CSF flow compensation in spine

Application tip, contributed by Mark Pijnenburg and Marco Nijenhuis
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In TSE imaging of the spine, CSF flow may cause flow voids. These may be most notable in axial imaging of the cervical spine where CSF flow velocity can be quite high and the imaging plane is perpendicular to the flow direction. Flow voids are visible as dark areas. The signal loss occurs because moving spins may not experience both the full excitation pulse and the refocusing pulse and thus have a slightly different phase than immobile spins in the slice.

The tips below apply to Ingenia 3.0T and 1.5T release 4.1.3 SP1 as well as Ingenia and Achieva systems at release 5.

**Reducing flow voids**

Flow void reduction is more relevant at 3.0T than at 1.5T.
- In general, sensitivity to flow voids may be decreased by increasing slice thickness and shortening TE. However, in cervical spine a small slice thickness is usually desired.
- Increasing the number of packages can also help, but this will usually increase scan time.

At 3.0T, acquire the T2W TSE sequence in multiple packages, for instance 6 packages for cervical spine. A lower number of packages may be used for the thoracic spine (4 packages) and the lumbar spine (2 packages). For 1.5T using 4 packages for cervical spine is recommended to maintain a reasonable scan time.

- Set scan direction to interleaved.
- Switch on flow compensation in the slice direction (through-plane).
Through-plane flow compensation

Through-plane flow compensation is another way to address flow voids. This flow compensation in slice direction maintains the phase of the signal for spins moving with constant velocity. Signal losses (flow voids) due to CSF flow will therefore be reduced.

In general, flow voids are more pronounced at higher field strengths. So, particularly 3.0T users may want to switch on through-plane flow compensation in their 2D multislice TSE scans.

Combining it with a multiple package approach is recommended for robust flow artifact reduction on transversal T2-weighted spine images.

To enable through-plane (slice direction) flow compensation, go to the Motion tab and set Flow compensation to yes. That offers the option to select in-plane or through-plane flow compensation.

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TIP 2

Through-plane flow compensation in spine

Through-plane flow compensation can help to reduce flow voids in transverse T2W TSE sequences in the spine.

Example for cervical spine on Ingenia 3.0T:

Without flow compensation, 2 packages

With through-plane flow compensation, 6 packages

References

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Cutting Edge Imaging of the Spine