Opposed-phase MR Imaging with FIESTA or True FISP Sequence in the Upper Abdomen: Comparison with Opposed-phase GRE T1WI

Z. Yang¹, C. Zhou², M. Chen², G. Li²

¹Radiology, Beijing Hospital, Beijing, China, People's Republic of; ²Radiology, Beijing Hospital, Beijing, China, People's Republic of

Synopsis
The purpose of this study is to investigate the usefulness of opposed-phase True FISP/FIESTA sequence in the detection and characterization of focal lesions containing fat in the upper abdomen. In-phase GRE T1WI, opposed-phase GRE T1WI, and True FISP/FIESTA opposed-phase images were performed in 54 patients with various upper abdominal lesions containing fat. Our results indicate that compared with opposed-phase spoiled GRE T1WI, opposed-phase True FISP/FIESTA sequence can provide similar or more effective information in the detection and characterization of lesions containing fat in the upper abdomen.

Methods
54 patients formed the clinical study population, and their diseases included focal fatty liver in 24 cases (28 lesions), hepatocellular carcinoma (HCC) with fat degeneration in 7 cases, adrenal adenoma in 9 cases, and angiomyolipoma in 14 cases (17 lesions). MR imaging was performed at a Twinspeed (GE) or Vision (Siemens) 1.5T MR scanner. The pulse sequences included HASTE T2WI or FSE T2WI, FLASH (or SPGR) T1WI (in-phase [TE=4.2 ms] and opposed-phase [TE=2.1 ms]), and True FISP opposed-phase (TE=2.3 ms) or FIESTA opposed-phase (TE=1.9 ms). The changes of signal intensity of the lesions in different sequence were analyzed, and the contrast-noise ratio (CNR) between lesion and normal tissue was measured in each sequence.

Results
1. Focal fatty liver: On in-phase FLASH/SPGR T1WI, 13 lesions were mildly hyperintense, and 15 were isointense (Fig B). On opposed-phase FLASH/SPGR T1WI, 21 lesions were mildly hypointense (Fig C), and 7 showed isointense. On opposed-phase True FISP/FIESTA images, 25 lesions showed mildly or moderately hypointense (Fig D), and 3 were isointense. The mean CNR of lesions on opposed-phase True FISP/FIESTA images was little higher than that in opposed-phase T1WI (P<0.05). 2. HCC with fat degeneration: All 7 lesions were mildly hypointense on in-phase FLASH/SPGR T1WI, 5 lesions were mildly or moderately hypointense on opposed-phase True FISP/FIESTA images. 3. Adrenal adenoma: All 9 lesions were isointense or mildly hyperintense on in-phase FLASH/SPGR T1WI. On opposed-phase FLASH/SPGR T1WI, 3 lesions were mildly hypointense and 6 were isointense. On opposed-phase True FISP/FIESTA images, 6 lesions showed mildly or moderately hypointense, and 3 were isointense. 4. Renal angiomyolipoma: 12 lesions were mildly or moderately hyperintense on in-phase FLASH/SPGR T1WI, and 5 were isointense. On opposed-phase FLASH/SPGR T1WI, 10 lesions were mildly hypointense, 4 were isointense, and 3 were mildly hyperintense. On opposed-phase True FISP/FIESTA images, all 17 lesions were mildly or moderately hypointense (Fig E). The mean CNR of lesions on opposed-phase True FISP/FIESTA images was significantly higher than that on opposed-phase T1WI (P<0.01).

Discussion and Conclusion
Some lesions in the upper abdomen contain fat. The detection of fat within lesions is very important for the characterization of lesions, because most lesions containing fat are benign or well-differentiated malignant tumors. With a high sensitivity and specificity, chemical shift MR imaging using spoiled GRE T1WI has been an indispensable tool for detecting fat within the lesions. Due to different precession phase between water and fat, the lesions containing fat show decreased signal intensity on opposed-phase T1WI. In this study, opposed-phase images were obtained with a True FISP or FIESTA sequence in a reasonable short TE (2.3 ms in 1.5 Tesla). The lesions containing fat showed similar reduction of signal intensity on opposed-phase True FISP/FIESTA images as on opposed-phase FLASH/SPGR T1WI. The mean CNR between renal angiomyolipoma and renal parenchyma was significantly higher on opposed-phase True FISP/FIESTA images than that on opposed-phase FLASH/SPGR T1WI.

In Conclusion, our results indicate that compared with opposed-phase spoiled GRE T1WI, opposed-phase True FISP or FIESTA images can provide similar or more effective information in detection and characterization of lesion containing fat in the upper abdomen. However, due to technique limitation in our MR scanner, in-phase True FISP or FIESTA images is not included in this study. Further evaluation of comparison including in-phase True FISP or FIESTA sequence is needed to confirm our conclusion.

References

Figure A-D. A lesion of focal fatty liver (arrows) in 1 53-year-old woman. On HASTE T2WI (A), the lesion is mildly hyperintense, which mimicks malignant lesion. The lesion was isointense on FLASH in-phase T1WI (B). The lesion appears hypointense on both FLASH opposed-phase T1WI and True FISP opposed-phase image.

Figure E. A angiomyolipoma of the right kidney in 43-year-old man. The lesion (yellow arrow) is heterogeneous hypointense on True FISP opposed-phase image (E).