Application of Liver MR Elastography in Clinical Practice

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Introduction: MR elastography [MRE] has been validated as a diagnostic tool for non-invasive assessment of liver fibrosis in several independent studies [1,2]. Based on this evidence, MRE was introduced as a clinical test at our institution in January 2007. In this paper, we describe our experience with the application of MRE technique for assessment of diffuse and focal liver pathology, including a review of indications and the effect on subsequent management.

Materials and Methods: MR Elastography of the liver was performed in 281 patients. The most common indication was follow-up imaging of patients with known hepatic fibrosis (Table 1). All patients were scanned in supine position. MRE technique [1] was performed with either body coil or surface coil to according to the body habitus of the patient. Axial MRE slices (4-6) through the largest cross-section of the liver were obtained in each patient. The slice thicknesses were 6-10mm, modified according to the liver size and any focal lesion studied. Stiffness maps were generated by an automated process using multi scale direct inversion algorithm. Stiffness values were measured by manual placement of 3 or more regions of interest in each slice. Mean value of the measurements from all the slices were reported. A stiffness value >2.9kPa [1] was reported as elevated and represent fibrosis in diffuse liver diseases. In this retrospective case review, correlation with histopathology was done wherever possible.

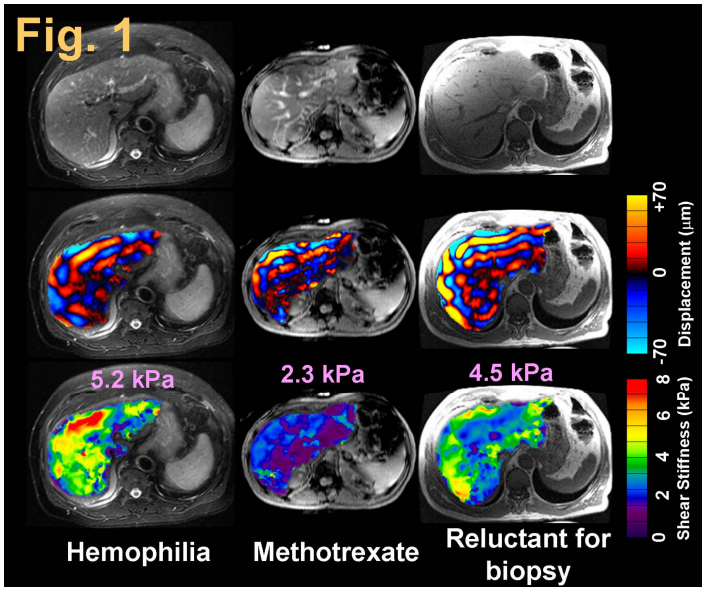
Table 1

Clinical indications	Number
Detection of liver fibrosis	117
Follow-up of liver fibrosis	114
Liver tumors	44
Post treatment assessment	6

Results

Diagnostic-quality elastograms of the liver were obtained in 261 of the 281 patients in which the procedure was performed. In 16 patients, MRE was not successful due to low signal in the liver resulting from high iron content (Hemochromatosis) and for similar reasons was not successful in 2 patients who received Feridex administration before MRE. In 2 patients, the elastograms were not considered to be of good quality due to inadequate breath-holding during acquisition. A total of 109 patients who underwent MRE had a previous diagnosis of liver fibrosis, and the MRE examination was performed as a substitute for follow-up biopsy. Of these 103 (95%) patients had elevated liver stiffness by MRE, confirming the ongoing presence of fibrosis. In 105 patients with suspected but not previously established diagnoses of liver fibrosis, elevated stiffness values were demonstrated in 49. Of these, 13 patients went on to biopsy, which in all cases confirmed the presence of fibrosis. A total of 56 patients had normal stiffness values. Of these 13 underwent liver biopsy and confirmed the absence of fibrosis in 7 cases. In 6 patients pathology reported mild fibrosis.

Figure 1 illustrates examples showing how MRE typically affected patient management. (a) A patient with hemophilia A with Hepatitis C was evaluated with MRE instead of biopsy, due to the risk of complications. The MRE showed a stiffness value of 5.2kPa, consistent with moderate fibrosis. Treatment for Hepatitis C was instituted. (b) A patient with psoriasis, treated with methotrexate therapy for 15 years, previously required regular liver biopsies every 2 years to rule out methotrexate-induced liver fibrosis. MRE showed a stiffness of 2.3kPa. No liver biopsy was performed this time and patient is to be followed up with MRE in 2 years time. (c) A patient with Hepatitis C was reluctant to undergo liver biopsy. MRE demonstrated a stiffness of 4.5kPa. Patient was informed of the stiffness values and agreed to undergo liver biopsy, which confirmed the presence of F2 fibrosis. In six patients, MRE was performed after treatment for specific etiologies. MRE demonstrated normal stiffness in five patients and elevated stiffness in one patient, who later underwent biopsy, confirming the presence of F1 stage fibrosis. In 41 patients, MRE was evaluated for characterization of liver masses.



Discussion and Conclusion: The experience to date indicates several general trends. Clinicians are increasingly using MRE as a non-invasive test for confirmation of liver fibrosis in follow-up of patients with known fibrosis. The information provided by MRE generally increases the confidence levels of the clinicians in a diagnosis of cirrhosis. Stiffness values from MRE are used to classify patients for surveillance for portal hypertension and/or tumor.

In patients with suspected liver fibrosis, MRE is often being used to triage patients for liver biopsies. Patients with elevated liver stiffness with MRE and other clinical indications for treatment such as viremia are being biopsied before initiation of treatment. In contrast, those patients with normal stiffness are usually followed up and rarely are a liver biopsy is performed.

MRE is emerging as an alternative to liver biopsy in situations where biopsy is contraindicated, when multiple biopsies are necessary, and especially when patients are reluctant to undergo biopsy. MRE is also being used as a screening tool is for assessment of liver stiffness following treatment for diffuse liver pathologies. MRE is also proving to be a promising tool for differentiating benign and malignant solid liver tumors.

Overall the impact of MRE in clinical practice has been high, with clinicians increasingly using MRE for screening and follow up for liver fibrosis.

References: [1] M. Yin, et al. 2007, Clincal Gastroenterol Hepatol 2007;5:1207-1213. [2] Huwart Nov 2007