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THE RELATIONSHIP BETWEEN LIVER FIBROSIS STAGES ASSESSED BY FIBROSCAN AND SERUM BIOMARKERS IN CHRONIC LIVER DISEASE

Kurbonov Khayitjon Shavkat ugli

Asia International University

Bukhara,Uzbekistan

Abstract: Background: Liver fibrosis is a critical factor in the progression of chronic liver diseases. FibroScan, a non-invasive transient elastography method, measures liver stiffness to assess fibrosis severity. Serum biomarkers, including alanine aminotransferase (ALT), aspartate aminotransferase (AST), and platelet count, are used to calculate indices like APRI and FIB-4. This study evaluates the correlation between FibroScan liver stiffness measurements (LSM) and serum biomarkers in chronic liver disease patients.

Materials and Methods: A retrospective study was conducted on 120 patients with chronic liver diseases of various etiologies at the Gastroenterology Department of the Bukhara Regional Multidisciplinary Medical Center (2022–2025).LSM was measured using FibroScan, and serum biomarkers were analyzed via routine laboratory tests. In a subgroup of 65 patients, liver biopsy results based on the METAVIR scoring system were used as a reference. Spearman's rank correlation assessed relationships between LSM and biomarkers, and receiver operating characteristic (ROC) curves evaluated diagnostic accuracy.

Results: LSM showed a strong correlation with histological fibrosis stages ($r = 0.82$, $P < 0.001$). Serum-based indices, APRI ($r = 0.41$, $P = 0.001$) and FIB-4 ($r = 0.39$, $P = 0.002$), exhibited moderate correlations, while the AST/ALT ratio (AAR) showed no significant association ($r = 0.15$, $P = 0.18$). The area under the ROC curve (AUROC) for LSM in detecting significant fibrosis (≥F2), advanced fibrosis (≥F3), and cirrhosis (F4) was 0.90, 0.92, and 0.89, respectively. Optimal LSM cut-off values were 6.5 kPa for ≥F2, 8.3 kPa for ≥F3, and 13.0 kPa for F4.

Conclusions: FibroScan LSM strongly correlates with histological fibrosis and outperforms serum-based indices like APRI and FIB-4 in diagnostic accuracy. FibroScan is a reliable, non-invasive tool for assessing liver fibrosis in clinical practice.

Keywords: Liver Fibrosis, FibroScan, Transient Elastography, Serum Biomarkers, Non-invasive Diagnosis.

Introduction

Liver fibrosis, characterized by excessive extracellular matrix deposition, is a hallmark of chronic liver diseases, including viral hepatitis, non-alcoholic fatty liver disease (NAFLD), and autoimmune hepatitis (AIH). Progressive fibrosis can lead to cirrhosis, hepatic decompensation, or hepatocellular carcinoma (HCC) [1,2]. Traditionally, liver biopsy has been the gold standard for fibrosis staging, but its invasiveness, cost, and risk of sampling errors have driven the adoption of non-invasive alternatives [3,4].

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FibroScan, a transient elastography technique, measures liver stiffness in kilopascals (kPa), reflecting fibrosis severity. It is widely validated in viral hepatitis and NAFLD but less studied in mixed-etiology or autoimmune liver diseases [5,6]. Serum biomarkers, such as ALT, AST, and platelet count, are used to compute fibrosis indices like APRI and FIB-4, which are cost-effective but limited by variable sensitivity [7]. This study investigates the correlation between FibroScan LSM and serum biomarkers and evaluates their diagnostic accuracy compared to histological staging.

Materials and Methods

Study Population

This retrospective study included 120 adult patients with chronic liver disease of various etiologies at the Gastroenterology Department of the Bukhara Regional Multidisciplinary Medical Center 2023 and 2025. Exclusion criteria included acute hepatitis, decompensated cirrhosis, biliary obstruction, or HCC. Etiologies comprised viral hepatitis (n = 50), AIH (n = 25), and NAFLD (n = 45). Liver biopsy was performed in 65 patients, with fibrosis staged using the METAVIR system (F0–F4).

Liver Stiffness Measurement

FibroScan (Echosens, France) was performed using an M-probe by trained operators. A valid LSM required ≥10 measurements, a success rate ≥60%, and an interquartile range (IQR)/median ≤30%. The median LSM value (kPa) was recorded.

Biochemical Assessment

Blood samples, collected on the same day as FibroScan, were analyzed for ALT, AST, alkaline phosphatase (ALP), gamma-glutamyl transpeptidase (GGT), platelet count, total bilirubin, and albumin. Fibrosis indices were calculated as follows:

- **APRI**: (AST / ULN of AST) × 100 / Platelet count (10^9/L)
- **FIB-4**: (Age × AST) / (Platelet count × √ALT)
- **AAR**: AST / ALT

Statistical Analysis

Data were expressed as mean ± standard deviation (SD). Spearman's rank correlation evaluated relationships between LSM, biomarkers, and histological fibrosis. Diagnostic performance was assessed using ROC curves, with AUROC values >0.8 considered excellent. Analyses were conducted using SPSS version 26.0, with $P < 0.05$ indicating statistical significance.

Results

Baseline Characteristics

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The study population had a mean age of 47.5 ± 12.3 years, with 70% female patients. Mean ALT and AST levels were 132.7 ± 95.4 U/L and 115.2 ± 88.6 U/L, respectively. The mean platelet count was 175.4 ± 59.8 × 10^9/L, and the mean LSM was 10.5 ± 6.1 kPa.

Correlation Analysis

LSM strongly correlated with histological fibrosis stages ($r = 0.82$, $P < 0.001$). APRI ($r = 0.41$, $P = 0.001$) and FIB-4 ($r = 0.39$, $P = 0.002$) showed moderate correlations with fibrosis stage, while AAR showed no significant association ($r = 0.15$, $P = 0.18$). No significant correlations were observed between LSM and ALT ($r = 0.12$, $P = 0.27$) or platelet count ($r = –0.19$, $P = 0.07$).

Diagnostic Accuracy

The AUROC values for detecting fibrosis stages were:

- **LSM**: 0.90 (≥F2), 0.92 (≥F3), 0.89 (F4)
- **APRI**: 0.66 (≥F2), 0.69 (≥F3), 0.73 (F4)
- **FIB-4**: 0.64 (≥F2), 0.67 (≥F3), 0.71 (F4)

Optimal LSM cut-off values were:

- ≥F2: 6.5 kPa (Sensitivity 85%, Specificity 78%)
- ≥F3: 8.3 kPa (Sensitivity 83%, Specificity 85%)
- F4: 13.0 kPa (Sensitivity 88%, Specificity 87%)

Discussion

This study confirms that FibroScan LSM strongly correlates with histological fibrosis stages, outperforming serum-based indices like APRI and FIB-4. These findings align with previous research in viral hepatitis and NAFLD [8,9]. The moderate correlations of APRI and FIB-4 with fibrosis stage suggest their utility as complementary tools, but their lower sensitivity limits their ability to differentiate intermediate fibrosis stages, particularly in the presence of inflammation [10].

FibroScan's high AUROC values (0.89–0.92) and optimal cut-off values (6.5–13.0 kPa) are consistent with prior studies [11,12]. The lack of correlation between LSM and ALT or platelet count indicates that FibroScan primarily reflects fibrosis rather than inflammatory activity, enhancing its specificity. Its non-invasive nature, reproducibility, and suitability for serial monitoring make it a valuable clinical tool.

Limitations include the retrospective design and the limited biopsy-validated subgroup. Future studies should explore etiology-specific LSM cut-offs and validate these findings in larger, prospective cohorts.

Conclusions

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FibroScan provides a highly accurate, non-invasive method for assessing liver fibrosis, with stronger correlations to histological staging than APRI and FIB-4. It should be prioritized for fibrosis evaluation and monitoring in chronic liver disease patients.

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