

# Exudative Pleural Diseases in Small Animals

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## KEYWORDS

• Pyothorax • Chylothorax • Bilothorax • Hemothorax

## KEY POINTS

- Exudative pleural effusions have high total protein and high nucleated cell counts.
- Hemothorax is most frequently caused by trauma or a coagulopathy, with neoplasia, infectious causes, and lung-lobe torsion implicated less commonly.
- Pyothorax in dogs and cats can be successfully managed medically or surgically. Surgical indications include migrating foreign bodies or pulmonary abscessation.
- Chylothorax is a rare disease, and idiopathic effusion is the most common diagnosis. Surgical intervention is typically needed for resolution, and involves thoracic-duct ligation with pericardectomy or cisterna chyli ablation for optimal chances of success.

## ANATOMY AND DEVELOPMENT OF PLEURAL EFFUSIONS

The pleural cavity, a potential space formed by the visceral and parietal pleura, is divided into a right and left pleural cavity separated by the mediastinum. There is controversy in dogs and cats as to whether the right and left pleural cavities communicate or are complete structures representing a barrier to movement of fluid from one side of the pleural cavity to the other.<sup>1</sup> Anatomists have described the mediastinum to be complete in the dog, although clinical experience suggests this might not be accurate. Infusion of saline unilaterally in dogs has resulted in bilateral distribution experimentally,<sup>2</sup> whereas infusion of air has been localized unilaterally in some experimental dogs.<sup>3</sup> Clinical experience would suggest that disease starting unilaterally can become bilateral or stay unilateral. This process likely indicates that some dogs and cats have a communication between the left and right pleural space, whereas in others it does not communicate, or that communications can be sealed because of disease.

In healthy animals a small volume of fluid is present in the pleural space to create minimal friction during movement of the lungs during respiration. The amount of fluid in normal dogs and cats is approximately 0.1 and 0.3 mL/kg body weight, respectively.<sup>4</sup> The amount of fluid present is related to Starling forces and removal of this fluid

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Disclosures: None.

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by pleural lymphatic drainage. Starling forces that promote development of pleural effusion include an increase in capillary hydrostatic pressure, a decrease in capillary colloid osmotic pressure, and an increase in permeability of the capillary wall (**Box 1**). Alterations in the first 2 features tend to lead to a transudate or modified transudate (**Table 1**).

Exudative effusions usually result from an inflammatory process within the pleural cavity that results in elaboration of cytokines or other vasoactive mediators. These substances lead to an increase in capillary permeability (filtration coefficient), allowing protein-rich fluid to enter the pleural space along with a variety of inflammatory cells. This initial inflammatory response can be derived from endogenous mediators (eg, chyle, neoplastic cells) or exogenous mediators (eg, bacteria, virus, or fungus). The lymphatic system is responsible for draining fluid formed within the pleural space. Obstruction, disruption, or decreased efficacy of the lymphatic drainage system can also result in exudative effusions.

## CLASSIFICATION AND TYPES OF EFFUSIONS

Sampling of pleural effusion via diagnostic or therapeutic thoracocentesis is indicated to classify the fluid as pure transudate, modified transudate, or exudate, as outlined in **Table 1**. The main causes of exudative pleural effusions are listed in **Box 2**.

## HEMOTHORAX

### *Diagnosis*

There is no standardized definition of hemothorax in veterinary medicine, as the hematocrit in the effusion will depend on the peripheral circulating hematocrit. Hemothorax can be defined as a pleural-space effusion with a hematocrit that is at least 25% of the peripheral blood.<sup>5</sup> Iatrogenic hemorrhage caused by thoracocentesis can be differentiated from an existing hemorrhagic effusion by the presence of platelets and the lack of erythrophagocytosis.

### *Etiology*

There is a multitude of causes of hemothorax in cats and dogs, the first of which to consider is blunt, sharp, or iatrogenic trauma. The history of the patient can be used to identify whether the patient was hit by a car, or had recent thoracic surgery, thoracocentesis, intrathoracic fine-needle aspirate, venipuncture, or jugular catheter placement. When there is no history of trauma, coagulopathies, neoplasia, lung-lobe torsion, or infectious causes can be considered.

#### **Box 1**

#### **Modified Starling Law applied to the pleural cavity**

$$\text{Net filtration} = \text{LA} [(P_c - P_{pl}) - \sigma(\pi_c - \pi_{pl})]$$

LA: filtration coefficient

P: hydrostatic pressure

c: capillary

pl: pleural liquid

$\sigma$ : reflection coefficient to protein

$\pi$ : osmotic pressure

*Data from* Lai-fook SJ. Pleural mechanics and fluid exchange. *Physiol Rev* 2004;84:385–410.

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