

Quantitative assessment of clinical stage of aplastic anemia by using dual phase chemical shift sequence

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Introduction

MR imaging is an ideal technique for non-invasively studying bone marrow cellularity in large portion. MRI of bone marrow in patient with aplastic anemia has been reported [1,2]. However there are few quantitative studies directly measuring the intensity of bone marrow with aplastic anemia [3,4]. The aim of the present study is to compare between signal intensity ratio (SIR) of opposed-phase and in-phase imaging ratio in patient with clinical stage of aplastic anemia.

Material and method

During 42 months period (April 2002 to October 2005), thirty-two patients with aplastic anemia (13 males and 19 females, 38-84 years old [mean 63.3]) were included in this study. All patients were studied with 1.5 T MR imaging units (Symphony 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=110/2.3, and 4.6/90) are scanned. Thirty-two patients with aplastic anemia were divided into three groups with clinical classification (Japanese Ministry of Health and Welfare study group (1982) : mild type group (Group I), moderate type group (Group II) and severe type group (Group III) were 12 patients, 14 patients and 6 patients, respectively.

The relative signal intensity ratio (SIR) was calculated at $SIR = \text{Opposed phase signal intensity} / \text{In phase signal intensity}$. Measurement of the region of interest was done at sagittal vertebra excluding cortex at the L2-L4.

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 0.05.

Results

The mean SIRs and SD for the three groups were as follows; Group I : 0.50±0.13, Group II : 0.69±0.18 and Group III : 0.93±0.05. Group III showed the highest mean SIRs, while Group I showed low values (Fig. 1, and Fig. 2). Statistically significant differences were seen on each group by the Tukey-Kramer test (p<0.05) (Fig. 3).

Discussion and conclusion

In this study the mean SIRs of severe type of aplastic anemia were significantly higher than those of moderate type and mild type of aplastic anemia. These results suggest severe type of aplastic anemia may contain much fat element and little water element, and mild type of aplastic anemia contained both water and fat element.

The SIR values of moderate type of aplastic anemia were significant higher than those of mild type of aplastic anemia. As those bone marrow include in both water and fat, drop of signal on opposed phase image is seen, and as fat proton is bigger on both type, moderate type of aplastic anemia may show high SIR values.

In conclusion, IP and OP dual phase chemical shift MRI could be predicting clinical staging of aplastic anemia.

References

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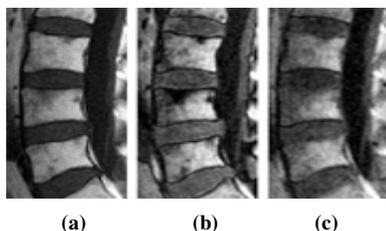


Fig. 1 A 57-year old male of aplastic anemia (severe type): SIR=0.92 (a)T1-WI (b) OP image (c) IP image

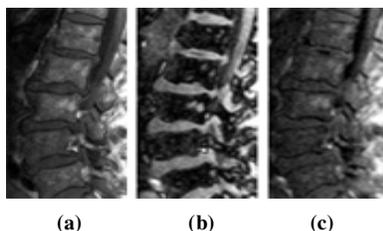


Fig. 2 A 67-year old female of aplastic anemia (mild type): SIR=0.36 (a)T1-WI (b) OP image (c) IP image

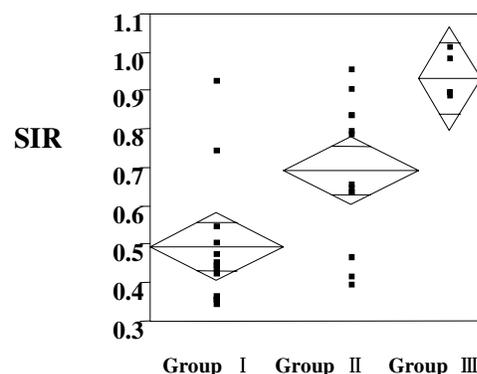


Fig. 3 SIRs of aplastic anemia (clinical stage)