

Focal liver lesion detection and characterization: comparison of SSEPI diffusion-weighted imaging with T2-weighted imaging; early experience.

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Introduction:

Current MRI techniques for assessing liver lesions include T2-weighted imaging (T2WI) and dynamic gadolinium-enhanced T1-weighted imaging. Accurate lesion detection and characterization are very important especially in patients with cirrhosis or cancer. Surgical and interventional treatment requires accurate knowledge of number, location, and size of liver lesions. Previous studies have shown that diffusion weighted imaging (DWI) may be helpful in characterizing liver lesions (1-3). Comparable image quality can be achieved with DWI compared with T2WI (4), but there are no reports comparing the detection and characterization of liver lesions using these sequences. Our objective was to describe our early experience using DWI to detect and characterize liver lesions, and to compare DWI with T2WI in terms of detection and characterization.

Methods:

We prospectively evaluated 21 patients (14 men, mean age 57.7 y) at 1.5 T (Magnetom Avanto and Sonata, Siemens Medical Solutions) with liver lesions. Only lesions ≥ 1 cm in greatest dimension were evaluated. Breath hold and non respiratory triggered (using a navigator echo) DWI was obtained using: TR/TE 1300-1400/67- 82, matrix 144-256 x 192-256; FOV 360-400 mm; slice thickness/gap 7/1.4 mm, 10-15 slices, 2-4 averages; $b = 0.50, 500 \text{ sec/mm}^2$; parallel imaging (GRAPPA) factor 2. Breath hold T2WI was performed using fast-STIR sequence (n=15) [TR/TE 3620-4350/85-86; 112x256, slice thickness/gap 8/1.6 mm, 20-30 slices, 1 average, GRAPPA 2]; and TSE T2WI (n=6) with frequency selective fat suppression [TR/TE 3570/101, 192x256, slice thickness/gap 8/1.6 mm, 1 average, GRAPPA 2]. Dynamic gadolinium enhanced images were obtained using a standard 3D GRE T1 (VIBE) sequence. Images were assessed by 2 independent readers for:

1. Lesion detection in each liver segment on DWI (b0-b50) and T2WI
2. Lesion characterization, using a 3-point scale (1: benign, 2: indeterminate, 3: malignant). The scale was based on morphology, signal, and signal change on DWI. Strong signal drop on b500 was considered to be benign; limited or no signal drop was considered malignant; and intermediate signal drop was considered indeterminate.

The reference standard for diagnosis was obtained with a consensus review by the two readers of all datasets (DWI, T2WI, and VIBE) as well as prior and follow-up MRI, and pathology.

Results:

Overall, 92 lesions (46 benign and 46 malignant, mean size 3.0 cm) were detected on the consensus reading. More lesions were detected with DWI compared with T2WI for both observers (see table), the additional lesions were seen in 6 patients. In particular, more malignant lesions were detected using DWI vs. T2WI (see table). Lesion characterization is shown in the table, benign lesions were slightly better characterized with T2WI, but malignant lesions were better characterized with DWI (at least for reader 2).

Lesion detection and characterization with DWI vs. T2WI (first number: number of lesions, second number: sensitivity, readers 1 and 2)

	Number of lesions detected with DWI (Sensitivity)	Number of lesions detected with T2WI (Sensitivity)	% lesions correctly characterized with DWI	% lesions correctly characterized with T2WI	Consensus reading
Benign lesions					
Reader 1	40 (86.9%)	38 (82.6%)	77.5%	84.2%	46
Reader 2	39 (84.7%)	37 (80.4%)	71.8%	83.7%	
Malignant lesions					
Reader 1	38 (82.6%)	28 (60.8%)	92.1%	89.2%	46
Reader 2	36 (78.2%)	27 (58.6%)	94.4%	77.7%	
Total					
Reader 1	78 (84.7%)	66 (71.7%)			92
Reader 2	75 (81.5%)	64 (69.5%)			

Discussion:

Our early experience shows that DWI improves the detection of liver lesions particularly of malignant lesions, by improving lesion conspicuity when compared to conventional T2WI. Lesion characterization of malignant lesions is also improved when compared with T2WI. These preliminary data suggests that DWI may potentially replace T2WI for liver imaging, particularly in patients with cirrhosis.

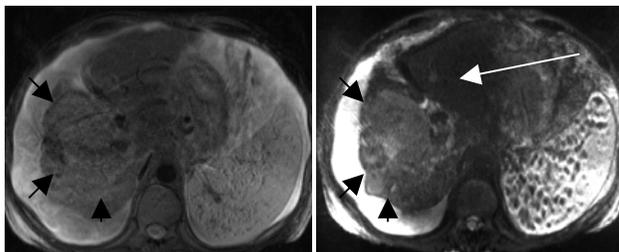


Fig 1: T2WI and DWI (b50) both show a large HCC in a cirrhotic patient located in the right lobe of the liver which is more conspicuous on DWI (short arrows). In addition, a small satellite left lobe nodule is only seen on DWI (long arrow).

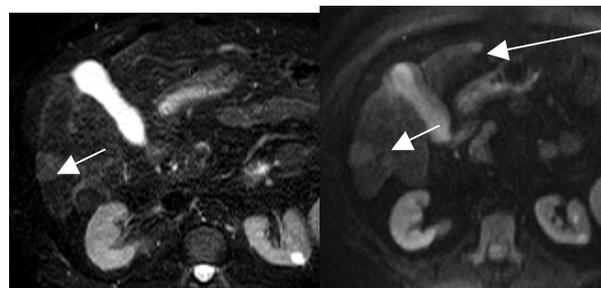


Fig 2: T2WI and DWI (b50) both show a lesion in segment 6 of this cirrhotic liver (short arrow), but an additional lesion in segment 3 is seen only on DWI (long arrow).

References:

1. Ichikawa T et al. AJR 1998;170 (2):397-402.
2. Kim T et al. AJR 1999;173 (2):33-398.
3. Taouli B et al. Radiology 2003;226 (1):71-78.
4. Hussain SM et al. J Magn Reson Imaging 2005;21:219-225.