Evaluation of Different T2-Weighted Imaging Techniques for Liver MRI

J. Szklaruk[1], A. Balachandran[1], E. P. Tamm[1], J. Ma[2], L. D. Broemeling[3]

[1]Diagnostic Radiology, UT M.D. Anderson Cancer Center, Houston, Texas, United States, [2]Imaging Physics, UT M.D. Anderson Cancer Center, Houston, Texas, United States, [3]Biostatistics, UT M.D. Anderson Cancer Center, Houston, Texas, United States

Introduction

The evaluation of liver by magnetic resonance imaging (MRI) currently includes T1, T2 weighted images (T1WI, T2WI), as well as dynamic post contrast images. The detection of liver lesions, including metastatic disease or primary hepatocellular carcinoma (HCC), is dependent on the pre-contrast evaluation.

Our goals are to evaluate the efficacy of four different T2WI techniques that are commercially available and to obtain an optimized imaging parameters for liver imaging. We compared the following techniques FSE (fast spin echo), SSFSE (single shot fast spin echo), fast recovery fast spin echo (FRFSE), and spin echo echo planar imaging (SE-EPI).

Methods

During a six month period 22 patients with known history of hepatic lesions visualized on prior imaging studies were enrolled in the study. Whenever possible, the torso phase array coil was used with all the sequences. All patients had the following sequences performed with the following imaging parameters utilizing a 1.5T MRI scanner (GE, Milwaukee, WI): Dual Echo FSE: TR/TE 6000msec/68/136, ETL = 12, RBW 32kHz, FOV =32x 32cm, 6mm/2mm, matrix: 256 x 192, S/I spatial and fat saturation, imaging time: ca. 6-7 minutes. FRFSE: TR/TE: 2500msec/70msec, ETL=20-22, RBW: 32kHz, 30x22cm FOV, 7mm/2mm, matrix: 256x192, S/I spatial and fat saturation, imaging time: 2 x 25 seconds. Multi-shot SE-EPI: TR/TE: 2000msec/70msec, 8 shots, 36x26 cm FOV, 7mm/2mm, matrix = 256x128, RBW= 62.5kHz, S/I spatial saturation with spectral water excitation, imaging time: ca. 20 seconds. SSFSE: TR/TE (inf/ 130ms), ETL = 104, matrix = 256x192, RBW = 62.5kHz, 30x21cm FOV, 7mm/2mm, imaging time: ca. 20-30 seconds.

Two radiologists experienced in abdominal MRI reviewed the images independently and evaluated the number and the size of the lesions. In addition, the radiologists also rated their confidence in the study with a score of 0-2. (0 = not visualized, 1 = questionable lesion, 2 = definite lesion). Region of interest (ROI) signal intensity for lesion, liver, and spleen and standard deviation of noise were performed. The signal to noise ratio (SNR) was calculated for each lesion by dividing the intensity of liver with the standard deviation of noise. The contrast to noise ratio (CNR) was calculated by dividing the difference the signal intensity between lesion and liver with the standard deviation of noise.

Results

Seventy-eight lesions were detected in 22 patients. Thirty-seven lesions were less than 2 cm and 41 lesions were more than 2cm. Fourteen lesions were considered benign by MR imaging criteria. For all lesion, there was a statistically significant difference for lesion visualization between the SSFSE (score = 1.65 +/- 0.41) compared to the other sequences (score = 1.87 +/- 0.54; p = 0.00).

For lesions considered benign, the SNR and CNR for SE-EPI was statistically less than the other sequences (Figures 1 and 2). For lesions considered malignant, the SNR and CNR of SSFSE was statistically less than the other sequences. For both subsets that include both benign and malignant lesions, there was no statistically significant difference between the FSE and FRFSE sequences.

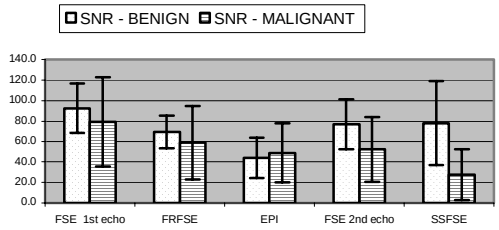


Figure1. Comparison of mean SNR.

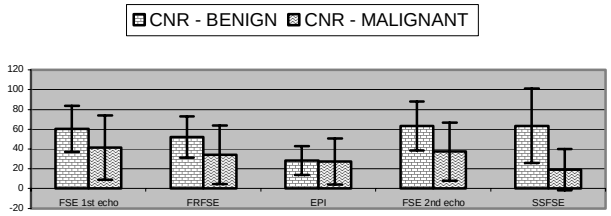
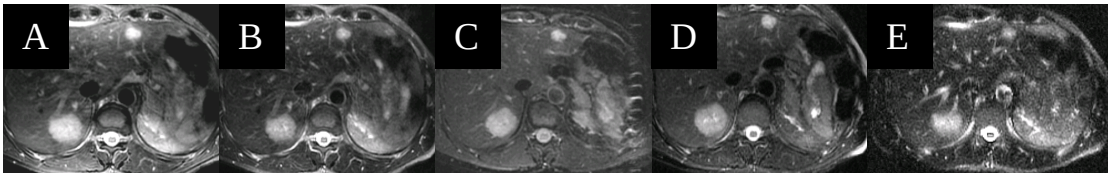


Figure 2. Comparison of mean CNR.

·Figure 3. Axial T2W images of the liver obtained with 1st (A) and 2nd echo FSE (B), SE-EPI (C), FRSE (D), and SSFSE (E)



Discussion and Conclusion

The capability for detecting and characterizing hepatic lesions has been well-documented for the traditional FSE technique . However, imaging time is usually quite long and motion artifacts could be severe. The availability of several new T2WI techniques allows for breath-hold exams and therefore complete removal of motion artifacts and breathing averaging artifacts. Nevertheless, the contrast mechanism of these new imaging techniques is usually more complicated and their diagnostic value is not well-established.

Our results show that there were no significant difference in lesion detection, CNR, and SNR for malignant lesions between FSE and SE-EPI and FRFSE. Whereas, the SSFSE is significantly inferior to the other sequences in lesion visualization, CNR, and SNR. Further no significant difference in CNR and SNR was detected between FSE and FRFSE for all types of lesions. These results suggest that for the detection of the clinically significant lesions, both SE-EPI and FRFSE could be used in lieu of the traditional FSE.

References.

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