Effect of gadolinum on hepatic fat quantification using multi-echo reconstruction technique with T2* correction and estimation

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Purpose: To determine whether hepatic fat quantification is affected by administration of gadolinum using a multiecho reconstruction technique with T2* correction and estimation (IDEAL IQ).

Methods: Forty-eight patients underwent thrice fat quantification measurements with IDEAL IQ during triphase liver MRI examination at 3.0T (Discovery MR 750; GE Medical Systems, Milwaukee, WI), once before and twice at about 1.4 min and 3.6 min after administration of gadolinium (post-contrast1 and post-contrast2). The parameters were as follows: six echoes in total in two consecutive TRs; TR/TE1/ΔTE =7.2/1.3/2 ms; receiver bandwidth =±166.7 kHz; FOV = 26 - 33 cm; matrix = 160 × 160; slice thickness = 10 mm. A low flip angle of 3° was used to reduce the T1 bias, and the parallel imaging method was used with an acceleration factor of 2 to obtain a sufficient coverage while keeping the scan time, approximately 21 s, within a single breath hold. Fat fraction (FF) and R2* maps could be auto-generated on the host scanner after each acquisition of IDEAL IQ (**Fig.1**). A one-way repeated-measures analysis of variance was conducted to evaluate the variability of the mean FF and R2*. A *P* value <0.05 indicated statistically significant difference.

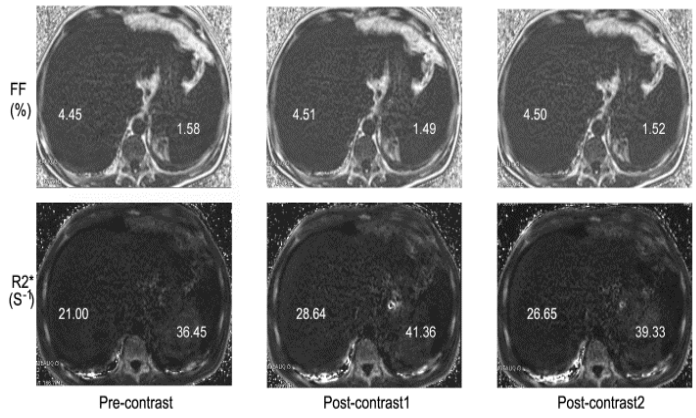

Fig.1 *The FF (%, upper row) and R2* (s^{-1}, bottom row) mappings of the right liver lobe and spleen of a 57-year-old male patient with rectal cancer.*

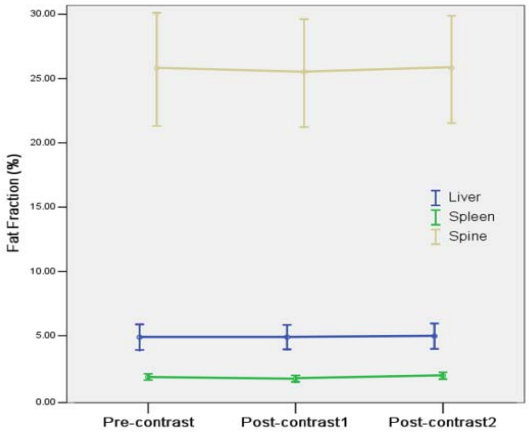

Fig. 2 *The fat fraction values of the liver, spleen, and spine before and after Gd-CM injection. No significant changes, including corrections for multiple comparisons, were observed.*

Results: The measured FF values of liver, spleen and spine in this study revealed no significant difference between pre-contrast, post-contrast1 and post-contrast2 (P>0.05 for all pairwise comparisons, **Fig2**）. R2* increased in the liver and spleen after the administration of the gadolinium-based contrast media (Gd-CM) as expected, while no significant difference observed in spine.

Discussion: Fat quantification MR sequence is usually performed before the injection of Gd-CM to avoid the bias from susceptibility effect. In the present investigation we tested the changes of FF and R2* derived from IDEAL IQ before and after Gd-CM administration to validate this technique under the Gd-CM administration. IDEAL IQ employs a multi-echo acquisition for T2* fitting and uses the obtained T2* value to perform the T2* correction to remove the inherent T2* effect. The present study demonstrated that FF derived from IDEAL-IQ was stable and not influenced significantly by the Gd-CM in the liver as well as spleen and spine, thus it could be performed in both pre- and post-contrast duration with very closer outcomes.

Conclusions: IDEAL IQ fat quantification in liver remains stable after Gd-CM administration. Therefore, it could be performed in the post-contrast procedure to help optimize liver MR protocol and improve efficiency of clinical examination.

Reference 1.Tang A, Tan J, Sun M, et al. Nonalcoholic fatty liver disease: MR imaging of liver proton density fat fraction to assess hepatic steatosis. Radiology.2013; 267(2):422-431.