Breath-hold perfusion of hepatic malignancies using dynamic susceptibility contrast-enhanced echo-planar imaging: A preliminary study

W. bin[1], P. weijun[2]

[1]dignostic radiology, cancer hospital, shanghai, shanghai, China, People's Republic of, [2]cancer hospital, shanghai, shanghai, China, People's Republic of

Introduction: Dynamic susceptibility contrast-enhanced magnetic resonance imaging (DSCMRI) has been used in nervous system for cerebral infarction and brain neoplasm. When a bolus of MR contrast agent pass through the intravascular system, producing local magnetic susceptibility (T2*) effects with a transient signal drop. The degree of the signal drop during the first pass (i.e. perfusion phase) is directly proportional to the concentration of contrast agent in the blood. A graph of transient signal drop versus time can be used to compute hemodynamic blood volume map reflecting the microvascularity (capillary level) of the tissue and detecting hemodynamic blood changes after treatment such as transcatheter arterial chemoembolization(TACE) and anti-angiogensis therapy. In this pilot work, we investigate the feasibility of doing this procedure in abdominal regions, and focus on the quantitative analysis of time-intensity curves as well as the enhancement patterns with further assessment of effectiveness after treatment.

Materials and Methods: 10 consecutive patients with hepatic tumors were enrolled in this examination with lesions histopathologically confirmed by fine needle biopsy(FNA) prior to MR imaging. MR perfusion imaging was performed before and 1 week after TACE on 1.5T MR whole-body scanner(Twinspeed Signa Excite GE) by the gradient echo version of echo planar(TR, 2000ms; TE, 80ms; number of phases, 40; matrix, 128×128; FOV,36cm; slice thickness, 8mm; inter-slice gap, 2mm; number of excitation(NEX) 1.The acquisition time was 1 minute 20 seconds and patients were asked to hold one's breath as long as they could to reduce respiratory motion artifacts. Finally, post-contrast axial and coronal T1WI spin echo images were acquired. The whole procedures were accomplished within half an hour.
The perfusion sequence was started as soon as the bolus injection of 0.2mmol/kg of gadopentetate dimeglumine Gd-DTPA(Magnevist, Schering, German) by an MR compatible power injector and the injection rate was 4ml per second, with 20ml saline flushed subsequently. The post processing and perfusion map were generated via commercially available software named Functool2 after transfering to the Advantage Windows Workstation(version4.0, General Electric Medical Systems).

Results: All patients had good toleration to the procedure with no adverse reactions. The hepatic lesions appeared hypointense on T1WI spin echo sequence and mildly hyperintense on fat-suppressed T2WI fast spin echo sequence. Most lesions displayed heterogeneous on post-contrast images. The HBV maps were successfully reconstructed in all patients and all lesions demonstrated hyper-perfusion on the HBV maps except in areas of necrosis. Signal-time curve showed sharp drop of MR signal in the perfusion phase compared with pre-contrast baseline. The extent of signal intensity decrease and slope of perfusion curve showed meaningful difference after therapy.

Conclusions: As a noninvasive examination, DSCMRI plays an important role in evaluating the vascularity of hepatic malignances, and providing some supplemental information like oxygen status of tumor as well. The versatile utility of this procedure also has the potential to the assessment of the effectiveness of TACE, making invasive methods seldom necessary, such as angiography.

Reference:

[1] Jimmy H. M, Edmund Y. K, Sau H.L, et al *Clinical Imaging* 1999; 23:190-194
[2] E.Y.K. Tsui, J. H.M. Chan, Y.K. Cheung, et al *Clinical Imaging* 2000; 24:210-216
[3] Kjell A. K, Jana R, Jari V. et al *Radiology*;216:545-553

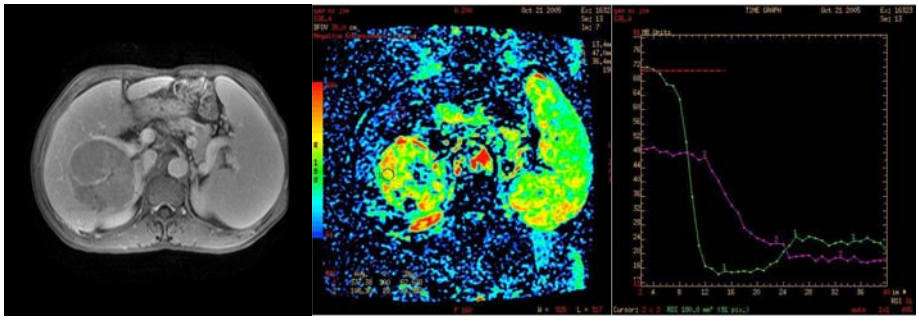

Fig1: T2* first-pass perfusion curve, acquired with HBV map. Green curve: ROI within the tumor; purple one: ROI within the uninvolved liver parenchyma.

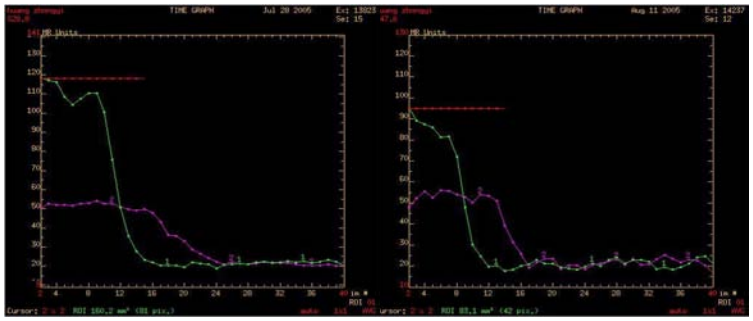

Fig2: The changes within the tumor of signal intensity and maximum slope of decrease by perfusion imaging indicate vascularity change after TACE.