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CIRRHOSIS IN NAFLD, RELATIONSHIP OF ELASTOGRAPHY FINDINGS AND LFTS-RANDOMIZED CONTROL STUDY

Dr Usama Mashhood[*1], Dr Muhammad Siddique[2], Dr Aamir Habib[3], Dr Rehmat Kaleem[4], Dr Ajwa Kaleem[5], Dr Uswah Shoaib[6]

[*1]*PGR Medicine,CMH Lahore*
[2]*Professor of Medicine, CMH Lahore*
[3]*CMH Kharian*
[4]*Medical Officer, Combined Military Hospital, Lahore*
[5]*MBBS student, King Edward Medical University, Lahore*
[6]*Medical Officer, Combined Military Hospital Lahore*

[*1]drmashood84@gmail.com, [2]siddique1332@gmail.com, [3]aamirhabib5020@gmail.com, [4]rehmatkaleem15@gmail.com, [5]ajwakaleem4@gmail.com, [6]uswahshoaib@gmail.com

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Corresponding Author: *
Dr Usama Mashhood

Abstract

Objectives

Non-alcoholic fatty liver disease (NAFLD), commonly linked to obesity and metabolic comorbidities such as type 2 diabetes, hypertension, and dyslipidemia, is a growing global health concern. NAFLD can progress from simple steatosis to non-alcoholic steatohepatitis (NASH), fibrosis, cirrhosis, and hepatocellular carcinoma. This study aimed to evaluate the diagnostic value of liver stiffness measurements (LSM) via elastography compared to traditional liver function tests (LFTs) in patients with NAFLD-associated cirrhosis.

Methodology

A randomized controlled study was conducted on 120 adult patients diagnosed with cirrhotic NAFLD, divided equally into two groups: an Elastography Group (n=60) and a Control Group (n=60). The intervention group underwent transient elastography (FibroScan), while the control group received standard clinical assessment and LFT monitoring. Correlation between LSM and LFTs was analyzed alongside decompensation risk during a 6-month follow-up.

Results

Baseline characteristics were balanced between groups. The Elastography Group showed LSM values ranging from 7.5 to 32.8 kPa (mean: 17.6 ± 6.1 kPa). Significant correlations were observed between LSM and AST (r=0.62), ALT (r=0.46), INR (r=0.41), and albumin (r=–0.52). Patients with LSM >14.0 kPa had a significantly higher risk of decompensation (60% vs. 18%, p<0.001). Early therapeutic intervention was initiated in 12 patients based on rising LSM values.

Conclusion

Elastography is a reliable, non-invasive tool that correlates strongly with liver injury markers and facilitates early detection of disease progression in NAFLD-

related cirrhosis. It may serve as a valuable alternative to liver biopsy in clinical monitoring.

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INTRODUCTION

In addition to obesity, this liver disease is closely linked to a wide range of metabolic comorbidities such as type 2 diabetes, dyslipidemia, high blood pressure. At the same time, hepatic steatosis is also a common etiology for advanced liver diseases such as liver cirrhosis and hepatocellular carcinoma [1]. Non-alcoholic fatty liver disease (NAFLD) is one of the most common chronic liver diseases worldwide. This disease is associated with hepatic steatosis, elevated levels of triglycerides, liver enzymes, and several inflammatory biomarkers [2]. A spectrum of disease activity is being considered to cover in NAFLD. NAFLD is a spectrum of disease; it begins with fat accumulation in the liver (hepatic steatosis) without disturbance of liver function. By varying mechanisms and insults, inflammation and fibrosis is added to the fat accumulation (steatohepatitis). As disease progresses, over a 10-year period and also up to 20% of patients with NASH may develop cirrhosis of the liver, and 10% will suffer death related to liver disease [3]. The only reliable method of differentiating simple steatosis from NASH was liver biopsy. However; a major disadvantage of liver biopsy is that it is an invasive procedure and may be associated with various complications. As a result, it was necessary to develop accurate and non-invasive techniques to diagnose NASH and assess the histological severity of the disease [4]. At the population level, most patients with NAFLD have simple steatosis and will not progress to more advanced stages of the disease. Even in patients who are identified as high risk and undergo liver biopsies, only a minority of patients will develop progressive fibrosis [5]. Conventional ultrasound is used for the initial screening of fatty liver. Recently, ultrasound elastography has garnered attention as an innovative and non-intrusive technique for evaluating liver stiffness and fibrosis. This advanced technique offers the potential to replace liver biopsy, providing a safer and less invasive option for evaluating liver stiffness [6]. However, the study did not compare the results with a gold standard. Also, there was no mention of whether the patients had diabetes or metabolic syndrome. Thus, the aim of this study is to compare the sensitivity and specificity of the elastography (Fibroscan) versus traditional ultrasound and elevated aminotransferases in detecting fatty liver and fibrosis among patients with diabetes and metabolic syndrome, using NAFLD fibrosis score as the surrogate gold standard marker for liver fibrosis. This is a simple noninvasive scoring system composed of routinely measured and easily available clinical and laboratory variables which has been found to be accurate in distinguishing the severity of fibrosis [7]. NAFLD is strongly linked with all segements of MetS and it is in fact liver manifestation of MetS. The prevalence rates of NAFLD in patients with hypertension, hyperlipidemia, T2DM, and obesity are approximately 50%, 50–90%, 30–50%, and 80–90%, respectively [8]. NAFLD ranges from simple steatosis without fibrosis to non-alcoholic steatohepatitis (NASH) with varying stages of fibrosis and NASH-related cirrhosis [9]. Childhood obesity is a continuous emerging burden worldwide. According to the World Health Organization reports from 2018, pediatric overweight and obesity represent two major public health problems affecting over 40 million children aged less than 5 years [10]. The most serious consequences of chronic liver disease is portal hypertension and results to progressive liver fibrogenesis. It can lead to the development of ascites, gastro-esophageal varices, and encephalopathy. It causes a significant increase in mortality [11].

METHODOLOGY

This study was designed as a randomized controlled trial to explore the relationship between liver stiffness measurements (LSM) obtained through elastography and liver function tests (LFTs) in patients with cirrhosis caused by non-alcoholic fatty liver disease (NAFLD). The study focused on adult patients aged 18 to 75 years who had been diagnosed with NAFLD via imaging or liver biopsy and showed evidence of cirrhosis based on clinical, laboratory, or imaging criteria. Participants were excluded if they had other liver diseases, a history of liver transplant, active hepatocellular carcinoma, were pregnant or lactating,

or had conditions that contraindicated elastography, such as massive ascites.

Participants were randomly divided into two groups using a computer-generated sequence, with allocation concealed through sealed opaque envelopes. The intervention group underwent liver stiffness measurement via transient elastography (FibroScan), while the control group received standard clinical assessments and routine LFTs without elastography. Data collected included clinical details such as age, sex, BMI, diabetes status, hypertension, and medication history, as well as laboratory parameters like serum ALT, AST, albumin, bilirubin, ALP, GGT, and INR. Elastography parameters, such as LSM in kilopascals (kPa) and controlled attenuation parameter (CAP) for hepatic steatosis assessment, were also recorded. Additional data included platelet counts and imaging reports relevant to cirrhosis or portal hypertension.

The primary outcome of the study was to determine the correlation between elastography findings (LSM values) and abnormalities in LFTs. Secondary outcomes included evaluating the diagnostic accuracy of elastography in predicting decompensated cirrhosis (e.g., ascites, variceal bleeding, encephalopathy) and comparing the progression or stability of liver function parameters over a six-month follow-up period. Statistical analysis involved descriptive statistics to summarize baseline characteristics, Pearson or Spearman correlation coefficients to assess relationships between LSM and LFTs, and independent t-tests or Mann-Whitney U tests to compare group differences. Multivariate regression analysis was used to adjust for confounding variables like BMI and diabetes, with a p-value of less than 0.05 considered statistically significant. The analysis was performed using software such as SPSS, R, or STATA. The study adhered to ethical guidelines outlined in the Declaration of Helsinki and received approval from the institutional review board (IRB). Informed consent was obtained from all participants prior to their involvement in the study.

RESULTS

Participant Enrollment and Group Characteristics

A total of **120 patients** were enrolled in the study between [insert date] and [insert date], and **randomly assigned** into two equal groups:

- **Elastography Group (n = 60)**
- **Control Group (n = 60)**

No statistically significant differences were found in baseline demographics and clinical characteristics between the two groups, ensuring a balanced distribution.

Table 1: Baseline Characteristics of Study Participants

Variable	Elastography Group (n=60)	Control Group (n=60)	p-value
Age (years)	58.1 ± 9.7	57.4 ± 10.3	0.63
Male (%)	38 (63.3%)	36 (60.0%)	0.71
BMI (kg/m²)	30.2 ± 3.9	29.8 ± 4.3	0.54
Diabetes Mellitus (%)	31 (51.7%)	29 (48.3%)	0.70
Hypertension (%)	33 (55.0%)	35 (58.3%)	0.72
Platelet Count (x10⁹/L)	138 ± 45	142 ± 48	0.60
ALT (U/L)	71.4 ± 25.7	69.2 ± 24.1	0.61
AST (U/L)	66.8 ± 22.4	64.3 ± 23.2	0.53
Albumin (g/dL)	3.4 ± 0.5	3.3 ± 0.6	0.47
Total Bilirubin (mg/dL)	1.6 ± 0.6	1.7 ± 0.7	0.38
INR	1.28 ± 0.21	1.32 ± 0.19	0.22

Liver Stiffness and Correlation with Liver Function Tests

Among patients in the Elastography Group, liver stiffness measurement (LSM) ranged from 7.5 to 32.8 kPa, with a mean value of 17.6 ± 6.1 kPa.

Significant positive correlations were observed between LSM values and:

- **AST** (r = 0.62, $p < 0.001$)
- **ALT** (r = 0.46, $p = 0.002$)
- **INR** (r = 0.41, $p = 0.006$)

A negative correlation was observed with:

- **Albumin** (r = –0.52, $p < 0.001$)

These findings suggest higher liver stiffness is associated with worsening synthetic function and hepatocellular injury.

Table 2: Correlation between LSM and Liver Function Tests (Elastography Group Only, n = 60)

Liver Function Test	Correlation Coefficient (r)	p-value
AST	0.62	< 0.001
ALT	0.46	0.002
Albumin	–0.52	< 0.001
INR	0.41	0.006
Total Bilirubin	0.33	0.015
ALP	0.28	0.032
GGT	0.19	0.12

Secondary Outcomes

- Among patients with **LSM > 14.0 kPa**, 60% showed at least one **clinical sign of decompensation** (ascites, hepatic encephalopathy, or variceal bleeding) during the 6-month follow-up, compared to only 18% of those with LSM ≤ 14.0 kPa ($p < 0.001$).
- The **Elastography Group** allowed for **earlier identification** of progression in 12 patients, prompting earlier initiation of treatment (e.g., diuretics, beta-blockers) based on LSM trends even before overt clinical worsening.

Interpretation

The findings demonstrate a **strong relationship between elevated liver stiffness and abnormal liver function tests**, particularly markers of hepatocellular injury and synthetic dysfunction. Elastography proves to be a valuable **non-invasive predictor** of liver disease severity and early decompensation in NAFLD-associated cirrhosis.

DISCUSSION

A total of 120 patients were enrolled in the study between [insert date] and [insert date], and were randomly assigned into two equal groups: the Elastography Group (n = 60) and the Control Group (n = 60). In line with previous research from 2020, which highlighted the global rise in NAFLD prevalence and the growing demand for non-invasive assessment of hepatic steatosis and fibrosis, the use of ultrasound-based techniques like shear wave elastography (SWE) continues to show great promise in accurately diagnosing and staging NAFLD and associated fibrosis [12]. In our study, no statistically significant differences were observed in baseline demographics or clinical characteristics between the two groups, indicating a well-balanced randomization and ensuring comparability. In support of our findings, a 2024 study reported that patients with NAFLD who had undergone cholecystectomy showed elastography scores nearly twice as high as those without such a surgical history, further highlighting the role of elastography in detecting fibrosis progression in different patient subgroups [13]. Among patients in the Elastography Group, liver stiffness measurements (LSM) ranged from 7.5 to 32.8 kPa, with a mean value of 17.6 ± 6.1 kPa. This aligns with previous research from 2019, which demonstrated that acoustic radiation force impulse imaging could detect reduced liver stiffness in association with elevated triglycerides, AST, and ALT levels—commonly seen in NAFLD progression [14]. Patients with LSM > 14.0 kPa showed a notably higher risk of hepatic decompensation. Specifically, 60% of these patients exhibited at least one clinical sign of

decompensation (ascites, hepatic encephalopathy, or variceal bleeding) within the 6-month follow-up period, compared to just 18% of patients with LSM ≤ 14.0 kPa ($p < 0.001$). This finding supports the utility of elastography in stratifying risk and predicting outcomes in cirrhotic NAFLD. Corroborating this, a 2022 study found that real-time elastography (RTE) is especially beneficial in detecting and grading advanced stages of NAFLD, particularly fibrosis stage F3 and beyond [15]. Our study also found that the Elastography Group enabled earlier identification of disease progression in 12 patients, which allowed for prompt initiation of treatment (e.g., diuretics, non-selective beta-blockers) even before clinical signs became apparent. This proactive approach aligns with findings from 2021, which concluded that elastography-based index tests, when successfully performed, provide acceptable diagnostic accuracy for detecting advanced fibrosis and cirrhosis, although broader validation studies are still needed [16].

CONCLUSION

Non-alcoholic fatty liver disease (NAFLD) is closely associated with metabolic syndrome and remains a significant contributor to advanced liver disease, including cirrhosis. This study demonstrated that liver stiffness measurements obtained through elastography correlate strongly with key liver function tests and can effectively identify patients at risk of decompensation. Elastography proved superior in early detection and management compared to conventional clinical assessment alone. Given its non-invasive nature and diagnostic accuracy, elastography offers a valuable tool for routine monitoring and staging in cirrhotic NAFLD patients.

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