

# Optimizing Cervical Spine MRI in Canine and Feline Patients

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Scanning veterinary patients requires a mindset shift from scanning human patients. Veterinary patients tend to be fully anesthetized and intubated for scans, requiring some flexibility in positioning to accommodate the endotracheal tube. In our hospital, patients undergoing spinal MRI are completely anesthetized and intubated with an endotracheal tube. This allows control of ventilation to help reduce movement artifacts, whilst ensuring oxygen saturation is maintained. Care should be taken to not kink the endotracheal tube.

The nature and severity of spinal disease is typically estimated by a neurological assessment prior to anesthesia. Cervical spinal pathology will cause signs ranging from neck pain to tetraparesis or complete quadriplegia. It can sometimes be difficult to separate pathology in the cervical

spinal cord from the brainstem, so scans will often include the caudal fossa to screen for brain pathology.

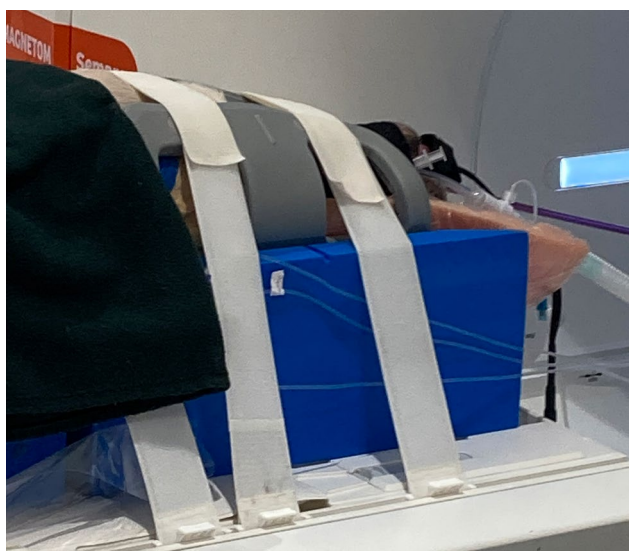
## Positioning

Setting the patient up in the magnet tends to take longer than a human patient, given the complexity of positioning the head and neck, and associated tubing (endotracheal, intravenous). It also takes some time to ensure that the body is positioned so the lungs can still inflate (i.e., the patient is not wrapped too tightly).

It is vital that every effort is made to ensure that the cervical spine is straight and the sagittal midline of the spine aligns with the sagittal midline of the brain. This may be easier said than done. Like humans, canine and feline



**1** French Bulldog (15 kg), spine imaging  
(1A) Patient positioned in dorsal recumbency (supine) with thoracic limbs pulled along body. (1B) Note the flexible coil wrapped under the head and neck.



**2** French Bulldog (15 kg), spine imaging  
Center the beam localizer over the central neck.

patients have 7 cervical vertebrae, but each vertebra is relatively longer than a human vertebra, creating a long and flexible neck. Imagine a dog or cat standing and lowering their head to the ground to eat or drink, and then compare this to a human, who has much less flexibility and length in their cervical spine. Positioning aids can help with spinal alignment. The leg braces provided with the MRI scanner are excellent for lying veterinary patients on, to ensure optimal positioning.

For spinal disease, patients are positioned head first, in dorsal recumbency (supine). Position the head and neck extended in the coil with a cushion, then straighten and immobilize (Figs. 1A and 1B). Pull the thoracic limbs backward toward the chest, then strap. Center the beam localizer over the central neck (Fig. 2).

## Coil examples

Flex Small 8, Flex Large 8, Extremity 12, Flex Body coil.

## Sequences

Sequence selection will be guided by the neurological evaluation and patient status. Our typical sequence selection for a cervical spine scan includes:

3-plane localizer, SAG\_T2\_TSE, Dorsal\_T2\_TSE\_STIR, T1\_MPRAGE, TRA\_T2\_TSE, TRA\_T1\_TSE, T2\_SPACE, T2\_MED, CISS, POST C+ T1\_MPRAGE, TRA\_T1\_TSE, CISS.

The most common cervical spine pathology in veterinary patients is intervertebral disc protrusion or extrusion. Chondrodystrophic dogs (small breeds) have a very high incidence of intervertebral disc degeneration and deterioration, but it can also affect any breed and lead to marked pain or paralysis.

Spinal neoplasia is not infrequent, with meningioma and bone or soft tissue sarcoma more likely than intramedullary pathology.

Inflammatory and infectious conditions (meningitis, often immune-mediated) are common. Spinal cord infarction occurs (and may be related to intervertebral disc pathology). Syrinx formation is relatively common, particularly in brachycephalic breeds. Infection of the intervertebral disc (discospondylitis) is not uncommon, and may be bacterial or fungal in etiology.

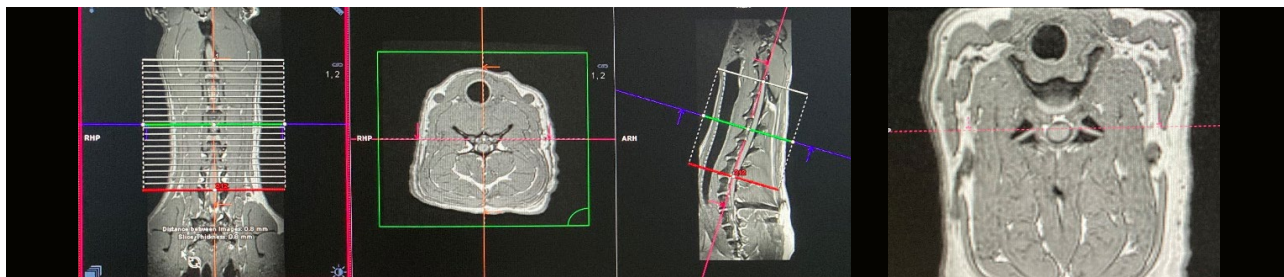
Cervical vertebral malformation is relatively common in large breeds like Dobermans and Rottweilers. Typically, the caudal cervical vertebrae (C4–C6) are malformed with flared facet joints and altered shape, resulting in a dynamic compression of the spinal cord, that causes a so-called “wobbler” ataxic gait.

## Sagittal plane



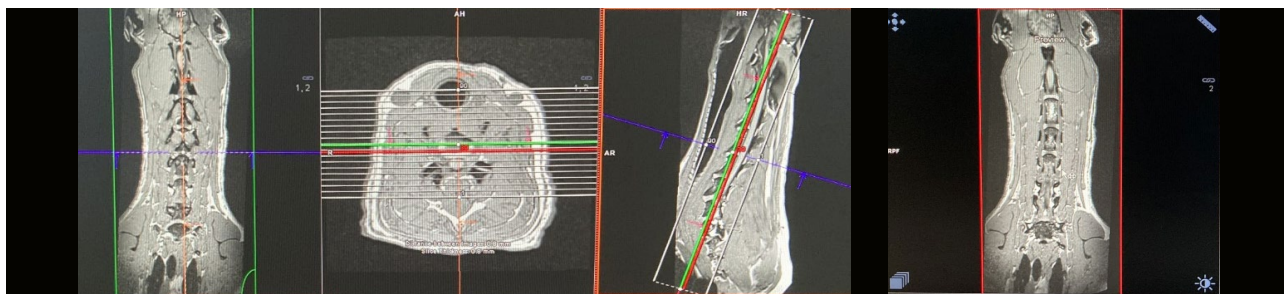
Plan the sagittal slices on the dorsal and transverse plane. Make sure to angle the position block along the spinal cord. Make sure to check both planes and ensure that appropriate slices are covering the entire cervical spine. Center the block in between the cervical vertebrae on the dorsal and transverse plane to ensure the angle is straight. Saturation bands may not be required as swallowing does not occur under general anesthesia. Phase direction should be H>F to avoid artifacts from the neck.

## Transverse plane



Plan the transverse slices on the sagittal and dorsal plane. The number of slices will depend on the region of interest (ROI). Angle the position block perpendicular to the spinal cord. Make sure to check the angle on the dorsal plane to ensure it is parallel to the intervertebral disc (IVD) space. Saturation bands over the ventral neck can be helpful to reduce pulsation artifacts from carotid vessels; swallowing does not occur under general anesthesia.

## Dorsal plane



Plan the dorsal slices on the transverse and sagittal plane. Angle the position block along the spinal cord in the sagittal plane, and angle the position block parallel to the cervical vertebral body in the transverse plane. Apply saturation band along the neck to avoid ghosting artifacts.

## References

- 1 Mai W, editor. Diagnostic MRI in Dogs and Cats. Boca Raton (FL): CRC Press; 2018.
- 2 Wisner E, Zwingerberger A. Atlas of Small Animal CT and MRI. Hoboken (NJ): Wiley Blackwell; 2015.

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