Assessment of cervical spinal disorders: Comparison of T2-weighted IDEAL water-only imaging and fat-saturated T2-weighted FSE imaging

K. Sato[1], T. Masui[1], M. Katayama[1], H. Ikuma[1], H. Seo[1], A. Kutsuna[1], M. Sugimura[2], and K. Asano[3]

[1]Radiology, Seirei Hamamatsu General Hospital, Hamamatsu, Shizuoka, Japan, [2]Radiology Center, Seirei Hamamatsu General Hospital, Hamamatsu, Shizuoka, Japan, [3]MR Engineering, GE Yokogawa Medical Systems Ltd., Hino, Tokyo, Japan

INTRODUCTION: Fat suppression techniques are occasionally required for the evaluation of trauma or posterior part of the neck in spine MRI. To date, the most commonly used MRI techniques for fat suppression include frequency-selective fat saturation and inversion recovery. Limitations of CHESS techniques include failed or erroneous signal suppression especially in the posterior neck region when local magnetic field (B0) or radiofrequency (B1) inhomogeneities are encountered. Iterative decomposition of water and fat with echo asymmetry and least-squares estimation (IDEAL) technique with the three-point Dixon method has been proposed to overcome problems due to magnetic field inhomogeneities [1]. We compared T2-weighted IDEAL water-only imaging with fat-saturated T2-weighted FSE imaging for cervical spinal disorders including posterior neck lesions.

METHODS: Within a 2-month period we examined 31 adult patients (11 men and 21 women; average age, 58 years; age range, 32-79 years) who had been referred because they were known to have or were suspected of having cervical spinal disorders. Four patients had posterior neck lesions, 1 bone metastases involving vertebral arch, 1 subcutaneous cyst, and 2 soft tissue edemas. Studies were conducted using a 1.5T system (Signa HDx; GE Healthcare) with a spine coil. We obtained sagittal fat-saturated T2-weighted FSE (FS-T2) images and sagittal T2-weighted IDEAL water-only (IDEAL-T2-WO) images (FS-T2 images (5000/84 [repetition time msec/echo time msec], 3mm thickness, 22cm field of view, 288x224
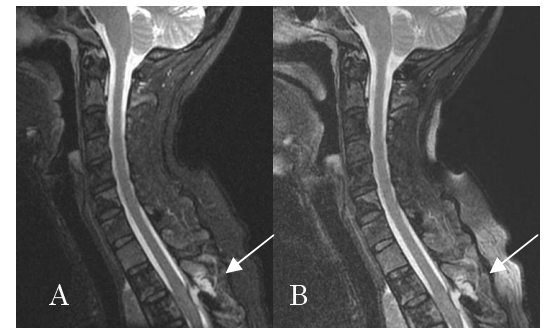

Fig 1. 54-year-old woman with multiple bone metases. A, T2-weighted IDEAL water-only image shows bone metastases at vertebral arch producing soft tissue mass into the canal. B, Fat saturated T2-weighted FSE image shows bone metases at vertebral arch, however, subcutaneous fat suppression is incomplete.

matrix, 5.00 mm thickness, acquisition time of 145 seconds with chemical shift selective technique, an investigational version of IDEAL-T2-WO images (3000/ 83 [repetition time msec/echo time msec], 22cm field of view, 256x224 matrix, 3 mm thickness, acquisition time of 252 seconds with the IDEAL technique). We assessed overall image quality using a 5-point scale (1; poor to 5; excellent). For each patient, matching regions of interest were placed over the subcutaneous fat in the posterior neck at C2, C4, and C6 level, and placed over cerebrospinal fluid (CSF), spinal cord, at C2 level respectively. On the basis of these

measurements, the following values were obtained: subcutaneous fat to spinal cord signal-intensity-ratio (fat-cord SIR), CSF to spinal cord signal-intensity-ratios (CSF-cord SIR). Four patients with posterior neck lesions were assessed the depiction of it.

RESULTS: The IDEAL-T2-WO images had a significantly higher score (4.3+- 0.7) for overall image quality than did the FS-T2 images (3.1+- 0.3) (p<0.05). Fat-cord SIR at C2, C4, C6 level was consistent with the IDEAL-T2-WO images (0.53+- 0.12 at C2, 0.41+- 0.10 at C4, 0.42+-0.08 at C6) compared with the FS-T2 images (0.24+- 0.27 at C2, 0.21+- 0.26 at C4, 0.88+-0.43 at C6), due to uniform and reliable fat suppression at the posterior neck for the IDEAL-T2-WO images. CSF-cord SIR was significantly higher on the IDEAL-T2-WO images (2.72+- 0.40) compared with the FS-T2 images (2.12+- 0.23) (p<0.05). All 4 patients with posterior neck lesions were delineated clearly by the IDEAL-T2-WO images than FS-T2 images.
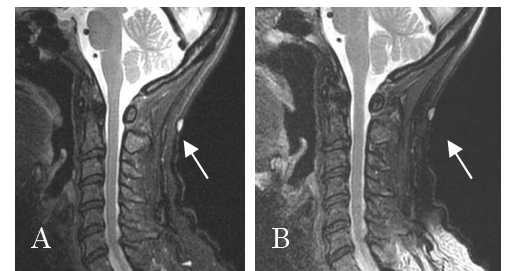

Fig 2. 77-year-old woman with a cystic lesion in the posterior subcutaneous fat at C1/2 level. T2-weighted IDEAL water-only image (A) shows uniform fat suppression in the posterior neck and depicts the cystic lesion clearly than fat saturated T2-weighted FSE image (B).

SUMMARY AND CONCLUSION: T2-weighted IDEAL water-only imaging can provide uniform and reliable fat suppression of the soft tissue in the posterior neck and depict the soft tissue lesion clearly, and can be an alternative to fat suppression techniques for cervical spine MRI.

REFERRENCES: [1] Reeder SB et al., MRM 2004;51:35-45