

# *Pacific Tide*

*An informational newsletter*

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## About our Author

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Dr. Kerr received his Doctorate in Veterinary Medicine from Mississippi State University in 1981. He attended UC Davis as a radiology resident and was board certified in radiology in 1985. Following two years as a staff radiologist at UC Davis, he entered private practice. He also offers mobile radiographic and ultrasound services through his own radiology practice, Veterinary Radiology Specialists. Dr. Kerr is one of the founders of Pacific Veterinary Specialists & Emergency Service. He has been an integral part of our success.



**Larry Kerr,  
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# Systematic Interpretation of Thoracic Radiographs

Accurate and efficient radiographic interpretation requires knowledge of anatomy, physiology, pathology and radiographic signs. In order to be able to use that knowledge effectively, an organized system of visual searching is imperative. It is important that any system of reviewing radiographs cover all anatomical structures and be organized in a fashion which permits easy use.

At least two orthogonal views are essential. Which views should be taken depends upon what structures are of prime importance to the individual case and personal preference. The dorsal ventral view is better for visualization of the heart while the ventral dorsal view allows better visualization of the caudal and accessory lung lobes, as well as being preferred whenever pleural fluid is present. Either of the lateral views are fine, however most radiologists prefer the right lateral because the heart is in a more standard orientation on that view. The opposite lateral view should be performed when needed to further assess lesions in the dependent lung. This is because significant volume loss occurs in the dependent lung during lateral recumbency, and pulmonary lesions in those lobes will be more difficult to detect. By performing the opposite lateral view, a lesion will be surrounded by a fully aerated lung, and be easier to detect. This is why three views (two lateral views plus DV or VD) are recommended for metastasis screening examinations.

Properly positioned and exposed radiographs are a priority before interpretation can begin. Proper positioning can be assessed on the DV or VD views by checking for superimposition of the sternbrae and vertebrae. On the properly positioned lateral view, the proximal portion of the ribs should be superimposed. Properly exposed radiographs allow for visualization of ribs or vertebra through the cardiac silhouette without overexposure of the small vasculature present in the peripheral lung lobes. Radiographs should be viewed in a darkened room, away from any distractions. ***The most important part of radiography is gleaning all available medical information from the images. Don't shortchange the patient by rushing through the interpretation process.***

My systematic approach to interpretation is presented in Table 1 and begins with external soft tissue and skeletal structures. These are important not only for detection of lesions in those areas, but also to avoid possible confusion with intrathoracic lesions. Nipple shadows are particularly troublesome because they can easily be mistaken for intrapulmonary nodules. Observe the vertebrae and the appendicular skeleton for general bone density and focal lesions. While the incidence of important lesions in these areas is low, beginning with extra thoracic structures reduces the temptation to focus on one area within the thorax first, possibly leading to incomplete evaluation.

The first intrathoracic structure to be evaluated is the mediastinum. The cranial mediastinum is the space between the parietal layers of the pleura and contains vessels, lymph nodes, the esophagus and the trachea. A guideline for normal width of the cranial mediastinum is the width of the vertebrae, measured on the DV or VD view. Many times, overweight normal dogs will have a widened cranial mediastinum due to fat accumulation. Certain breeds, such as the brachiocephalic breeds, normally have increased width of the cranial mediastinum. In these patients, the mediastinum should be symmetrical, without bulges or displacement of adjacent structures. If a mediastinal mass is suspected, other techniques for confirmation include ultrasound, esophagram and CT. The sternal lymph node, which lies in the cranioventral thorax adjacent to the second sternbrae, is also considered to be in the cranial mediastinum. The esophagus should be searched for, but only identified occasionally by small amount of gas or fluid opacity. The caudal mediastinum is only a thin membrane, which is best identified as a thin radiopaque line located to the left of midline, extending from the pericardium to the diaphragm on the DV/VD view. (*Nerd Jewel: This line is not the pericardiodiaphragmatic ligament. The PD ligament is a midline structure which is only occasionally seen when pneumothorax is present.*) Pleural fluid frequently is seen accumulating at this location, where the mediastinum reflects around the accessory lung lobe.

Evaluation of the respiratory system represents a major portion of thoracic radiographic interpretation and should be performed in an orderly fashion. Before concentrating on individual structures, the relative inflation of individual lobes should be observed. This allows the detection of pathologic changes such as atelectasis and hyperinflation. The position of the cardiac silhouette and mediastinum are important features to use in estimation of degree of inflation. Positioning of radiographs is critical for this to be accurate. Examination of the pleural space by identification of lung margins and the thoracic wall should be performed to rule out either pleural effusion or pneumothorax.

Structures of the respiratory tract should be individually examined by beginning with the trachea as far cranially as possible and following the flow of air to the alveolus. Examine the trachea for diameter, displacement, wall thickness and smoothness of luminal surface. Next, the mainstem bronchi should be inspected for similar changes. Dorsal and cranial displacement of the mainstem bronchi occurs commonly with left atrial enlargement, while ventral displacement occurs with hilar lymphadenopathy. The bifurcation of the caudal lobar mainstem bronchi as seen on the DV/VD view, forms an acute angle of less than 90°, known as the carina. This acute angle may become rounded and widened by left atrial enlargement or hilar lymphadenopathy. Inspect the smaller airways for size and wall thickness. Thickened airway walls, described commonly as resembling doughnuts and tram tracks, are the hallmark finding of bronchial pulmonary patterns. Next, the pulmonary parenchyma should be inspected for changes in the interstitial connective tissue and the alveoli. All lung fields should be carefully inspected, not forgetting the areas over the cranial mediastinum and liver.

Examination of the cardiovascular system follows the same general pattern as for the respiratory system. General cardiac size and shape should be observed. The position of the heart within the thorax is important to note, as changes in shape may be due to abnormal positioning. Individual cardiac structures are evaluated beginning with the cranial and caudal vena cava, and following the flow of blood through the right cardiac chambers to the main pulmonary artery, peripheral pulmonary arteries and veins, left cardiac chambers and the

aorta. When evaluating cardiac shape, use the clock face analogy on the DV/VD view. The Vertebral Heart Score is a useful tool to assist in evaluation for cardiomegaly.

The final section to be examined is the diaphragm and any portions of the abdomen seen on the radiographs. Evaluate the diaphragm for symmetry and position. Important findings, such as hepatomegaly, free abdominal air or gastric lesions, may be picked up in the cranial abdomen.

If one lesion is found, continue systematic interpretation to avoid missing additional lesions. If lesions which are part of the syndrome are identified, search for the other components of that syndrome. Also, inspect areas of high suspicion repeatedly, taking additional radiographs or contralateral views if required.

**Table 1. Systematic Approach to Thoracic Radiographic Interpretation**

**External Soft Tissues and Skeletal Structures.**

Thoracic Wall, Skin and Subcutaneous Tissues  
Sternebrae, Ribs, Vertebrae, Appendicular Skeleton

**Cranial and Caudal Mediastinum**

Cranial Mediastinum, Assess for Width and Symmetry  
Trachea, Esophagus, Vessels and Lymph Nodes. Sternal Lymph Node.  
Caudal Mediastinal Reflection.

**Respiratory System**

Pleural Space  
Relative Lobar Inflation, Cardiac or Mediastinal Shift  
Respiratory Tract from the Trachea to Alveolus

**Cardiovascular System**

General Cardiac Size and Shape  
Cranial and Caudal Vena Cava  
RA-RV-MPA-Pulmonary Arteries-Pulmonary Veins-  
LA-LV-AO

**Diaphragm and Abdominal Structures**

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