

Anthony Fischetti DVM, MS
Diplomate, American College of Veterinary Radiology
Department Head, Diagnostic Imaging; Schwarzman Animal Medical Center, NYC
Owner/Consultant, Veterinary Imaging of New York

Basic Radiology of the Thorax

Some basic concepts for prioritizing a differential diagnosis list can be applied to radiographic interpretation of the CANINE thorax. However, as is true with other rules-of-thumb in veterinary medicine, the cat is anything but basic... cats do what they want! With that said, the following tips will help with both dogs and cats. Exceptions to the rules will be noted in lecture.

Location or Distribution

Like real estate, LOCATION or distribution of lung disease tends to be the most helpful sign for determining the cause of a lung abnormality on radiographs. In general:

Cranioventral distribution : most commonly seen with pneumonia

Caudodorsal distribution : most commonly seen with pulmonary edema (either cardiogenic or non-cardiogenic)

The distribution is almost never purely cranioventral or caudodorsal. Consider where the distribution is worst when making this distinction. “Worst” is a relative term, but we can use lung patterns to help us with grading severity.

Lung Patterns

Most schools teach the traditional concept of lung patterns (interstitial, alveolar, bronchial, vascular, mixed). I have always found these patterns helpful when stressing that they do not necessarily equate to a specific disease process. This is especially true for interstitial and alveolar lung patterns. Lung patterns are not meant to mirror the same locations a pathologist may describe a disease process... radiographs are not microscopes! So let's define the lung patterns as easily as possible.

A *lung pattern* is any increase in opacity (increased whiteness) to normally lucent (black) lungs.

An *interstitial lung pattern* is defined by an increase in opacity to the lung that PARTIALLY obscures the margins of the pulmonary blood vessels.

An *alveolar lung pattern* is defined by an increase in opacity to the lung that COMPLETELY obscures the margins of the pulmonary blood vessels.

- In general, an alveolar lung pattern is just a greater opacity of the lung and interstitial is a less opaque appearance to the lung. An interstitial lung pattern can progress to an alveolar lung pattern and alveolar lung patterns, in turn, will become interstitial as the disease resolves.

A *bronchial pattern* is any increase in opacity that follows the airways. Bronchial mineralization is common and often associated with clinical signs. A clinically relevant bronchial pattern tends to

also partially obscure the pulmonary blood vessels. This is why I prefer to speak of the *bronchointerstitial lung pattern* in cases of clinically relevant bronchial patterns.

A *vascular pattern* is not truly a pattern that is increasing opacity to the lungs, although it can be seen with other lung patterns to obscure the pulmonary blood vessels. A vascular pattern simply means an enlargement of pulmonary blood vessels that gives the impression of an increase in opacity of the lungs.

- Pulmonary vein > artery: classically associated with left-sided cardiogenic edema
- Pulmonary artery > vein: classically associated with pulmonary hypertension
- Pulmonary artery AND vein are large: classically with left-to-right shunting congenital cardiac diseases (eg PDA) and in some cases of fluid overload
- Pulmonary artery and vein are small: classically in cases of hypovolemia

Pulmonary nodules? In my view, pulmonary nodules are nodules, not really a classic pattern although some teach a *structured interstitial lung pattern* to describe nodules. Nonetheless, identifying nodules in the lung really help narrow the differential diagnosis list to neoplasia, abscesses, or granulomas (NAG lesions).

Heart Size

Heart size is crucial for differentiating non-cardiogenic from cardiogenic edema. We will briefly review strategies for assessing heart size on radiographs.

Quick Tips:

- A large left atrium is helpful in identifying cardiomegaly in small dogs, but not so much in large breed dogs
- The vertebral heart score (VHS) is helpful for equivocal cases and has survived the rigors of peer review. It may be especially helpful in cases where we are monitoring progression or resolution of cardiac enlargement
- 3/5-2/5 rule for right-sided cardiomegaly can be useful, especially in cases of pulmonary hypertension
- Assessment of the pulmonary blood vessels is always important in assessing cardiac disease or decompensation, but vessel changes are unreliable, especially in dogs/cats that have been in failure before and are on cardiac medication

Concurrent Pleural Effusion

Lung disease with concurrent pleural effusion is common in both dogs and cats. The presence or absence of pleural effusion certainly changes the differential diagnosis list. In general, the presence of pleural effusion decreases suspicion for pneumonia (remember, exceptions to the rules exist!). The presence of pleural effusion increases suspicion of congestive heart failure in cats (and to a lesser extent dogs). Pleural effusion often obscures the heart as well as the lung parenchyma. Chest tap, cytological evaluation of the effusion, and repeat radiographs can be extremely helpful in narrowing the differential once the effusion is identified.

References:

1. Thrall DE. Principles of radiographic interpretation of the thorax, In Veterinary Diagnostic Radiology, 7th Ed. Elsevier. St. Louis, MO, 2018.
2. Schwarz T, Johnson V. BSAVA Manual of Canine and Feline Thoracic Imaging, 1st Ed. 2008.
3. Bergamaschi NA, Huber L, Ludewig E, et al. Association between clinical history in the radiographic request and diagnostic accuracy of thorax radiographs in dogs: A retrospective case-control study. J Vet Intern Med. 2023;37:2453-2459. DOI: 10.1111/jvim16899
4. Burnotte P, Graziano N, Gommeren K. A retrospective study on paraneumonic effusion in 130 dogs with a clinical diagnosis of pneumonia. Frontiers in Veterinary Science, 2023. DOI: 10.3389/fvets.2023.1144148