioavailability, thus plasma
levels do not predict therapeutic effects. This explains the lack of systemic side effects, however it also suggests that clinically effective absorption into the airway mucosa is delayed. Optimal clinical effects therefore may not occur for 1-2 weeks.

**Dosage and administration of Flovent**

Flovent comes in three strengths; 44/110 and 220 ug per actuation. For cats with mild/moderate disease, 110 ug given twice daily frequently results in clinical responses equivalent to that achieved by administration of oral doses of prednisone 5 mg PO BID. Cats with more serious disease may require twice this dose, or 220 ug inhaled BID. Administration of flovent in excess of twice daily has not resulted in greater clinical efficacy in the author’s experience.

**Albuterol Sulfate**

Albuterol is a selective beta2-adrenergic bronchodilator. This drug is available through different manufacturers and is commonly prescribed as Ventolin or Proventil. Albuterol only comes in a single uniform strength (i.e., 90 µg per inhalation).

**Drug Dosages**

Albuterol usually results in relaxation of airway smooth muscles within 1 to 5 minutes, so the effect is almost immediate. This drug should be used in animals with documented or assumed bronchoconstriction. Symptoms that may indicate bronchoconstriction are wheeze, noisy lower airway breathing, and coughing. Albuterol can be used once daily prior to administering fluticasone or as needed for acute coughing and wheezing. In emergency cases, albuterol can often be used q 30 minutes for up to 4 to 6 hours without serious side effects.

**Conclusion**

Chronic bronchitis and asthma cause a constellation of symptoms in the feline patient, including cough, wheeze and variable amounts of disability at rest. Other non-airway disorders can
cause similar signs in these patients, and there are only a small number of diagnostic tests available to distinguish one disorder from another. Therefore, the clinician in general practice must rely on careful history taking, physical exam skills and accurate interpretation of thoracic radiographs to insure that a proper diagnosis is made. The use of inhaled medications to treat asthma and bronchitis is considered the standard of care in humans and is now widely recommended for cats with chronic bronchial disease. This approach avoids many of the side effects previously seen in patients treated with systemic medications.