Low b-value Diffusion Weighted Imaging in the Evaluation of Hepatic Metastases from Neuroendocrine Tumor

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Purpose

T2-weighted fast spin-echo (FSE) and 3D dynamic contrast enhanced images are frequently used in the evaluation of patients with hepatic metastatic disease. Diffusion-weighted imaging (DWI) using low b-values has been suggested as an additional or alternative technique to increase the sensitivity for detection of metastases. DWI is sensitive to microscopic motion of water, and the use of low b-values reduces susceptibility artifacts, improves SNR, and may also sensitize the images to perfusion. The purpose of this paper is to compare DWI against traditional FSE sequences and dynamic contrast enhanced sequences for detection of the hepatic metastases from neuroendocrine tumor.

Methods

Twenty-eight patients with liver metastases from neuroendocrine tumors were evaluated with MRI using DWI, FSE, and dynamic contrast enhanced 3D SPGR (CE-LAVA (Liver Acquisition with Volume Acceleration)). DWI consists of a spin echo-echo planar pulse sequence (SE-EPI) with the following parameters: TR 2500 ms, TE 82 ms, 250 kHz receiver bandwidth, 7 mm slice thickness, gap of 1 mm, 160x256 imaging matrix, 2 excitations, parallel imaging (ASSET) with acceleration factor of 2, and b-values of 20 and or 100 s/mm2. Parameters for FSE sequences included: TR (based on respiratory rate, 5000-8000ms), TE 90ms, 20.8 kHz bandwidth, 6 mm slice thickness, gap of 1 mm, 256x224 imaging matrix, 2 excitations, and spectral fat saturation. Parameters for CE LAVA included: TR 3.6 ms, TE 1.6ms, 83.3 kHz receiver bandwidth, 50 sections with 3 mm thickness and 256x224 matrix. Images were retrospectively evaluated by two abdominal radiologists in consensus for lesion conspicuity, perceived SNR, and degree of image artifact, grading on a 5 point scale. The sequences were also ranked in order of preference.

Results

The data is summarized in Table 1. DWI had superior lesion conspicuity compared with FSE and CE-LAVA, although it also had lower scores for perceived SNR, and degree of image artifacts. The preferred sequence was CE-LAVA in 13/28 cases, DWI in 10/28 cases and FSE in 5/28 cases.

Table 1: Scale 1-5, 5 being excellent

	FSE	CE-LAVA	DWI
Lesion Conspicuity	3.46	3.96	4.29
Perceived SNR	4.5	4.84	3.25
Artifacts	4.04	4.12	3.11
Preferred Sequence	5/28	13/28	10/28

Discussion

Preliminary results are promising using DWI to evaluate hepatic metastases from neuroendocrine tumors. DWI had the best lesion conspicuity rating but exhibited more artifacts and less perceived SNR, perhaps due to the significant susceptibility artifacts inherent in EPI sequences (Fig. 1). This most likely is the reason CE-LAVA was preferred more often than DWI. Lesion conspicuity on CE-LAVA sequences was dependent on appropriate timing of image acquisition in relation to the contrast administration. In a few cases, the images were obtained too early or too late for optimal lesion enhancement despite the use of a timing bolus sequence in all patients. Particularly in such cases, DWI outperformed the CE-LAVA.

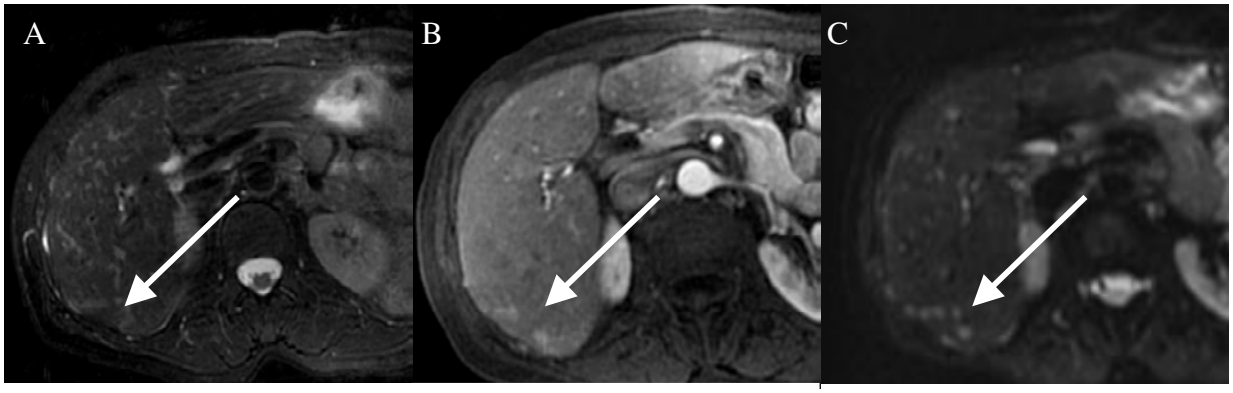

Fig. 1. Small neuroendocrine metastases (arrows) are poorly visualized on FSE (A) and CE-LAVA (B) images. Note improved lesion conspicuity on DWI (C).