

# Effect of superparamagnetic iron oxide on high-b-value diffusion-weighted imaging for evaluation of focal hepatic lesions

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## INTRODUCTION

On high-b-value diffusion imaging (DWI), only pathological lesions with low apparent diffusion coefficient (ADC) values, such as malignant tumor, can be delineated without contrast material (1). Recent study suggests that combined reading DWI, T2-weighted images, and dual-echo T1-weighted images show higher accuracy in detection of hepatic metastases than dose reading of superparamagnetic iron oxide (SPIO)-enhanced MR images (2). There are some limitations of DWI for hepatic applications, however. The ADC values of malignant hepatic tumors range by their microperfusion effect and in some situations, their ADC values overlap ADC value of the liver. In addition, the signal of liver may be slightly high because its ADC value is relatively lower among other abdominal organs on DWI. Thus, some malignant hepatic tumors occasionally fail in be delineated on DWI. On the contrary, SPIO-enhancement on DWI makes the signal of the liver decrease and expects to improve accuracy of DWI for evaluation of these lesions (3). Moreover, SPIO-enhancement DWI is able to suppress signals from small cysts and hepatic blood vessels, the identification of small metastatic foci becomes even easier.

The purpose of this study was to examine whether SPIO-enhancement affect image quality of DWI, ADC values at hepatic lesions, and diagnostic accuracy of DWI in evaluation of focal hepatic lesions.

## MATERIALS AND METHODS

37 patients with 96 focal hepatic lesions were retrospectively reviewed. The focal hepatic lesions were consisted of 46 metastases, 24 hepatocellular carcinomas, 15 cysts, 6 hemangiomas, 3 abscess, and 2 focal nodular hyperplasia. Diagnosis confirmation was made by surgery (n=16), CTAP and /or intra-operative US (n=8), biopsy (n=7) and follow-up imaging studies (n=6). The each imaging parameters of DWI under breath-holding with 1.5-T superconducting MR units were as follows: TR/TE=1873/70, NEX=2, acceleration factor of 2, b value of 0 and 700sec/mm<sup>2</sup>. The image quality and lesion conspicuity on DWI before and after SPIO-enhancement were scored by two abdominal radiologists. The signal-to-noise ratio (SNR) of liver and spleen, and contrast-to-noise ratio (CNR) of each hepatic lesion were evaluated for quantitative analysis. The ADC values of liver and each hepatic lesion were also calculated. For qualitative analysis, two abdominal radiologists assessed the presence of malignant hepatic lesions by using a five-point confidence scale on DWI before and after SPIO-enhancement and area under the receiver operating characteristic (ROC) curve (Az) was calculated.

## RESULTS

The image quality of DWI was not significantly different between before and after SPIO-enhancement. SNR of liver and spleen were markedly decreased and CNR of solid hepatic lesions were significantly increased after SPIO-enhancement on DWI (Fig 1). Mean ADCs (10<sup>-3</sup> mm<sup>2</sup>/sec) of liver (1.24±0.17/1.17±0.20) and each solid hepatic lesion (1.17±0.23/1.34±0.23) were not significantly different before and after SPIO-enhancement. DWI after SPIO-enhancement resulted in significantly larger area under the ROC curve (Az=0.97) and accuracy (88.7%) (P<0.05), as compared with that before SPIO-enhancement (Az=0.93; accuracy, 81.7%) (Fig 2). The sensitivity and specificity of malignant hepatic lesions were 0.58 and 0.98 for before SPIO-enhancement and 0.78 and 0.99 for after SPIO-enhancement on DWI, respectively.

## CONCLUSION

SPIO-enhancement improves accuracy of DWI for evaluation of focal malignant hepatic lesions, which in particular are smaller (less than 1cm in diameter) or show similar ADC value as its normal liver tissue due to achieving higher lesion-liver contrast.

## REFERENCES:

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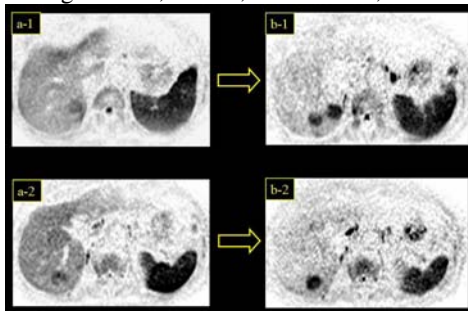


Fig1 78-year-old-man with multiple HCCs  
DWI before (a-1, 2) and after SPIO-enhancement (b-1, 2)

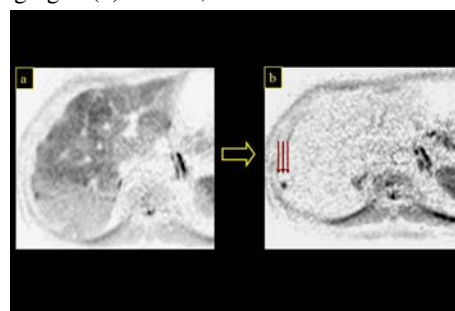


Fig1 65-year-old-man with colonic metastasis  
DWI before (a) and after SPIO-enhancement (b)