Brachial Plexus MRI

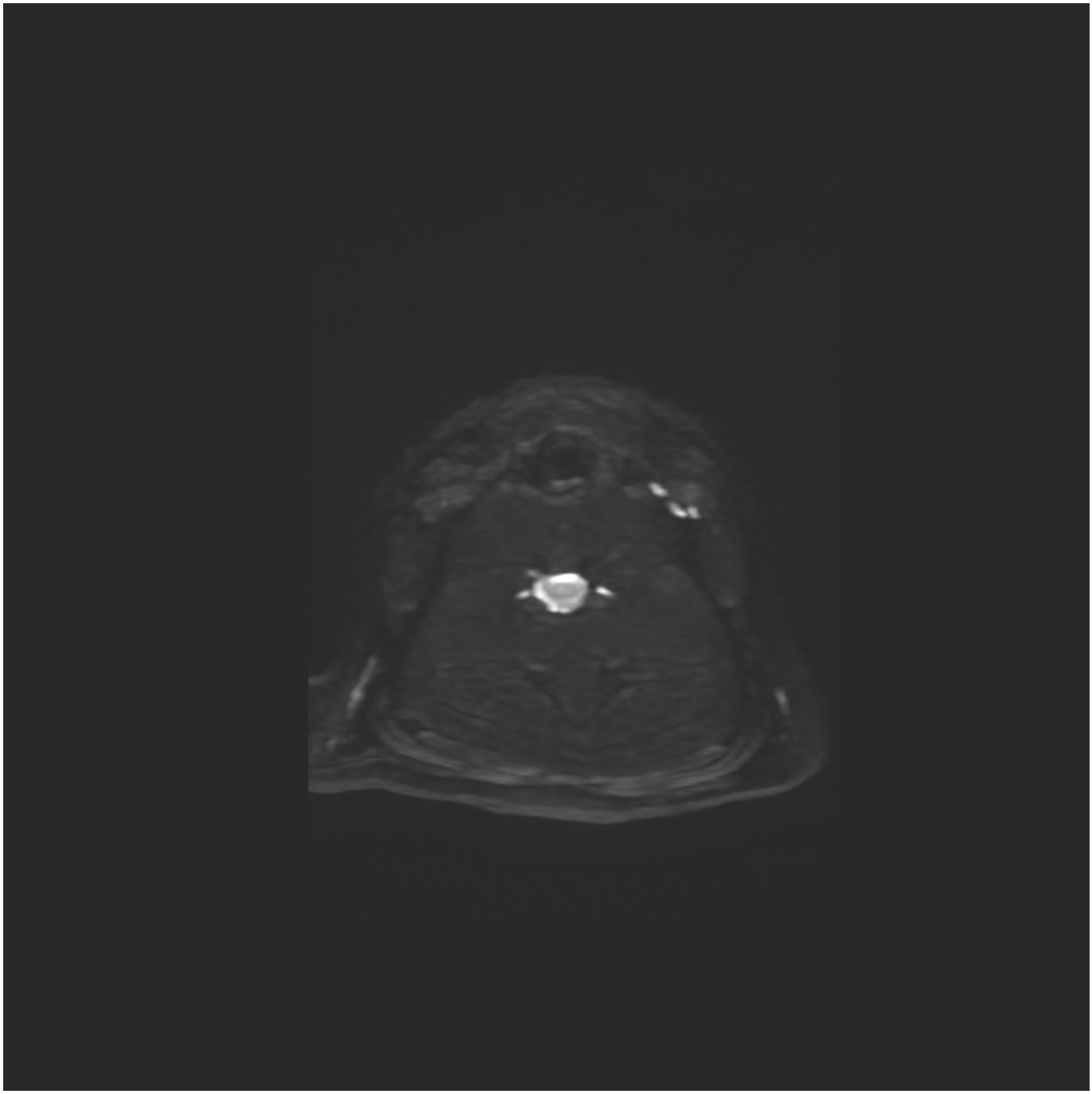
Positioning

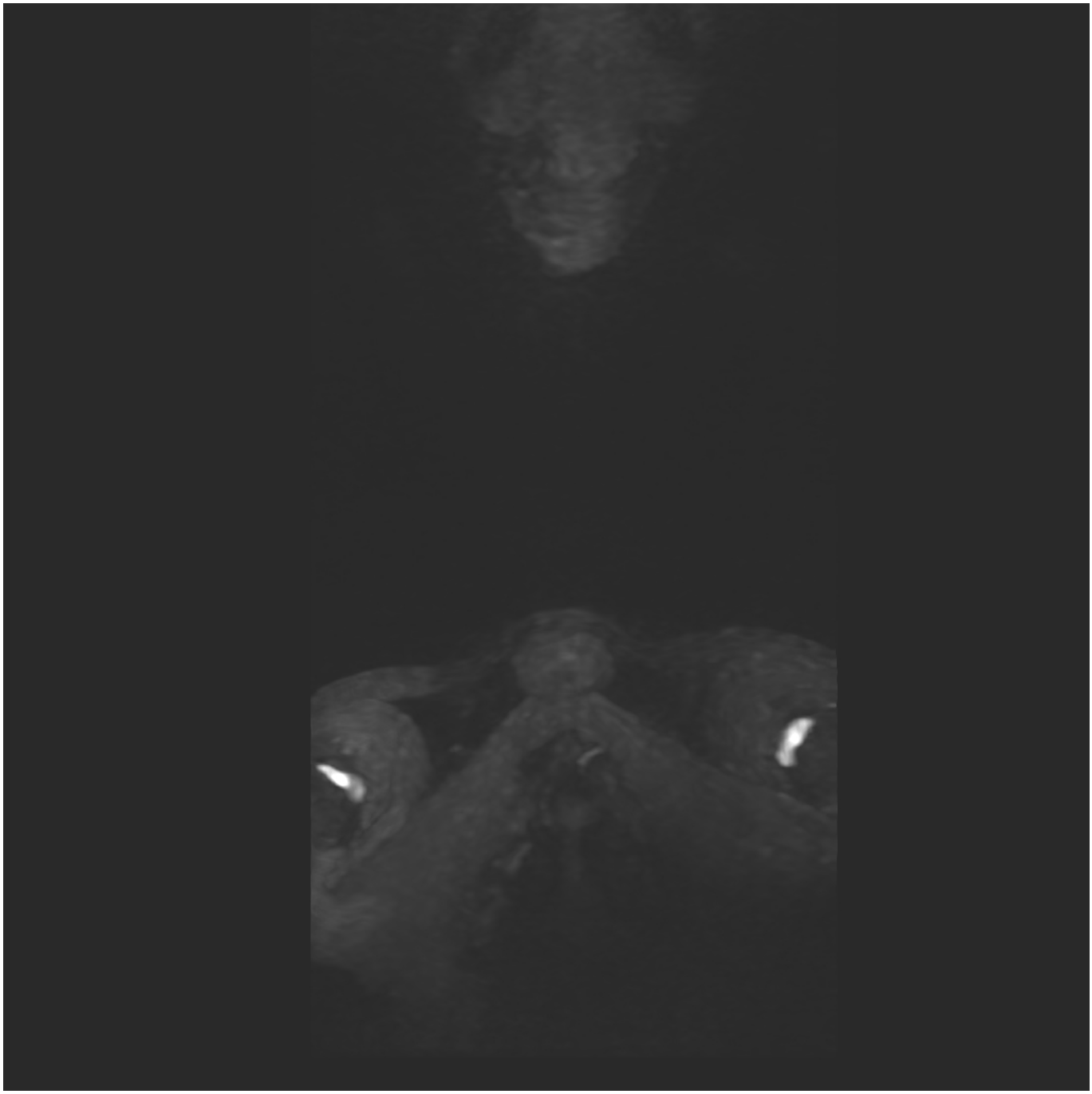
Positioning for the brachial plexus exam is especially important. To ensure the nerves and forelimbs can be well assessed, both limbs should be positioned as symmetrical as possible, and pulled rostrally and well secured. Proper limb positioning will ensure that the peripheral brachial plexus nerves can be imaged closest to isocenter, compared slice-to-slice, and without excessive slice coverage. Typically dorsal recumbency is preferred, and any compatible coils that can be positioned over the elbows or sternum will help with SNR.

Anatomy

The brachial plexus exam can be more difficult than a standard brain or spine exam, as there is more complex anatomy, different positioning requirements, and different scanning challenges. A good sense of the anatomy is crucial to proper coverage and slice orientation.

The brachial plexuses are bundles of nerves that originate from about C4/5 to T2/3 and extends into the forelimbs on both sides. When there is an injury or lesion in the brachial plexus, a patient may present with muscle atrophy or forelimb lameness without an orthopedic cause. Below are MIPs of the brachial plexus nerves in 3 planes. Keep in mind that the nerves extend deeper into the forelimb than visualized on these sequences, so the required coverage will be larger.





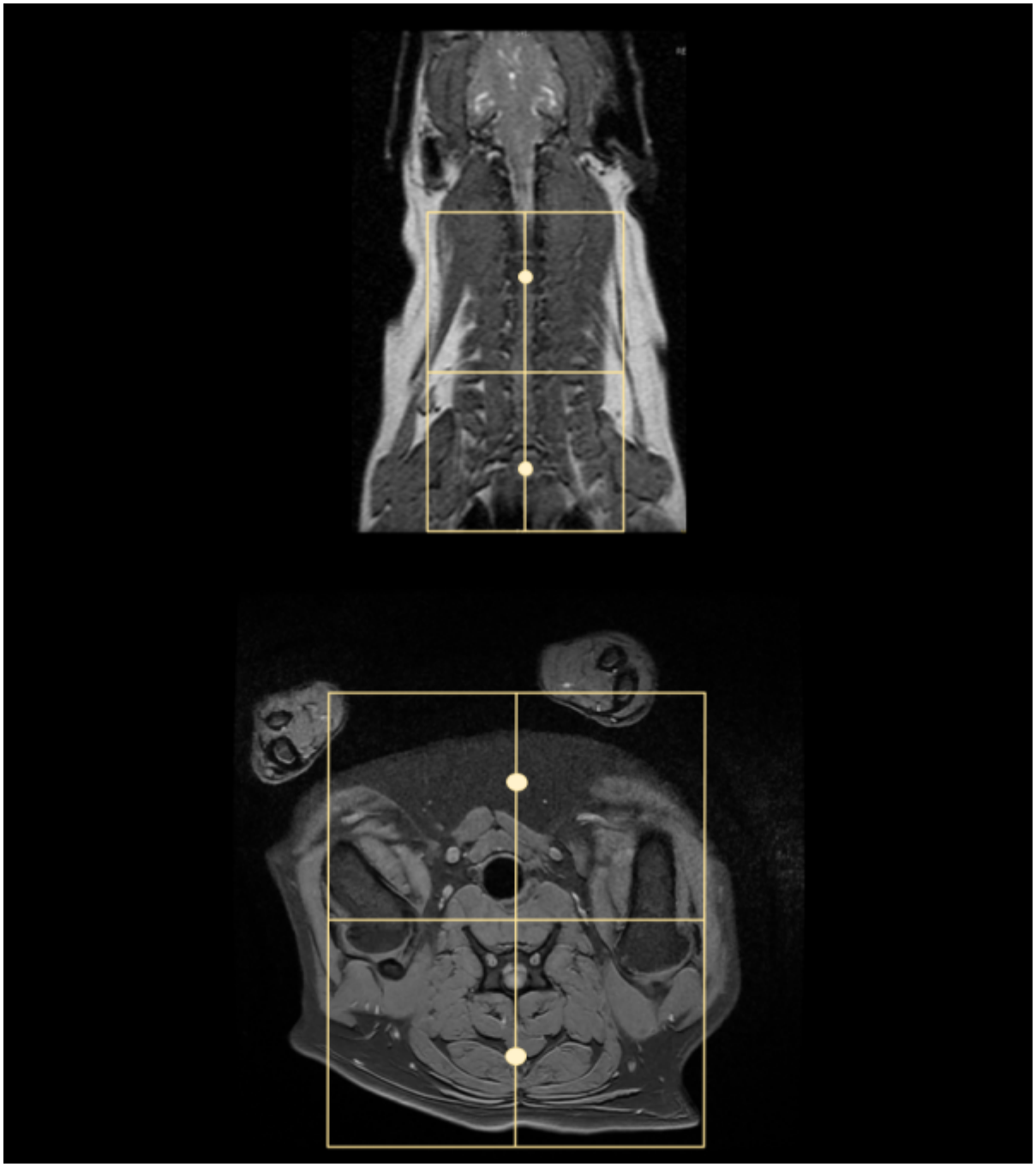
Scan Coverage and Planning

A note on Localizers

When planning out your localizer images, be sure to use a LARGE FOV so that the forelimbs are well demonstrated, positioning can be checked, and coil extents can be seen. Use a LOT of slices to cover all the anatomy; you want to be able to find the shoulder joints, elbows, and sternum on all three planes.

Sagittal Plane

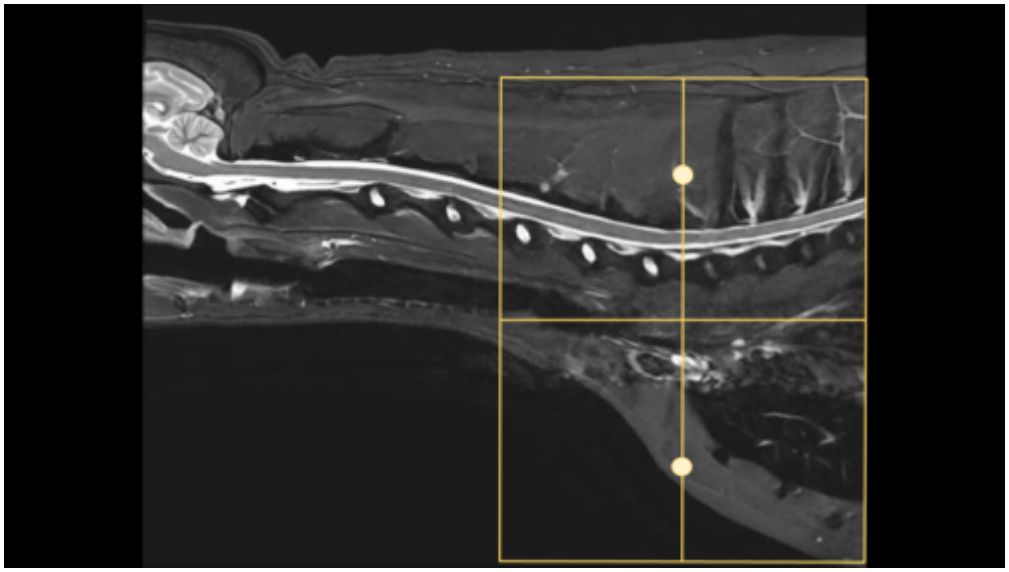
For brachial plexus scout images, add more slices on all planes to cover sternum to spine dorsally, shoulder to shoulder sagittal, and C3 to T3 axially. On the axial and dorsal scout imaging, plan the slices parallel to the center of the spinal cord. On the sagittal scout image, center the FOV on C6/7. For each patient, the FOV should be re-sized to include at least C4/5 to include the T3/4. On the dorsal scout image, add enough slices to cover out to the humeral head on both sides unless specifically doing a unilateral study. **Be sure to use an ODD number of slices. This will ensure that the center slice is in true midline through the spinal cord.**



Axial Plane

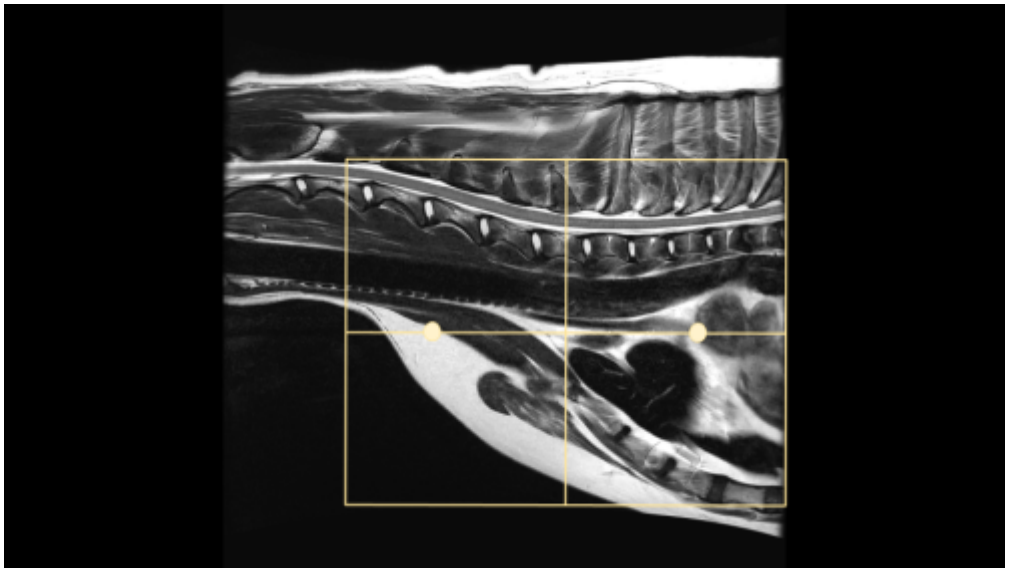
Axial coverage for the brachial plexus should cover from typically C4/5 to T3/4 to ensure that the entire plexus is covered. Angling parallel to the intervertebral disc will generally display the nerves exiting the foramen more clearly. The FOV should relatively large and be centered at the inferior aspect at the vertebrae and large enough to include the sternum and mid shaft of the humerus on

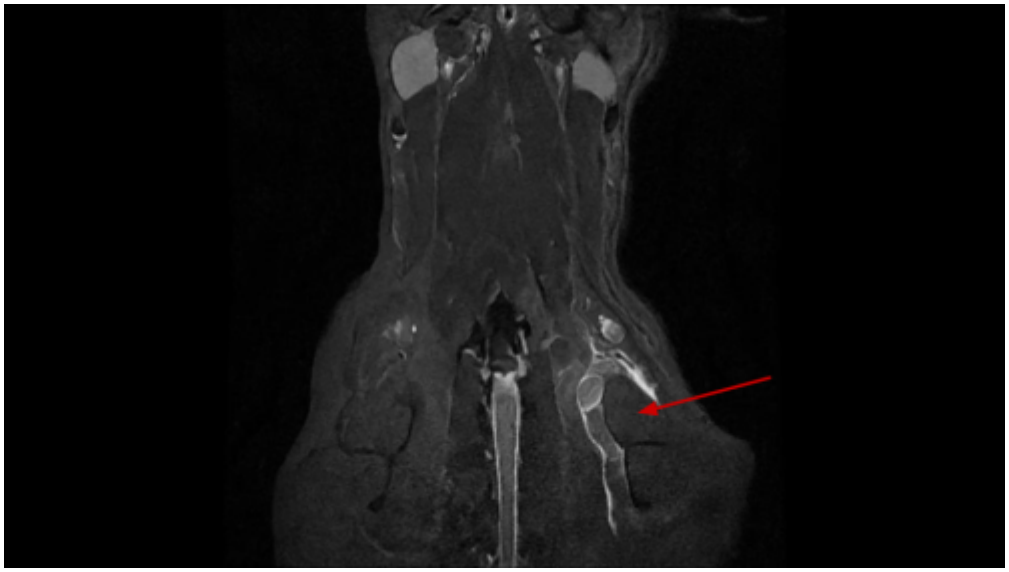
both sides.



Dorsal Plane

The dorsal plane is particularly useful when scanning for brachial plexus pathology, as it provides a good overview of both forelimbs symmetrically. As a first screening sequence, the dorsal should cover from the sternum to just past the vertebral bodies, with the FOV large enough to demonstrate both forelimbs. The Brachial Plexus nerves exit ventrocaudally from C4/5 to T1/2 and extend into the forelimbs and dorsal to the humeral head. Incidental findings are also frequently located on the dorsal plane (Right image, red arrow)





Tips and Tricks

Selecting Phase Direction

When imaging the brachial plexus, any phase direction may be used, but the A/P direction will allow for greater flexibility. A/P phase direction may allow for a rectangular FOV and reduced oversampling, both of which will save time that can be used for other motion reduction strategies. Unlike the cervical spine, saturation bands should not be used ventral to the spine to reduce flow and respiration artifact, as the nerves of interest run parallel to all the vessels and would be obscured.

Reducing Motion and Flow

As the use of saturation bands would obscure important anatomy, motion reduction must be achieved with other methods. Here are a few parameter changes that can be made to reduce the effect of respiratory motion in the brachial plexus area:

- Increase NEX/Averages; 4 or more
- Square matrix; ie 256×256 select a slightly lower resolution to save time and keep it square
- Utilize higher bandwidth
- If applicable to your system, try PROPELLER/BLADE

To reduce the effect of flow artifact:

- Use a slightly longer ETL/Turbo factor
- Select a later TE (second echo for T1's)
- If applicable to your system, 3D FSE's like CUBE/SPACE will naturally do an excellent job suppressing signal from vessels in all contrasts

Find Pathology

Locating pathology in brachial plexus scans can be difficult when a large lesion isn't present. There

are a few things that can be done to help:

- Run a dorsal early in the exam, preferably a STIR
- Check for symmetry; denervation changes are more easily spotted as fluid like intensity in muscles
- Good fat saturation; use Dixon techniques whenever possible. If no Dixon is available, be sure to manually shim the area of interest