

# Evaluated angiogenesis and its maturation in hepatocellular carcinoma by using diffusion-weighted imaging at 3.0 Tesla

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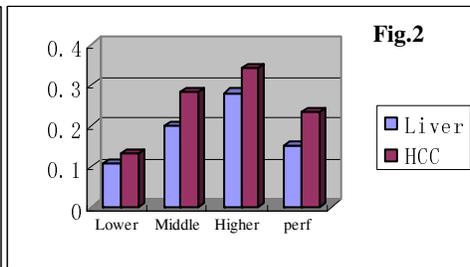
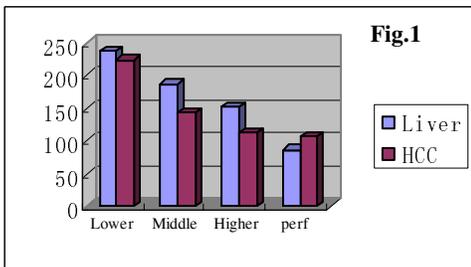
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**Objective** To investigate the significance for assessment the angiogenesis and its maturation in hepatocellular carcinoma (HCC) by using DWI.

**Material and methods** DWI scanning was carried out before operation in 31 patients of HCC proved pathologically. The apparent diffusion coefficient (ADC) and exponential apparent diffusion coefficient (eADC) value of liver and HCC in three b value groups with low (100s/mm<sup>2</sup>, 200s/mm<sup>2</sup> and 300s/mm<sup>2</sup>), middle (400s/mm<sup>2</sup> and 600s/mm<sup>2</sup>) and high (800 s/mm<sup>2</sup>, 1000 s/mm<sup>2</sup> and 1200 s/mm<sup>2</sup>) b value were obtained respectively. According to the difference in ADC value with low b value and high one, the perfusion ADC and eADC(ADC<sub>perf</sub> and eADC<sub>perf</sub>) value was calculated. After operation, the continuous slices were stained with hematoxylin-eosin(HE) and immunohistochemistry of five antibodies against VEGF, Flk-1, PCNA, CD34 and alpha smooth muscle actin(SMA). The expressions of the VEGF and the Flk-1, and PCNA index (PI) were also evaluated. According to CD34 and SMA staining, some vascular parameters were counted by a computed analysis system including the vessel number, mean vessel area, total vessel area, circumference, diameter, distance between adjacent vessels (DAV), and variety index of microvessels and mature vessels. In addition, the little arteries and veins, the ratio of the number of the artery or vein to the mature vessel, mature vessel index and mean perfused fraction (mPF) were also calculated. All these vessel parameters were compared with the results from DWI.

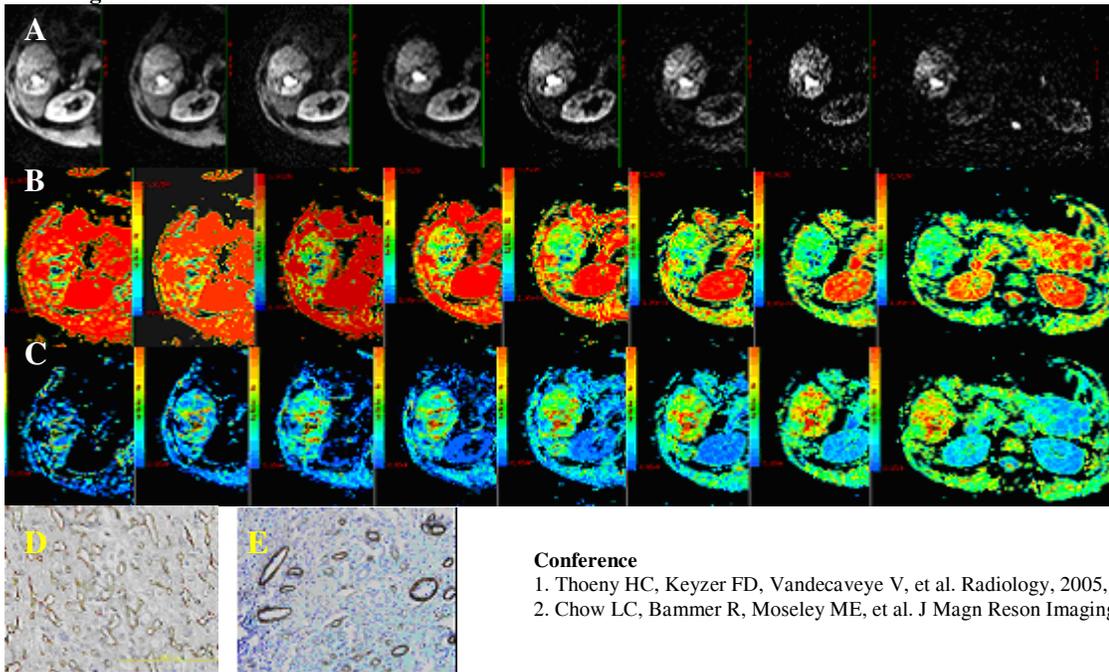
**Results** The ADC and eADC values became stable when higher b values. Both the ADC and eADC values in the groups with lower or middle b value showed significant correlations with the mean area microvessel and mature vessel ( $P<0.05$ ). The eADC<sub>perf</sub> was correlated negatively with the numbers of little artery ( $P=0.048$ ,  $r=-0.558$ ), and so was the correlation between ADC<sub>perf</sub> and the mean area of microvessel ( $P=0.038$ ,  $r=-0.628$ ).

**Conclusion** The eADC<sub>perf</sub> with lower b value may be used to evaluated little artery in HCC as a simple index.



**Fig.1:** Bar chart shows the differences in ADC value of liver and HCC among four groups with lower, middle, higher b values and ADC<sub>perf</sub>.  
**Fig.2:** The bar chart about the differences in eADC value among the groups as Fig.1.

**Fig.3:**



**Fig.3:** A 43-year-old male case with HCC in right lobe. The images are DWI images(A), ADC maps (B) and eADC maps (C) with the b values 100s/mm<sup>2</sup>, 200 s/mm<sup>2</sup>, 300 s/mm<sup>2</sup>, 400s/mm<sup>2</sup>, 600 s/mm<sup>2</sup>, 800 s/mm<sup>2</sup>, 1000 s/mm<sup>2</sup> and 1200 s/mm<sup>2</sup> respectively. **D:** There are many microvessels with large diameter in the margin. **E:** Many mature vessels appear in the margin, and most vessels are little arteries.

**Conference**

1. Thoeny HC, Keyzer FD, Vandecaveye V, et al. Radiology, 2005, 237(2): 492-499.
2. Chow LC, Bammer R, Moseley ME, et al. J Magn Reson Imaging, 2003, 18(3): 377-382.