Inter-observer Agreement of Liver Biopsy and Liver MR Elastography

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Target audience: Audiences who are interested in noninvasive diagnosis of liver fibrosis.

PURPOSE: Liver fibrosis is a common result when a healthy liver is damaged; it can further cause liver cirrhosis and hepatocellular carcinoma if left untreated. Liver biopsy has been regarded as the reference standard; however, the major limitation of liver biopsy is its sampling error because it represents only about 1/50,000 of the whole liver [1], a single biopsy can misclassify fibrosis by at least ± 1 stage in 20%-30% of patients [2, 3]. Liver MR Elastography (MRE) is a 2D cross-sectional stiffness imaging modality that can accurately diagnose liver fibrosis, for example, in patients with chronic liver diseases, the diagnostic accuracy for detecting hepatic fibrosis (F2 - F4) was 99.4% with MRE [4]. MRE has also shown good repeatability and reproducibility [5]. However, as far as we know, there is no study comparing the inter-observer variability of liver biopsy and liver MRE. In this study, our goal is to investigate the inter-observer agreement of liver biopsy and liver MRE using intra-class correlation coefficients (ICCs) analysis in the same group of patients. Our hypothesis is that the ICC values of MRE is greater than that of liver biopsy.

METHODS: ***(1) Subjects***: Our Institutional Review Board approved the study. A total of 113 patients with different liver disease causes were enrolled in the study according to the including criteria. ***(2) Liver biopsy:*** Liver biopsy was performed using either a percutaneous, transjugular, or intraoperative approach within our clinical practice. METAVIR (for hepatitis C) and Brunt (for nonalcoholic and alcoholic liver disease) were used to assess fibrosis stage. Two biopsy interpretations on liver fibrosis stages were given by two different pathologists, double blinded to each other, without knowing MRE results. ***(3) MRE:*** Subjects underwent 2D, 60-Hz liver MRE performed in a 1.5-T MRI scanner (GE, Signa HDxt, Wisconsin, USA), with a MRE driver positioned on their chest wall close to the liver [6]. Two MRE readers measured the liver stiffness independently and double blinded to each other, without knowing the biopsy results. ***(4) Statistic analysis:*** To evaluate inter-observer variation, Intraclass correlation coefficients (ICCs) were calculated between two liver biopsy interpretations of fibrosis stages, as well as between two MRE liver stiffness measurements. Linear correlation coefficients were calculated for each method. JMP Pro (SAS, USA) software was used.

Method	Intraclass Correlation Coefficient (ICC)
Liver Biopsy	0.8858
Liver MRE	0.9544

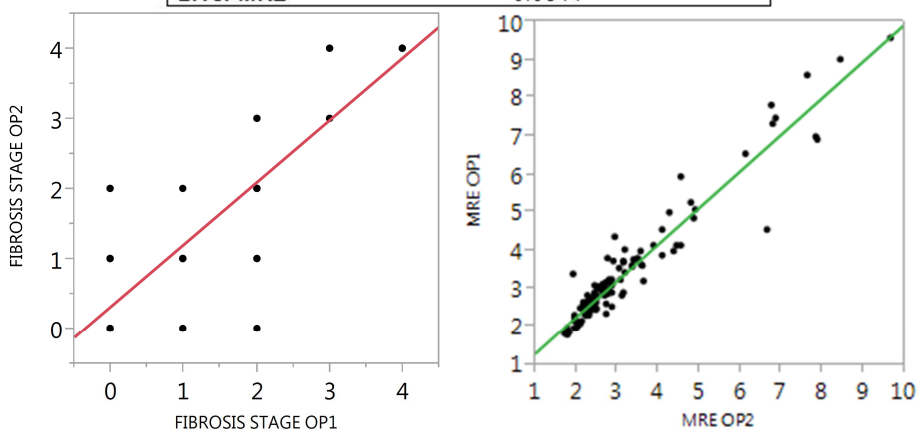

Fig 1. Linear correlation between two operators of liver biopsy and liver MRE. Liver MRE: R^2 = 0.922; Liver Biopsy: R^2 = 0.797

RESULTS: 111/113 underwent liver biopsy and 105/113 underwent 2D MRE. One sample was considered too small for fibrosis staging in the first biopsy review, but was judged adequate in the second biopsy review. ICC values: liver biopsy = 0.8858, MRE = 0.9544. Linear correlation coefficients R^2: liver biopsy = 0.797, MRE = 0.922.

DISCUSSION & CONCLUSION: In this study, we found MRE had a greater ICC value than liver biopsy; MRE had better inter-observer agreement (ICC = 1 means 100% agreement).

REFERENCES: [1] Bravo, A.A., N Engl J Med, 2001. 344(7): p. 495-500. [2] Standish, R.A., Gut, 2006. 55(4): p. 569-78. [3] Regev, A., Am J Gastroenterol, 2002. 97(10): p. 2614-8. [4] Huwart, L., Gastroenterology, 2008. 135(1): p. 32-40. [5] Lee, Y. JMRI, 2014. 39(2): p. 326-31. [6] Yin, M., Clin Gastroenterol Hepatol, 2007. 5(10): p. 1207-1213 e2.