APPLICATION OF 3D DOUBLE INVERSION RECOVERY SEQUENCE IN THE DEMYELINATING DISEASE OF CERVICAL AND THORACIC CORD

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Target audience: Radiologists, neurologist, and MRI researchers interested in demyelinating disease and spinal cord imaging.

Introduction: Due to the effect of the cerebrospinal fluid, the surrounding fat and the thin structure of the spinal cord, routine T2w-TSE imaging of the spinal cord is limited, with a high chance of missed diagnosis or misdiagnosis. The 3D double inversion recovery sequence (3D-DIR) is able to inhibit the signal of water, fat and white matter, which could be more sensitive in clearly showing the size and scope of the lesions, and has been successfully used for imaging multiple sclerosis (MS), hippocampal sclerosis, optic neuritis, subarachnoid hemorrhage, and gray-matter heterotopias etc[1,2]. This study compared the imaging of DIR and T2w in demyelinating disease to find out which one has a higher diagnostic value.

Materials and method: 20 patients with demyelinating disease in cervical and thoracic cord participated in this study. All data were collected on a MAGNETOM Skyra 3T MR scanner (Siemens AG, Erlangen, Germany) including 2D T2-TSE in sagittal plane and 3D double inversion recovery sequence (SPACE-DIR) with the same slice position. The T2w and SPACE-DIR images were acquired with the following parameters. T2w: TR/TE 4000/135 ms, 13 slices, slice thickness 3 mm, FOV 260×260 mm^2, matrix size=192x192, total acq. time 3min. SPACE-DIR: TR/TE 7500/320 ms, 120 slices, slice thickness 1.4 mm, FOV 260x260mm^2, matrix size=192x192, IR-Delays 450/3000 ms, slice oversampling 60%, total acq. time 6min. Two neuro-radiologists assessed the number of lesions, maximum cross-sectional area and rated lesion visibility and overall image quality on 5-point scales independently. The CNR was defined as the Mean Lesion signal-intensity divided by Mean signal intensity of the normal spine. The CNR was calculated with signal intensity of the same section and same area. The statistic result of the CNR differences between T2-TSE and SPACE-DIR was computed using the paired t-test algorithm in SPSS17.0.

Results: Fig.1 shows three cases with demyelinating disease and the profile of the lesion in SPACE-DIR are much better than T2-TSE. The average SNR of SPACE-DIR is 1.53±0.22, which is significantly (p=0.0007) higher than T2-TSE (1.26±0.13). The CNR of SPACE-DIR is 18% higher than T2-TSE among 20 patients. Also the total number of lesion detected by SPACE-DIR (63) are significant higher (paired t-test, p=0.0001) than T2-TSE (40), while the total lesion volume observed on SPACE-DIR is 166% of the T2-TSE (paired t-test, p=0.011).

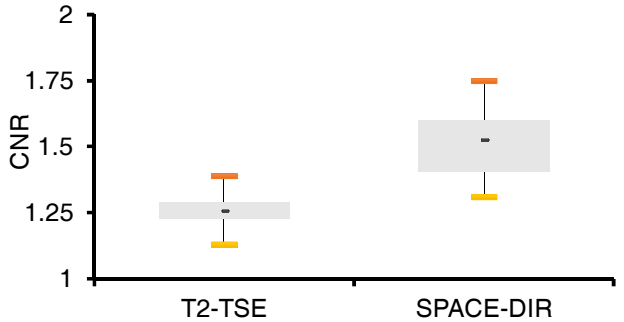

Figure 2. Statistic result of CNR in the lesion area measured by using T2-TSE and SPACE-DIR sequences.

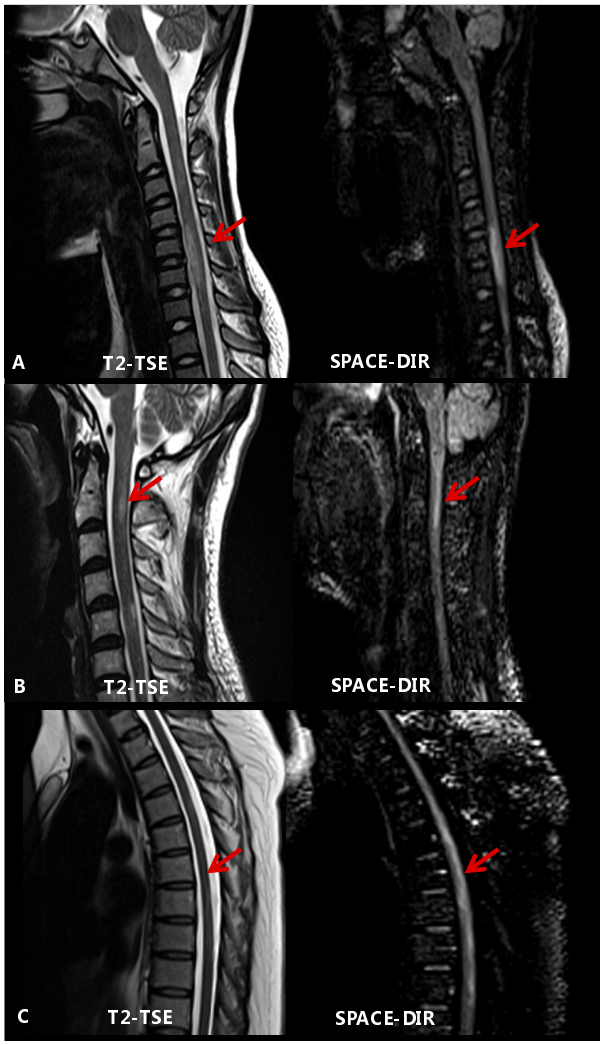

Figure 1. T2WI and SPACE-DIR images of patient diagnosed as ophthalmoneuromyelitis and had lesions in cervical cord (A), patient diagnosed as multiple sclerosis and had lesions in cervical cord (B), patient diagnosed as multiple sclerosis and had lesions

Conclusions: SPACE-DIR has significantly higher CNR and found more lesion than T2-TSE in detecting lesion in cervical and thoracic cord for demyelinating disease diagnosis.

References: 1. I. Riederer, et al., AJNR 2014. 2. M. Calabress, et al., Arch Neurology 2007.