Quantitative estimation of the degree of macrosteatosis in living related liver donors using IDEAL gradient echo imaging

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PURPOSE: To evaluate the diagnostic performance of the interactive decomposition of water and fat with echo asymmetry and least squares estimation (IDEAL) gradient echo (GRE) imaging to predict the appropriateness of a donor liver with respect to macrosteatosis before liver transplantation and using histopathologic results as the reference standard.

MATERIALS AND METHODS: To assess hepatic fat accumulation, 49 potential liver donors (32 male, 17 female; mean age, 30.6 years) were included in this study. All patients were imaged using standard in- and out-of-phase (IOP) imaging and IDEAL –GRE sequence on a 1.5-T MR scanner (GE HDxt). To estimate the hepatic fat fraction (FF), one radiologist performed regions-of-interest measurement in 15 areas of the liver. The FF was calculated according to the signal intensity decrease on OP images compared with that seen on IP images and was measured directly from IDEAL FF images. The degree of histologic macrosteatosis and microsteatosis (%) was quantitatively assessed using biopsy specimens. The imaging and pathology values of the degree of macrosteatosis, and microsteatosis were correlated using the Pearson correlation coefficient. The diagnostic performance for predicting the appropriateness of liver donation was then analyzed.

RESULTS: The results of the FF on the IDEAL sequence were significantly correlated with the histologic degree of macrosteatosis (γ=0.902, P<0.001), although not with the degree of microsteatosis (P=0.07). The IDEAL sequence showed a higher FF value than the standard IOP image (mean difference: 3.09, P<0.001). When the cut-off value of the normal fat fraction was set at 5%, IDEAL showed 100% sensitivity and 90.9% specificity for detection of hepatic macrosteatosis (> 5% FF) whereas IOP images showed 87.5% sensitivity and 97% specificity.

CONCLUSION: IDEAL can be used as a highly specific modality for the diagnosis of hepatic macrosteatosis as it does not have the confounding influence caused by hepatic iron deposition. IDEAL can accurately depict minimal macrovesicular hepatic steatosis within the normal range, thereby avoiding biopsy in potential living liver donors with an acceptable degree of steatosis for transplantation.