PNEUMONIA IN DOGS AND CATS

Lynelle R. Johnson DVM, MS, PhD, Diplomate ACVIM
2108 Tupper Hall
University of California
Davis, CA  95616    USA

Dogs or cats with bacterial pneumonia usually have a history of a productive cough, tachypnea, and respiratory difficulty or labored breathing. Other animals may present with more vague signs of illness such as malaise, depression, anorexia, and weight loss. An early clue to the diagnosis of bacterial pneumonia is a change in the respiratory pattern. Parenchymal infection with alveolar flooding by inflammatory debris leads to restrictive lung disease, and a rapid shallow breathing pattern results. Thoracic auscultation is typically abnormal with loud bronchial noises and moist crackles variably detected throughout the lung fields. Absence of lung sounds in an area could be suggestive of total lung consolidation, however pleural disease must be ruled out. A mucopurulent nasal discharge can be seen when animals cough respiratory secretions into the nasopharynx or have coincident nasal infection. Fever may or may not be present.

Primary bacterial pneumonia is rare in the dog and cat, although Bordetella or Mycoplasma might result in primary lung infection. Bordetella infections are problematic in young kittens housed in over-crowded unhygienic environments, although this organism is not a substantial risk for normal domestic pets. It is a common pathogen in young dogs with infectious respiratory disease but has also been isolated from older dogs. Factors that relate to pathogenicity of Mycoplasma species remain unknown, although primary Mycoplasma pneumonia has been reported in cats. In most situations, when bacterial pneumonia is diagnosed, a search should begin for any underlying disease or predisposing disorder that allows parenchymal infection, including pre-existing lung disease, abnormal respiratory defense mechanisms (such as laryngeal paralysis or bronchiectasis), or immune suppression due to viral infection or chemotherapy.

A complete database will aid in establishing the severity of the pneumonia and identifying predisposing conditions. Leukocytosis with a left shift supports the diagnosis of bacterial pneumonia in an animal with appropriate signs. Neutropenia with a degenerative left shift suggests fulminant pneumonia with pulmonary sequestration of neutrophils. A biochemical profile and urinalysis assist in the diagnosis of underlying conditions and systemic involvement. Diseases such as diabetes and hyperadrenocorticism that are associated with defective neutrophil function must be diagnosed and controlled in animals with pneumonia. FeLV/FIV serology should be performed in cats with pneumonia, although a direct association has not been made between viral status and the incidence of bacterial pneumonia. Cats or dogs with pneumonia that have a history of travel to areas endemic for the bubonic plague (Southwestern USA) should have fluorescent antibody testing on aspirates or hemagglutination titers for Yersinia pestis performed immediately. Animals should be quarantined when bubonic plague is suspected because of the serious zoonotic potential of this organism. Canine distemper virus and calicivirus should be considered as predisposing causes of pneumonia in young animals, and it appears that parainfluenza virus can be associated with pneumonia in older dogs. Documentation of viral presence can require use of PCR on airway samples.

Alveolar infiltrates with air bronchograms are considered the classic radiographic findings in bacterial pneumonia, however early cases of pneumonia can display subtle lesions such as diffuse interstitial or bronchial infiltrates. In severe cases, lobar consolidation occurs when alveolar infiltration coalesces to involve an entire bronchial tree. A cranioventral distribution of infiltration is typical of aspiration pneumonia. The right middle lung lobe or both middle lobes are often involved when pneumonia occurs secondary to aspiration or bronchial obstruction because of the ventral branching of these lobar bronchi from the trachea. Pleuropneumonia is uncommon in small animals unless a pleural foreign body or bite wound is the cause of pneumonia. In these cases, infection with Actinomyces or Nocardia can be found.
Direct airway sampling through tracheal wash, bronchoscopy with bronchoalveolar lavage, or occasionally fine needle aspiration of the lung is indicated to confirm pneumonia by obtaining samples for gram stain, culture/antibiotic sensitivity testing, and cytology. Gram staining characteristics and cytology can be useful for initiating early antibiotic therapy. Fulminant pneumonia with gram negative bacteria can be treated initially with parenteral fluoroquinolones. Additional drugs are needed to provide broad spectrum coverage, particularly for anaerobic organisms or infection with gram positive bacteria. The combination of a fluoroquinolone with a beta lactam antibiotic should be efficacious against most of the commonly encountered pathogens of the lower respiratory tract. Efficacy against a lung infection is improved when a high serum:tissue concentration gradient is achieved through administration of intravenous doses of drug given at appropriate intervals.

Poor response to therapy may be due to an unrecognized systemic disorder or poor antibiotic choice. Use of antibiotics with good lipid solubility can improve outcome since these drugs have better penetration of lung tissue. The presence or absence of local inflammation also affects antibiotic efficacy since some drugs, such as penicillins and cephalosporins, depend on inflammation for tissue penetration. As disease and inflammation resolve, inadequate drug concentrations can develop within the lung parenchyma and a low-grade infection may persist. Additionally, certain drugs are inactivated by the acidic pH associated with inflammation (eg, gentamycin) or are degraded by bacterial enzymes such as beta-lactamases (eg, penicillins and cephalosporins), thus impairing therapeutic response.

In an animal with non-resolving pneumonia, the possibility of a foreign body or pulmonary abscess should also be considered. Migrating pulmonary infiltrates on radiographs may be an indication of smoldering or recurrent infection. Consolidation of one or more lung lobes, with or without abscessation, may serve as a nidus for recurrent infection or result in failure of antibiotic therapy. In these cases, lobectomy is a viable option for controlling disease. In one study, over half of the animals treated with lung lobectomy had resolution of disease. One-quarter of animals had persistence of disease, and these dogs most commonly had uncontrolled bacterial or fungal pneumonia. Biopsy of the affected region may indicate a cause for therapeutic failure, such as an unrecognized foreign body, fungal infection, or an underlying neoplastic process.

Generalized supportive care and ancillary respiratory therapy will aid in resolution of pneumonia. Oxygen supplementation is beneficial in decreasing respiratory effort and improving clinical status. Oxygen can be provided in an oxygen cage or with a nasal catheter. Nasal catheters are often more efficient in delivering oxygen and allow greater freedom of movement, as well as more efficient examination. A soft red rubber catheter is used to supply nasal oxygen. The outer surface is lightly coated with anesthetic gel and is initially directed into the naris in a medial direction to get beyond the alar fold. The catheter is immediately oriented ventrally and advanced to pass into the ventral nasal meatus so that oxygen enters the pharyngeal region. Oxygen flow rates of 1-5 Liters/minute can provide 30-50% fraction of inspired oxygen depending upon the size of the dog.

Systemic hydration is extremely important in maintaining hydration of respiratory secretions and to facilitate their removal from the respiratory tree. Saline nebulization with use of an ultrasonic nebulizer is also beneficial in treatment of pneumonia by providing direct hydration of the lower airways. Individual sterile vials of saline without purchase can be purchased for use in the nebulizer. Fifteen-30 minutes of nebulization can be done 2-4 times daily and should be followed by light exercise or coupage to help remove secretions from the lower airways. Cough suppressants are contra-indicated in the animal with pneumonia. Use of bronchodilators is somewhat controversial, although these drugs may decrease the work of breathing in some dogs.

**Aspiration pneumonia**

Risk factors for aspiration pneumonia include swallowing disorders (megaesophagus or esophagitis), decreased level of consciousness (post-anesthesia, post-ictus, head trauma), decreased laryngeal sensation, or laryngeal surgery. Acid injury is primarily responsible for the ventilatory abnormalities in animals with aspiration pneumonia. Aspiration of acidic gastrointestinal contents leads to ventilation:perfusion mismatching, hypoxemia, and potentially acid-induced bronchoconstriction. In addition, acid injury can potentiate oxygen toxicity. With fluid aspiration into the alveoli, surfactant is
diluted and denatured, resulting in atelectasis and collapse of alveoli. In severe cases, pulmonary injury can lead to non-cardiogenic pulmonary edema, acute respiratory distress syndrome (ARDS), and multi-organ failure. Gastrointestinal flora may lead to parenchymal infection if airway defenses are overwhelmed.

Clinically it seems that aspiration pneumonia is more common in dogs than in cats. Typically, the animal has an acute history of vomiting or regurgitation followed by intense respiratory distress, malaise, and tachypnoea. However, in some animals, a prolonged history of dysphagia, regurgitation, or vomiting is noted in association with chronic cough. In other animals, gastrointestinal signs are lacking and silent aspiration might be suspected. Physical examination is expected to be characteristic of pneumonia with a rapid, shallow breathing pattern, tracheal sensitivity, and increased lung sounds, however findings expected with lower respiratory tract inflammation such as tachypnoea, fever, or tachycardia may be absent. During physical examination, careful auscultation over the larynx is warranted to detect evidence of stridor, which could suggest laryngeal paralysis as a predisposing feature. Harsh or loud bronchovesicular sounds are found most often in dogs with pneumonia, but crackles may be evident in some cases, either throughout all lung fields or localized to the cranioventral regions.

A complete blood count usually reveals neutrophilia, often with a left shift, although in the acute stages, neutropenia can be present because of pulmonary sequestration. Radiographs typically show a cranioventral alveolar infiltrate or middle lung lobe disease, however, the position of the animal at the time of aspiration will affect the radiographic distribution. In early stages of disease or with mild aspiration, an interstitial pattern may be present. Airway samples can be collected to determine optimal antibiotic therapy, however the risk of anesthesia and repeat aspiration must be considered. Mixed bacteria (gastrointestinal and oral flora) are expected to be present most commonly. If the aspiration event has been witnessed, immediate bronchoscopic suction of the material might be beneficial, however this is rarely encountered clinically. If bronchoscopy is performed, excessive fluid lavage should be avoided since this can force particulate matter deeper into the parenchyma and result in airway obstruction or deep-seated inflammation.