What challenges does MR-Touch address and what solutions does it create?

Chronic liver disease and cirrhosis are major public health problems worldwide. In 2004, these conditions were associated with nearly 40,000 deaths and a cost of at least $1.4 billion for medical services in the U.S. alone.

Liver biopsy is the current standard of care for detecting hepatic fibrosis, but its invasive nature limits its value to use as a screening tool for a large population. There are also limitations with the technique that include poor acceptance by patients, measurement errors, and cost.3,4 Current noninvasive alternatives to liver biopsy are serum-based testing,5 which is not reliable for detecting early disease, and transient ultrasound elastography,6 which has technical limitations in patients with obesity and conditions such as ascites.

MR-Touch uses the MR Elastography (MRE) technique to provide diagnostic information without the discomfort and risk of complications due to invasive procedures, enabling more frequent evaluation when closer monitoring is needed.

What are the main benefits of the technology?

By creating a vivid visual representation of liver tissue stiffness, MRE helps radiologists deliver a more confident diagnosis. Both comprehensive and non-invasive, the technique can appeal to patients and referring physicians, and can help expand the role of radiology into new areas.

**Magnetic resonance elastography**

Magnetic resonance elastography (MRE), a technique developed by Richard Ehman, MD, and colleagues at Mayo Clinic (Rochester, MN), uses low-frequency mechanical waves to probe the elastic properties of tissue. These mechanical waves are generated in the body through an external acoustic driver, which are then imaged using a special phase-contrast MR sequence. Using a sophisticated mathematical algorithm, the mechanical wave data collected by the MR is then used to generate “elastograms” – diagnostic images that depict relative stiffness of tissues.

MRE gives referring physicians a powerful new option for liver assessment. It is a new tool that provides diagnostic information without the discomfort and risk of complications due to invasive procedures, enabling more frequent evaluation when closer monitoring is needed. By creating a visual representation of liver tissue stiffness, MRE helps radiologists deliver a more confident diagnosis at a lower cost than previous techniques. Both comprehensive and non-invasive, MRE can appeal to patients and referring physicians and can help expand the role of radiology into new areas.

*More than anything else, MRE holds the promise of better outcomes at lower costs to the healthcare system.*

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How does MRE work?
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Using a sophisticated mathematical algorithm, the mechanical wave data collected by the MR is then used to generate “elastograms” – diagnostic images that depict a relative stiffness of tissues. MRE gives referring physicians a powerful new option for liver assessment. It is a new tool that provides diagnostic information without the discomfort and risk of complications due to invasive procedures, enabling more frequent evaluation when closer monitoring is needed.

Patient management with MRE
MRE provides additional assessment of liver disease beyond routine lab and imaging tests, so that the patients can be more appropriately referred for further diagnosis options such as biopsy. Because liver biopsy is invasive, some patients with suspected liver disease may decline the procedure. MRE can enable referring physicians to assess more patients who may need liver biopsy and to identify patients who present tissue stiffness that is symptomatic of fibrosis.

How does MRE technology improve care and decrease costs?
Improved quality: MRE is noninvasive and provides a color-coded visual representation of tissue stiffness overlaid on the anatomy. Mechanical properties of the liver tissue has been strongly correlated with the extent of fibrosis. MRE technology also improves quality of care due to its attractiveness for use in early diagnosis.

Diagnostic value: Sampling variability appears to be one of the major limitations of liver biopsy. Even though small biopsy specimens may be sufficient for diagnostic purposes in certain situations, the possibility that sampling variability exists must be recognized, so that the absence of key findings does not rule out a suspected diagnosis. By showing information about liver stiffness over one or more cross sections of the entire liver, MR elastography provides a more comprehensive view than before available.

Elastogram on volunteer patient is shown (right) and corresponding anatomic image (left). In the elastogram, relative stiffness is shown on a color scale, ranging from softest (purple) to hardest (red). For reference, a dashed outline has been superimposed on the elastogram to indicate the approximate location of the liver. Note that the stiffness of normal liver tissue is very low and similar to that of adipose tissue. The spleen is usually considerably stiffer than other tissues, as shown by the corresponding red areas.

A 61-year-old with elevated serum liver tests and nonalcoholic fatty liver disease. In this case of advanced liver fibrosis, the elastogram shows that the liver is much stiffer than subcutaneous tissues and overall stiffness of the liver. The heterogeneity of the stiffness of the liver is also increased (compared to volunteer in images shown above).

A 61-year-old with hepatitis C, cirrhosis, and hepatocellular carcinoma. The oval outline in the anatomic image (left) shows the location of the hepatocellular carcinoma. The elastogram (right) shows a corresponding area of high stiffness in the right lobe of the liver (red arrow), as well as an area of very high stiffness in the left lobe of the liver (green arrow) that is consistent with advanced fibrosis.