

Diffusion-weighted MR imaging of hepatocellular carcinoma with single-shot echo-planar imaging : Assessment of early response to transcatheter arterial chemotherapy embolism(TACE)

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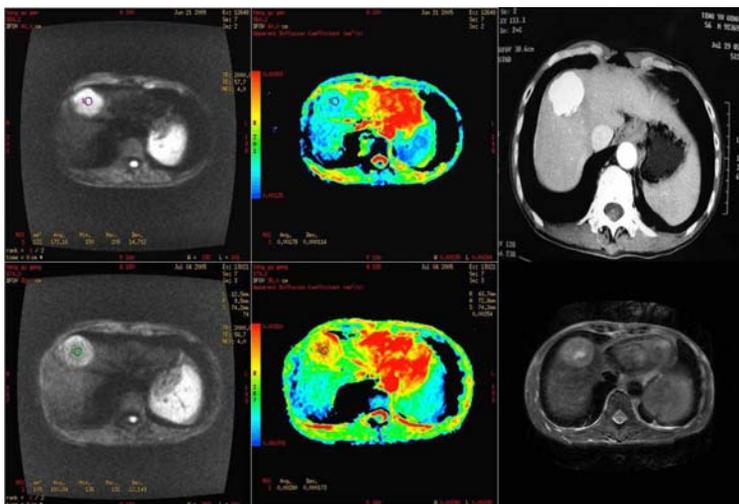
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Introduction: Diffusion-weighted magnetic resonance imaging (DWMRI) enables noninvasive characterization of tissue biology on the basis of their water diffusion properties. DWMRI should be sensitive to reveal several physiologic and morphologic characteristics of tissue associated with the slow or fast diffusion of water molecules. These characteristics include cell density and tissue viability, as well as changes in tissue in response to various treatments. In this work, we explore to study the feasibility of using DWMRI with breath-hold for upper abdominal organ like liver and to evaluate the use of DWIMRI for early assessment of hepatocellular carcinoma(HCC) response to transcatheter arterial chemoembolism (TACE).

Materials and Methods: 30 consecutive patients with 43 HCC confirmed by biopsy were examined with MR imaging. DWMRI was performed with single-shot echo-planar sequence, accomplished within 16 seconds by breath-hold (matrix:128×128; TR/TE range: 2000/46.7-78.1ms; slice thickness: 8mm; inter-slice gap: 2mm; b value (200,400,600,1000,2000). Apparent diffusion coefficient (ADC) maps were obtained in all cases before and 1 week after TACE, and values were recorded by placing regions of interest(ROI) on the viable tumors and necrotic regions, as well as over the entire area of the mass seen on the axial image with the maximum lesion size. The conventional T2WI with fat-suppressed, unenhanced and contrast-enhanced T1WI were also done with 8 phased array torso coil.

Results: ADC values were greater in unenhanced (presumed necrotic) tumor portion than in enhanced (presumed viable) and changed in inverse proportion to b values. The mean ADC values of viable, necrotic and entire tumor area were $1.15 \times 10^{-3} \pm 0.03 \text{ mm}^2/\text{sec}$, $2.12 \times 10^{-3} \pm 0.07 \text{ mm}^2/\text{sec}$, $1.54 \times 10^{-3} \pm 0.03 \text{ mm}^2/\text{sec}$ respectively, indicating significant difference of the ADC value between the viable and necrotic tumors in untreated tumor. ADC values significantly increased of viable tumor versus necrotic one in early stage after TACE($1.88 \times 10^{-3} \pm 0.04 \text{ mm}^2/\text{sec}$ for viable tumor and $2.20 \times 10^{-3} \pm 0.06 \text{ mm}^2/\text{sec}$ for necrotic tumor, $p < 0.05$ paired t-test), while The values over entire area of axial maximum size had no significantly changed after treatment ($1.62 \times 10^{-3} \pm 0.05 \text{ mm}^2/\text{sec}$ $p > 0.05$).

Conclusions: Breath-hold DWMRI with SE-EPI is clinically available in liver examination. Conventional CT and MRI have limitation in quantitatively depict necrotic changes of tumor, which is essential in determining prognosis. DWMRI can detect the degree of tumor viability during the treatment.. However, challenges still exist particularly in determination the ROI into the tumor, or in refinement of the sequence for small lesions and patients who can not hold breath.



Reference:

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- [2] Geschwind JF, Artemov D, Abraham S, et al. *J Vasc Interv Radiol* 2000; 11:1245-1255
- [3] Yiftach R, Thomas T, Genady K, et al. *Radiology* 2004; 232: 685-692

Figure: left column: The signal intensity of tumor dimmed after TACE on DW images
middle column: ADC value increases from $1.78 \times 10^{-3} \text{ mm}^2/\text{sec}$ to $2.8 \times 10^{-3} \text{ mm}^2/\text{sec}$
Right column: CT scan show good retention of lipiodol while conventional T2WI has no conspicuous changes after treatment