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.

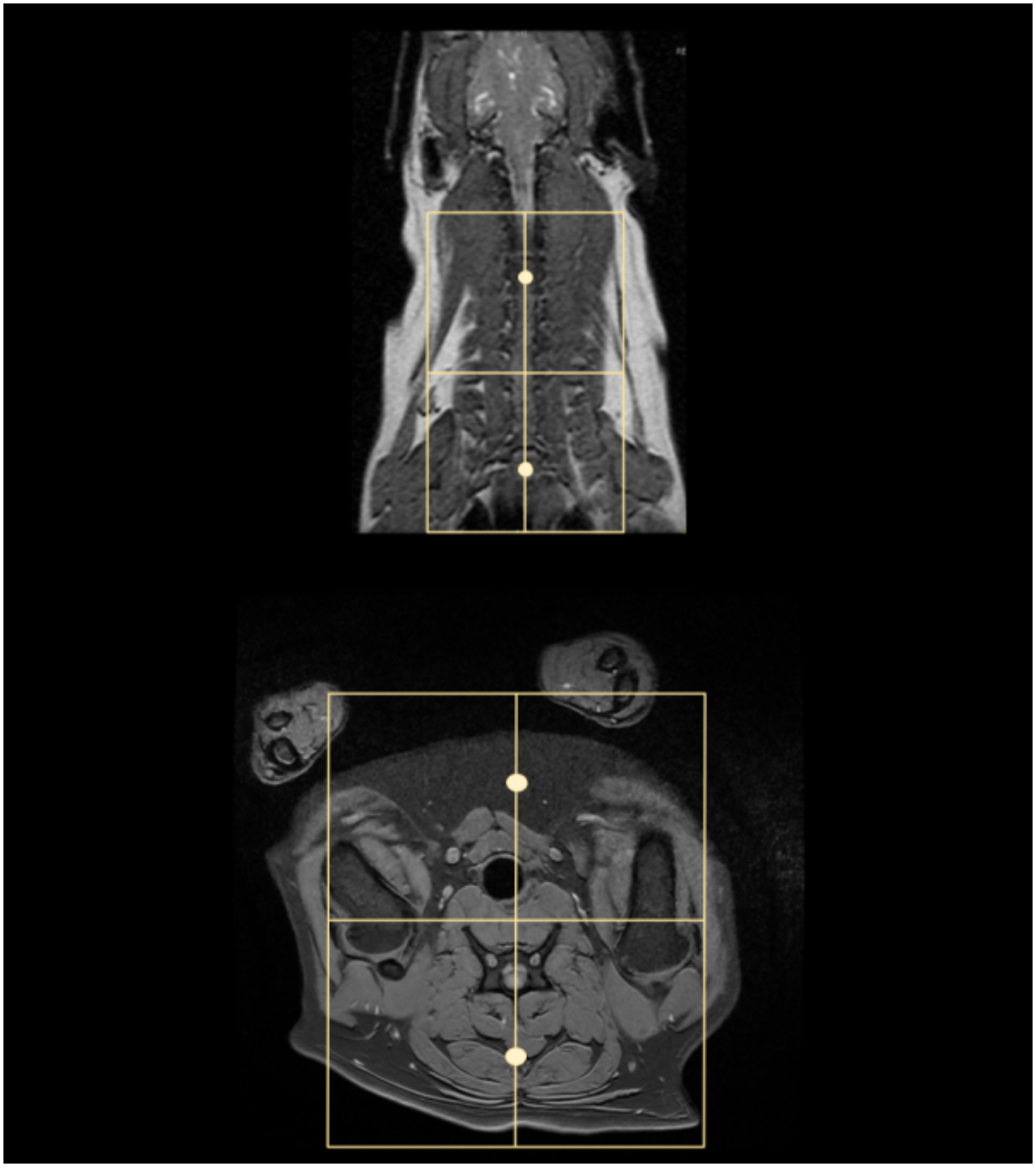
Scan Coverage and Planning

A note on Localizers

When planning out your localizer images, be sure to use a LARGE FOV so that the forelimbs and shoulders 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.

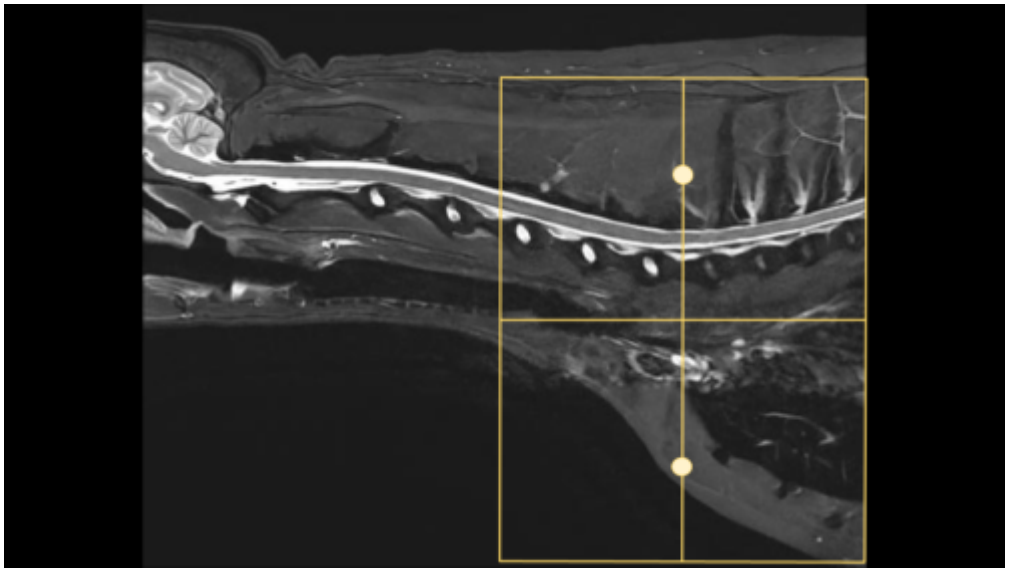
Sagittal Plane

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.**



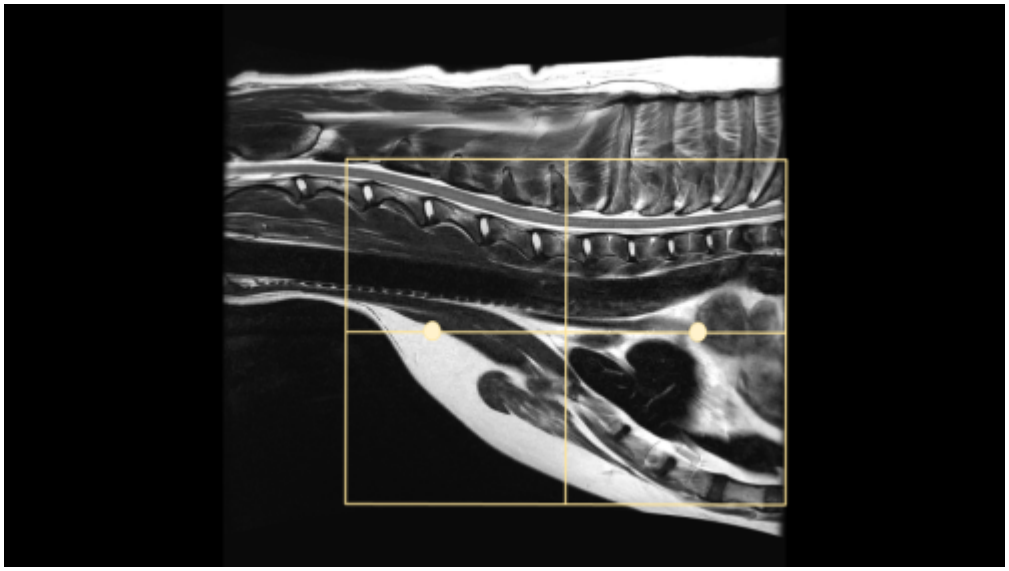
Axial Plane

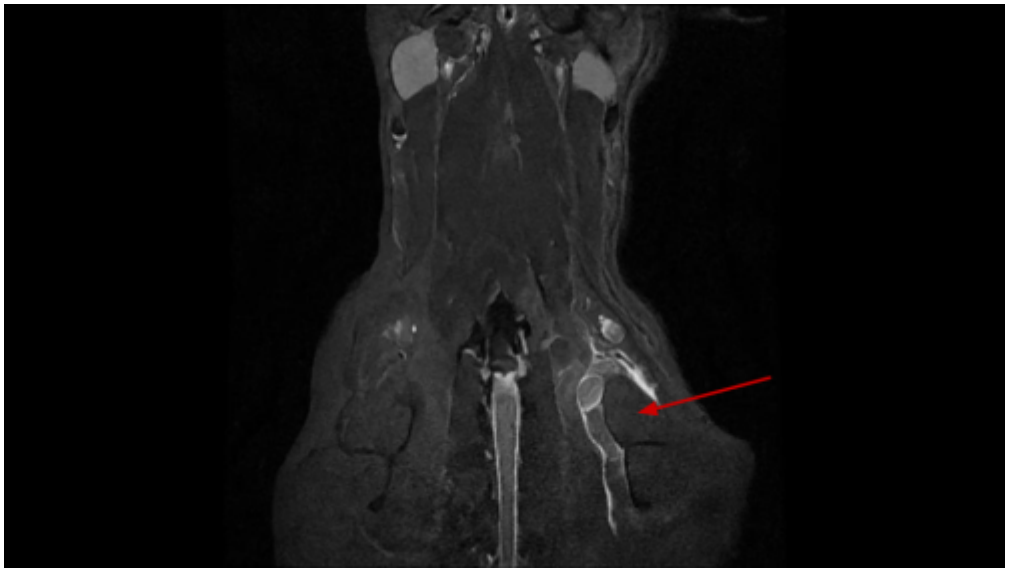
Axial coverage for the brachial plexus should cover from typically C4/5 to T3/4 to ensure that the entire plexus is covered. Angling parallel to the intervertebral disc will generally display the nerves exiting the foramen more clearly. The FOV should relatively large and be centered at the inferior 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 and shoulders. The Brachial Plexus nerves exit ventrocaudally from C4/5 to T1/2 and extend into the forelimbs and dorsal to the humeral head. Some plexus pathology may lead to changes in the signal intensity of muscles (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; pretty good for motion and also reduces flow artifact

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

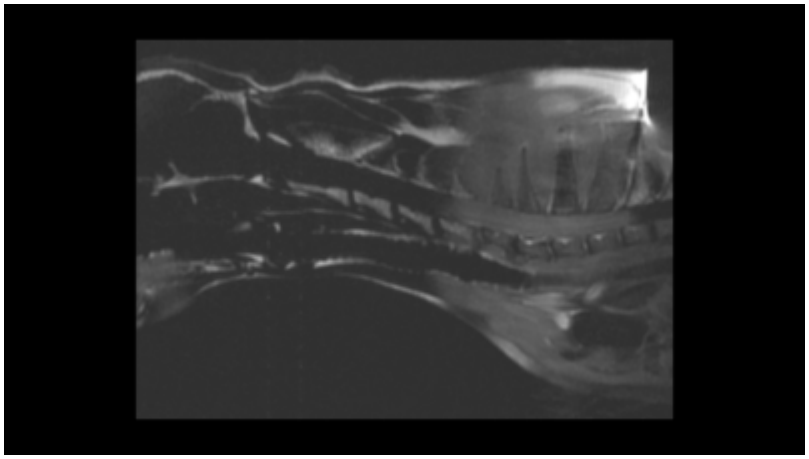
Find Pathology

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 can lead to T2 hyperintensity or muscle atrophy
- Good fat saturation; use Dixon techniques whenever possible. If no Dixon is available, be sure to manually shim the area of interest
- Run high resolution NON-fat saturated sequences; the nerves are fairly dark and will be more apparent when surrounded by bright fat

Fat Saturation

Fat saturation can be tricky in the cervical/plexus area due the uneven anatomy, presence of microchips, and large FOV's required.



- Use Dixon techniques for fat saturation (Dixon, FLEX, IDEAL)
- SPAIR/SPECIAL techniques may be a bit more homogenous if available
- Manually shim to the area of interest
- Position and scan close the isocenter
- Use the smallest appropriate FOV