

White Pleural Effusion: Pyothorax and Chylothorax

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INTRODUCTION

Pleural effusion is a relatively common cause of respiratory distress in the dog and cat. Both species are affected by a variety of types of effusion, with numerous causes and variable prognosis. Pleural effusion may be discovered incidentally or may cause respiratory distress resulting in presentation of the pet for veterinary care. In the case of pyothorax, the animal may present with signs of sepsis rather than respiratory compromise. Small amounts of effusion may not result in changes on physical examination. In fact, it may require approximately 10 ml/kg of effusion to result in radiographic detection of pleural fluid, and more than 30 ml/kg of effusion to result in altered physical examination (note - normal fluid volumes are 0.1 to 0.3 ml/kg for dogs and cats, respectively). Respiratory distress may not be severe until at least 50–60 ml/kg of effusion have accumulated.

When clinical signs related to pleural effusion are present, they may include tachypnea, respiratory distress (primarily on inspiration), shallow respiration, decreased bronchovesicular lung sounds in dependent portions of the thorax and/or increased bronchovesicular sounds in the remainder of the thorax, and hyporesonance on percussion of the dependent portions of the thorax (detection of “fluid line”). Cough is uncommonly associated with pleural disease, and is typically found in association with disease extension to or from the lungs or airways. Because pleural effusion may be associated with systemic illness, clinical findings may be related to systems other than the respiratory system or may be related to an underlying respiratory pathology (e.g., sepsis associated with bacterial pyothorax).

Confirmation of pleural effusion may be obtained radiographically or via thoracocentesis. Animals presenting with inspiratory distress and quiet dependent lung sounds may be harmed by the restraint required to obtain radiographs; in such cases, thoracocentesis may prove life-saving as well as providing crucial diagnostic information. Even if radiographs are obtained first to document pleural fluid, an aliquot of the fluid will be required for further diagnosis. Analysis of the collected fluid varies with differential diagnosis. In general, samples should be submitted for fluid and cytologic analysis with aliquots saved for aerobic and anaerobic culture if needed. Other tests may be appropriate depending on signalment, clinical signs, and ancillary evidence of disease.

Pleural fluid may be classified as hemorrhagic, transudative, or exudative. Frank hemorrhage in the pleural space is most often associated with trauma or defects in secondary hemostasis (e.g., vitamin K antagonist rodenticide exposure). Transudate type fluids are poorly cellular fluids (< 500 TNC/ul) with low protein content (< 3 g/dl); modification of these fluids (often with time) may increase either cell number (500–5,000 TNC/ul) or protein content (3–5 g/dl). Exudates have higher cell counts and protein content than transudates or modified transudates but vary tremendously in type. Pyothorax and chylothorax are exudative effusions.

PYOTHORAX

Bacterial infection of the pleural space leading to accumulation of purulent fluid occurs in both dogs and cats. In dogs, infection often follows the entry of foreign material such as grass awns into the thoracic cavity (this may be more or less common as a cause of pyothorax depending on geography).

Traditionally, pyothorax in cats was associated with cat fight injuries. More recently, an association has been made in cats between pyothorax and upper respiratory infection. Often, no cause is ever identified in either cats (C) or dogs (D). Animals with pyothorax are often systemically ill and may demonstrate lethargy, anorexia, fever, and other non-specific signs with or without respiratory compromise. It is not uncommon, especially in dogs, for signs to have been present for many weeks prior to diagnosis of pyothorax.

The purulent fluid which accumulates in animals with pyothorax is usually off white, beige, pink, or red (“cream of tomato soup” color) and malodorous. When *Nocardia* or *Actinomyces* infections are present, the fluid may contain white or yellow granular material (sulfur granules). Degenerate

neutrophils are the predominate cell type and are often degenerate and typically contain intracellular bacteria. Bacteria are often observed cytologically both inside and outside the neutrophils. In *Nocardia* or *Actinomyces* infection granular material should be squashed and examined, and acid fast stains applied; in these cases degenerate neutrophilic changes may not be pronounced. Both *Nocardia* and *Actinomyces* are gram-positive filamentous bacterial but *Nocardia* is acid fast while *Actinomyces* is not.

The pleural effusion in pyothorax is typically acidic and has a low glucose content. Both aerobic and anaerobic cultures should be requested from the fluid. The most common pathogens identified in pyothorax are *Pasteurella* (C), *Bacteroides* (D&C), *Actinomyces* (D&C), *Clostridium* (C), *Nocardia* (D); infections are often mixed. Remember that occasional non-bacterial infections (e.g., *Toxoplasma gondii*, *Candida albicans*) can also cause pyothorax and will not respond to routine antibiotics.

Animals with pyothorax are usually systemically ill and may have complications of sepsis. Although aggressive broad-spectrum antibiotics including anaerobic coverage is mandatory for therapy of pyothorax, it is not adequate. The purulent fluid must be drained. Some argument exists as to the ideal method of dealing with effusion; success has been documented after drainage a single time, after intermittent drainage, and after continuous evacuation. It is the author's preference to use continuous evacuation for at least several days, or until < 1 ml/kg day fluid is produced from the tube. Thoracic lavage (with or without antibiotics) has not been demonstrated to provide additional benefit over simple drainage of the purulent fluid.

Reasonable initial choice of antibiotics must include anaerobic coverage. Gram stain and acid fast stain can provide more timely results than pending culture, but once culture results are available coverage can be changed. A combination of ampicillin and metronidazole are frequently prescribed for initial therapy, unless acid fast or gram-negative bacterial are identified on stains. Sulfonamides are the antimicrobials of choice for acid fast *Nocardia*. Gram-negative organism may or may not respond to ampicillin, so fluoroquinolones are often used in combination with another antibiotic to provide additional gram-negative spectrum of action. Antibiotics are typically continued for an extended period of 4 to 6 weeks, and at least one full week past apparent radiographic resolution of effusion.

In a single study in dogs, surgical thoracotomy was demonstrated to provide a survival benefit over medical management. However, medical management can also be successful without surgery, provided that evidence does not support *Actinomyces* or Nocardiosis (non-granular effusion) and there is no known foreign material, organized abscess, or mass within the chest and. Thoracic ultrasound or CT scan may be used to help determine if it is reasonable to forgo surgery. Thus far, there is no evidence that thoracotomy provides an advantage over medical management of pyothorax in cats.

In addition to treatment of the thoracic infection, animals with pyothorax often require supportive care. Electrolyte abnormalities, diminished oncotic pressure, anemia, malnutrition, and other metabolic disorders may complicate the care of these patients. The prognosis for treatment of pyothorax is generally considered guarded to fair, but may vary with the severity of illness at presentation.

CHYLOTHORAX

Chyle is lymphatic fluid from the intestines and mesentery. Normally, it is carried by a network of lymphatics to a large sac called the cistern chyli and then into the thoracic duct. The duct terminates in the venous system allowing chyle to be dumped into the bloodstream. Occasionally, it fails to follow the normal route and may accumulate in several locations; the most common of these is pleural accumulation, i.e., chylothorax. A variety of recognized and idiopathic causes can result in chylothorax of both cats and dogs. Documented causes include heart failure, thoracic trauma, heartworm disease, and thoracic neoplasia or granuloma. Unfortunately, the condition is most often idiopathic.

Animals with chylothorax may be presented due to manifestations of an underlying disease, due to respiratory compromise from fluid accumulation, or due to complications of the third space loss of calories and other nutrients. Drainage of the fluid may result in electrolyte imbalances such as hyponatremia and hyperkalemia.

Chyle is typically off white or pinkish colored opaque fluid. When animals have been anorexic, have malabsorption syndromes, or consume a low fat diet the fluid maybe clear. Cellularity is often low to moderate. Initially, lymphocytes are the predominate cell type in the fluid. As time progresses, more neutrophils can be identified in the fluid. Protein content of chylous effusion is moderate. Chylous effusion is not defined by the color, cell type or protein content. Instead, it is defined by a triglyceride

content in excess of that of the serum. Cholesterol content is usually lower in the pleural effusion than the serum.

Treatment of chylothorax is often challenging. Traumatic rupture of the thoracic duct, as follow trauma, usually heals spontaneously and animals with traumatic duct rupture have a good prognosis for recovery. Likewise, if an underlying disease which caused chylothorax can be identified and corrected (e.g., congestive heart failure due to hyperthyroid heart disease) the prognosis is good. For this reason, efforts (including cardiac echocardiography) should be made to identify an underlying cause. If no such cause can be found, idiopathic chylothorax carries a guarded prognosis and neither medical nor surgical management is always successful.

Traditional medical therapy for chylothorax involves feeding a very low fat diet supplemented with medium chain triglycerides. The success for dietary management is said to be only about 20 to 25% resolution. Over the last decade a few other treatments have been described. The bioflavonoid compound rutin is used to treat lymphedema in humans following resection of lymph nodes. This compound, which is inexpensive and readily available at health food stores, has been used with limited success in cats with idiopathic chylothorax typically at a dose of 250 to 500 mg PO TID. Proposed mechanisms of action include a reduction of leakage from vessels, increased proteolysis and enhanced macrophage phagocytosis of chyle.

Another medical management option involves the administration of the somatostatin analog octreotide. This treatment was effective in relieving chylothorax in dogs with iatrogenic thoracic duct injury, and anecdotally has been used in the clinical treatment of the condition as well. The mechanism of action for octreotide is not understood.

A variety of surgical therapies have been attempted including thoracic duct ligation (TDL) or embolization, pleurodesis, pleurovenous shunting, pleuroperitoneal shunting, thoracic omentalization, pericardiectomy, and ablation of the cistern chyli. These procedures have been used either alone or in combination. Currently, TDL combined with either cistern chyli ablation or pericardiectomy seem to be most effective. Unfortunately, as many as 40% of dogs and cats may fail to respond to surgical therapy.

Chylothorax cannot be managed indefinitely by simple repeated thoracocentesis. Fibrinous tags and compartmentalization of fluid develops. Once this happens, fluid becomes loculated and cannot be emptied by simple thoracocentesis from one or even several locations. Additionally, chylothorax leads to fibrosing pleuritis. This inhibits the ability of the lungs to expand even if the fluid itself were to be resolved. Surgical pleurectomy is a dangerous procedure to relieve fibrotic pleuritis and is associated with a high morbidity and mortality. Every effort should be made to prevent the condition by relief of chylothorax.

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