1.5T vs. 3T Body MRI: Qualitative and Quantitative Comparison of T2 Weighted Images for Liver Lesion Detection

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Introduction

MRI of the liver is routinely used in the staging and follow-up of oncologic patients. The current clinical practice is to use a 1.5T magnet. 3.0T MRI scanners offer superior signal to noise ratio (SNR) over the conventional 1.5T. There are limited reports of the assessment of the switch from lower field strength magnet to 3T. Our goal is to compare T2 weighted liver lesion detection at 3T MRI compared to images obtained at 1.5T.

Methods:

Patients with known solid liver lesions larger than 1cm and first detected at 1.5T magnetic field strength were enrolled in the study. Within a one-week period after the 1.5T exam the patients underwent an additional MRI of the liver at 3T. At 1.5T a total of 56 solid lesions were detected in 17 patients. The T2 weighted images at 1.5 T were acquired using fast recovery fast spin echo (FRFSE) at two settings, TE/TR/ETL= 85ms/2500ms/23 and TE/TR/ETL= 140msec/2500 msec/23. At 3T, FSE images were acquired at three different TE's (85, 160, and 200 msec) and with a TR of 3200 msec and an ETL of 24. All images were fat suppressed, and obtained at 7mm/0mm slice thickness. To decrease the specific absorption rate at 3T partially parallel imaging with an acceleration factor of 2 was utilized.

Three radiologists specializing in body MRI independently reviewed the images. Each radiologist scored lesion detection on a 1 to 5 scale: 1=definitely absent; 2=probably absent; 3=equivocal; 4=probably present; and 5=definitely present. The null hypothesis that the average scores were the same was tested using ANOVA statistical analysis and the hypothesis rejected if $p < .05$.

Region of interest (ROI) signal intensity of lesion, liver, and standard deviation of noise were performed. The SNR was calculated for each lesion by the dividing the intensity of the lesion by the standard deviation of noise. The contrast to noise ratio (CNR) was calculated by subtracting the SNR of lesion to liver. The null hypothesis that the CNR for both fields were the same was tested using ANOVA statistical analysis and the hypothesis rejected if $p < .05$.

Results

A total of 56 solid liver lesions were detected at both 1.5T and 3T. At 1.5T, the T2 weighted images received an averaged score of 4.0 ± 0.08 and 4.1 ± 0.07, for the FRFSE at TE = 85msec and FRFSE at TE = 140 msec, respectively. At 3T the T2 weighted images received an averaged score of 4.2 ± 0.07, 4.2 ± 0.07, and 4.1 ± 0.08 for the FSE at TE = 85, 160, and 200 msec, respectively. For the qualitative analysis the null hypothesis was not rejected with $p = 0.15$. The averaged CNR for lesions for the FRFSE at TE = 85msec and 140 msec at 1.5T were 61.4 ± 46.9 and 48.0 ± 51.5, respectively. At 3T the averaged CNR for the FSE at TE = 85, 160, 200 msec were 83.9 ± 95.1, 62.8 ± 65.6, and 67.7 ± 58.5, respectively. For the quantitative analysis the null hypothesis was not rejected with $p = 0.07$.

Conclusion

Evaluation of liver lesions by T2-weighted images at 3T and 1.5T did not alter the sensitivity for lesion detection. Quantitative and qualitative lesion detection was not statistically significant between the two different magnetic field strengths.