Current Roles and Future Prospects for Contrast-enhanced Liver MR Imaging

Myeong-Jin KIM

Department of Diagnostic Radiology and Research Institute of Radiological Science, Yonsei University College of Medicine, Seoul, Korea

Routine dynamic magnetic resonance (MR) imaging using extracellular fluid (ECF) agents involves quadraphasic scans comprising unenhanced, arterial, portal, and equilibrium phases. Recently, multi-pass arterial examination has drawn attention for evaluating the rapid hemodynamic changes that occur during the hepatic arterial phase. Although a conventional 3-dimensional-gradient recalled echo (GRE) sequence may be used for multi-pass arterial imaging by reducing spatial resolution, a new sequence that allows multi-pass arterial imaging with high-spatial resolution has been developed that combines a 3D-GRE sequence with central k-space filling and keyhole acquisition techniques.

Reticuloendothelial system (RES) agents have been demonstrated to improve detection and characterization of focal hepatic lesions that were not depicted or poorly defined in imaging utilizing ECF agents. However, some well-differentiated or hypervascular hepatocellular carcinomas (HCC) may not be seen on postcontrast MR imaging alone, even if they were depicted on precontrast images. Therefore, the combined use of gadolinium and superparamagnetic iron oxides (SPIO) agents may be helpful for evaluating problematic or equivocal focal liver lesions.

Mangafodipir trisodium (MnDPDP) is a hepatocyte-directed agent that can be useful for differentiating whether a focal hepatic lesion is of hepatocellular or non-hepatocellular origin, but this agent is rarely used because it lacks dynamic imaging capability. Gadobenate dimeglumine (Gd-BOPTA) and gadoxetic acid (Gd-EOB-DTPA) have characteristics of both ECF and hepatocyte-directed agents by elimination through both renal and hepatobiliary pathways. These agents enable acquisition of dynamic MR images for evaluating perfusion phase and delayed images for hepatobililary or parenchymal phase.

In summary, multi-pass arterial imaging using a keyhole imaging technique may help evaluate rapid hemodynamic changes of HCC on arterial phase. Combining ECF and RES agents may provide better detection and characterization of HCC than a single agent alone. Currently available biphasic agents have great potential for evaluating focal and diffuse liver diseases.