

Breath-hold T2-weighted MR imaging of the liver: Comparison of true FISP, true FISP with driven equilibrium preparation pulse, and breath-hold fast spine-echo with or without fat suppression.

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Purpose: To evaluate true FISP (tFISP), fat-suppressed true FISP (tFISP-FS), true FISP with driven equilibrium preparation pulse (tFISP-DE), breath-hold fast spine-echo (FSE) and fat-suppressed breath-hold fast spine-echo (FSE-FS) for the detection of focal hepatic lesions and image quality.

Method and MATERIALS: From March 2001 to January 2002, fifty-seven patients with 69 focal hepatic lesions (32 solid lesions [18 hepatocellular carcinomas (HCCs), 5 cholangiocarcinoma and 9 metastases] and 37 nonsolid lesions [27 hemangiomas and 10 cysts]) underwent hepatic MRI with five T2-weighted sequences: 1) tFISP (TR/TE/FA = 4.8/2.3/70), 2) tFISP-FS (TR/TE/FA = 5.1/2.5/70), 3) tFISP-DE (TR/TE/FA = 5.1/2.5/70), 4) FSE (TR/TE/ETL = 3500/138/29) and 5) FSE-FS (TR/TE/ETL = 3500/138/29). The diagnosis of HCCs was histopathologically proven at biopsy or surgery in all patients. The diagnosis of metastases was histopathologically proven at surgery (n=1) or based on lesion progression on serial CT examinations (n=3). The diagnosis of hemangiomas and cysts was based on characteristic dynamic CT findings. The lesion-to-liver C/N was calculated for each sequence. Image quality for each sequence was analyzed in terms of hepatic contours, clarity of vessels, and artifacts by 2 radiologists blinded to the sequences. Detection rates were evaluated with receiver operating characteristic (ROC) curve analysis. Analysis was performed using a paired Student's t-test with 95% confidence interval.

RESULTS: The lesion-to-liver CNR of solid lesions on tFISP-FS was significantly higher than those on tFISP (P < 0.01), FSE (P < 0.05), and FSE-FS (P < 0.05). The lesion-to-liver CNR of nonsolid lesions on FSE and FSE-FS was significantly higher than that on true FISP (P < 0.05). (the mean lesion-to-liver C/N [solid/nonsolid]: tFISP=6.3/29.0, tFISP-FS=12.6/32.7, tFISP-DE=9.9/30.2, FSE 6.9/37.2, FSE-FS 7.2/37.7). The hepatic contours and clarity of vessels were superior and respiratory ghost artifacts were less on tFISP, tFISP-FS, or tFISP-DE than on FSE or FSE-FS. On the basis of ROC analysis, the detection rates of solid lesions were highest on tFISP-FS. The detection rates of non-solid lesions were highest on FSE-FS (area under ROC curve (Az) [solid/nonsolid]: tFISP=0.87/0.98, tFISP-FS=0.95/0.99, tFISP-DE 0.94/0.99, FSE 0.94/0.97, FSE-FS 0.88/0.99).

CONCLUSIONS: Fat-suppressed true FISP and true FISP with driven equilibrium preparation pulse provide good image quality and are useful in the detection of solid tumors in the liver.

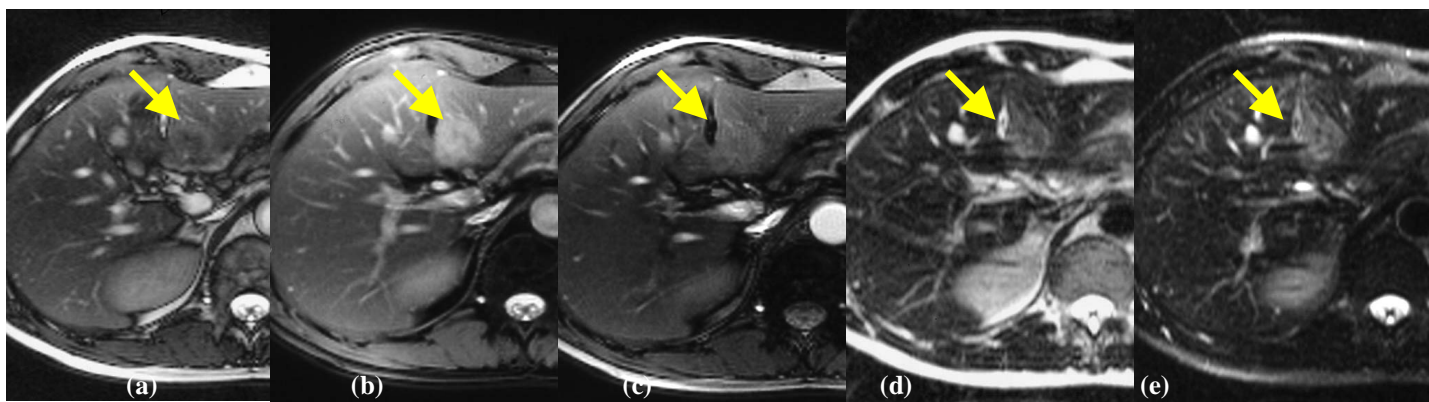


Figure 1. Comparison of (a) true FISP (TR/ TE/flip angle, 4.8/2.3/70), (b) fat-suppressed true FISP (tFISP-FS) (TR/ TE/flip angle, 5.07/2.54/70), (c) true FISP with driven equilibrium pulse (tFISP-DE) (TR/ TE/flip angle, 5.07/2.54/70), (d) breath-hold fast spine-echo (FSE) (TR/TE [effective], 3,500/138) and fat-suppressed fast spine-echo images (FSE-FS) (TR/TE [effective], 3,500/138). MR images in a 65-year-old male with metastasis (arrows) from colorectal cancer. The fat-suppressed true FISP image is good lesion-to-liver CNR and best for depicting the sharpness of the contours of the solid hepatic lesion.

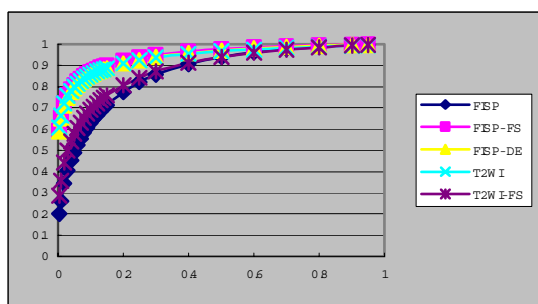


Figure 2. Graph shows composite receiver operating characteristic (ROC) curves for solid lesions.

The mean Az values of solid lesions on tFISP-FS, FSE, or tFISP-DE were significantly higher than those on tFISP (p < 0.01) or FSE-FS (p < 0.05). The mean Az value of solid lesions on tFISP-FS for the three observers was higher than those on the other sequences.

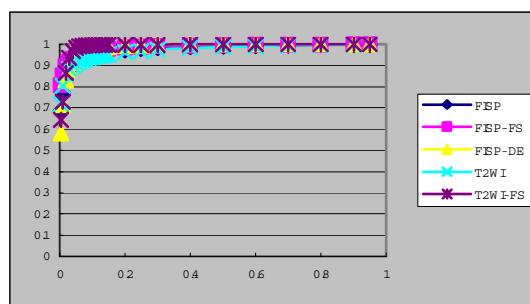


Figure 3. Graph shows composite receiver operating characteristic (ROC) curves for nonsolid lesions.

The mean Az value of nonsolid lesions on FSE-FS for the three observers was higher than those on the other sequences. However, no significant differences existed among the five sequences in the mean Az values for nonsolid lesions.