

# Diffusion-Weighted Imaging versus Superparamagnetic Iron Oxide (SPIO)-Enhanced MRI: Exclusive and Combined Values in the Assessment of Hepatic Metastases

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## Background

During the recent decades, various magnetic resonance imaging (MRI) techniques have been successfully applied for hepatic imaging and nowadays, liver-specific contrast material-enhanced imaging is rather generalized for the assessment of focal liver lesions at the daily clinical practice. Diffusion-weighted MRI (DWI) is also one of the recently advanced MRI technologies adopted in the hepatic imaging. Different from the T1 or T2 relaxation times which are the determinants of the conventional pre- and post-contrast MRI techniques, DWI derives its image contrast on the basis of differences in the free mobility of protons (primarily associated with water), which is called Brownian motion, between the tissues and doesn't need contrast agents. For the patients of extrahepatic malignancy especially from colorectal cancer, it has been suggested that complete resection of hepatic metastases could expect better patient's prognosis and survival, and imaging assessment of disease extent is crucial for the therapeutic planning for the hepatic metastases. Among the various imaging modalities using the computed tomography (CT) and MRI technologies, MRI with the liver specific contrast agents such as superparamagnetic iron oxide (SPIO) has been regarded as one of the most feasible and reliable methods for detection of the hepatic metastases. before the era of hepatobiliary contrast agents which are not thoroughly validated yet for the same purpose.

## Purpose

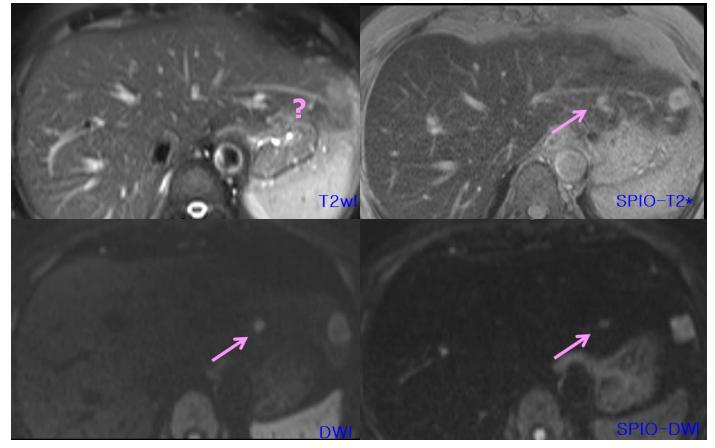
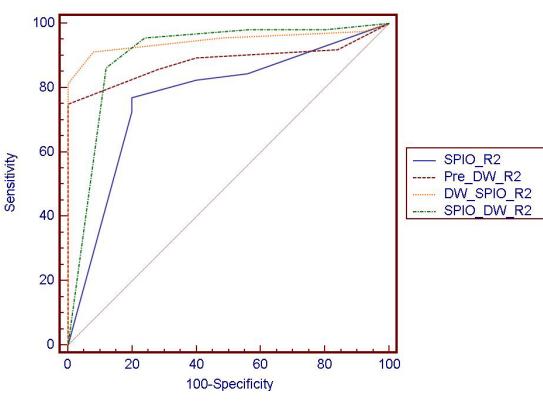
To retrospectively validate the role of DWI in the assessment of hepatic metastases through a comparative study with SPIO-enhanced imaging and additional value for the diagnostic accuracy when performing DWI before and after the injection of SPIO.

## Materials and Methods

Twenty-one consecutive patients having 160 metastases from extrahepatic malignancy and 25 benign focal lesions who underwent hepatic MRI including DWI and SPIO-enhanced MRI were enrolled. Two independent radiologists evaluated four separated review sessions (I, SPIO-enhanced T2\*-weighted images; II, pre-contrast DWI; III, SPIO-enhanced T2\*-weighted images and pre-contrast DWI; IV, SPIO-enhanced T2\*-weighted images plus pre-contrast and SPIO-enhanced DWI) and assigned confident level using a five-grade scale for each hepatic lesions. During each review session, pre-contrast T1- and T2-weighted images were always referenced. The area under the receiver operating characteristic curve ( $A_z$  value) was calculated as an indicator of the diagnostic accuracy of each image sets.

## Results

The  $A_z$  values for reader 1 and reader 2 were 0.80 and 0.75 on session-I, 0.91 and 0.91 on session-II, 0.97 and 0.96 on session-III, and 0.96 and 0.96 on session-IV, respectively. The  $A_z$  value of session-II was significantly larger than session-I (reader 1,  $P=0.004$ ; reader 2,  $P<0.001$ ), and that of session-III was significantly greater than that of session-I ( $P<0.001$  for each reader) or session-II (reader 1,  $P=0.004$ ; reader 2,  $P=0.003$ ). There were no significant difference of  $A_z$  values between session-III and session-IV (reader 1,  $P=0.231$ ; reader 2,  $P=0.878$ ). But sensitivity was improved on session-IV



**Fig. A.** ROC curve for the assessment of liver metastases using SPIO images session(I), pre-contrast DWI images session(II), DWI and SPIO combined images session(III) and SPIO-DWI images session(IV). The areas under curves ( $A_z$ ) are shown with their 95% confidence intervals.

**Fig. B.** 49-year-old man with multiple hepatic metastasis from colon cancer. DWI and SPIO-DWI show higher signal intensity lesion in Lt. lobe of liver (arrow).However, this lesion is masked by adjacent vascular structure on T2-weighted images and SPIO-enhanced T2\*-weighted images, which was confirmed metastasis by surgical pathology

## Conclusion

For assessment of hepatic metastases, pre-contrast DWI could provide more accurate information compared with SPIO-enhanced T2\*-weighted images and enhance the diagnostic accuracy by combination of both techniques. SPIO-enhanced DWI showed higher sensitivity in the detection of liver metastases