

# Case Study: Simultaneous Multi-Slice Accelerated Turbo Spin-Echo Magnetic Resonance Imaging of the Spine

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## Introduction

Magnetic Resonance Imaging (MRI) of the spine may be performed for a wide range of clinical symptoms and indications including evaluation of back pain, radiculopathy, spondylosis, infection, and neoplasms. Standard MRI spine protocols include multiplanar T1-weighted (T1w), T2-weighted (T2w), and short tau inversion recovery (STIR) or a T2w fat-saturated sequence most commonly in the sagittal and axial planes. Post-contrast imaging is indicated for evaluation of infection, neoplasm, and in the post-operative setting. Because imaging of the spine in the axial plane requires a large number of slices to adequately detect pathology, the simultaneous multi-slice (SMS)

imaging technique using multiband (MB) pulses may be valuable for imaging the spine as it reduces imaging time while providing similar detection of pathology and similar image quality. In this case study we describe the use of SMS turbo spin echo (SMS TSE)<sup>1</sup> for evaluation of the lumbar spine among patients who have been given intravenous contrast for various clinical indications including neoplasms and post-operative scenarios.

## Sequence details

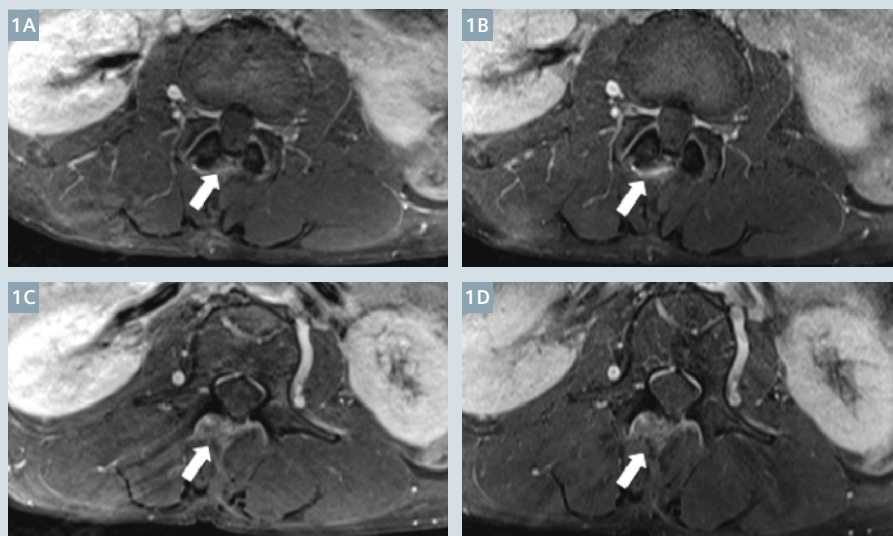
MRI of the lumbar spine was performed at a 1.5T MR scanner

<sup>1</sup> The product is still under development and not commercially available yet. Its future availability cannot be ensured.

(MAGNETOM Symphony, A Tim System, Siemens Healthcare, Erlangen, Germany). Post-contrast axial T1 TSE sequences (conventional and SMS) with fat saturation (T1w contrast-enhanced (CE) TSE FS) were performed following administration of 0.1 mmol/kg intravenous gadolinium dimeglumine (Multihance; Bracco Diagnostics, Princeton, NJ, USA) contrast. Parameters for the conventional TSE sequence were TR 637-684 ms, TE 12-13 ms, 4 mm slice thickness, and 192 x 256 matrix. The SMS T1w CE TSE fat saturation sequence consisted of TR 632 ms, TE 14 ms, 4 mm slice thickness, and 192 x 256 matrix. Average acquisition times for conventional axial T1w CE FS TSE and SMS T1w CE TSE FS were 5:33 min (range 5:24 to 5:48 min) and 4:00 min respectively.

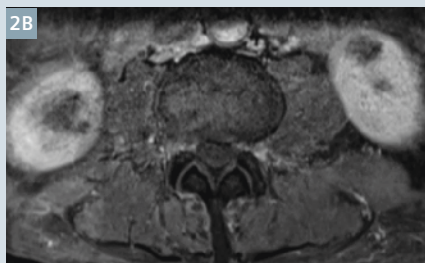
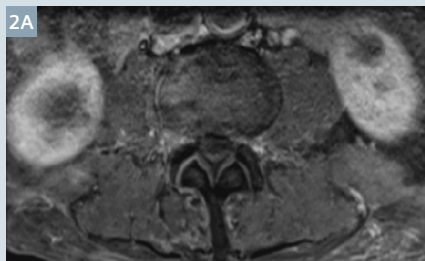
## Case 1

A 60-year-old female with a previous history of an intradural schwannoma resection in 2013 who reported continued low back pain and left lower extremity radiculopathy. Representative images from the conventional axial T1w CE TSE FS (1A, C) and SMS axial T1w CE TSE FS (1B, D) demonstrate a laminectomy site at L2-3 with small amount of enhancing scar tissue at the laminectomy site but no evidence of recurrent schwannoma in the thecal sac.



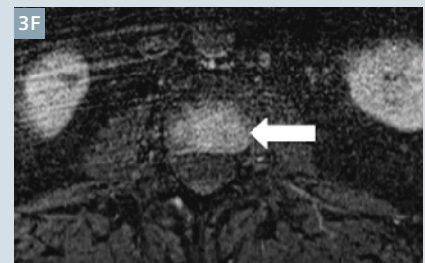
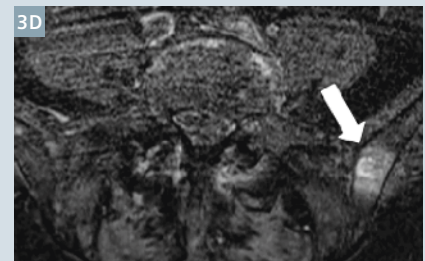
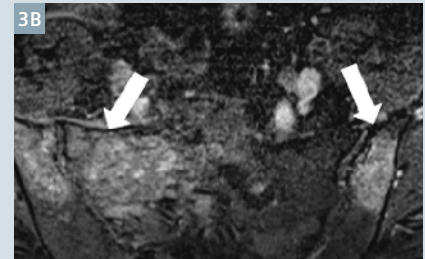
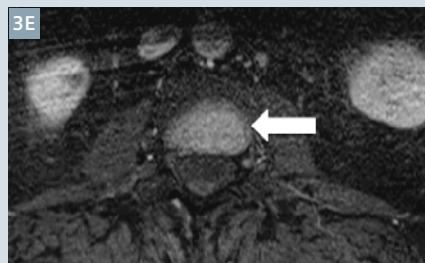
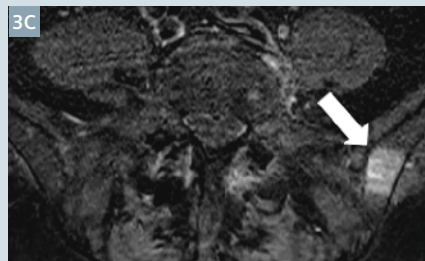
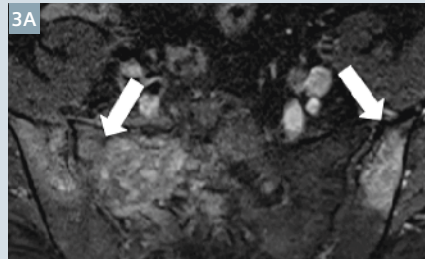
## Case 2

An 80-year-old male presented with a history of metastatic cholangiocarcinoma and left leg weakness. Both, the conventional axial T1w CE TSE FS (2A) and SMS axial T1w CE TSE FS (2B) demonstrated no evidence of metastatic disease. Representative images of the lumbar spine demonstrate similar differentiation of the bones, muscles, spinal canal, and remainder of the extraspinal soft tissues.



## Case 3

A 58-year-old patient with metastatic breast cancer and low back pain. Representative images from both the conventional axial T1w CE TSE FS (3A, C, E) and SMS axial T1w CE TSE FS (3B, D, F) demonstrate multifocal enhancing lesions in the bones consistent with osseous metastases. There is similar conspicuity of the bone lesions with the SMS TSE compared to the conventional TSE.



## Conclusion

We performed SMS TSE of the lumbar spine in this small clinical case series and determined that SMS TSE can be reliably performed in the clinical setting. Compared to the conventional T1w CE TSE, the T1w CE SMS TSE demonstrates similar detection of pathology while reducing imaging time compared to conventional TSE which is considered a clinical advantage of the SMS TSE. No qualitative differences in image quality, such as anatomic detail or imaging artifacts, were encountered with SMS TSE which would preclude its use in the clinical setting. Further quantitative investigation of image quality and pathology detection in the clinical setting using SMS TSE will be under-

taken to evaluate if this technique can replace conventional TSE imaging of the spine in the near future.

## References

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- 2 Wang D, Kollasch P, Li X et al., "Multiband Slice Accelerated TSE: Clinical Applications in Brain imaging", Proceedings of the International Society for Magnetic Resonance in Medicine (22) 2014, 4317.
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