

# Evaluating MRI T1rho Contrast in Hepatic cell carcinoma: initial study

Jiayu Sun<sup>1</sup>, Rui Xia<sup>1</sup>, Fabao Gao<sup>1</sup>, Jie Zheng<sup>2</sup>, and Bing Wu<sup>1</sup>

<sup>1</sup>Department of Radiology, West China Hospital, Sichuan University, Chengdu, Sichuan, China, <sup>2</sup>Mallinckrodt Institute of Radiology, Washington University School of Medicine in St. Louis, St. Louis, Missouri, United States

## Introduction:

Hepatic cell carcinoma accounts for 90% of primary liver neoplasms, represents the fifth most common cancer in the world, and is responsible for up to 1 million deaths annually worldwide. Despite the prevalence of the pathological grading of hepatic cell carcinoma, the gold standard to diagnose remains limited to liver biopsy. Yet, liver biopsies are invasive, associated with high complication rates, poor reproducibility. All of these shortcomings mandate a new reliable and noninvasive clinical tool, able to objectively diagnose. T1  $\rho$ -based MR imaging is a technique that has been previously shown to be dependent on the exchange processes that are associated with water protons and other exchangeable protons on macromolecules (-OH and-NH) and residual static dipolar coupling between protons and macromolecules. Quantifying relaxation times in pathology provides a measure of disease status and its progression potentially independent of inter- and intrascan variability.

## Objective:

To prospectively evaluate the value of MRI spin-locking T1rho contrast in the detection of hepatic cell carcinoma.

## Materials and methods:

All studies were approved by the local ethical committee. Patients (n=6, 5M) with hepatic cell carcinoma confirmed on liver biopsy were scanned on a Siemens Trio 3.0 T (Siemens Medical Solutions, Germany) whole body scanner using a dedicated abdominal coil. A series of multi-slice True-FISP images in 3 orthogonal planes to locate the liver and tumor were acquired. Axial T2 weighted images (TR 2700ms, TE102 ms; spatial resolution 1.6mm x 1.3mm x 6mm) were acquired after the scout scan. A novel B0- and B1-insensitive multi-contrast T1rho imaging with segmented trueFISP readout was performed on the slice of the central tumor during end-inspiratory breath holding. The sequence acquired two images (image1 and image2) at different spin-locking times (20 and 80 ms) within one breath-hold. The spin locking frequency was 298 Hz and other imaging parameters included TR/TE= 3.8/1.9 ms, flip angle = 55°, spatial resolution = 1.3 mm x 1.3 mm x 5 mm, and segment = 21. The ratio of image1 to image2 and T2w signal intensities were obtained by ROI measurements in the center of tumors and surround normal liver tissues.

## Results:

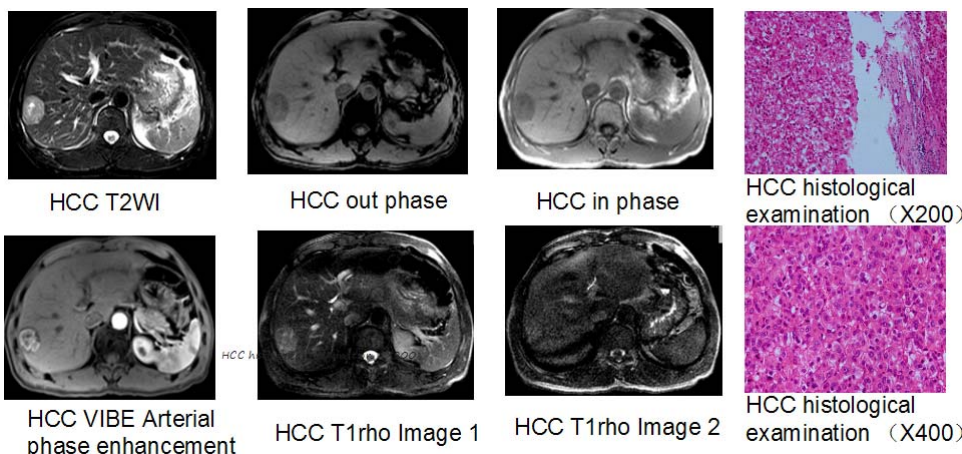
The mean ratio of the normal liver was significantly lower than that of liver tumors ( $1.6 \pm 0.3$  versus  $2.3 \pm 0.4$ ,  $P < 0.05$ ). In contrast, mean signal intensity of T2WI in normal tissue was higher than that of hepatic tumors ( $251.8 \pm 21$  versus  $113.8 \pm 21.9$ ,  $P < 0.05$ ).

## Discussion:

Correlation between mean T1  $\rho$  and pathological grading was excellent in all cases for liver tumors. T1rho improved discrimination of normal and malignant tissue compared to previous results at higher frequencies.

## Conclusion:

T1rho contrast reflects altered interactions of macromolecules in tumor cells. The longer T1rho ratio in tumor tissue may add additional dimension for staging tumors and treatment monitoring.



## Reference:

1. Witschey WR, Borthakur A, Elliott MA, et al. T1rho-prepared balanced gradient echo for rapid 3D T1rho MRI. *J Magn Reson Imaging*. 2008. 28(3): 744 - 754.
2. Martino AF, Damadian R. Improved discrimination of normal and malignant tissue using 1H NMR relaxation time measurements at 2.18 MHz. *Physiol Chem Phys Med NMR*. 1984; 16(1): 49-55.