

## Improved diagnostic accuracy on SPIO-enhanced MRI of the liver with weak diffusion sequences

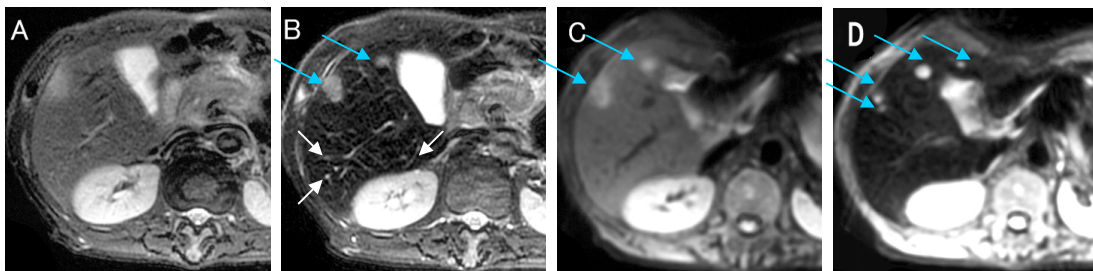
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**Purpose:** In the general practice for examining the liver, SPIO-enhanced MRI has been approved to be useful and widely applied for detecting liver tumors. However, to distinguish small tumors from vessels in section is often difficult since both appear 'bright dots' on the dark liver. To resolve this problem, we applied diffusion-weighted images (DWIs) with low b-value on SPIO-enhanced MRI of the liver.

**Subjects and Methods:** Twenty-four patients with known liver lesions (nine patients with liver cysts, seven with liver metastases, five with hemangiomas and three with hepatocellular carcinomas) were enrolled. MRI was performed on 1.5-T System (either Phillips Gyroscan Intera or GE EchoSpeed). T1 weighted spin echo images (T1-WI; TR=202-230, TE=4.9 in-phase images and TE=2.3 for out-of-phase images), T2 weighted fast spin echo images (T2-WI; TR=1300-2300, TE=70-80) were obtained before intravenous injection of 8 micromole Fe/kg of ferucarbotran (Nihon Schering). Post-contrast T2 weighted images, single-shot EPI DWI (TR=2150-2365, TE=44-39) and multi-shot EPI DWI (TR=817-1021, TE=39-33) were obtained with parallel imaging technique (SENSE). B-value of 150, 100 and fifteen was compared and B-value of fifteen was chosen for DWIs. On pre- and post-contrast T2-WIs, single-shot and multi-shot EPI-DWIs, the image interpretation were done with diagnoses and imaging sequences blinded. Diagnoses were confirmed either pathologically (five patients) or by clinical follow-up with angiography, CT and abdominal ultrasound examination as well as tumor marker tests such as AFP and CEA.

**Results:** Total sixty nodules (twenty-five cysts, twenty-two metastases, seven hemangiomas and six HCC) were disclosed on this study. All lesions larger than 10 mm in diameter (five cysts, four metastases, four hemangiomas and three HCC) were visualized on post-contrast T2-WI and multi-shot EPI, however, one HCC and one metastasis were missed on pre-contrast T2 WI. One cyst and one metastasis located near the top of the liver were difficult to pick up on single-shot EPI due to image distortion that were demonstrated on multi-shot EPI. For 44 lesions (<10mm), pre- and post-contrast T2-Wis, single-shot and multi-shot EPIs showed 26, 32, 33, 34 lesions, respectively. False-positive results were counted as five on pre-contrast T2-WI and eleven on post-contrast T2-WI. There was no false-positive call on the both EPI images.



A. Precontrast T2WI B. Postcontrast T2WI C. Precontrast DWI D. Postcontrast DWI

Postcontrast T2WI (B) and Precontrast DWI (C) show two tumors, however four tumors are revealed on Postcontrast DWI (D) (large arrows). Punctate high intensity lesions are seen on Postcontrast T2WI (B, small arrows) that are not obvious on pre- and postcontrast DWIs turned out to be false-positive lesions.

**Discussion/Conclusion:** Our results indicated that applying additional diffusion weighted images after SPIO administration could be useful in detecting small liver tumors. Including large number of cysts and the poor image quality of abdominal EPI, especially with single-shot, resulted in relatively poor sensitivity in this study, however, more tumor cases and the use of SENSE might improve the clinical utility on SPIO-enhanced MRI of the liver.