Utility of MR Elastography in Staging of Liver Fibrosis among Asia Patients with Chronic Liver Disease

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Purpose

According to the American Association for the Study of Liver Diseases (AASLD) and The European Association for the Study of the Liver (EASL) guidelines, antiviral medication is advised for patients with chronic hepatitis and histological examination of fibrosis stages greater than F2. Liver biopsy is currently the gold standard for the diagnosis of liver cirrhosis and determining fibrosis stage. However, it is invasive and is not well accepted by patients, especially infeasible when repeated examinations are required. The effort to develop noninvasive markers to assess liver fibrosis is expected to facilitate the design of clinical trials. In addition, liver biopsy has several limitations, including significant sampling errors up to 14.5%-25% and high inter-observer variability. Therefore, there is a clear need for non-invasive alternatives to liver biopsy. Magnetic resonance elastography (MRE) is a noninvasive method of measuring the viscoelastic properties of the liver. The purpose of our study was to determine the efficacy of MR elastography in the staging of liver fibrosis among Asia patients with chronic liver disease.

Materials and Methods

From Jan. 2011 to Jul. 2013, 205 patients with chronic liver diseases and 51 healthy patients (living related liver donors) underwent MRE and histological examination during a 3-month interval. MRE was performed on a 1.5-T unit (Avanto, Siemens) with an acoustic driver system (Resoundant, Mayo Clinic), a gradient-echo MRE pulse sequence, and special software for data analysis. The mean liver stiffness values were measured on the elastograms in kilopascals (kPa)(fig.1). Laboratory datas was recorded and aspartate aminotransferase to platelet ratio index (APRI) was calculated. Receiver operating characteristic curve (ROC) analysis was performed to determine the cutoff value and accuracy of MRE and APRI for staging liver fibrosis. Pathological staging of liver fibrosis according to the METAVIR scoring system served as the standard of reference. The steatosis of liver parenchyma was also determined. The mean stiffness of different fibrosis stage between the two underlying disease subgroups (hepatitis B virus, HBV; hepatitis C virus, HCV) was compared.

Results

Liver stiffness increased systematically along with the fibrosis stage. With shear stiffness cutoff values of 2.46 kPa (F0 vs.F1-4), 2.83 kPa (F01 vs. F2-4), 3.58 kPa (F0-2 vs. F34), and 3.94 kPa (F0-3 vs. F4) in differentiating different fibrosis stage, the predicted sensitivity and specificity were 94.4% and 94.6%, and 93.4 %, 91.0% and 89.3%, 89.1% and 96.2, 83.3%, respectively (Table 1). The diagnostic performance of MRE was significantly higher than APRI in prediction of liver fibrosing stage with using ROC analysis. There was no significant difference of liver stiffness between underlying disease of hepatitis B virus and hepatitis C virus. There was no significant difference of liver stiffness between patients with normal/mild hepatic steatosis and moderated/severe hepatic steatosis.

Discussion

According to the American Association for the Study of Liver Diseases guidelines, aggressive treatment is advised if the liver fibrosis score ≥ 2. As patients with significant fibrosis, almost invariably progress to cirrhosis over a 10- to 20-year period, antiviral treatment should be strongly recommended. In our results, the liver stiffness values measured by MRE had a good correlation with the METAVIR score. In differentiation of fibrosis stage ≥ 2 from fibrosis stage 0-1 with MRE, the sensitivity and specificity were 93.4% and 91.0%, respectively, with a cutoff value of 2.83 kPa. As an effective and, noninvasive study for staging hepatic fibrosis, MRE could be a screen tool for patients with chronic liver disease.

Table 1. Most discriminating cutoff values with stiffness value by MRE and APRI according to the pathologic METAVIR Scores using receiver operating characteristic curve analysis were shown.

		Liver fibrosis stage			
		F0 vs. F1~4	F0~1 vs. F2~4	F0~2 vs. F3~4	F0~3 vs. F4
MRE					
	Az	0.982±0.008	0.969±0.010	0.949±0.013	0.959±0.011
	Cutoff value (kPa)	2.46 kPa	2.83 kPa	3.58 kPa	3.94 kPa
	Sensitivity	94.4%	93.4%	89.3%	96.2%
	Specificity	94.6%	91.0%	84.1%	83.3%
APRI					
	Az	0.925±0.021	0.879±0.027	0.810±0.028	0.797±0.029
	Cutoff value	0.41	0.43	1.09	1.24
	Sensitivity	88.3%	94.6%	64.5%	62.8%
	Specificity	86.5%	70.1%	84.1%	79.5%

MRE= MR elastography; APRI= aspartate aminotransferase to platelet ratio index; Az= area under the curve; kPa= kilopascal. Value was depicted as mean ± standard deviation.

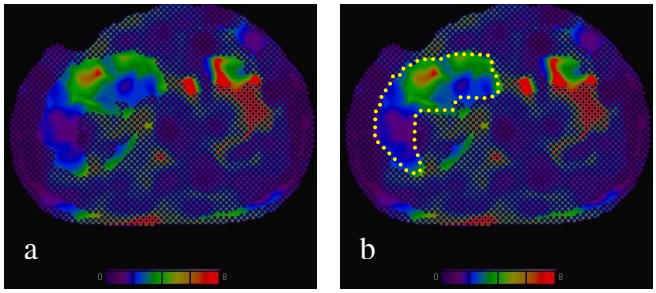

Fig.1. A 46 year-old male with HBV hepatitis underwent MRE. a) Hepatic elastogram with statistical confidence map was shown. b) Liver stiffness value was determined by placed a region of interest (dot line) as large as possible in the statistical confidence area.

Conclusion

Due to the high diagnostic performance of MRE in the differentiation between fibrosis stages, MRE could be a promising, noninvasive technique for prediction of fibrosis stage among patients with chronic liver disease. No significant difference of liver stiffness in different fibrosis stage between the patients with HBV or HCV liver disease.