

Quantification of IVIM diffusion parameters of HCC at 3T: Preliminary experience.

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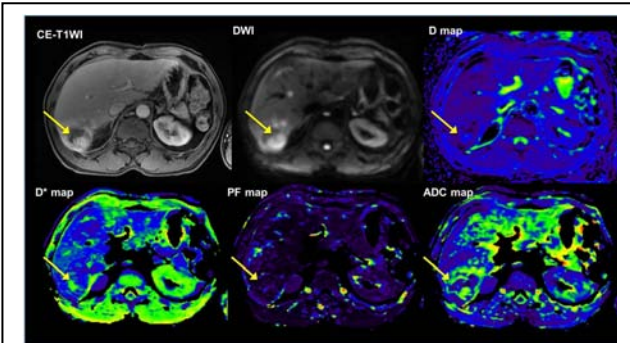
Target Audience: Radiologists and physicists interested in diffusion and body functional imaging.

Purpose: Intravoxel Incoherent Motion (IVIM) DWI is a promising tool for characterization of liver disease (1, 2). The few published studies used a 1.5T system. The aim of this study is to quantify IVIM diffusion parameters of hepatocellular carcinoma (HCC) and background cirrhotic liver at 3T and to evaluate the correlation between IVIM parameters and degree of tumor necrosis in treated HCCs post TACE (transarterial chemoembolization).

Table 1	D	D*	PF	ADC
HCC (n=79)	1.12 ± 0.24	41.94 ± 39.93	21.20 ± 10.71	1.37 ± 0.28
Liver (n=46)	1.01 ± 0.17	45.95 ± 39.93	14.35 ± 6.00	1.15 ± 0.15
p	<0.0001	0.62	<0.0001	<0.0001
HCC ≥50% necrosis (n=27)	1.26 ± 0.22	30.45 ± 25.25	18.46 ± 9.52	1.510±0.283
HCC < 50% necrosis (n=52)	1.05 ± 0.22	47.90 ± 54.61	22.62 ± 11.10	1.30 ± 0.25
p	0.0002	0.36	0.10	0.00133
Necrotic component (n=41)	1.29 ± 0.25	27.10 ± 24.33	18.68 ± 9.26	1.56 ± 0.33
Viable component (n=57)	1.05 ± 0.23	43.0 ± 53.33	22.06 ± 11.15	1.31 ± 0.27
p	<0.0001	0.20	0.19	<0.0001

Table 1: Mean ± SD values of IVIM parameters and ADC (ADC, D and D* ×10⁻³ mm²/sec, PF in %) in HCC and cirrhotic liver.

Methods: In this retrospective IRB approved study, 46 patients with cirrhosis and HCC (M/F 22/24, mean age 61 y) who underwent IVIM DWI (free breathing SS EPI DWI using 16 b-values 0-800 sec/mm²) and contrast-enhanced imaging at 3T (GE MR750) were evaluated. Lesions were evaluated by 2 observers in consensus. Tumor necrosis was evaluated on subtracted images. Signal intensity was measured in tumors with a size > 1.0 cm and background liver. Using Bayesian bi-exponential fitting and mono-exponential fitting with 16 b-values, true diffusion coefficient (D), pseudo-diffusion coefficient (D*), perfusion fraction (PF) and apparent diffusion coefficient (ADC) were calculated in HCC and liver parenchyma. IVIM and ADC metrics were compared between HCC and background liver and between HCC with less than 50% vs. those with more than 50% necrosis, and between viable and necrotic



54 year old male patient with HCC post TACE. There is a partially necrotic HCC in the right lobe (arrows). CE-T1WI shows enhancing viable component, which has different diffusion characteristics compared to necrotic component.

tumors components.

Results: 79 HCCs (mean size 2.6 cm, range 1-14 cm) were evaluated in 46 patients, including 41 untreated and 38 treated tumors post TACE. HCCs demonstrated significantly higher D, PF and ADC compared to background liver (Table 1). HCCs with more than 50% necrosis demonstrated higher D and ADC compared to HCC with <50% necrosis. There were significant differences in D and ADC and no significant difference in PF between necrotic components and viable components of treated HCCs. There were moderate significant correlations between each of D and ADC and tumor necrosis (Table 2). Examples of parametric maps are shown in the Fig.

Discussion: We observed that IVIM parameters of HCC were different than those of cirrhotic liver. Our study is the first mentioning the correlation between tumor necrosis and IVIM parameters in HCC at 3T. We showed a stronger correlation between D and necrosis, compared to ADC and PF. ADC is a composite coefficient that includes both microcirculation and pure diffusion. Our results indicate that the ADC in necrosis is more affected by true diffusion D than by PF.

Conclusion: IVIM parameters are higher in HCC compared to cirrhotic liver, and can be used to assess HCC response to therapy.

Table 2	D	D*	PF	ADC
r	0.433	-0.145	-0.279	0.342
p	<0.0001	0.202	0.0126	0.00201

Pearson correlations between IVIM parameters and % of tumor necrosis assessed with subtraction.

References:

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