Diffusion-weighted imaging (DWI) - by means of apparent diffusion coefficient (ADC) calculation - can be used for in vivo quantification of the combined effects of capillary perfusion and diffusion. With the advent of echoplanar imaging (EPI), DWI of the abdomen has become possible with fast imaging times minimizing the effect of gross physiologic motion from respiration and cardiac movement. Several studies have investigated the use of DWI for liver [1-4], kidney [5-8], and prostate [9].

**DWI Technique:** We use breath-hold single SS EPI sequences to obtain diffusion-weighted images on 1.5 T scanners with phased-array coils, short TR (around 1300 msec) to decrease acquisition time, and minimum TE to improve SNR. We use parallel imaging to decrease distortion and ghosting artifacts and to obtain better SNR [10]. We typically use b-values between 400-800 sec/mm².

**DWI for liver imaging:**
DWI can be used both for liver lesion detection and characterization. By using a small b-value < 100 sec/mm², black-blood images can be achieved in the liver, and better lesion conspicuity could be obtained [11]. Our preliminary experience showed a better sensitivity for liver lesion detection using DWI with a b-value of 50 sec/mm² when compared to conventional T2-weighted imaging (sensitivity of detection of lesions > 1 cm was 87.7% for DWI vs. 70.1% for T2). However, DWI has been mostly used for liver lesion characterization [1-4]. Most studies have found higher ADC values in benign lesions, as compared to malignant lesions, with some degree of overlap. We demonstrated that a threshold ADC value <1.5 x 10⁻³ mm²/sec for diagnosis of malignant liver lesions would result in a sensitivity and specificity of 84% and 89% [4].

Diagnosis of liver fibrosis-cirrhosis: Several studies have shown that decreased ADCs in liver cirrhosis versus non-cirrhotic liver [1-4, 12], which may be related to restricted water diffusion in relation with fibrosis. In our experience, like others [13], we demonstrated that DWI can be used to quantify different degrees of liver fibrosis in patients with chronic hepatitis [14]. High b-value > 300 sec/mm² is needed to show the differences between different degrees of liver fibrosis.

**DWI for renal imaging:**
DVI could be used for better characterization of diffuse renal disease [6-8]. For example, two studies [7, 15] showed decreased ADC in chronic renal failure. In addition, a recent study showed restricted diffusion in malignant renal lesions, as opposed to benign lesions [16]. We showed also a significant decrease of ADC values of cystic renal lesions with increasing degrees of complexity.

**Future improvements in DWI:** Image quality of DWI is still limited, related to low resolution and limited SNR. A non-breath hold DWI sequence using navigator echo correction improves the image quality and lesion to liver contrast. In addition, signal gain with 3T will likely also improve image quality. Several applications in body imaging are also under way, such as whole body diffusion imaging in oncologic patients.
References: