1 Localization of Disease

Clinical signs that provide clues to the existence of respiratory disease include nasal discharge, cough, respiratory noise, tachypnea, difficulty breathing, or exercise intolerance. The first step toward making a diagnosis requires accurate localization of the anatomic origin of disease within the respiratory tract: the nasal cavity, upper or lower airway, lung parenchyma, or pleural space. This will allow construction of an accurate list of differential diagnoses, will facilitate efficient diagnostic testing, and will allow rational empiric therapy while waiting for test results.

Nasal Discharge

History

Nasal discharge is almost always a sign of local disease within the nasal cavity. One exception is eosinophilic bronchopneumopathy, an inflammatory condition of the lung and airways that can also involve the nasal epithelium. A second exception can be found in the dog or cat with lower respiratory tract disease (usually bacterial pneumonia) that coughs airway material into the nasopharynx, which subsequently drains from the nose. In both situations, animals usually have a combination of cough and nasal discharge. The most common causes of nasal discharge include infectious, inflammatory, and neoplastic disorders as well as dental-related nasal disease and foreign bodies (Table 1.1). Additional clinical signs that can be seen in animals with nasal disease include sneezing or reverse sneezing, pawing or rubbing at the face, noisy breathing or mouth breathing, facial pain, or an unexplained odor near the head.

Table 1.1. Causes of nasal discharge in dogs and cats

	Dog	Cat
Infectious	Canine infectious respiratory disease complex[a] *Aspergillus* *Penicillium* *Rhinosporidium*	Acute upper respiratory tract disease complex[b] *Cryptococcus* *Aspergillus*
Inflammatory	Lymphoplasmacytic rhinitis	Feline chronic rhinosinusitis
Neoplastic	Adenocarcinoma Sarcomas Lymphoma	Lymphoma Adenocarcinoma Sarcomas
Local	Tooth root abscess Oronasal fistula Trauma Foreign body Nasal or nasopharyngeal polyp	Nasal or nasopharyngeal polyp Tooth root abscess Oronasal fistula Foreign body Trauma
Other	Primary ciliary dyskinesia Nasal mites Xeromycteria (dry nose syndrome)	Primary ciliary dyskinesia

[a]Reported causes include canine adenovirus-2, canine parainfluenza-3 virus, canine respiratory coronavirus, canine herpesvirus, canine distemper virus, *Bordetella* and *Mycoplasma*. Canine influenza virus is a new addition to the list of etiologic agents.
[b]Reported causes include feline herpesvirus-1, feline calicivirus, *Chlamydophila*, *Bordetella*, and *Mycoplasma*.

When evaluating the animal with nasal discharge, important considerations include the duration of signs, the type of discharge as well as changes in its character over time, and the presence of unilateral or bilateral signs. Acute nasal discharge is often accompanied by sneezing and is most commonly associated with viral upper respiratory tract disease or a foreign body. Animals with acute nasal discharge usually have dramatic clinical signs that either resolve within a week without treatment or are so severe that animals are rapidly evaluated by a veterinarian. More frustrating cases are those with chronic nasal discharge, which often have low level but progressive signs from weeks to months to years before the severity of disease prompts veterinary care.

With many causes of nasal disease including viral disease or foreign body, discharge is serous initially and then progresses to a mucoid character when inflammation induces mucus production or when secondary bacterial infection develops. Yellow-green nasal discharge can be an indicator of eosinophilic disease but is also encountered in other inflammatory conditions, while brown-tinged discharge suggests the presence of blood within the mucus. Bright red blood can be found in combination with nasal discharge because of trauma to blood vessels associated with the primary disease process or due to the severity of sneezing. Pure epistaxis has been associated with local causes of disease, including inflammatory rhinitis, canine aspergillosis, and neoplasia; however, systemic vascular disorders must also be considered including coagulopathies and systemic hypertension.

Nasal discharge that is strictly unilateral is most suspicious for local disease due to a foreign body, trauma, tooth root abscess or oronasal fistula, or an early fungal infection

or neoplasm. However, systemic vascular disease or a coagulopathy can result in unilateral signs. Also, inflammatory diseases such as lymphoplasmacytic rhinitis in the dog and feline chronic rhinosinusitis can also present with lateralizing clinical signs, although in most cases, imaging and histology reveal that both sides of the nasal cavity are affected.

Signalment

Young animals with nasal discharge are most often affected by infectious upper respiratory tract diseases. A nasopharyngeal polyp should be considered when discharge is accompanied by obstructed breathing. Primary ciliary dyskinesia is a defect of innate immunity that results in effectual mucociliary clearance, failure to clear secretions, and recurrent infection. Therefore, this condition would be more frequently recognized in a younger animal. Affected dogs are often purebred, with an increased prevalence in the Bichon Frise, although any breed of dog or cat can be affected. While neoplastic disease most typically affects older animals, it also occurs in animals 2–4 years of age and can be particularly aggressive, especially in dogs. Canine aspergillosis is most often encountered in younger dogs and older cats. Cryptococcus and inflammatory rhinitis can affect dogs or cats of any age.

Nasal disease of most types (fungal, neoplastic, and inflammatory) is most commonly found in dolicocephalic dog breeds. An unusual combination of rhinitis and bronchopneumonia has been reported in the Irish wolfhound, where a genetic defect in respiratory immunity is suspected.

Physical Examination

A complete physical examination is essential in every animal presented for evaluation of respiratory disease. In animals with nasal discharge, important features to focus on include the presence or absence of nasal airflow, changes in ocular retropulsion, lack of soft palate depression, regional local lymph node enlargement, and facial asymmetry or pain. These parts of the physical examination are most important because they can help identify the space-occupying nature of some nasal diseases, particularly nasal neoplasia, feline cryptococcosis, and nasopharyngeal polyps, and because these findings can detect local extension or metastasis.

Nasal airflow can be assessed by holding a chilled microscope in front of each nostril to show fogging of the glass or by using a wisp of cotton (from a cotton ball or Q-tip) to watch for air movement. The mouth should be held closed during the procedure, and occlusion of the alternate nostril can be helpful for enhancing airflow through the side of the nasal cavity to be examined (Figure 1.1). An animal with a mass effect in the nasal cavity or nasopharynx will fail to fog the glass or move the cotton wisp and will often object to this manipulation because it obstructs airflow. Conversely, even animals with heavy mucus accumulation in the nasal cavity will retain nasal airflow.

Facial palpation is performed to assess for a pain response, to locate swellings and depressions in bony structures, and to check for symmetry of the skull. Ocular retropulsion is a part of the facial examination and is performed by placing each thumb over the closed lids and pressing gently backward, upward, medially, and laterally (Figure 1.2). Nasal lesions that are producing a mass effect behind the globe (primarily a neoplasm

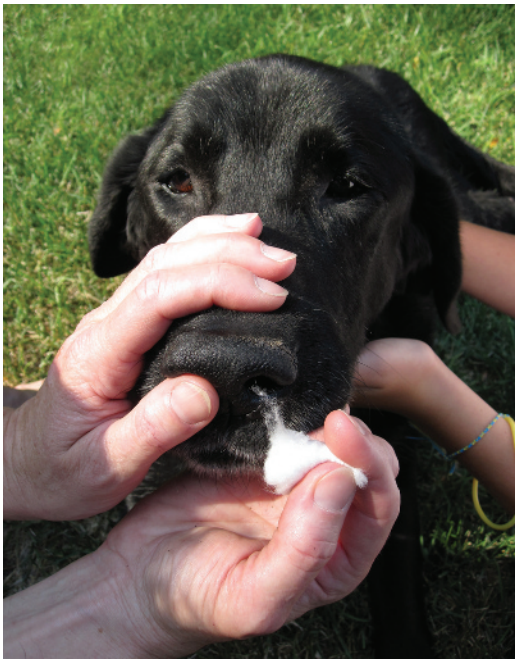

Figure 1.1. Nasal airflow can be assessed by occluding one nostril and assessing flow from the alternate nostril with a cotton wisp or chilled microscope slide.

or retrobulbar abscess) will cause a lateralizing difference in the resistance to depression. Similarly, palpation within the oral cavity can reveal bony abnormalities in the hard palate or might suggest a mass lesion above the soft palate. To perform this examination, the mouth is held open, and the roof of the mouth is palpated from the front of the hard

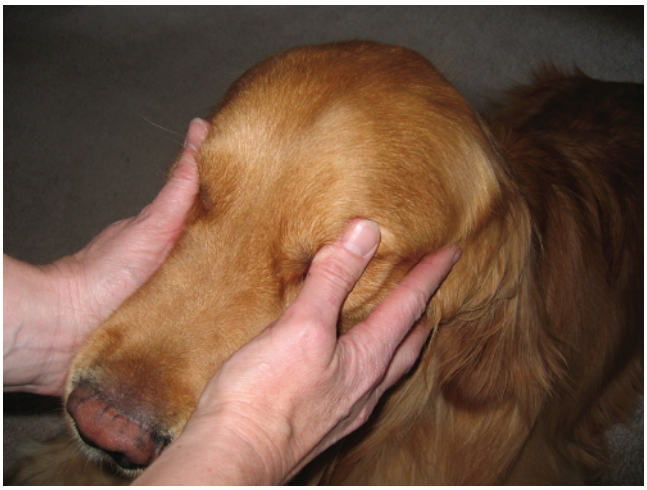

Figure 1.2. Palpation during ocular retropulsion can suggest the presence of a mass lesion within the optic tract.

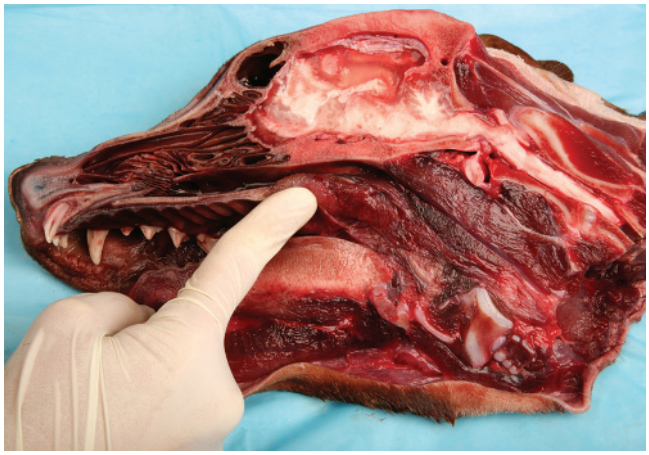

Figure 1.3. In the normal animal, palpation of the soft palate will readily depress tissue into the nasopharyngeal region. The presence of a mass lesion in the nasopharynx will result in resistance to depression.

palate through to the end of the soft palate. In the normal animal, the soft palate is readily depressed upward into the nasopharyngeal region (Figure 1.3). A mass in this area (most commonly a neoplasm, fungal granuloma, or polyp) will resist depression. The dental arcade should also be evaluated during the oral examination, although it is important to remember that tooth root disease can be present in the absence of external signs.

Neoplastic disease, fungal infection, or inflammatory diseases within the nasal cavity can involve mandibular lymph nodes and the disease process can sometimes be identified by cytology of a lymph node aspirate, even when there is no palpable enlargement. Nasal depigmentation is a relatively specific feature of canine nasal aspergillosis found in up to 40% of cases and is thought to result from elaboration of a dermonecrotic toxin by the fungus.

Loud Breathing

Definition

Loud breathing most commonly results from a disorder affecting the nasal cavity or upper airway (larynx, pharynx, or cervical trachea), although occasionally animals with lower airway disease will present for loud breathing. Stertor is a gurgling or snoring sound that is produced as air flows past a soft tissue obstruction. It can be caused by narrowing of the nasal cavity, by elongation or thickening of the soft palate, or by edema or eversion of laryngeal saccules. It varies in tone and pitch, and it may be audible on both inspiration and expiration. In contrast, stridor is classically an inspiratory noise of a single, high pitch that results from rapid flow of air past a rigid obstruction, such as a paralyzed or collapsed larynx. Stridor can also be heard in an animal with a laryngeal mass effect, or occasionally in an animal with nasopharyngeal stenosis or fixed cervical tracheal collapse or stenosis.

Signalment

Stertor is commonly encountered in brachycephalic dog breeds such as bulldogs (English and French), Pugs, and Boston Terriers and is also seen in Himalayan and Persian cats. Loud breathing is often present early in life and becomes worse with development of additional respiratory disease or with weight gain. Some animals are not presented for evaluation of stertor and respiratory difficulty until late in life because of the perception that noisy respiration is "normal" for the breed.

Animals with stridor due to congenital laryngeal paralysis are usually young (6–12 weeks) when the disease is manifest. Affected breeds include the Dalmatian, Rottweiler, Great Pyrenees, Bouvier des Flandres, Siberian Husky, White German Shepherd, and some cats (see Chapter 5). Acquired laryngeal paralysis is most commonly found in older large breed dogs such as Labrador and Golden retrievers. Brachycephalic breed dogs that develop laryngeal collapse are usually older at the time of diagnosis, however because this is an end-stage manifestation of airway obstruction, age varies depending on the severity of disease.

Physical Examination

In a normal animal, breathing is quiet at rest. Stertor and stridor can be heard without the use of a stethoscope; however, in some instances, careful auscultation over the neck region is needed to confirm stridor. Increasing respiratory flow rate by gentle exercise can improve detection of stridor; however, panting must be discouraged. In the normal animal, auscultation over the larynx and trachea will reveal loud, hollow sounds that are heard equally on inspiration and expiration. Because upper respiratory noises are typically loud and can obscure lung sounds, auscultation of the larynx and tracheal region is recommended in all patients/prior to thoracic auscultation to improve differentiation of upper from lower respiratory sounds and to improve detection of heart sounds. This is particularly helpful in brachycephalic breeds (Figure 1.4). Brachycephalic breeds commonly have visible stenotic nares as part of the disease complex, and excessive oropharyngeal folds may be evident.

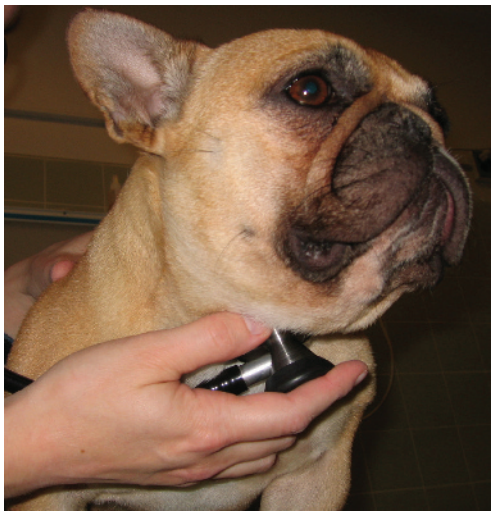

Figure 1.4. Prior to thoracic auscultation, the laryngeal and cervical tracheal regions are ausculted to define upper airway sounds.

Cough

History

Cough occurs because of activation of irritant receptors that lie between epithelial cells lining the airways and can be triggered by inflammatory products of neutrophils or eosinophils, by the presence of excess secretions, and by airway compression or collapse (Table 1.2). Important historical features to determine include the onset and duration of cough, the character of the cough, and environmental features that appear to trigger cough.

Animals with a wet- or moist-sounding cough most likely have excessive airway secretions due to infectious or inflammatory airway or parenchymal disease. Observant owners of the animal with a productive cough may note that the animal swallows after coughing or retches to remove secretions from the airway. However, infectious, inflammatory, and structural diseases of the airway can also result in a dry cough when secretions are minimal or early in the course of disease. Cough in animals with airway disease is often harsh and can be chronic, intermittent, or paroxysmal in nature. Animals with pneumonia may have a softer cough along with a vague history of illness characterized by anorexia and lethargy.

Determining environmental and travel history is important for animals with cough. Exposure to a high-density dog population should raise concern for disease associated with canine respiratory disease complex. If the cough is harsh and dry, *Bordetella* should be considered, while a soft, chronic cough could be suggestive of canine influenza virus infection. Sporting dogs that develop an acute onset of cough or have a chronic, antibiotic-responsive cough may have foreign body pneumonia. Fungal pneumonia should be suspected in animals with cough that have traveled to endemic regions. In those animals, cough is usually

Table 1.2. Respiratory causes of cough in dogs and cats

	Dog	Cat
Infectious tracheobronchitis	Canine infectious respiratory disease complex[a]	*Mycoplasma* *Bordetella*
Pneumonia	Bacterial Aspiration Foreign body Fungal Eosinophilic Interstitial	Bacterial Aspiration Foreign body Fungal Interstitial
Inflammation	Chronic bronchitis Eosinophilic bronchopneumopathy	Asthma/chronic bronchitis
Neoplasia	Primary Metastatic	Primary Metastatic
Structural	Bronchiectasis Airway collapse	Bronchiectasis

[a]Reported causes include canine adenovirus-2, canine parainfluenza-3 virus, canine respiratory coronavirus, canine herpesvirus and canine distemper virus along with *Bordetella* and *Mycoplasma*. Canine influenza virus can also be included in the list of etiologic agents.

accompanied by tachypnea and systemic signs of illness. Finally, environmental history is important because exposure to pollutants and airway irritants can exacerbate upper or lower airway diseases in both dogs and cats.

Physical Examination

One of the more difficult challenges in assessing animals with respiratory disease is the development of good auscultation skills. Practice and patience are required because audible sounds are altered by age, body condition score, conformation, respiratory pattern, and the presence of disease. As mentioned earlier, careful examination should include the larynx and trachea, followed by auscultation of all lung fields. The anatomic origin for lung sounds has not been fully established; however, normal lung sounds are usually designated as bronchial, vesicular, or bronchovesicular. Bronchial sounds are loud and are heard best over the large airways near the hilus. Typically, they are louder and longer during expiration than inspiration and have a tubular character. Vesicular lung sounds are soft, heard best on inspiration, and can be detected over the periphery of the chest in normal animals. The sound resembles a breeze passing through leaves on a tree. Bronchovesicular sounds (a mixture of bronchial and vesicular qualities) can be heard on inspiration more than expiration.

Lung sounds in animals with airway or parenchymal disease are often increased in loudness or harshness. Adventitious (abnormal) lung sounds (crackles and wheezes) are discontinuous noises that should always be taken as an indicator of disease. Crackles are thought to result from rapid opening of airways but could also arise from equalization in pressure as air passes through fluid or mucus-filled airways. They can be heard at any point during inspiration or expiration. Wheezes result from air passing through airways narrowed by intraluminal mucus, extraluminal compression, or by collapse or constriction, and are usually heard on expiration. Adventitious lung sounds can be enhanced by inducing a cough or a deep breath, or by exercising the patient. In normal animals, it is difficult to induce a cough by palpating the trachea; however, animals with airway or parenchymal disease usually have increased tracheal sensitivity due to activation of irritant receptors by infection or inflammation.

Fine crackles are suggestive of pulmonary edema, particularly if ausculted in the hilar region of a dog, whereas coarse crackles are more suggestive of pneumonia or airway disease. Dogs or cats with pulmonary fibrosis can display either fine or coarse crackles that are auscultable diffusely across the chest. Auscultation in dogs with airway collapse can reveal diffuse crackling sounds because of the presence of concurrent bronchitis or because of small airways that suddenly pop open. A loud snapping sound over the hilar region at end expiration is suggestive of collapse of the intrathoracic trachea, carina, or mainstem bronchi.

Tachypnea

History

Tachypnea is most often associated with parenchymal or pleural disease, although in the cat, tachypnea can also be seen with bronchial disease. Therefore, in the cat, tachypnea can be found in conjunction with historical features of cough and decreased activity. Parenchymal diseases that lead to tachypnea are primarily pneumonia and pulmonary edema, and these

disorders can be acute or chronic and insidious in onset. They are typically associated with systemic signs of illness such as lethargy, anorexia, and weight loss. Tachypnea due to with pneumothorax is usually acute; however, pleural effusive disorders can result in either an acute presentation with respiratory distress or a more chronic development of signs due to slow accumulation of fluid. Usually, the degree of respiratory distress is associated with the rapidity of fluid or air accumulation rather than with the specific volume present. Cats seem to be particularly sensitive to addition of a final, critical volume of fluid that overcomes their ability to compensate for filling of the pleural space.

Physical Examination

Cervical and thoracic auscultation as described for evaluation of animals with cough is important for animals that present with tachypnea since many diseases will result in both clinical signs. In addition to listening for increased sounds, it is important to determine if there is an absence of lung sounds, which might indicate either lung consolidation or the presence of fluid or air in the pleural space.

A notable clinical sign associated with parenchymal or pleural disease is a rapid, shallow breathing pattern, although with pleural disease, exaggerated chest wall motion can sometimes be present. In animals with severe respiratory distress, elbows are abducted and the neck is extended to facilitate movement of air into the alveoli. Parenchymal diseases are characterized by increased lung sounds or detection of adventitious sounds. When pleural effusion is present, lung sounds are ausculted in the dorsal fields only and muffled sounds are heard ventrally; heart sounds are also muffled. Pneumothorax leads to an absence of lung sounds dorsally due to compression by air, and lung sounds are present in the ventral fields only.

In addition to auscultation, thoracic percussion aids in determining if pleural disease is present. Percussion can be performed using a pleximeter and mallet or by placing the fingers of one hand on the chest and rapidly striking them with fingers of the opposite hand (Figure 1.5). The sound that develops varies depending on whether an air or fluid density is

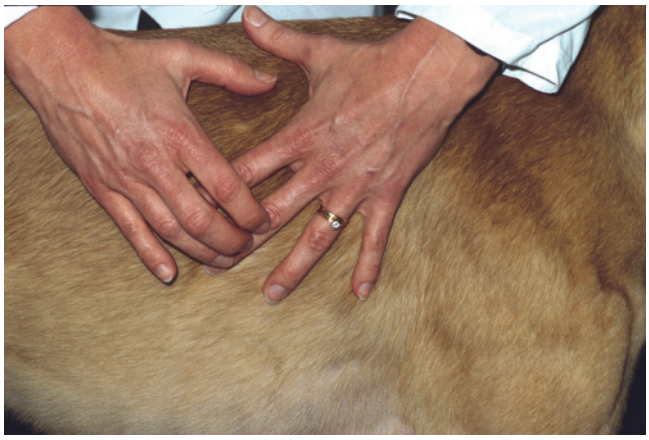

Figure 1.5. Each region of the thorax should be percussed to detect regional differences in the air/soft tissue sounds that are created. One hand is placed against the thorax and is rapped quickly and sharply with the curved fingers of the alternate hand.

present within the thoracic cage. Percussion of the chest in a region filled with fluid reveals a dull sound while in an animal with pneumothorax or air trapping, percussion results in increased resonance. This technique is somewhat limited in a cat or small dog because of the small size of the thoracic cavity.

Careful auscultation of the heart is also indicated in animals with parenchymal or pleural disease because congestive heart failure can lead to respiratory signs due to pulmonary edema or pleural effusion. In such a case, a heart murmur or gallop would be expected along with tachycardia, and jugular veins are often distended in an animal with right ventricular failure. If the apical impulse is poorly audible, this is an additional clue to the presence of pleural effusion.

Exercise Intolerance

History

In general, exercise intolerance can result from respiratory, cardiac, musculoskeletal, neurologic, or metabolic diseases. Respiratory disorders that result in exercise intolerance usually do so through airway obstruction in diseases such as laryngeal paralysis or bronchitis, or through hypoxemia associated with parenchymal disease. Historical features in animals with airway obstruction can include loud breathing noises as well as progressive tiring and a reduced level of activity. Upper airway obstruction due to laryngeal disease may be accompanied by reports of dysphonia, decreased vocalization, gagging, or retching, while lower airway obstruction due to bronchoconstriction or inflammation is usually associated with cough.

Physical Examination

In the older, large breed dog presented for evaluation of exercise intolerance, careful attention should be paid to laryngeal auscultation for stridor suggestive of laryngeal paralysis. Increased tracheal sensitivity and loud or adventitious lung sounds in cats or dogs with exercise intolerance but no systemic signs of illness suggest that bronchial narrowing or inflammation may be responsible for exercise intolerance. Animals that display tachypnea on physical examination, abnormal lung sounds, and systemic signs of illness likely suffer from some form of pneumonia.