

# MRE in Clinical Practice: Case Review Compendium

MR Elastography (MRE) is a non-invasive method for evaluating tissue elasticity utilizing special phase encoding sequences with an MR system. Previously, a physician used palpation, a subjective technique limited to tissue of interest close to the surface, to find and evaluate pathological changes in the targeted tissue. GE launched MR-Touch, its commercial implementation of MRE, in July 2009.

Initially, MRE was used in conjunction with biopsy and other techniques. As physicians become more experienced with MRE in the clinical setting, their confidence in the information obtained with MRE grows stronger. MRE is now routinely used in clinical practice for the evaluation of liver disease at several sites worldwide. The cases reviewed here are collected from sites across the world and illustrate the clinical value of MRE in the evaluation of liver tissue due to many liver diseases.



## Sites contributing MRE cases

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San Diego, CA  
Baltimore, MD  
Madison, WI  
Yamanashi, Japan  
Seoul, Korea  
Compiègne, France  
Singapore  
St. Paul, MN



## Sites currently using MRE

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Scottsdale, AZ  
San Diego, CA  
Jacksonville, FL  
Rochester, MN  
Houston, TX  
Cambridge, United Kingdom  
New Delhi, India



## Sites pending MRE implementation

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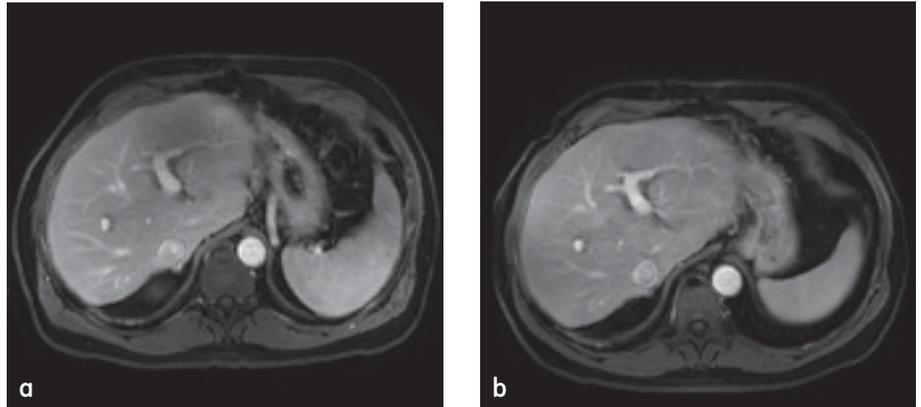
Seongnam, Korea  
San Bernardino, CA  
Dallas, TX  
Milwaukee, WI  
Pittsburgh, PA  
Paris, France  
Hong Kong



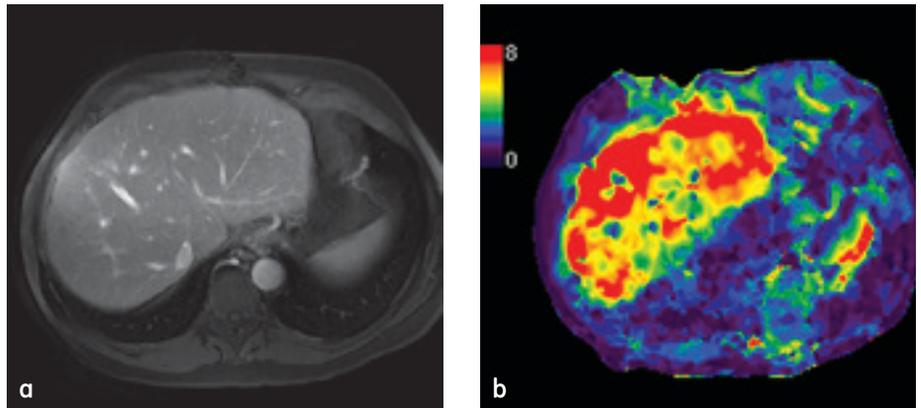
Dr. Russell N. Low

**Contributor:** Russell N. Low, MD, Medical Director  
Sharp and Children's MRI Center, San Diego, CA

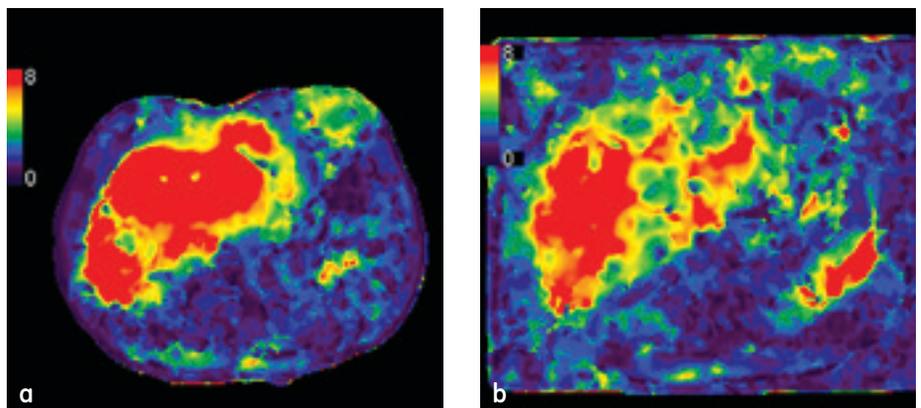
**Case 1:** A 55-year-old man with rising liver function tests; two years post liver transplantation. The patient had many MR exams that show mild Splenomegaly and a normal appearing liver.



**Figure 1.** (a) MR image from December 2008, initial post-liver transplantation MR. (b) March 2009, liver biopsy shows mild fibrosis.



**Figure 2.** (a) MR image from December 2009, (b) MRE at this time shows stiffness levels consistent with moderate to marked fibrosis.



**Figure 3.** MRE images from March 2010, stiffness levels consistent with marked liver fibrosis. MRE on right suggests recurrent hepatitis C.

**MRE Finding:** The elastogram showed abnormal liver stiffness that is consistent with fibrosis from reinfection with hepatitis C. Results were confirmed by liver biopsy.

**Contributor:** Susanne Bonekamp, DVM, PhD, Research Associate in the Division of Clinical MRI, Department of Radiology, Johns Hopkins University School of Medicine, Baltimore, MD

**Case 1:** A 50-year-old female patient with hepatitis C and HIV co-infection. Patient received biopsy 89 days after MRE (as part of a research study).

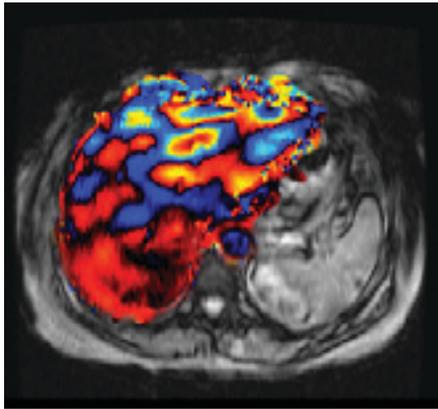


Figure 4a. MRI with color coded wave.

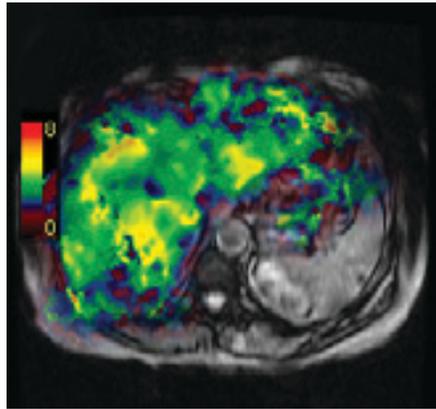


Figure 4b. MRI with elastogram.

**MRE Finding:** Elastogram is consistent with that of mild fibrosis. Biopsy showed steatosis, inflammation, and mild fibrosis (F1).

**Case 2:** A 47-year-old male patient with hepatitis C and HIV co-infection. Patient received biopsy 48 days after MRE (as part of a research study).

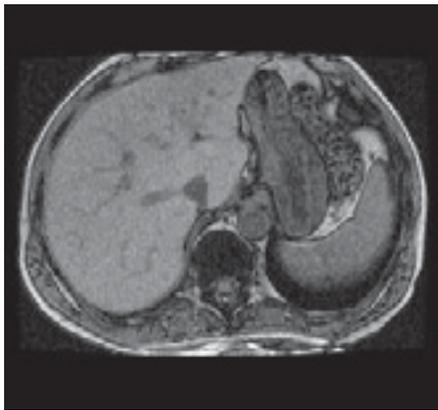


Figure 5a. MRI magnitude image.

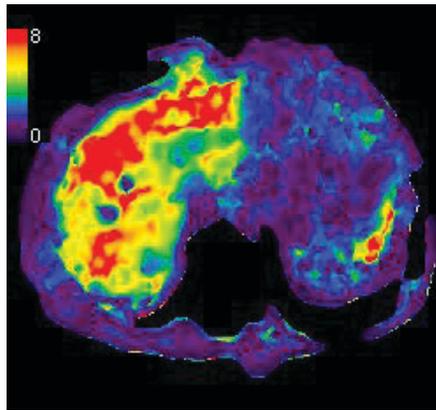


Figure 5b. MRI with elastogram.

**MRE Finding:** Elastogram shows stiffness consistent with that of severe fibrosis (METAVIR F4), 5–30% macrovascular fat, and mild necroinflammatory activity (overall MHA1=6).



Dr. Susanne Bonekamp



Dr. Utaroh Motosugi

**Contributor:** Utaroh Motosugi, MD, PhD, Assistant Professor, Department of Radiology, University of Yamanashi, Yamanashi, Japan

**Case 1:** A 52-year-old female with clinically suspected primary biliary cirrhosis for seven years. Blood exam showed elevated ALP, anti-mitochondria antibody, and IgM.

Alkaline phosphatase (ALP): 712 IU/L (normal range: 100-248)

anti-mitochondria antibody: > 320 (normal range: < 20)

IgM: 311 mg/dL (normal range: 35-225)

Total bilirubin: 0.6 mg/dL (normal range: 0.3-1.3)

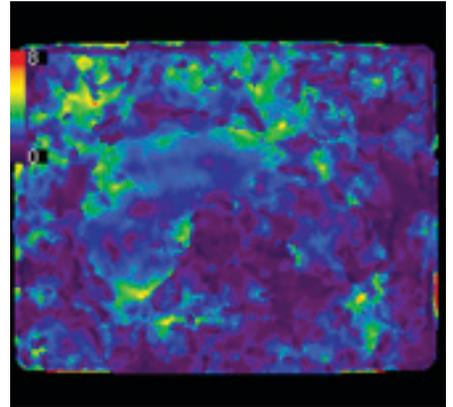
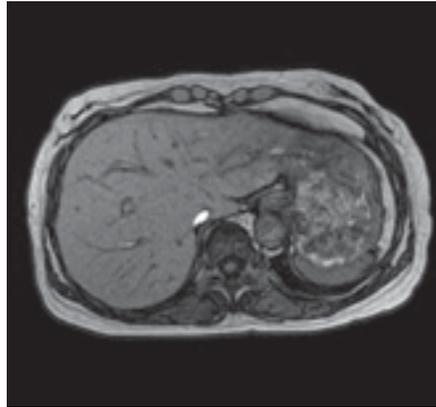


Figure 7.

**MRE Finding:** Based on the MRE, the mean stiffness for the region of interest did not indicate the onset of liver fibrosis. The planned biopsy to confirm liver fibrosis was deemed unnecessary and postponed.

**Case 2:** An 81-year-old male without history of liver disease: HBs-Ag (-), HCV-Ab (-), non-alcohol drinker, and no history of fatty liver disease.

Dynamic MRI using gadoxetic acid; Slight hypervascularity on arterial-phase image in the hepatic dome with subsequent hypointensity, suggesting hepatocellular carcinoma (HCC).

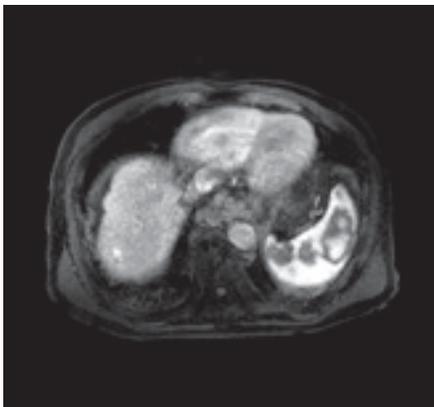


Figure 6a. Arterial-phase image of gadoxetic acid-enhanced MRI.

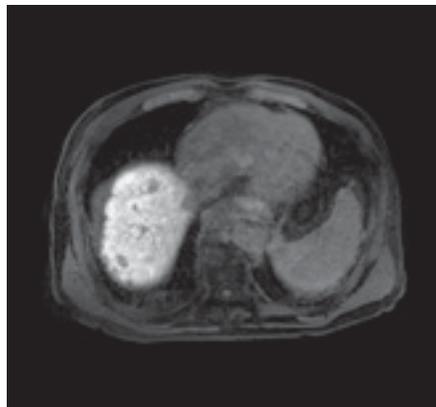


Figure 6b. Hepatocyte-phase after gadoxetic acid-administration.

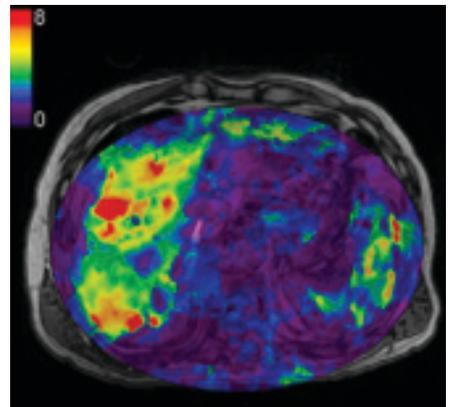


Figure 6c. MRE.

**MRE Finding:** MRE showed mean stiffness consistent with liver cirrhosis, which gave the radiologist more confidence in the diagnosis of HCC.

**Contributor:** Jeong Ming Lee, MD, Associate Professor,  
Seoul National University Hospital, Seoul, Korea

**Case 1:** A 14-year-old with glycogen storage disease. Conventional MRI is not able to show definite changes of fibrosis.

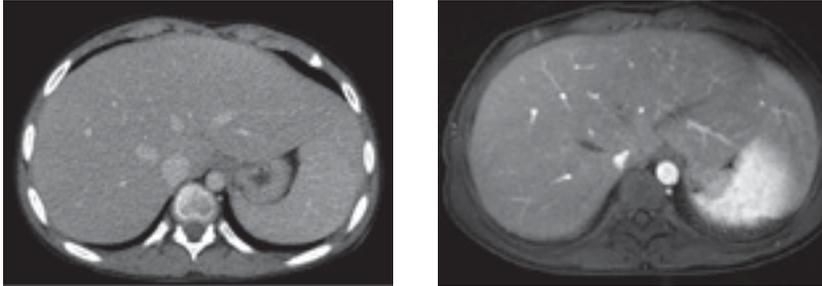


Figure 8.

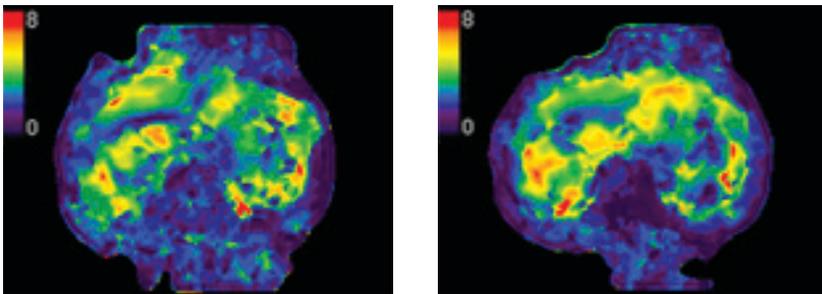


Figure 9.

**MRE Finding:** Elastogram indicates liver stiffness consistent with significant fibrosis. Pathology reveals F3 fibrosis.

**Case 2:** A 69-year-old male Hepatocellular carcinoma (HCC) with central necrosis.

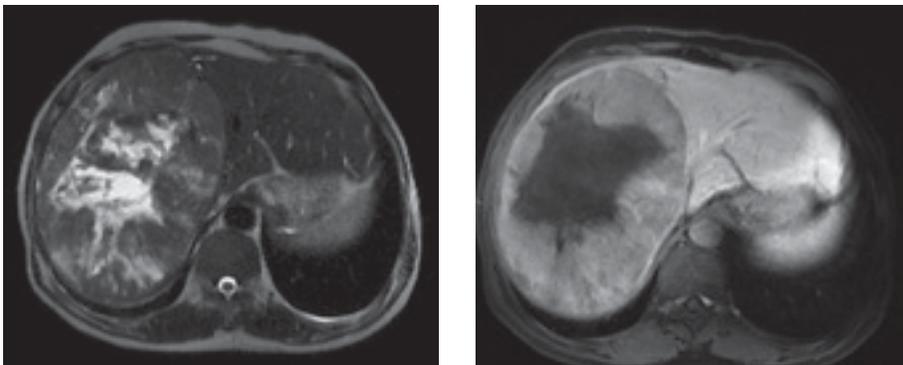


Figure 10.

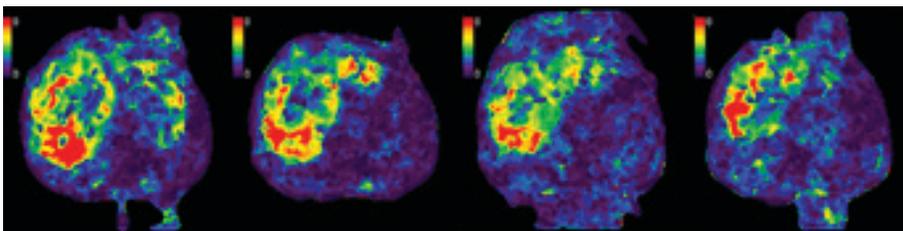


Figure 11.

**MRE Finding:** Elastogram shows elevated liver stiffness for the tumor and liver parenchyma, consistent with stage 1 fibrosis (F1). Pathology confirmed that this tumor was grade III HCC, and the liver showed no evidence of severe fibrosis.



Dr. Jeong Ming Lee



Dr. Scott Reeder

**Contributor:** Scott Reeder, MD, PhD,  
Associate Professor, Section Chief of MRI, Department  
of Radiology, University of Wisconsin-Madison, Madison, WI

**Case 1:** A 27-year-old male with increased ALT (241) and AST (79) and a BMI of 27kg/m<sup>2</sup>

**MRE Finding:** The MRE stiffness is normal; chemical shift based imaging with T2\* correction shows marked dropout of signal on the opposed phase image demonstrating the presence of severe steatosis; R2\* map ( $=1/T2^*$ ) shows a normal T2\* (27ms). The biopsy shows severe steatosis and no fibrosis or inflammation, and therefore the biopsy is concordant with MRE. In this case, MRE successfully differentiated (the tissue stiffness) between isolated steatosis and steatohepatitis.

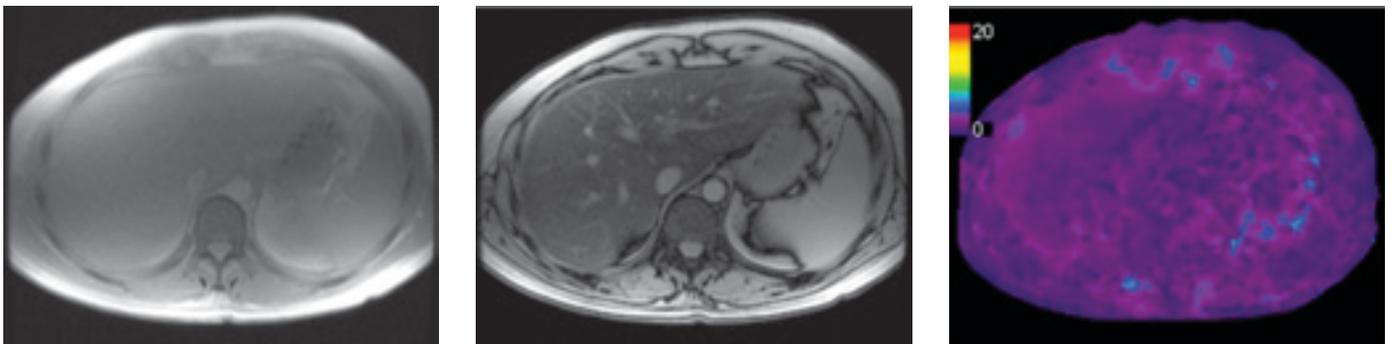


Figure 12. Marked dropout of signal on the opposed phase image demonstrates the presence of severe steatosis.

**Case 2:** A 10-year-old pediatric patient with abdominal pain.

**MRE Finding:** MRE study shows highly elevated stiffness. Chemical shift based imaging with T2\* correction and long T2\* (40ms) is consistent with steatosis and edema. Overall, the combined findings of MRE and chemical shift based imaging fit a clinical picture of acute steatohepatitis from non-alcoholic fatty liver disease. These findings were confirmed with biopsy that demonstrated severe steatohepatitis with severe bridging and pericellular fibrosis, most consistent with nonalcoholic fatty liver disease.

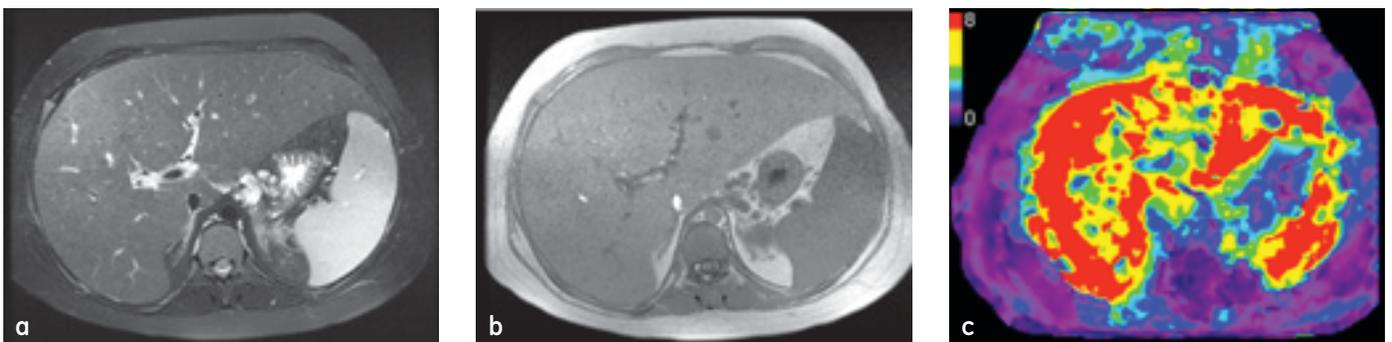


Figure 13. (a) T2 with fat sat, (b) in phase, (c) elastogram

**Contributors:** Sabine F. Bensamoun, MD, PhD, Researcher CNRS in the Biomechanics and Bioengineering Laboratory at the University of Technology of Compiègne, Compiègne, France and Fabrice Charleux, MD, MRI radiologist, Department of Radiology, Polyclinic St. Côme, Compiègne, France

**Case 1:** A 54-year-old, female, alcoholic. Fibroscan and Fibrometer revealed a liver fibrosis stage F4.

**MRE Finding:** The mean stiffness for the region of interest was consistent with that of stage F4 liver fibrosis, thus confirming the diagnosis. The patient was placed in detoxification therapy during three weeks.



*Dr. Sabine F. Bensamoun*



*Dr. Fabrice Charleux*

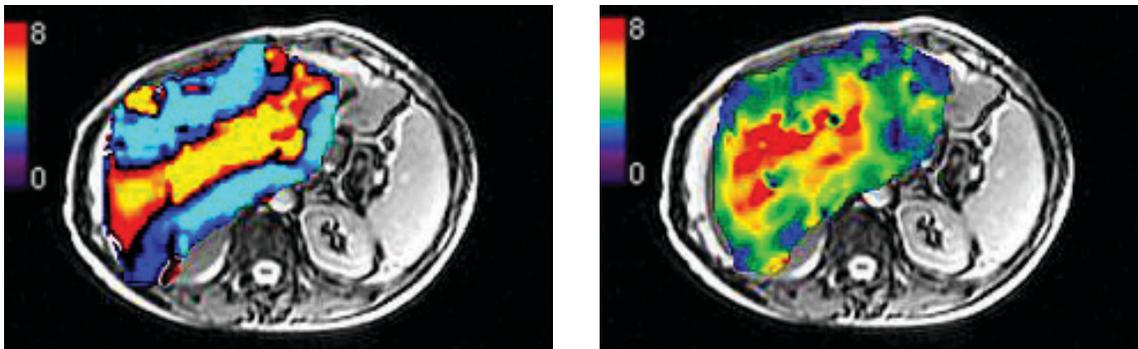


Figure 14.

## Acknowledgement

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