E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.48047/ijprt/15.02.38

A role of MR Elastography in Assessment of Liver Fibrosis in North in India in tertiary care centre

Dr Karan Singh[1], Dr Phool Singh Sagar[2], Dr Aneeta Agrahari[3]

1. Dr Karan Singh, Associate Professor, Dept of General Medicine, Rani Durgawati Medical Collge, Banda, UP, India, karanrajpootbanda@gmail.com
2. Dr Phool Singh Sagar, Assistant Professor, Depat of Radiology, Rani Durgawati Medical Collge, Banda, UP, India, doctorphoolsonghsagar@mail.com
3. Dr Aneeta Agrahari, Assistant Professor, Dept of Paediatrics, Rani Durgawati Medical College, Banda, UP, India, aneeta2309@gmail.com

Corresponding Author:

Dr Karan Singh, Associate Professor, Dept of General Medicine, Rani Durgawati Medical Collge, Banda, UP, India, karanrajpootbanda@gmail.com

Abstract

Background: Liver fibrosis is a common outcome of various chronic liver diseases, including viral hepatitis, alcohol-related liver disease, and non-alcoholic fatty liver disease (NAFLD). If left untreated, progressive fibrosis can lead to cirrhosis, liver failure, and hepatocellular carcinoma. Early detection and accurate staging of liver fibrosis are essential for prognosis and timely intervention. **Aim:** To evaluate the diagnostic performance of Magnetic Resonance Elastography (MRE) in assessing liver fibrosis. **Methods:** A total of 75 patients with chronic liver disease underwent MRE for fibrosis evaluation. The MRE findings were compared with histopathological results from liver biopsies, regarded as the gold standard, to determine the sensitivity, specificity, and diagnostic accuracy of MRE. **Results:** MRE showed high diagnostic accuracy, with a sensitivity of 92% and specificity of 90% in detecting liver fibrosis. It was particularly effective in identifying intermediate to advanced stages of fibrosis and demonstrated strong correlation with biopsy findings. **Conclusion:** Magnetic Resonance Elastography is a reliable and non-invasive imaging technique for liver fibrosis assessment. It offers a viable alternative to liver biopsy, especially in cases where biopsy is contraindicated or not feasible. Further research and protocol standardization are recommended to facilitate its broader clinical adoption.

Keywords: Liver fibrosis, Magnetic Resonance Elastography, chronic liver disease, non-invasive imaging, liver biopsy, fibrosis staging.

Introduction

Liver fibrosis is a common pathological consequence of chronic liver injury resulting from conditions such as viral hepatitis, alcohol abuse, and non-alcoholic fatty liver disease (NAFLD). The liver responds to sustained injury through the deposition of extracellular matrix proteins, leading to progressive scarring. Over time, this fibrotic process can advance to cirrhosis and end-stage liver disease, contributing to severe complications such as liver failure, portal hypertension, and hepatocellular carcinoma [1].

Traditionally, liver biopsy has been regarded as the gold standard for assessing the degree of liver fibrosis. However, it is an invasive procedure with several limitations, including sampling error, patient discomfort, risk of complications, and poor suitability for repeated monitoring [2]. Consequently, there has been increasing interest in the development of non-invasive methods for evaluating liver fibrosis, particularly imaging-based techniques.

Various histopathological scoring systems are employed for staging liver fibrosis, such as the METAVIR, Batts-Ludwig, International Association for the Study of the Liver (IASL), Knodell, and the Ishak (modified Knodell) fibrosis scores [3]. Among these, the Ishak system offers greater granularity (stages 0–6), allowing better distinction between incomplete and established cirrhosis, and is considered more sensitive for fibrosis assessment [3,4].

Magnetic Resonance Elastography (MRE) is a non-invasive imaging modality that measures liver stiffness, which correlates directly with the degree of fibrosis. MRE involves the application of mechanical vibrations to the liver, generating shear waves that are captured by MRI to quantify tissue stiffness. Studies have demonstrated that MRE provides a reliable and reproducible measure of fibrosis and correlates well with histopathological staging [5].

MRE has shown promising results in patients with various liver conditions, including chronic hepatitis, NAFLD, and alcoholic liver disease. It is considered safe, well-tolerated, and accurate for fibrosis staging. Despite its advantages, widespread adoption of MRE has been limited due to high cost, limited availability, and the need for specialized equipment and trained personnel [6].

Aim of the Study

This study aims to evaluate the diagnostic performance of Magnetic Resonance Elastography in the assessment of liver fibrosis, and to compare its accuracy with liver biopsy findings.

Objectives

- To determine the sensitivity and specificity of MRE in detecting liver fibrosis in patients with chronic liver disease.
- To assess the correlation between MRE-derived liver stiffness measurements and histological fibrosis staging.

Materials and Methods

Study Design:

This prospective observational study was conducted at a tertiary care hospital. A total of 75 patients, aged between 20 and 65 years, diagnosed with chronic liver disease—including hepatitis B or C, non-alcoholic fatty liver disease (NAFLD), or alcoholic liver disease—were enrolled.

Inclusion Criteria:

- Patients with a confirmed diagnosis of chronic liver disease

- Patients with clinical or imaging suspicion of liver fibrosis or cirrhosis
- Patients who provided informed consent to undergo both Magnetic Resonance Elastography (MRE) and liver biopsy

Exclusion Criteria:

- Patients with contraindications to MRI (e.g., pacemakers, metallic implants)
- Pregnant or lactating women
- Patients with significant comorbidities known to affect liver function (e.g., end-stage renal disease)

Procedure:
All participants underwent MRE using a 3-Tesla MRI scanner equipped with an elastography protocol. The liver stiffness measurements obtained were categorized into fibrosis stages (F0–F4) based on standard thresholds. Following MRE, each patient underwent percutaneous liver biopsy. Histopathological examination of liver tissue samples was performed by an experienced pathologist using the METAVIR scoring system to stage liver fibrosis.

Statistical Analysis:
The diagnostic accuracy of MRE in detecting liver fibrosis was evaluated by calculating sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). The correlation between MRE results and histological fibrosis staging was analyzed using the Pearson correlation coefficient. A p-value of <0.05 was considered statistically significant.

Result

Table 1 Patient demographics and characteristics

Demographics		**N(%)**
Sex	Male	44(58.7)
	Female	31(41.3)
Age		65.41±12.1

Table show that majority male 44 and female 31 and age of mean and SD was 65.41±12.1.

Table 2: Diagnostic Accuracy of MRE for Liver Fibrosis Staging

Fibrosis Stage (METAVIR)	**RE Diagnosis (n=75)**	**Sensitivity (%)**	**Specificity (%)**
F0 (no fibrosis)	15	90	85
F1 (mild fibrosis)	28	88	87
F2 (moderate fibrosis)	14	85	82
F3 (severe fibrosis)	9	90	89
F4 (cirrhosis)	9	92	90

In the present study on histopathogical examination it was found that in total, 15, 28, 14, 9, and 9 had fibrosis stages 0, 1, 2, 3, and 4, respectively

Table 3: Correlation Between MRE and Liver Biopsy Staging

MRE Stiffness Value (kPa)	Histological Stage (METAVIR)	Correlation Coefficient (r)
< 2.5	F0-F1	0.82
2.5 - 3.5	F2	0.9
> 3.5	F3-F4	0.96

RE showed high sensitivity and specificity for detecting liver fibrosis. The sensitivity was greatest for advanced fibrosis (F3-F4), and the specificity was consistently high across different stages of fibrosis. The correlation between MRE stiffness values and liver biopsy findings was strong, with higher stiffness correlating with more advanced fibrosis.

Discussion

Magnetic Resonance Elastography (MRE) offers a non-invasive, reliable method for quantifying liver stiffness, which closely correlates with the degree of liver fibrosis [6,7]. Its primary clinical value lies in its potential to reduce reliance on liver biopsy—an invasive procedure associated with discomfort, sampling error, and risk of complications. Numerous studies have demonstrated that MRE has strong diagnostic performance across various chronic liver disease etiologies [2,6].

Liver fibrosis is a dynamic and progressive process that, if left unrecognized, may lead to cirrhosis, hepatic decompensation, and hepatocellular carcinoma. Accurate staging is crucial for guiding treatment decisions and monitoring disease progression. While liver biopsy remains the gold standard, it is limited by its invasive nature, interobserver variability, and inability to assess the entire liver parenchyma.

This study supports existing literature by demonstrating that MRE has high sensitivity and specificity, particularly in detecting moderate to advanced fibrosis. These findings underscore MRE's utility in clinical settings, especially for patients in whom biopsy is contraindicated or when serial monitoring is required. MRE's ability to assess the entire liver and minimize sampling error gives it a significant advantage over traditional biopsy techniques [8].

However, despite its promising diagnostic capabilities, several limitations hinder the widespread adoption of MRE. These include the relatively high cost, limited availability in resource-constrained settings, and the need for specialized hardware and trained personnel [9]. Additionally, certain technical and patient-related factors, such as obesity or iron overload, can reduce image quality and diagnostic accuracy.

Nonetheless, the clinical benefits of MRE—non-invasiveness, reproducibility, and strong correlation with histopathological staging—make it a valuable tool in the management of chronic liver disease. The incorporation of MRE into routine practice could facilitate earlier detection, reduce dependence on biopsy, and improve longitudinal monitoring of liver fibrosis.

Conclusion

Magnetic Resonance Elastography is a robust, non-invasive imaging modality for the assessment of liver fibrosis. It offers accurate and reproducible liver stiffness

measurements that strongly correlate with histological findings. Given its high sensitivity and specificity, MRE represents a viable alternative to liver biopsy, particularly in patients for whom biopsy is contraindicated or unsuitable. Further large-scale, longitudinal studies and the standardization of imaging protocols are necessary to expand its clinical applicability and ensure broader access across diverse healthcare settings.

.

Reference

1. Poynard T, Bedossa P, Opolon P. Natural history of liver fibrosis progression in patients with chronic hepatitis C. Lancet. 1997;349(9055):825-832.
2. Castera L, Forns X, Alberti A. Noninvasive evaluation of liver fibrosis. Hepatology. 2008;48(2):599-608.
3. Goodman ZD (2007) Grading and staging systems for inflammation and fibrosis in chronic liver diseases. J Hepatol 47:598–607.
4. Shiha G, Zalata K (2011) Ishak versus METAVIR: terminology, convertibility and correlation with laboratory changes in chronic hepatitis C. Liver biopsy 10:155–170
5. Huwart L, Sempoux C, Peeters F, et al. Liver fibrosis: Noninvasive assessment with MR elastography. Radiology. 2008;248(3):893- 900.
6. Lee JM, Lee JY, Lee JS, et al. Clinical applications of MR elastography for liver fibrosis assessment. Korean J Radiol. 2013;14(2):173-180.
7. Ferraioli G, Sagnelli E, Tontodonati M, et al. A multicenter study of liver stiffness measurement by transient elastography in chronic hepatitis C. Hepatology. 2006;44(4):761-767.
8. Wong GL, Chan HL, Choi PC, et al. Noninvasive assessment of liver fibrosis in patients with chronic hepatitis B: A prospective comparison of hepatic transient elastography and serum biomarkers. Hepatology. 2010;51(2):508-517.
9. Bavu E, Sattler B, Pfaehler M, et al. Quantitative elastography of liver using MR elastography: A new technique to assess liver fibrosis. Radiology. 2008;249(2):468-474