A fat suppressed, T1-weighted 3D gradient echo (GRE) sequence, such as LAVA-Flex (GE Healthcare), is used for contrast-enhanced imaging. LAVA-Flex supplies high speed and high resolution T1-weighted 3D GRE imaging with a high signal-to-noise ratio (SNR) and high quality fat suppression. Using a 3.0T MR system is advantageous for contrast-enhanced imaging due to a higher SNR than 1.5T, which enables faster scanning by using a larger reduction factor for parallel imaging. Our protocol using GE Signa HDxt 3.0T for contrast-enhanced imaging of the liver is introduced.

At Osaka University, we conduct all contrast-enhanced imaging of the liver on a GE Signa HDxt 3.0T MR system. Following our protocol, we obtain dual-echo (in-phase and out-of-phase) and fat suppressed T1-weighted images before contrast enhancement. LAVA-Flex allows us to simultaneously obtain water, fat, in-phase, and out-of-phase T1-weighted 3D GRE images. With LAVA-Flex, the fat suppressed T1-weighted images are extremely good quality (Figure 1).

After administration of a liver-specific contrast agent, we perform the LAVA-Flex sequence for dynamic multiphasic (arterial, portal venous, and late phase) and hepatocyte phase imaging in the axial plane (Figure 2). Arterial phase imaging is performed just after confirming arrival of contrast material at abdominal aorta by using the MR SmartPrep bolus tracking program from GE Healthcare; portal venous, late phase, and hepatocyte phase imagings are performed one, three, and 20 min after the injection, respectively. In the hepatocyte phase, coronal and sagittal images are also obtained with LAVA-XV using ARC, a parallel imaging technique that enables faster imaging in the coronal and sagittal planes without misregistration artifact and with a larger reduction factor than LAVA-Flex (Figure 2).

Use of a contrast agent does not affect image contrast on T2-weighted images, therefore, these are obtained using SSFSE (single shot fast spin echo) and respiratory triggered fat suppressed FSE between late phase imaging and hepatocyte phase imaging to shorten the examination time. However, because contrast excreted in the bile causes T2-shortening of the bile and deteriorates the depiction of bile ducts using MRCP, this sequence should be obtained before injecting the contrast agent.
Dr. Tonsok Kim, MD, is associate professor of Radiology and chief, Division of Abdominal Radiology, at Osaka University Hospital. Dr. Kim has gained much experience using 3.0T MRI for abdominal imaging in clinical and research studies since 2005, and he has completed several comparison studies of 1.5T and 3.0T MR.

About the institute

The Osaka University Hospital, established in 1931, is a national university hospital in the 2nd largest prefecture in Japan. The hospital has 1,076 inpatient beds and serves approximately 2,440 outpatients each day. Osaka University Hospital has used GE Healthcare MR scanners since 1993 and currently operates a Signa HDxt 3.0T and Signa EXCITE HD 1.5T.

Figures 1a to 1d. Images obtained with LAVA-Flex on a patient with early HCC confirmed by histopathology (arrow), demonstrating intratumoral fat and hemorrhage. High signal intensity of the lesion on the water image indicates intratumoral hemorrhage, while high signal intensity on the fat image indicates intratumoral fat. Signal intensity loss on the out-of-phase image compared to the in-phase image also suggests intratumoral fat.

Figures 2a to 2f. A patient case with chronic hepatitis type B after surgery for rectal cancer. Arterial phase image shows a hyperenhancing lesion (arrow) in the anterior segment of the liver. Portal venous phase image shows a lesion of hypoattenuation, but the lesion is more prominent on the hepatocyte phase image. The hypervascular lesion can be diagnosed as HCC rather than metastasis from rectal cancer. Histology confirmed the lesion was early HCC after hepatic resection.