

Fat fraction measurement using mFFE sequence with T2* correction and little T1 dependence: experience in chronic liver disease patients before and after Gd-EOB-DTPA enhancement

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Background and Purpose

It has been known that both fat and iron accumulate in the liver 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 (FFr) due to T2* effect. We have developed mFFE sequence with which FFr can be estimated with T2* correction and with little dependence on T1 property, and reported preliminary successful data using volunteer at the last ISMRM 2009. We have applied this sequence to fatty liver patients with CHC/NASH and evaluated its efficacy.

Materials and Methods

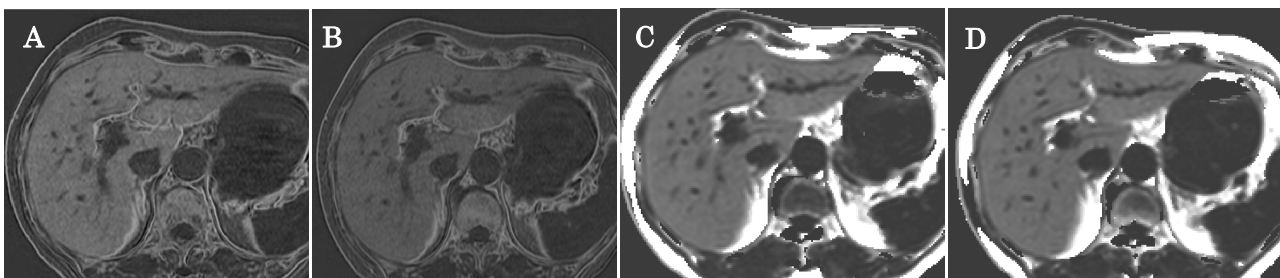
After obtaining informed consent, 22 patients (19 CHC and 3 NASH) with suspected liver mass and fatty liver on ultrasonography were examined with Gd-EOB-DTPA enhanced MR. A 1.5 T clinical unit was used and conventional dual-echo FFE (dFFE: TR/TE/FA=100/4.2 & 2.3/70) and mFFE (TR/TE/FA=48/2.15/20, Δ TE=2.15, 10 echoes, 128 matrix, and scan time 19.7s) were obtained before and after enhancement. FFr for dFFE was calculated as (SI_{lip}-SI_{op})/(2*SI_{pre}): that for mFFE was calculated using PRIDE software (3 parameter fitting model, Philips Medical Systems). dFFE and mFFE were compared in terms of the absolute value of the percentage difference in FFr between before and after contrast injection (Δ FFr ratio). Biochemical or histological data were also correlated when available.

Results

T2* of the liver decreases to $92 \pm 4\%$ after enhancement. Δ FFr ratio for mFFE (0.098 ± 0.092) was significantly smaller than that for dual-echo FFE (0.57 ± 0.32) ($p < .0001$). In one CHC patient with high serum ferritin level, mFFE successfully revealed the presence of mildly fatty liver (pathologically proven), whereas dFFE failed.

Conclusion

mFFE can provide consistent fat fraction regardless of T2* or T1 alteration of the liver tissue, as compared to conventional dFFE, and therefore may be particularly useful in evaluation of CHC or NASH patients.



Subtraction image of dFFE before (A, FFr 0.29) and after (B, FFr 0.20) enhancement.

Fat fraction image of mFFE before (C, FFr 0.21) and after (D, FFr 0.20) enhancement.

Δ FFr ratio was 30%.

Δ FFr ratio was 5%.