Multiarterial Phase Dynamic MR Imaging of the Whole Liver Using LAVA at 3T

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Introduction: Recently, several investigators have reported the usefulness of multiarterial phase dynamic MR imaging in improving the detection rate of hypervascular hepatocellular carcinomas (HCCs) [1], or differentiating between HCCs and pseudolesions [2]. The purpose of this study was to explore the efficacy of multiarterial phase dynamic MR imaging of the whole liver using LAVA (Liver Acceleration Volume Acquisition) at 3T to depict small early enhanced hepatic lesions as well as hepatic arterial system.

Materials and Methods: Nine patients with small early enhanced hepatic lesions were included in the study. MRI was performed on a 3-T unit (SIGNA EXCITE, GE Healthcare) using an 8-channel torso phased-array coil. As part of multiphasic contrast-enhancement dynamic MR imaging, multiarterial phase (four phases) imaging of the whole liver during a single breath-hold was performed in all patients using LAVA. The imaging parameters were as follows: scan plane, axial; TR/TE, 2.8/1.2 msec; inversion time, 5.0 msec; flip angle, 15; receiver bandwidth, 125 kHz; matrix, 270 x 124; FOV, 38-40 cm; slice thickness, 4.4 mm; locations per slab, 44. Array spatial sensitivity encoding technique (ASSET, the GE implementation of SENSE) was automatically employed, and the phase acceleration was 3 Ph. Zero fill interpolation processing (ZIP x 2) was used and thus a total of 80 sections covering the whole liver were acquired during 9 sec. After obtaining unenhanced images, multiphasic (nine phases) contrast-enhancement dynamic MR imaging of the entire liver was performed after an intravenous bolus injection of 0.1mmol/kg of gadopentetate dimeglumine flushed by 20 ml normal saline by means of a power injector at a rate of 3 ml/sec. The scanning delay was 10 sec, 60 sec and 180 sec after the beginning of the contrast material injection for multiphase scanning. The previous four phases during a single breath-hold (35 sec) were acquired for multiarterial phase imaging. First phase images were used as masked images for subtraction, so a test bolus injection or a bolus tracking technique was not used and the scanning delay of 10 sec earlier than usually advocated was used in this study. The subtraction images were reconstructed using 3D maximum intensity projection (MIP).

Results: Optimal images of four arterial phases were obtained in all patients who can suspend respiration for 35 sec (Fig. 1). Three patients who were not expected to hold breath long enough also got diagnostic quality images of three phases (26 sec). The main branches of hepatic artery were clearly displayed on the MIP images of first subtraction (second phase – first phase) (Fig. 2). Early enhanced hepatic lesions and main branches of portal veins were depicted as well as hepatic arterial system on the MIP images of second or third subtraction (third or fourth phase – first phase) (Fig. 3).

Conclusion: Multiarterial phase dynamic MR imaging of the whole liver during a single breath-hold using LAVA was a useful modality in demonstrating hepatic arterial and/or portal system. The contrast-enhancement dynamic process of small early enhanced hepatic lesions and their relationships with the hepatic vascular systems can be well depicted with increased spatial and temporal resolution.

References: [1] Yoshioka H, et al. JMRI 2002; 16: 259-266. [2] Ito K, et al. AJR 2004; 183: 699-705.

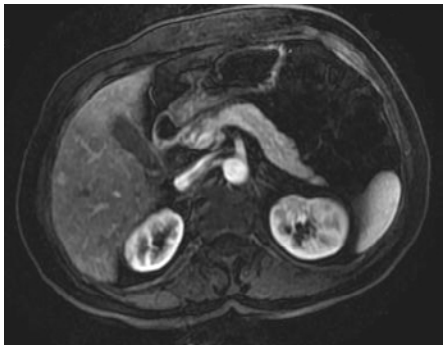

Fig. 1

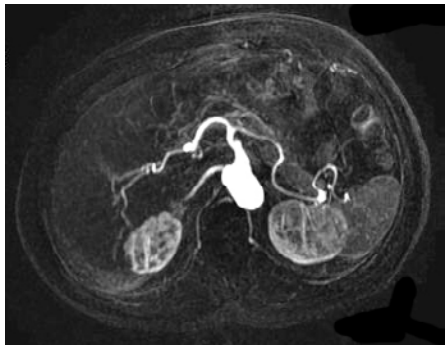

Fig. 2

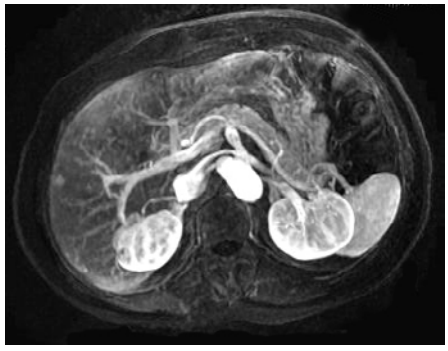

Fig. 3