Rapid evaluation of liver fat content using in-out-phase imaging in nonalcoholic fatty liver disease

R. Borra[1,2], S. Salo[1], K. Dean[1], R. Lautamäki[2], P. Nuutila[2,3], M. Komu[1], and R. Parkkola[1,2]

[1]Medical Imaging Centre of Southwest Finland, Turku University Hospital, Turku, Finland, [2]Turku PET Centre, University of Turku and Turku University Hospital, Turku, Finland, [3]Department of Medicine, University of Turku and Turku University Hospital, Turku, Finland

Introduction

The aim of the current study was to examine the possibilities for quantification of liver fat content (LFC) in patients with nonalcoholic fatty liver disease (NAFLD) by in-out-phase MR-imaging. Signal intensities (SI) measured from in-out-phase imaging were compared to liver fat measurements by proton magnetic resonance spectroscopy (^{1}H MRS), which as used as a reference method.

Materials and methods

Sixty-one in-out-phase and ^{1}H MRS examinations of patients with type 2 diabetes at high risk for NAFLD were included in the study. Written informed consent was obtained from all subjects and the study protocol was approved by the local ethics committee. A 1.5 T MR imager (Signa Horizon LX, GE Medical Systems, USA) was used for transverse T1W dual-echo FSPGR (in-out-phase) imaging (TR = 150 ms, TE = 2.1 ms and 4.4 ms, FA = 75°) and a single voxel ^{1}H MRS (PRESS, TR= 3000, TE = 25 ms, figure 1) examination of the liver. Liver SI differences between in-phase and out-phase images were measured at the same location as the ^{1}H MRS examination. Pearson`s correlation was used to study the relationship between measured SI differences from in-out-phase images and liver fat content measured by ^{1}H MRS.

Results

A highly significant linear correlation was observed between LFC measured by ^{1}H MRS and SI differences calculated from the in-out-phase images (P<0.001, r=0.94, figure 2). Using the simple difference in SI between in-phase images and out-phase images an intercept of the regression line with the x-axis was observed at 5.1%, comparable to the upper limit of normal LFC. A discrimination with high sensitivity (95%) and specificity (98%) between normal and elevated LFC was observed.

Conclusion

The findings of this study suggest that in-out-phase imaging can be used for estimation of LFC in patients with NAFLD. The cut-off value of 5.1% allows for objective rapid and reliable discrimination between normal or elevated LFC.

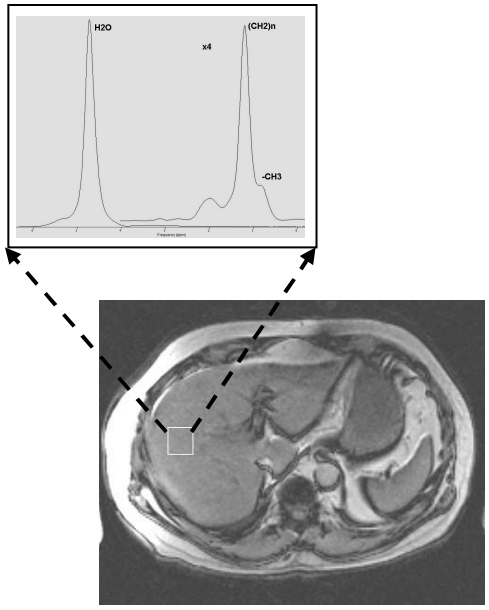

Figure 1: Typical voxel location and spectrum

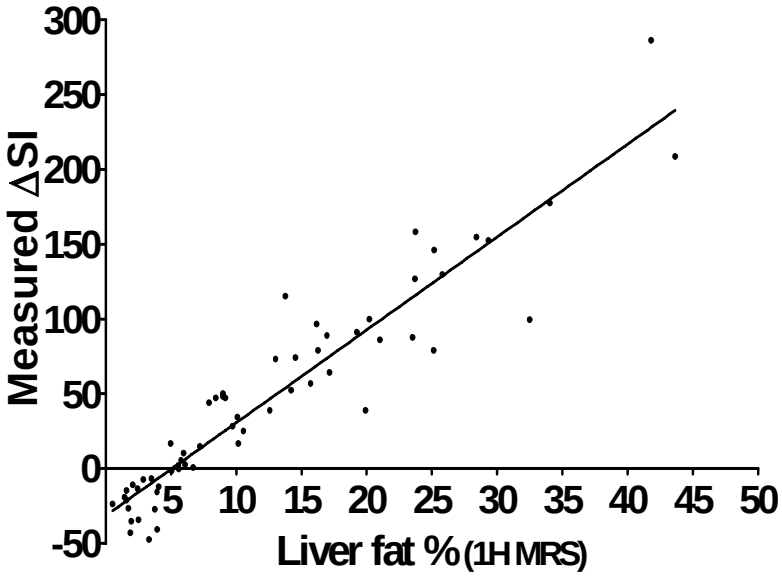

Figure 2:
Linear correlation between in-out-phase SI differences and liver fat content measured by ^{1}H MRS