



SMALL ANIMAL SPINAL RADIOGRAPHY SERIES

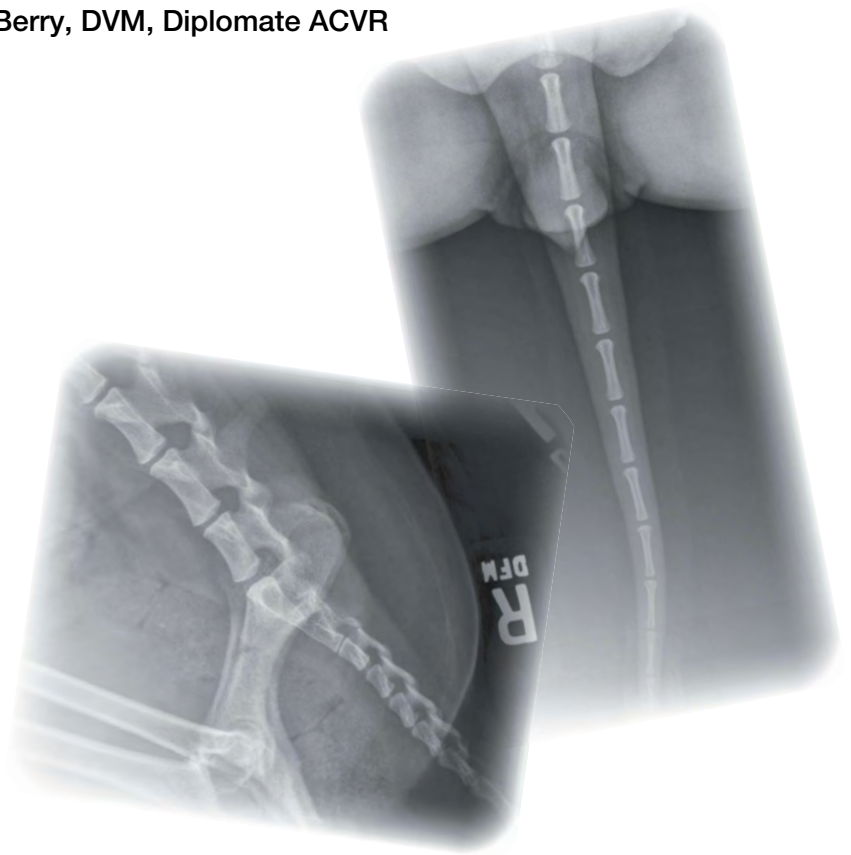
LUMBAR SPINE RADIOGRAPHY

Danielle Mauragis, CVT, and Clifford R. Berry, DVM, Diplomate ACVR

Imaging Essentials provides comprehensive information on small animal radiography techniques. This article is the third article in a 3-part series covering **cervical, thoracic, and lumbar spine radiography**.

The following anatomic areas have been addressed in previous columns; these articles are available at todaysveterinarypractice.com (search “Imaging Essentials”).

- Thorax
- Scapula, shoulder, and humerus
- Abdomen
- Elbow and antebrachium
- Pelvis
- Carpus and manus
- Stifle joint and crus
- Tarsus and pes



S **pinal radiographs** are indicated for:

- Evaluation of traumatic injuries
- Neck and back pain
- Pain or neurological issues associated with thoracic or pelvic limb lameness isolated to these regions.

Each radiographic projection is a separate study and should be radiographed as such. High quality, correctly positioned and collimated radiographs are required in order to provide an accurate assessment of the area of interest, especially for surgical planning. In addition to routine radiographic views, there are additional projections that may aid in the diagnosis of specific disease conditions or aid in the evaluation of certain anatomic areas.

ROUTINE VIEWS

Lateral and ventrodorsal views are considered the minimum orthogonal radiographs for the spine. Due

to the angled, divergent nature of the x-ray beam, the area of the spine in the center of the field of collimation will be the area that provides the correct anatomic detail and intervertebral disk space widths.

A routine lumbar spine study includes:

1. **Lateral** and **ventrodorsal** projections of the **lumbar spine**
2. **Lateral** and **ventrodorsal** projections of the **lumbo-sacral junction**
3. **Lateral** and **ventrodorsal** projections of the **caudal vertebra**.

MEASURING THE LUMBAR SPINE

Measure the thickest portion of the spine that is within the area of collimation.

Lateral Projection: Lumbar Spine

For the lateral projection, position the patient in lateral recumbency (**Figure 1**).

- Tape the thoracic limbs together evenly and pull cranially, keeping the sternum and vertebrae equidistant to the table.
- A foam wedge may be placed under the elbows to maintain the laterality of the patient.
- Tape the pelvic limbs together evenly and pull caudally, keeping the patient in a lateral position.
- Palpate the iliac crests to determine whether or not the patient is aligned in a lateral position and parallel to the table.

Lateral Collimation

For the lateral projection, the field of view (FOV) should:

- **Include** the dorsum just above the spinous processes.
- **Exclude** the ventral half of the abdominal cavity.
- Palpate and place the FOV just cranial to the thoracolumbar junction and just caudal to the iliac crest at the level of the greater trochanter of the femur (of the pelvic limb away from the table).
- Palpate the longissimus dorsi muscle and place the horizontal line of the FOV at this level. This muscle will be just ventral to the transverse processes of the lumbar vertebrae.
- Place the radiopaque marker along the craniodorsal aspect of the collimation on the table (not on the patient).

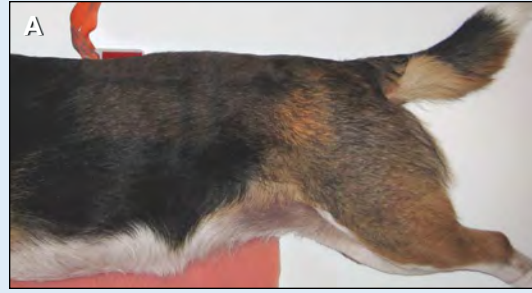


Figure 1. Dog positioned for lateral radiograph of the lumbar spine (A) and corresponding radiograph (B).

Ventrodorsal Projection: Lumbar Spine

For the ventrodorsal projection, position the patient in dorsal recumbency (**Figure 2**).

- A trough may be used to maintain the spine's straightness, but make sure to place the entire thoracic and lumbar spine within the trough to eliminate an edge artifact over the area of interest.
- Tape the thoracic limbs individually or together and pull cranially.
- Tape the pelvic limbs individually and pull both caudally.
- Make sure the sternum and thoracic spine are superimposed.

Ventrodorsal Collimation

For the ventrodorsal projection, the FOV should:

- **Include** only the caudal thoracic and lumbar vertebral bodies.
- **Exclude** the lateral abdominal body wall and lung fields in the thoracic cavity.
- Palpate and place the FOV cranial to the xiphoid of the sternum, and just caudal to the iliac crest.
- Place the center of the FOV halfway in between these landmarks, with the FOV horizontal line placed at midline.
- Place the radiographic marker on the soft tissues of the ventrum at the most lateral edge of the collimated light FOV.

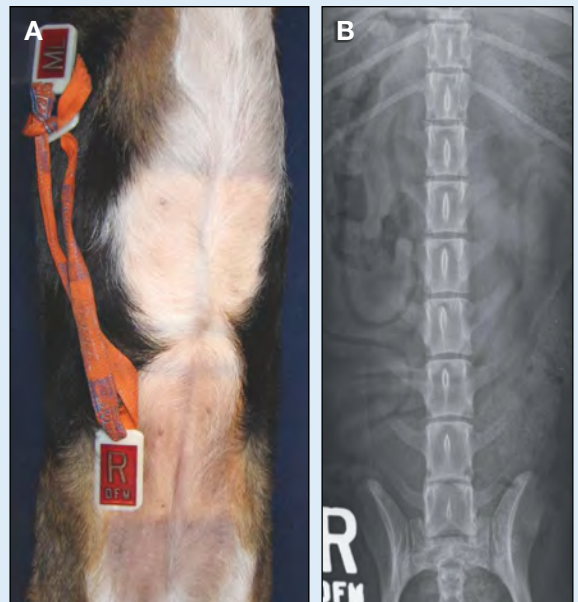


Figure 2. Dog positioned for ventrodorsal radiograph of the lumbar spine (A) and corresponding radiograph (B).

Lateral Projection: Lumbosacral Junction

For the lumbosacral junction lateral projection, position the patient in lateral recumbency (**Figure 3**).

- Tape the thoracic limbs together evenly and pull cranially, keeping the sternum and vertebrae equidistant to the table.
- A foam wedge may be placed under the cubital joints and sternum in order to maintain laterality of the patient.
- Tape the pelvic limbs together evenly and leave them in a neutral position, neither flexed nor extended.
- Palpate the iliac crests to determine whether or not the patient is aligned in a lateral position and parallel to the table.

Lateral Collimation

For the lumbosacral junction lateral projection, the FOV should **include** the caudal lumbar spine (L6 and L7) as well as the entire sacrum.

- Palpate and place the center of the FOV just caudal to the iliac crest at the lumbosacral junction.
- Locate the lumbosacral junction by palpating the caudal lumbar spinous processes located just cranial to the iliac crest; then follow the spinous processes caudally until a divot is felt, which should be at a level caudal to the iliac crest.
- Place the center of the FOV 1 to 2 inches ventral to this point depending on the size of the patient (1 inch for smaller dogs; 2 inches for larger dogs).
- Include the radiographic marker dorsal to the pelvis at the border of the collimation.

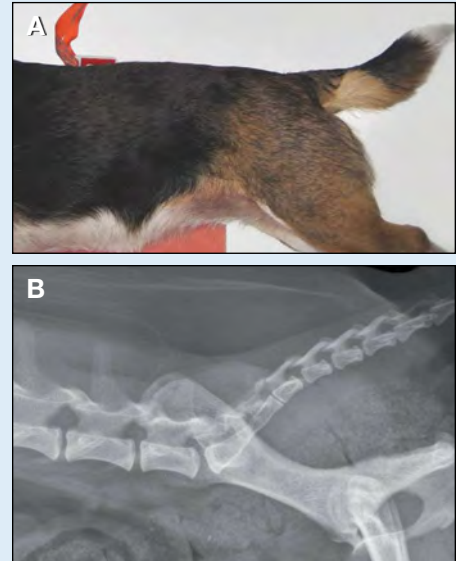


Figure 3. Dog positioned for lateral radiograph of the lumbosacral junction (A) and corresponding radiograph (B).

Ventrodorsal Projection: Lumbosacral Junction

For the lumbosacral junction ventrodorsal projection, position the patient in dorsal recumbency (**Figure 4**).

- A trough may be used to maintain the spine's straightness. The lumbosacral junction can be placed either within the trough or outside the trough directly on the table. To avoid edge artifact, make sure the lumbosacral junction is either well within or well outside the trough.
- Tape the thoracic limbs individually or together and pull cranially.
- Tape the pelvic limbs individually and pull caudally, or place them in a "frog-leg" position.

Ventrodorsal Collimation

For the lumbosacral junction ventrodorsal projection, the FOV should:

- **Include** only the wings of the ilia on either side of the lumbosacral junction.
- **Exclude** the lateral body wall and soft tissues.
- Palpate and place the FOV caudal to the iliac crest.
- Place the center of the FOV at this level with the horizontal line placed at midline.
- Place the radiographic marker along the ventral soft tissues at the lateral most edge of the collimated light FOV.

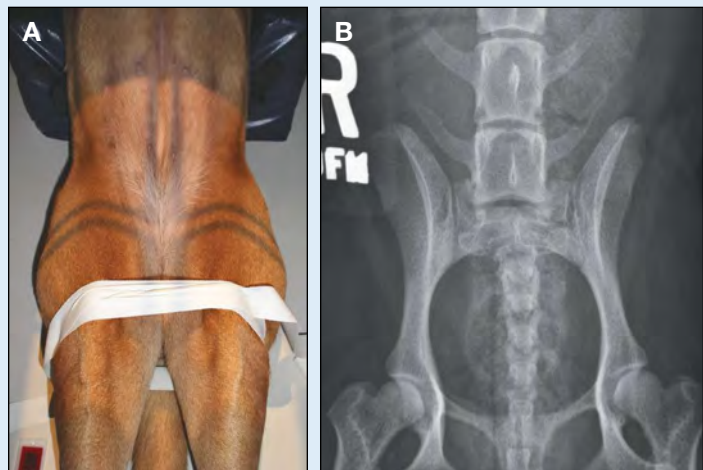


Figure 4. Dog positioned for ventrodorsal radiograph of the pelvis. Collimation should be adjusted to the iliac crest/wings cranially and the ischiatic tuberosity caudally for a correctly collimated position of the lumbosacral spine (A); corresponding radiograph (B).

Lateral Projection: Caudal Vertebra (Tail)

For the caudal vertebra lateral projection, position the patient in lateral recumbency (**Figure 5**).

- Tape the pelvic limbs together evenly and pull them slightly cranial to avoid superimposition of the musculature.
- Gently pull the tail straight from the pelvis caudally; tape placed around the tail tip can help keep the tail in place.
- Place a foam square or rectangle sponge under the tail to maintain laterality. The height of the sponge should align the tail evenly with the rest of the spine, not allowing the tail to angle up or down.

Lateral Collimation

For the caudal vertebra lateral projection, the FOV should **include** the caudal pelvis through the level of the tail.

- The FOV will be determined by the length of the tail.
- Palpate the caudal lumbar spinous processes just cranial to the iliac crest.
- Follow these spinous processes caudal until the divot at the lumbosacral junction is felt; this will be the cranial border of the FOV.
- The caudal border will be just past the last caudal vertebra or end of the tail tip.
- Place the radiographic marker dorsal to the tail.

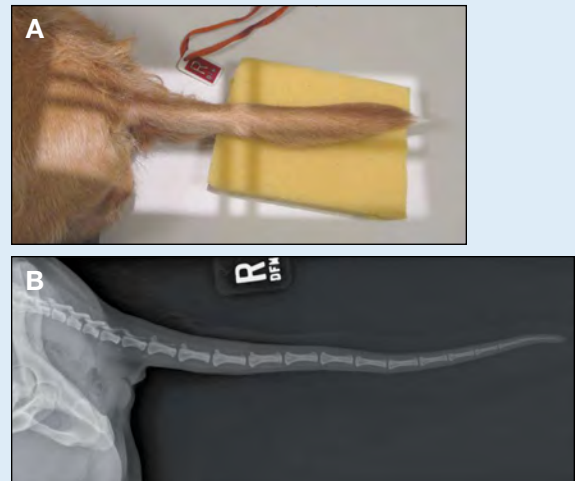


Figure 5. Dog positioned for lateral radiograph of the caudal vertebra (tail) (A) and corresponding radiograph (B).

Ventrodorsal Projection: Caudal Vertebra (Tail)

For the caudal vertebra ventrodorsal projection, position the patient in dorsal recumbency (**Figure 6**).

- A trough may be used to maintain the spine's straightness, but make sure to place the pelvis outside of the trough, directly on the table, to eliminate an edge artifact.
- Gently pull the tail caudally so it is straight; tape may be used to hold the tail in place.
- Tape the thoracic limbs individually or together and pull cranially.
- Place the pelvic limbs in a "frog-leg" position relative to the pelvis to prevent their superimposition on the caudal vertebrae and area of interest

Ventrodorsal Collimation

For the caudal vertebra ventrodorsal projection, the FOV should:

- **Include** both wings of the ilia on either side of the lumbosacral junction.
- **Exclude** the body wall on either side.
- Palpate and place the cranial point of the FOV caudal to the iliac crest.
- Place the caudal point of the FOV just beyond the tip of the tail.
- Place the radiographic marker lateral to the tail for the appropriate side.

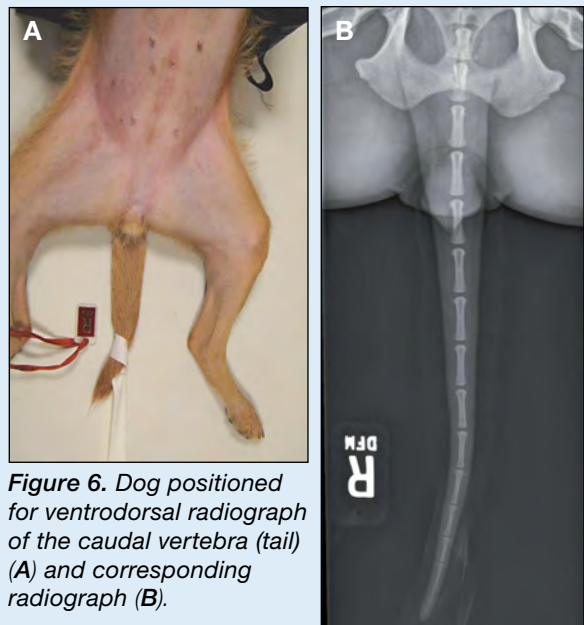


Figure 6. Dog positioned for ventrodorsal radiograph of the caudal vertebra (tail) (A) and corresponding radiograph (B).

ADDITIONAL VIEWS

Lateral Flexed & Extended Projections: Lumbosacral Junction

When lumbosacral disease or cauda equina syndrome is expected, flexed and extended projections are taken of the lumbosacral junction. Compression of this joint can be caused by malformation, degenerative joint disease, or intervertebral disk disease, and can result in pain, ataxia, unilateral or bilateral paraparesis, and urinary or fecal incontinence.

For both the lateral flexed and extended projections, position the patient in lateral recumbency (Figure 7).

- Tape both pelvic limbs evenly.
- For the **flexed projection**, pull the pelvic limbs cranially and up toward the ventral aspect of the abdomen; anchor with a sandbag.
- For the **extended projection**, place a sandbag at the cranial aspect of the lumbar spine to keep the patient from moving dorsally. Pull the pelvic limbs straight behind the pelvis, caudally and dorsally.

Collimate as described for the lateral projection of the lumbosacral junction (page 50).

Ventrodorsal Oblique Projection: Lumbar Spine

Subtle lesions, fractures, and intervertebral disk disease are a few of the conditions that may require a ventrodorsal oblique projection of the spine.

- From the straight ventrodorsal position of the lumbar spine, obliquely rotate the patient to the left approximately 10° to 15°; then take the radiograph.
- Rotate the patient to the right approximately 10° to 15° and take a second radiograph.

Collimate as described for the ventrodorsal projection of the lumbar spine (page 49).

QUALITY CONTROL

To make certain the desired technique has been achieved, use the following guidelines to determine whether the appropriate anatomy is included in the images.

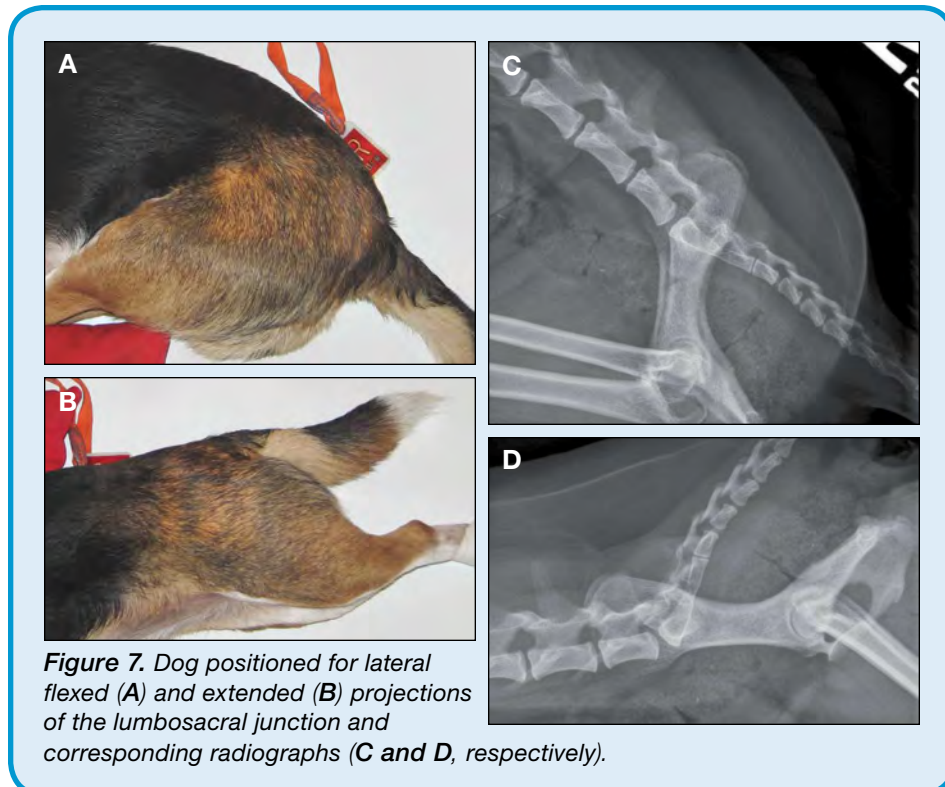
Lumbar Spine

For the **lateral projection** of the lumbar spine:

- The **cranial border** should include the caudal aspect of the thoracic spine at around the level of thoracic vertebra 11 (T11).
- The **caudal border** should, at least, include the lumbosacral junction.
- The rib heads should be superimposed at the vertebral body level. The transverse processes of the lumbar vertebra should be superimposed, resembling a “Nike swoosh.”
- The intervertebral foramen should resemble a horse head.

For the **ventrodorsal projection** of the lumbar spine:

- The **cranial border** should include the caudal aspect of the thoracic spine at the level of T11.
- The **caudal border** should include the lumbosacral junction.
- The spinous processes should be superimposed over the thoracic and lumbar vertebral bodies.



- For quality control of any diagnostic image, follow a simple 3-step approach:
1. Is the **technique** adequate (appropriate exposure and development factors)?
 2. Is the correct **anatomy** present within the image?
 3. Is the **positioning** anatomically correct and straight?

- In a straight dorsoventral projection, the dorsal spinous processes have a teardrop appearance.

Lumbosacral Junction

For the **lateral projection** of the lumbosacral junction:

- The **caudal border** should, at least, include caudal vertebra 2 (Cd 2) and the cranial border should include the caudal aspect of lumbar vertebra 6 (L6).
- The transverse processes of the lumbar vertebra should be superimposed and resemble a “Nike swoosh.”

For the **ventrodorsal projection** of the lumbosacral junction:

- The **cranial border** should include the caudal aspect of L6.
- The **caudal border** should include, at least, two of the caudal vertebrae. ■

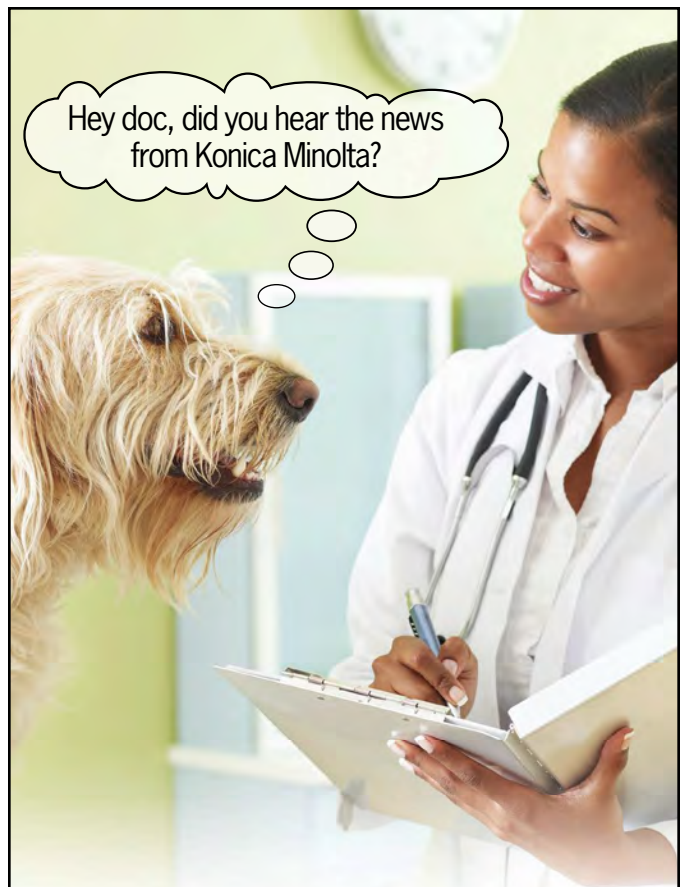
FOV = field of view



Danielle Mauragis, CVT, is a radiology technician at University of Florida College of Veterinary Medicine. She teaches veterinary students all aspects of the physics of diagnostic imaging, quality control of radiographs, positioning of small and large animals, and radiation safety. Ms. Mauragis coauthored the *Handbook of Radiographic Positioning for Veterinary Technicians (2009)* and was the recipient of the Florida Veterinary Medical Association's 2011 Certified Veterinary Technician of the Year Award. This award recognizes an individual for the many outstanding contributions that person has made to the overall success of a veterinary practice operated or staffed by an FVMA member veterinarian.



Clifford R. Berry, DVM, Diplomate ACVR, is a professor in diagnostic imaging at the University of Florida College of Veterinary Medicine. His research interests include cross-sectional imaging of the thorax, nuclear medicine applications in veterinary medicine, and molecular imaging applications of imaging in human and veterinary medicine. Dr. Berry has been a faculty member at North Carolina State University and University of Missouri. He received his DVM from University of Florida and completed a radiology residency at University of California–Davis.



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