

Quantitative assessment of vertebral fractures evaluated with dual chemical shift imaging: acute, chronic or neoplastic fractures?

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Introduction

In-phase (IP) and opposed-phase (OP) study is an established method for assessing of fat and water components in the adrenal adenoma¹). Recently IP and OP MRI has been proven to be effective method for evaluating bone metastasis in the spine^{2,3}) The purpose of this study is to determine if IP and OP MRI with dual phase chemical shift sequence can be predicted neoplastic or non-neoplastic compression fractures.

Subjects and Method

One hundred-eight compression fractures of 67 patients (32 males and 35 females, 24-87 years old [mean 65.8]) were entered the study. All patients were studied with 1.5 T MRI units (Magnetom Quantum and Sonata, Siemens, Germany) with a phased array spine coil. In addition to the routine sequences such as T1-weighted images and fast STIR images, dual chemical shift sequences (FLASH, TR/TE/FA=140/2.3 and 4.7/70). This sequence was obtained with TR of 140msec, one excitation, a 256x240 matrix, FOV 300x300, and 4mm thickness.

The patients were divided into three groups. Group 1 consisted of 27 patients with 38 neoplastic compression fractures of vertebral body. Group 2 consisted of 13 patients with 17 acute compression fractures was defined as a < 1 month accidental duration. Group 3 consisted of 68 patients with 87 compression fractures with disease duration of > 1 month.

The relative signal intensity ratio (SIR) was calculated at SIR=Opposed phase signal intensity/In phase signal intensity. Measurement of the region of interest was done at sagittal vertebra excluding cortex.

Mean and SDs were calculated for SIRs of the three groups. The mean values of SIR were compared the Tukey-Kramer test using commercially available software (JMP; SAS Institute Inc.). Significance was defined at p less than 0.01.

Results

The mean SIRs and SD for the three groups were as follows; Group 1: 1.05+/- 0.09, Group 2: 0.78+/- 0.09 and Group 3: 0.58+/-0.11. Group 1 showed the highest mean SIRs, while Group 2 showed the intermediate values and Group 3 showed low values (Fig. 1, and Fig. 2). Statistically significant differences (p<0.01) were seen on each group by the Tukey-Kramer test (p<0.01) (Fig. 3).

Discussion and conclusion

In this study the mean SIRs of neoplastic compression fracture were significantly higher than those of chronic compression fractures and acute compression fractures. These results suggest neoplastic compression fractures may contain little fat elements and non-neoplastic compression fractures contained both cellular and fat element.

The SIR values of acute compression fracture were significant higher than those of chronic compression fractures. Yuh et al. reported chronic compression fracture replaces fatty marrow⁴). As fatty marrow includes in both water and fat, drop of signal on opposed phase image is seen and chronic compression fracture may show low SIR values.

In conclusion, IP and OP dual phase chemical shift MRI could be predicting neoplastic or non-neoplastic compression fractures.

Reference

1. Mitchel DG et al. Radiology 185: 345,1992
2. Dovid G. Disler et al: AJR 169:1439, 1997
3. Virna Zampa et al: Eur Radiology 12:1811, 2002
4. Yuh W et al. Radiology 172:215, 1989

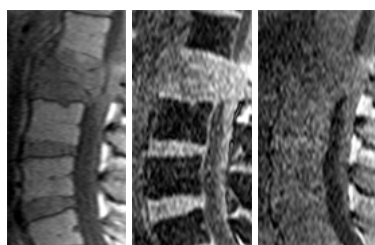


Fig. 1 Group 1: A 63-year-old female of breast cancer, neoplastic compression fracture at L2 vertebra: SIR=1.08 (a)T1-WI (b) OP image (c) IP image

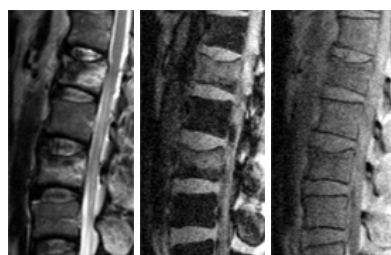


Fig. 2 Group 2: A 24-year old male dropped from paraglider, non-neoplastic compression fractures at L1 and L3: SIR=0.92 and 0.95 (a)T1-WI (b) OP image (c) IP image

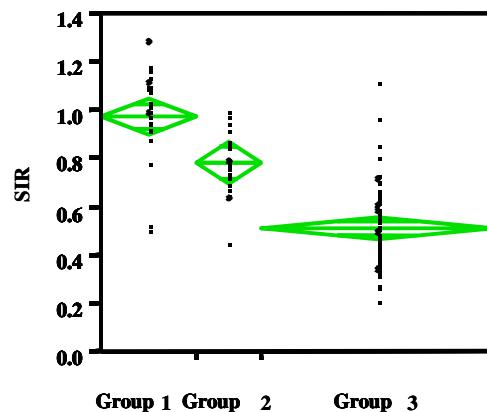


Fig. 3 SIR of compression fractures groups