

Clinical Utility of Quantitative Fat Imaging

By Scott B. Reeder, MD, PhD, Division Chief of MRI, University of Wisconsin, Madison, WI

The following clinical cases are presented to demonstrate the potential clinical utility of IDEAL IQ and how it could be used in conjunction with the MR-Touch application for assessment of diffuse liver disease.

Case 1

A 41-year-old patient with diabetes and recalcitrant hypertriglyceridemia (TG=1022) being treated with plasmapheresis. Note the decrease in triglyceride fat fraction and decrease in the size of the liver.

IDEAL IQ used in conjunction with MR-Touch may play an important role in the non-invasive assessment of diffuse liver disease.

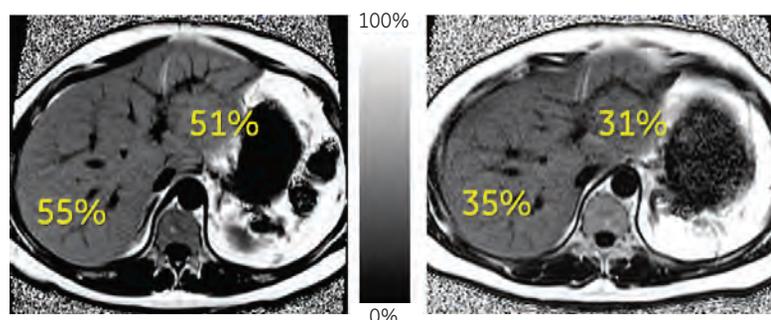


Figure 1. IDEAL IQ triglyceride fat fraction images in a patient with hypertriglyceridemia, before (left) and after three months of treatment with plasmapheresis (right).

Case 2

A 16-year-old patient with Polycystic Ovary Syndrome (PCOS) and non-alcoholic steatohepatitis (NASH) related to PCOS-associated insulin resistance. MR-Touch and IDEAL IQ images acquired at 3T reveal elevated liver stiffness and significant triglyceride fat deposition at 31%. The T2* measured from the R2* map (20 ms) was within normal limits. Biopsy results confirmed severe steatohepatitis with mild fibrosis.

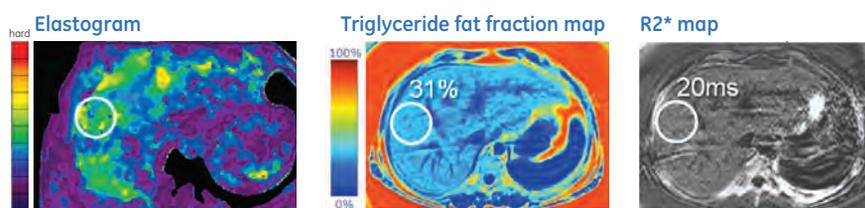


Figure 2. 16-year-old with PCOS and associated insulin resistance causing NASH. MR-Touch (Elastogram image) and IDEAL IQ reveal slightly stiff liver and 31% triglyceride fat in the liver, concordant with biopsy results that confirmed the diagnosis of NASH.



Dr. Scott B. Reeder

Scott B. Reeder, MD, PhD, is the Section Chief of MRI and Cardiovascular Imaging, and Director of the UW clinical MRI fellowship. He joined UW-Madison in 2005 from Stanford University where he completed his radiology residency and a fellowship in abdominal and cardiovascular imaging. Previously, he completed medical school at Johns Hopkins in Baltimore, where he also received his Masters and PhD in Biomedical Engineering. He is originally from Canada where he received his BScE in Engineering Physics at Queen's University in Kingston, Ontario. In addition to his clinical duties, Dr. Reeder is also the Director of the UW Liver Imaging Research Program, an active NIH-funded group that performs research in technical development and translation of new imaging methods to assess liver disease. Specific areas of research interests include development of new MRI methods for quantification of abdominal adiposity, liver fat, liver iron overload and other features of diffuse liver disease, quantification of perfusion in liver tumors, hemodynamics of portal hypertension and the use of new contrast agents in liver and biliary diseases.

Case 3

A 10-year-old patient presented with abdominal pain. Conventional MR scan revealed an enlarged liver on fat saturated T2 weighted images and a drop-out of signal on the out-of-phase image, indicating the presence of triglyceride fat. MR-Touch demonstrates markedly elevated liver stiffness (red regions), while IDEAL IQ demonstrates elevated triglyceride fat fraction (22%) and elevated T2* (40 ms). These findings, in addition to the enlarged liver, are consistent with steatohepatitis. Biopsy performed on the same day demonstrated severe steatohepatitis with severe fibrosis, just short of cirrhosis, concordant with imaging findings from MR-Touch and IDEAL IQ. Given the lack of alcohol intake and negative viral serologies, both imaging and biopsy findings are concordant and consistent with NASH, the aggressive subset of NAFLD.

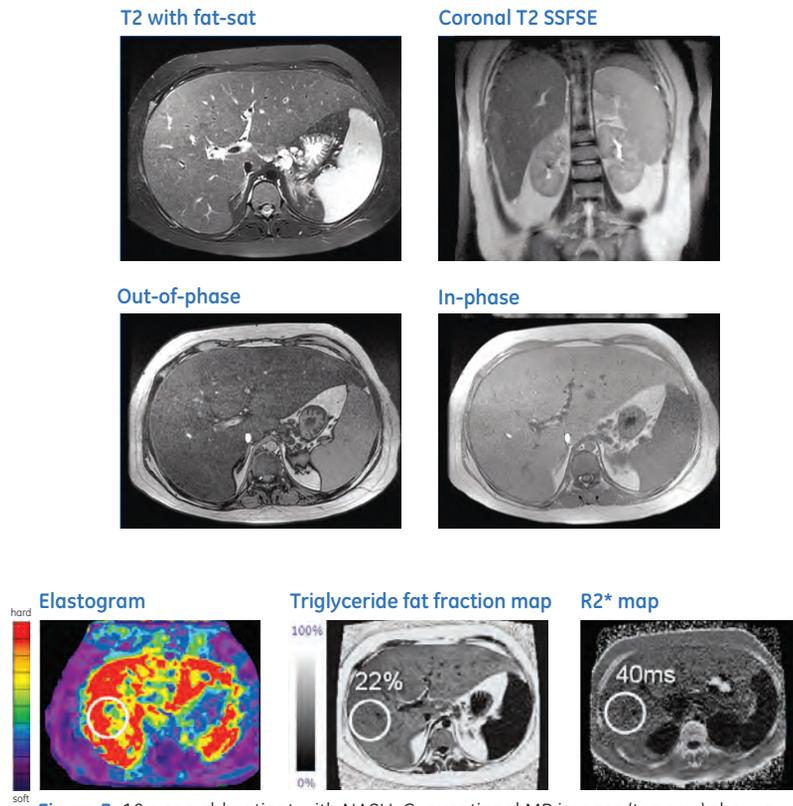


Figure 3. 10-year-old patient with NASH. Conventional MR images (top row) show an enlarged liver and steatosis, but provide no quantitative information on the severity of the disease. MR-Touch (Elastogram image) and IDEAL IQ reveal a very stiff liver (red regions in liver), elevated triglyceride fat fraction (22%), and increased T2* (40 ms). Imaging and biopsy findings are concordant and consistent with NASH.

Discussion

IDEAL IQ is a promising MR-based technique that provides volumetric, whole-liver coverage in a single breath-hold and generates estimated T2* and triglyceride fat fraction maps in a non-invasive manner.