

Thoracic Radiographs: Old Techniques Reinvented

Robert T. O'Brien, DVM, MS, ACVR
University of Illinois
Urbana, IL

The goals of this lecture are to provide you with techniques of radiography and radiology of the dog and cat thorax. Thoracic radiology remains the main imaging modality in the interpretation of pulmonary and other intra-thoracic diseases. These techniques should provide the basis for production of diagnostic images and ability to derive a reasonable set of differential diagnoses.

A few key points to remember

- Radiographs provide information NOT answers
- Answers are derived from proper interpretation of the radiographic signs in concert with other clinical aspects of the case
- Radiographs may lead you to ask more or different types of clinical questions
- If poor quality, radiographs are a waste of personnel time and client money
- Without a systematic approach to film interpretation, the information may be on the radiograph, but goes unseen
- Without a good knowledge of clinical medicine, the changes are noted on the radiographs but incorrect conclusions are reached

What is a radiograph

Radiographs are images on photographic film by x-rays that have passed through tissue. The interaction of x-ray photons with the intensifying screen in the cassette produces photons of visible light. The light interacts with silver in the film to produce a latent image. The latent image is converted into the blacks and whites by the developing process.

The whiteness of the film is termed “opacity”. There are five radiographic opacities

- metal
- mineral (bone)
- soft tissue
- fat
- air

The resultant opacity of the image is a function of both the object density and the thickness of the structure (which is why some end-on blood vessels can appear as opaque as a rib). The film has characteristics that allow us to image structures as varied as air-filled to metallic objects on the same radiograph. We are very dependent on proper technique, positioning, and developing for production of diagnostic images.

A radiograph is medical legal document and needs to be diagnostic, identify the patient, date, clinic name and properly marked with patient positioning (lateral views are marked by the side closest to the cassette) and anatomical sidedness (left versus right).

Thoracic radiography

Any “weak link in the chain” of positioning, technique or developing can lead to a nondiagnostic image. If hand developing then chemicals need regular maintenance. Remember to use time-temperature developing (not guesswork or “experience”). If you want consistent high quality radiographs with minimal maintenance, purchase an automatic processor. Use rare earth screens and a grid with bigger patients (> 10 cm thick) for optimal film quality.

Positioning

The diagnostic value of a radiograph is more dependent on positioning than any other single factor. Remove all foreign objects: collars, leashes, bandages, dirt, water or blood. Restrain the patient either chemically, physically, or both. Restraint techniques are limited by clinical concerns and patient compliance. Clever use of sand bags, rope, tape and straps minimize the radiation dose to holders. The front legs need to be pulled forward so that they are not superimposed on the chest. On VD/DV views, the spine MUST be superimposed on the sternum. On lateral projections, elevation of the sternum is often necessary so that the sternum and spine are the same distance above the cassette.

Features of the properly positioned lateral projection include

- Ribs extend equally and are parallel
- Costal arches do not extend more ventral than the sternum
- Ribs do not extend more dorsal than the spine (unless symmetrically)

Features of the properly positioned VD/DV include

- Sternum superimposed on the spine throughout the entire length of the thorax
- Symmetrical shape to ribs
- Spine is in a straight line

Views

Enough should be taken to provide the complete set of information. Typical studies include three views; left and right lateral and VD views. Opposite laterals provide better detection for focal diseases (lobar pneumonia and nodules). The VD view “opens” the chest providing better lung disease detection. The VD view is indicated with suspected pleural effusion.

Exceptions to the above listed recommendations are important to remember. The DV view provide a “better” view of the heart base and caudal lobar vessels. The DV view may be better tolerated by dyspneic patients, especially cats. Patients should not die while we attempt a diagnostic procedure.

With severely dyspneic patients

- Be judicious and efficient
- Premeasure the patient before transport to radiology
- Set the machine technique and gown up before bringing the patient
- Position the cassette and collimate the beam before the patient arrives
- Maybe take only one view: a lateral view is the least stressful
- Maybe wait until tomorrow!

Technique

Technique refers to the balance of KvP and mAs. We want a high KvP-low mAs technique because the thorax has inherent very high contrast. A low mAs means a very short exposure time will stop the breathing motion. Remember that interpreting a film that is a little too grey is easier than one that is too black and white. A technique chart should be derived for all species and body parts imaged. The technique chart is based on the maximum dimension, usually at the level of the last rib. Inaccurate measurements invalidate the technique chart insuring improperly exposed radiographs. Technique charts can be constructed from standing or recumbent patient positioning. Be consistent. If the technique chart was made assuming recumbent positioning, then measure your patients in the appropriate recumbency.

Thoracic radiology

Film reading technique

Learn a system then use it! Make sure to look at the entire film. My system is listed below, but any system used consistently, is a good system:

- Peripheral structures in a clockwise direction starting cranially:
- Forelimb
- Neck (soft tissues, spine and trachea)
- Thoracic spine (spinous processes, canal and bodies)
- Diaphragm
- Stomach
- Liver (and any other intrabdominal structure)
- Falciform fat pad and other intrabdominal fat
- Sternum
- Mediastinum and pleural spaces
- Ribs for symmetry
- Heart
- Lungs

Inevitable some portion of the films will be “dark” (overexposed). To best view these areas use a bright light. Alternatively use a “bob-o-scope” (two lightly clenched hands arranged in series or an empty paper towel roll!). Either of these devices limit the extraneous light, size of the portion evaluated and thereby, increase acuity of detecting lesions in the darker areas of the film. Bright lights are more expensive but fewer people laugh at you!