Primary Study of MR Diffusion Tensor Imaging in hepatocellular carcinomas

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Introduction

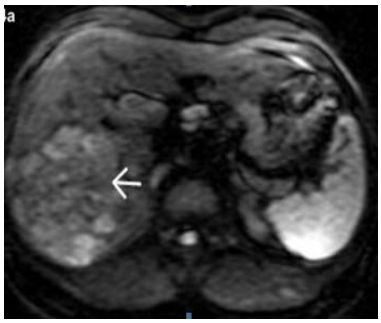
Hepatocellular carcinoma (HCC) accounts for 70%- 85% of the worldwide total liver cancer burden. Diffusion tensor imaging (DTI) can noninvasively provide functional information that indirect assessment of cellularity and the heterogeneity of the biology of HCC. An evaluation of the clinical effectiveness of using DTI to study HCC has thus far not been reported, moreover, no reports on the optimized parameters of liver DTI have been published. Therefore, the purpose of this study is to determine a set of optimized parameter and the feasibility of evaluating HCC using DTI.

Methods and Material

Fifteen healthy volunteers and eighteen HCC patients were consented to an abdomen DTI examination on a 3.0 T MRI scaner. An optimal set of DTI parameters was obtained from a group of fifteen volunteers with multiple b-values (100, 300, 500, and 800 s/mm^2) and various diffusion-encoding directions (NED=6, 9, and 12) using a respiratory-hold single-shot gradient echo-planar sequence. Two radiologists independently scored the image quality (IQ). Patients with HCC underwent conventional MRI and DTI with the optimized parameters. Apparent diffusion coefficient (ADC) maps and fraetional anisotropy (FA) maps were generated, and average ADC and FA values were measured. The differences of FA and ADC values between liver with HCC and heathy liver were compared by independent-samples t tests.

Result and Discussion

There was no significant change in liver IQ with increased NED (P>0.05), whereas the liver IQ decreased significantly with increased B values (P<0.05). NED=9 and B value = 500s/mm2 were chosen as the optimal set of parameters for liver. Using the new optimized DTI sequence, ADC value of HCC lesions were significantly lower than those of normal right liver (1.30+ 0.34 vs 1.52+ 0.27×10−3mm2/s, P=0.013) and the mean FA value of HCC lesions was significantly higher than normal right liver (0.42+ 0.11vs 0.32 + 0.10, P=0.004). The NED and the choice of B-values in the data are two key factors in DTI data acquisition, both the quantitative and qualitative aspects have to be considered, we recommend the use of NED=9 with B-value =500 s/mm2 for liver DTI at 3.0 T. Our finding represent that the diffusion in HCC lesions should be restricted and anisotropic, which points out low ADC value and high FA value provide useful information about celluar changes induced by HCC. In conclusion, DTI can detect cellular changes induced by HCC in a typical clinical setting, HCC lead to higher FA values and lower ADCs on DTI than healthy liver.



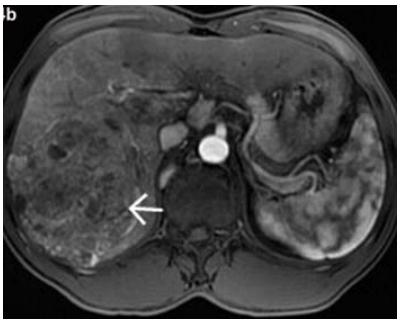


Fig 1a: HCC DTI imaging of NED=9 and B-value =500 s/mm^2**;** 1b: HCC dynamic gadolinium-enhanced imaging

Parameter	HCC lesions	Normal liver	P Value
ADC value	1.30 (0.34)	1.52 (0.27)	**0.013***
FA value	0.42(0.11)	0.32 (0.10)	**0.004***

Table1: Comparison of the FA and ADC value between HCC lesions and normal liver

References:

1 Erturk SM, Ichikawa T, Kaya E,et al. Diffusion tensor imaging of cysts, hemangiomas, and metastases of the liver. Acta Radiol 2013; 55:654-660.