

Estimation of fatty liver with T2* correction using 2D multiecho-FFE: human study before and after SPIO or Gd-EOB-DTPA administration

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Background and Purpose:

It has been known that both fat and iron accumulate in the liver in chronic liver diseases, typically in chronic hepatitis C (CHC) and non-alcoholic steatohepatitis (NASH) patients, and that the presence of iron interferes with the accurate MR estimation of fat fraction due to T2* effect. The aim of this study is to evaluate the efficacy of a newly developed multiecho-FFE (mFFE) sequence, which enables estimation of fat fraction (FFr) with T2* correction and with little T1 dependence, in the diagnosis of fatty liver.

Materials and Methods:

After obtaining informed consent, 12 volunteers with fatty liver of various degrees were examined using a 1.5T clinical unit before and after SPIO (n=11) or Gd-EOB-DTPA (n=6) administration. Scans included conventional dual-echo T1-weighted FFE (TR/TE/FA=100/4.2 & 2.3/70) and mFFE (TR/TE/FA=48/2.15/20, Δ TE=2.15, 10 echoes, 128 matrix, and scan time 19.7s). Scans were repeated at several time points till 10 min after SPIO injection: scans were repeated 20 min after Gd-EOB-DTPA injection. FFr for dual-echo FFE was calculated as $(S_{Iop} - S_{Ipre}) / (2 * S_{Ipre})$: that for mFFE was calculated using PRIDE software (3 parameter fitting model with little T1 dependence, Philips Medical Systems). With this PRIDE software, water fraction images, fat fraction images, and T2* images were automatically generated. Dual-echo FFE and mFFE were compared at each time point in terms of the absolute value of the percentage difference in FFr between before and after contrast injection (Δ FFr ratio).

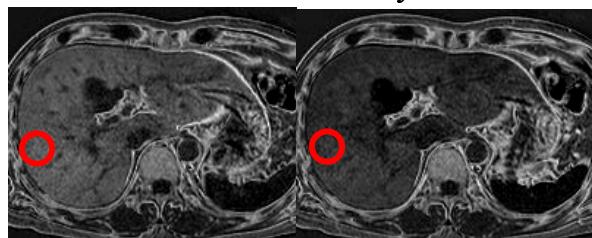
Results:

For SPIO group, 26 time points were available for analysis. Δ FFr ratio for mFFE (0.415 ± 0.422) was significantly smaller than that for dual-echo FFE (1.549 ± 3.084) (Wilcoxon's signed rank test, $p < 0.0001$). For EOB group, 6 time points were available. Δ FFr ratio for mFFE (0.084 ± 0.060) was significantly smaller than that for dual-echo FFE (1.06 ± 0.54) ($p < 0.05$).

Conclusion:

Newly developed mFFE sequence can provide consistent fat fraction regardless of T2* or T1 alteration of the liver tissue, as compared to conventional dual-echo FFE. This may be applicable to evaluation of the fatty liver in CHC or NASH patients, or even for patients after SPIO or Gd-EOB-DTPA administration.

37 y.o. male volunteer with uneven fatty liver



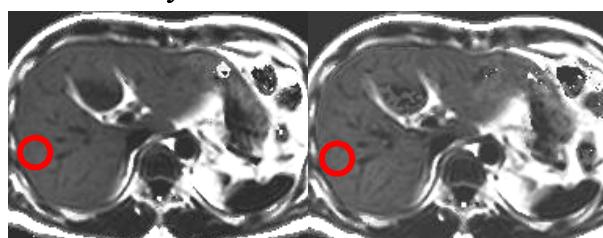
< dual-echo FFE subtraction image >

Before SPIO

FFr=18%

After SPIO

FFr=10%



< mFFE fat fraction image >

Before SPIO

FFr=16.5%

After SPIO

FFr=17.4%