Evaluation of Hepatic Focal Lesions Using Diffusion-weighted MR Imaging: comparison of apparent diffusion coefficient and intravoxel incoherent motion derived parameters

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Target audience: audience who are interested in body DWI, intravoxel incoherent motion model

PURPOSE: To determine whether parameters obtained from intravoxel incoherent motion (IVIM)-diffusion-weighted imaging (DWI) using multiple b-values can improve characterization of common focal liver lesions (FLLs), compared with the apparent diffusion coefficient (ADC).

MATERIALS AND METHODS: Our institutional review board approved this retrospective study, and informed consent was waived. One hundred forty two patients with 169 FLLs underwent liver MR including IVIM-DWI with multiple b factors at 3.0T. ADC total and IVIM-DWI-derived parameters including true diffusion ($D_t$), pseudodiffusion ($D_p$), and perfusion fraction ($f$) were calculated for each lesion and compared using dedicated software.

RESULTS: $D_t$ and ADC total were significantly lower in malignancies (0.95±0.21, 1.14±0.24, ($\times10^{-3}$mm$^2$/sec)) than in benign FLLs (1.61±0.34, 1.72±0.37, ($\times10^{-3}$mm$^2$/sec)). In the differential diagnosis of malignancies from benign lesions, $D_t$ (Az: 0.971) showed better diagnostic performance than ADC total (Az value: 0.933) (p<0.0005). $D_t$ (Az: 0.961) also showed better diagnostic performance than ADC total (Az: 0.919) in differentiating hypervascular malignancies from benign hypervascular FLLs (p<0.0005). In addition, $D_p$ and $f$ were significantly higher in hypervascular FLLs (35.74±20.08($\times10^{-3}$mm$^2$/sec), 28.14±11.82 (%) than hypovascular FLLs (21.87±13.8($\times10^{-3}$mm$^2$/sec), 12.2±5.92 (%)).

DISCUSSION: We also believe that $D_t$ may provide more accurate information regarding the cellularity of FLLs, which would be useful in diagnosing hypervascular malignancies compared with conventional ADC; in conventional ADC maps, perfusion contribution in hypervascular malignancies leads to increasing ADC values and may lower the diagnostic performance of DWI for characterization of FLLs.

CONCLUSION: $D_t$ provided better diagnostic performance than ADC total in differentiating benign from malignant lesions. $D_p$ and $f$ were significant parameters for diagnosing hypervascular FLLs.

A 3.2cm surgically confirmed HCC in 59-year-old man. The mass (arrow) shows a high SI on DWI (b factor, 800 sec/mm$^2$) (a). The tumor showed slightly lower ADC value than surrounding liver parenchyma on ADC total map (b), and $D_t$ was obviously lower than liver parenchyma on $D_t$ map (c).