3T Hi-Resolution Cervical spine 3T

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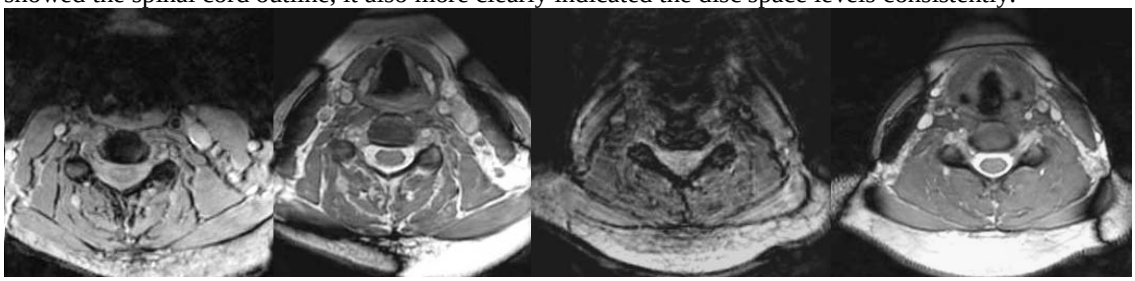
Abstract: FFE (spoiled gradient echo) was compared to balanced SSFP (B-FFE) for cervical spine 3T MRI in 25 patients. Assessment of the anatomy affected in spinal degenerative joint disease for image quality and diagnostic relevance was made. Both sequences were found to be useful in cervical spondylosis, B-FFE was found to be more tolerant of patient motion and depicted canal narrowing better than FFE but showed less contrast in depiction of foraminal fat and less able to indicate the disc space.

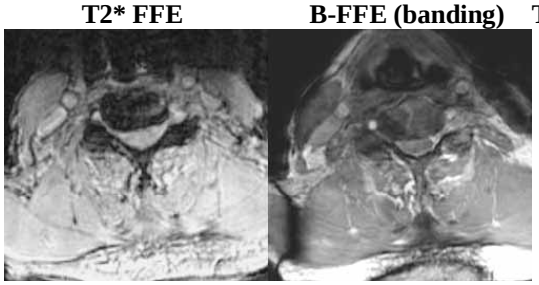
Introduction: Degenerative changes remain the most common indication for cervical spine imaging. 1.5T MRI remains suboptimal, are often degraded by motion artifact and suffer from low SNR, and often require a follow-up invasive CT-myelogram. There is no current universally accepted sequence to depict the neural foramina. Having found 3T cervical MRI to be consistently superior to 1.5T due to improved SNR, we compared 3D short TR, small FA gradient echo(T2* FFE) with balanced SSFP(B-FFE) to determine the best sequence for optimal cervical spine imaging.

Methods: All patients were studied on a 3T whole body MR scanner and the SENSE-capable, 12-element, CTL spine coil (Intera-NT, Philips Medical System, The Netherlands) equipped with self shielded gradients (30 mT/m, 150 T/m/s). The complete c-spine protocol included conventional T1 sagittal, TSE T2 sagittal and axial, 3D T2*-FFE (gradient echo, TR/TE/FA 45/9.2/10, thickness 2.4-3.0mm zero-filled overlap 1.2mm reconstruction, duration 7:00), axial B-FFE (balanced multishot(256) gradient echo, TR/TE/FA 3.9/1.54/45, thick 2.4-3.0/1.2-1.5mm, 4:01 duration). Both hi-resolution sequences were reviewed by 3 radiologists on a 4-point scale for image quality and diagnostic value.

Results: Both B-FFE and T2*-FFE gave exquisite anatomic depiction in the cervical spine for degenerative changes (consistently superior anecdotally to 1.5T MRI) in the patient with minimal movement. B-FFE was faster, showed the cervical spinal cord in sharp relief to the CSF allowing assessment of canal narrowing, and much more motion-tolerant allowing more confident assessment in the moving patients. However it suffered from off-resonance dephasing band artifacts which required careful attention to localized shimming in the lower neck and was severely degraded by metal in the FOV(even braces). T2* FFE showed higher contrast in the neural foramina allowing faster, more confident assessment but rarely showed the spinal cord outline, it also more clearly indicated the disc space levels consistently.



T2* FFE **B-FFE (banding)** **T2* FFE motion degraded B-FFE virtually unaffected**



T2* FFE has higher right foraminal and disc space contrast

Conclusion: 3T cervical spine MRI give excellent depiction of cervical degenerative changes with either B-FFE or T2*-FFE, each of which have some unique benefits. T2*-FFE has higher foraminal and disc space contrast, but B-FFE is more motion-tolerant and allows better assessment of the residual CSF in the presence of canal stenosis and may be useful in the less than ideal patient or in a problem solving role. B-FFE is very sensitive to any metallic susceptibility field inhomogeneity. Postoperative patients with metal are better imaged at 1.5T.