Advanced Abdominal MRI

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Recent magnetic resonance (MR) units with a stronger gradient system have allowed various fast and ultrafast subsecond MR imaging techniques to develop. These fast scan techniques have easily realized breath-holding acquisition in the abdomen and the image quality has been greatly improved without sacrificing spatial resolution. For example, now, gradient-echo (GRE) dynamic MR imaging for the liver and the pancreas can be performed with breath-holding, using a matrix of 512 x 256, and a section thickness of 5 mm to achieve high spatial resolution similar to that of dynamic CT.

The majority of the fast imaging techniques have been developed to T2-weighted imaging to obtain useful T2-weighted images in the shortest possible time. Among the fast sequences, fast spin-echo (FSE) sequence is the most promising technique and allows high-quality T2-weighted images with reduced motion artifacts. However, FSE sequences using multiple refocused pulses may essentially realize only poor soft-tissue contrast due to magnetization transfer and T2-filtering effects and may provide some pitfalls to lead to misregistration, and therefore, echo-planar (EP) imaging is expected to provide high image contrast. In addition, single-shot EP imaging allows even diffusion-weighted (DW) (and Tensor) and perfusion-weighted (PW) imaging in the abdomen due to its short scanning time. It has been already reported that apparent diffusion coefficient (ADC) measurement and the image contrast on DW images may be useful in detecting and characterizing hepatic tumors. We have also found that PW imaging with GRE-EP sequence may be useful for not only predicting abdominal organ function but also differentiating lesions in the abdomen. In addition, there may be a promising use of PW imaging combined with a superparamagnetic iron oxide in the liver. Recent development of fast gadolinium-enhanced 3D MR angiography has also impacted liver and pancreas imaging. Combined with such gadolinium-enhanced 3D MRA sequences and zerofilling image interpolation technique, biphasic gadolinium-enhanced 3D-MRA (whole liver and pancreas dynamic MR imaging in the arterial phase and MR portography in the portal phase) can be obtained. In the pancreatobiliary system, rapid emergence of MR cholangiopancreatography (MRCP) with single-shot FSE (i.e., SSFSE, HASTE) sequences is changing the role of ERCP in daily practice. Such same sequences are also applied to the urinary and gastrointestinal tract as MR hydorography.

The purpose of this presentation is to review the current state of MR imaging of the abdomen focusing on clinical applications of fast and ultrafast scanning techniques. And, If I still have time to refer to developing new MR techniques, I will address the possibility of MR endoscopy or interventional MRI.