FUTURE TECHNIQUES IN MR IMAGING OF THE LIVER: ECHO PLANAR IMAGING

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The dramatic success which magnetic resonance (MR) imaging has achieved in the diagnosis of diseases of the central nervous system has not been mirrored in abdominal applications. Problems associated with MR imaging of the abdomen arise almost entirely because of the artifacts secondary to gross physiological motion (e.g. respiration, peristalsis, cardiac pulsation). In addition, lack of a suitable contrast agent for marking the bowel, and inferior spatial resolution in comparison with computed tomography has limited the use of MR imaging in the abdomen. Recent introduction of fast gradient-echo techniques (scan time approximately 1 s) and echo planar MR (EP-MR) imaging (scan time <100 ms) has allowed radiologists to acquire motion artifact-free MR images. In this chapter, we shall review the potential utility of fast imaging techniques, particularly EP-MR imaging in evaluation of the liver.

Background

The concept of EP-MR imaging was first advanced by Mansfield in 1977. Initial clinical images were obtained in 1983 at a field strength of 0.15 T with imaging times of approximately 35 ms. However, interest in echo-planar imaging (EPI) was tempered because images had poor signal-to-noise ratios, low in-plane resolution (32 × 32 matrix), and only infants or young children could be imaged because of a small magnet bore. In 1986, Rzedzian and Pykett developed a prototype adult-sized whole body 2.0 T MR imaging system, with which high-resolution EP-MR images of the heart and abdomen were obtained with the Instascan technique. Recent technical advances have resulted in the implementation of echo planar capabilities as an add-on feature on conventional MR systems.

Principles of EP-MR technique

In contrast to conventional pulse sequences, where the total number of excitations equals the number of the desired phase encoding steps (typically 128–256), at EP-MR imaging, the spatial information necessary to generate an image is acquired after

Figure 10.1 Hemangioma. T1-weighted inversion recovery EP-MR images with TR = infinite, TE = 25 msec, TI = 100 (A), 380 (B), 600 (C), and 800 (D) msec. Liver signals null at 380 (B) while lesion incompletely nulls at TI 800 (D). Low signal intensity rim seen at TI 600 (C) represents voxels at null pool. (Reprinted with permission from reference 14).