POST-EOB-ENHANCED T2WI, DWI, AND BALANCED FFE: COMPARISON OF 1.5T AND 3T SCANNERS USING DILUTED EOB PHANTOMS

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Introduction: Gd-EOB-DTPA (EOB)-enhanced liver MRI has been useful in detection and characterization of focal liver lesions. One of the major problems is long examination time due to waiting time for hepatobiliary phase image. Possible solutions are shortening of the waiting time or post-contrast acquisitions of T2- and diffusion-weighted images. However, shortening of the waiting time may affect the diagnostic ability of hepatobiliary phase image. And the effects of EOB on post-contrast T2WI and DWI are not fully assessed especially in high-filed MR scanners. Our purpose of this study was to assess the effects of EOB and compared them between 1.5 T and 3T scanners to optimize imaging techniques for time-saving EOB-enhanced liver MRI.

Methods and Materials: The phantom studies were conducted using 1.5T- and 3T-MR scanners (Achieva, Philips Healthcare) and diluted EOB and water phantoms. FSE-T2WI, SE-EPI-DWI, balanced FFE images were obtained with the following parameters, FSE-T2WI (TRs: 1000, 2000, 3000, 4000, 5000, TEs: 70, 90, 110, 130), SE-EPI-DWI (TRs: 1000, 2000, 3000, 4000, 5000, TEs: 64, 90, 120, b values: 0, 500, 1000, 1500, 2000), and balanced FEE (1.5T; TR: 3.6, TE: 1.8, FA: 90、3T; TRs: 2.8, 3.5, 4.4, TEs: 1.4, 1.7, 1.9, FAs: 50, 70, 90). The concentrations of EOB were 1/10000, 1/5000, 1/1000, 1/ 500, 1/100, and 1/50. SNRs and ADC values of the phantoms were measured. The patterns of signal-to-noise ratio (SNR) and apparent diffusion coefficient (ADC) changes were evaluated and compared between 1.5 T and 3T.

Results: SNRs of the phantoms on both T2WI and DWI at both 1.5T and 3T scanners increased with EOB concentration of 1/10000 to 1/500 and markedly decreased with higher (Figs 1-5). The changes were more severe with TR shorter than 3000 (Figs 1, 3) and with longer TEs (Figs 2, 4). The patterns of SNR changes on DWI were similar among the b values (Fig 5). Changes of ADC values were more severe with longer TEs and higher b values (Figs 7, 8). In balanced FEE, SNR increased in proportion to EOB concentration at both 1.5T and 3T scanners and scan parameters did not affect patterns of SNR changes at 3T(Fig 9).

Conclusion: On post-contrast T2WI, DWI, and balanced FFE images, SNRs and ADC values are severely affected by EOB concentration unless imaging parameters are carefully chosen. The filed-strength of scanner affects patterns of neither SNR nor ADC changes.

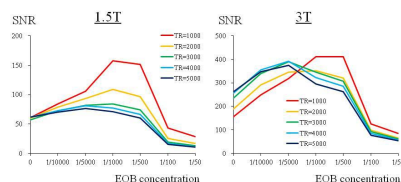Fig. 1. T2WI: SNR changes depending on TR (TE: 90msec)

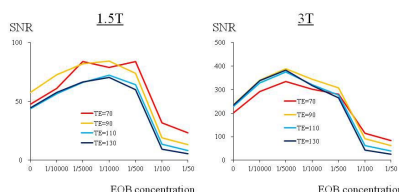Fig. 2. T2WI: SNR changes depending on TE (TR: 3000msec)

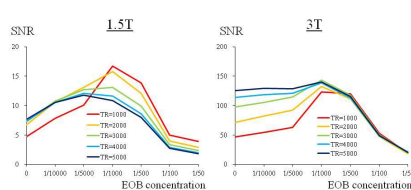Fig. 3. DWI: SNR changes depending on TR (TE: 64msec, b=1000)

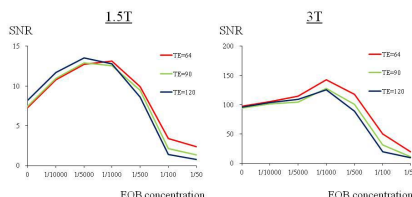Fig. 4. DWI: SNR changes depending on TE (TR: 3000msec, b=1000)

Fig. 5. DWI: SNR changes depending on b value (TR: 3000msec, TE: 64msec)
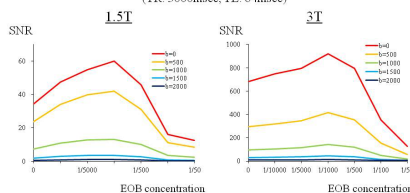
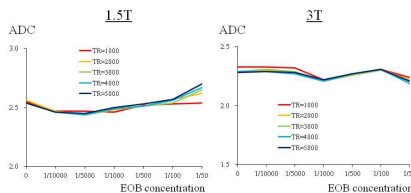Fig. 6. ADC changes depending on TR (TE: 64msec, b=1000)

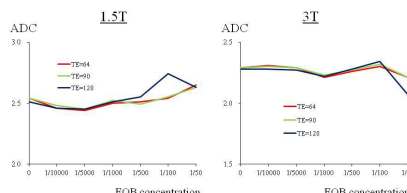Fig. 7. ADC changes depending on TE (TR: 3000msec, b=1000)

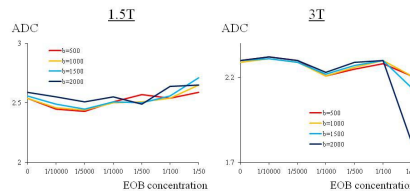Fig. 8. ADC changes depending on b values (TR: 3000msec, TE: 64msec)

Fig. 9. Balanced FEE