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ORIGINAL ARTICLE

# Diffusion-weighted MRI and fibroscan vs. histopathology for assessment of liver fibrosis in chronic HCV patients: (Pilot study)

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**KEYWORDS**

Fibroscan;
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**Abstract** *Introduction:* HCV infection is responsible for liver fibrosis. Fibroscan and diffusion MRI have been proposed for non-invasive diagnosis and staging of hepatic fibrosis.
*Aim of the work:* To assess the accuracy of diffusion MRI and/or fibroscan in the diagnosis of liver fibrosis as compared to histopathology. Patients and methods pre-treatment laboratory work up, fibroscan, diffusion MRI of the liver and liver biopsy were done for 52 chronic HCV patients for assessment of liver fibrosis.
*Results:* There was a significant difference between ADC values of F0 vs. F1, F3 and F4 ($P = 0.008$, 0.033 and 0.015) respectively, however no significant differences were seen in the ADC values between the other different fibrosis stages. As regard the liver stiffness values, there was a significant difference between F1 and F3 ($P = 0.001$), F1 and F4 ($P = 0.024$) and between F2 and F3 ($P = 0.014$).There was no significant difference in the ADC values between (F0, F1, F2) on one hand and (F3, F4) on the other hand ($P = 0.387$), while there was a highly significant difference in the liver stiffness values between both groups ($p < 0.001$).
*Conclusions:* Diffusion MRI can distinguish non-fibrotic liver (F0) from advanced fibrosis (F3 and F4) but cannot be used to distinguish between the intermediate stages of fibrosis-fibroscan can differentiate between (F0, F1, F2) and (F3, F4).


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## 1. Introduction

Chronic hepatitis C virus (HCV) infection is responsible for liver fibrosis and may lead to potential long-term complications such as liver cirrhosis and hepatocellular carcinoma (1).

Liver biopsy (LB) has traditionally been considered the gold standard for pretreatment evaluation of liver fibrosis in patients with chronic hepatitis C (CHC). However, LB is an invasive procedure with several shortcomings (intra- and interobserver variability of histo-pathological interpretation, sampling errors, high cost) and the risk of rare but potentially life-threatening complications. In addition, LB is poorly accepted by patients and it is not suitable for repeated evaluation. Furthermore, the prevalence of CHC makes LB unrealistic to be performed in all patients with this disease who are candidates for antiviral therapy (2).

These limitations have stimulated the search for new non-invasive approaches (3). Conventional cross-sectional imaging techniques have limited capability to demonstrate liver fibrosis. Ultrasound and CT-based modalities can demonstrate the morphologic alterations of cirrhosis, but they are limited in evaluating patients with earlier stages of liver disease (4,5).

In response to the rising prevalence of chronic liver diseases, a number of imaging based methods including ultrasonography-based transient elastography (fibroscan), computed tomography-based texture analysis and diverse magnetic resonance (MR) imaging-based techniques have been proposed for non-invasive diagnosis and grading of hepatic fibrosis across its entire spectrum of severity. MR imaging-based techniques in current practice and in development for noninvasive assessment of liver fibrosis include conventional contrast material-enhanced MR imaging, double contrast-enhanced MR imaging, MR elastography, diffusion weighted imaging and MR perfusion imaging (4).

There are several publications indicating the efficacy of quantitative apparent diffusion coefficient (ADC) measurement with diffusion weighted magnetic resonance imaging (DW-MRI) in proving liver fibrosis. Diffusion weighted imaging is an advanced application of MRI used in evaluating the microscopic structure of tissues. This imaging method relies on quantification of the diffusion of water molecules inside tissues. Combined with other methods, this imaging modality might be used in evaluating parenchymal tissue that has no proven abnormalities with routine imaging modalities (6).

Liver fibrosis results in extracellular accumulation of collagen, glycosaminoglycans and proteoglycans that may restrict the molecular diffusion of water, thus suggesting that diffusion-weighted imaging (DWI) may be useful for assessing fibrosis (6).

The aim of the study was to assess the accuracy of diffusion-weighted MRI and fibroscan in the diagnosis of liver fibrosis as compared to histopathology of liver.

## 2. Patients and methods

### 2.1. Patients

This pilot study included 52 chronic HCV patients as diagnosed by seropositivity for HCV antibodies and HCV RNA by PCR. They were referred for assessment prior to antiviral therapy.

Patients included were naïve to antiviral therapy, their ages ranged from 18 to 60 years. Patients with other liver diseases, decompensated liver cirrhosis, hepatocellular carcinoma, liver biopsy contraindication, those who were not fit for combined interferon and ribavirin treatment due to persistent hematological abnormalities and those with BMI $>35$ were excluded.

Patients were subjected to thorough history taking, clinical examination, pre-treatment laboratory work, abdominal ultrasound, fibroscan, MR diffusion and liver biopsy. The study protocol was approved by the institutional review board and written informed consent was given by each patient.

### 2.2. Liver stiffness measurement using fibroscan

Liver stiffness was measured using the ultrasound TE fibroscan device (Echosens, Paris, France), which consists of a 5-MHz ultrasound transducer probe mounted on the axis of a vibrator. TE measures liver stiffness in a volume that approximates a cylinder 1 cm wide and 4 cm long, between 25 and 65 mm below the skin surface.

The patient was lying in the dorsal decubitus with the right arm in maximal abduction. The tip of the transducer was covered with a drop of gel and measurements were taken in the right lobe of the liver by placing the tip of the transducer perpendicularly in the intercostal space.

The median value of ten successful acquisitions expressed in kilopascal (kpa) and was kept as representative of liver stiffness measurement.

- The clinical interpretation of TE depends on two important parameters for results to be considered reliable:
  (1) The interquartile range, which reflects the variability of the validated measures, should not exceed 30% of the median value.
  (2) The success rate (the ratio of the number of successful measurements to the total number of acquisitions) should be at least 60%.

Liver stiffness measurements can be difficult in obese patients or with narrow intercostal space and impossible in patients with ascites (7)

### 2.3. Ultrasound guided liver biopsy

It was performed after fibroscan examination, using a semi-automatic true-cut needle (16 G). Liver biopsy was fixed in formalin and embedded in paraffin and all biopsy specimens were analyzed by an experienced pathologist blinded to the result of fibroscan. All biopsy specimens were at least 15 mm lengths and contain 6 portal tracts. Liver fibrosis staging was evaluated according to the METAVIR scoring system (8).

### 2.4. Diffusion-weighted MRI of the liver

MRI was performed using 1.5-T MRI scanner (Philips Intera) equipped with phased-array torso surface coil.

Examination included axial T1 and T2 weighted images and Diffusion MRI. Acquisition parameters were TR 4.4 ms, TE 2.1 ms, flip angle 10°, matrix size, $172 \times 163$, field of view