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RESEARCH ARTICLE

FIB-4 AND FIBROSCAN IN ASSESSMENT OF LIVER FIBROSIS IN ALCOHOLIC LIVER DISEASE

[1]Dr. Bhanu Prakash, [2]Dr. Dheeraj Mittal, [3]Dr. Rajesh Meena, [4]Dr. Hemant Mahur, [5]Dr. Arpit Agarwal and [6]Dr. Vivek Kumar Yadav

[1]Junior Resident, Department of Medicine, RNT Medical College, Udaipur; [2,3]Assistant Professor, Department of Medicine, RNT Medical College, Udaipur; [4]Senior Professor, Department of Medicine, RNT Medical College, Udaipur; [5,6]Junior Resident, Department of Medicine, RNT Medical College, Udaipur

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****Corresponding author:***
Dr. Bhanu Prakash

ABSTRACT

Background: Alcohol-associated liver disease (ALD) is a leading cause of cirrhosis worldwide. Although liver biopsy is the gold standard for staging fibrosis, its invasiveness and limitations have prompted use of non-invasive tools. This study aimed to assess the role of FIB-4 in staging fibrosis in ALD and compare its diagnostic accuracy with Fibro Scan. **Methods:** This prospective cross-sectional study included 100 ALD patients at RNT Medical College, Udaipur. Patients >18 years with documented alcohol intake were enrolled after informed consent. Exclusions included HIV infection and other liver diseases (NAFLD, HBV, HCV). FIB-4 was calculated using age, AST, ALT, and platelet count (cut-off: >3.25 for cirrhosis). Liver stiffness was assessed using FibroScan. Data were analyzed using descriptive statistics and chi-square test. **Results:** The mean age of patients was 52.7 years; 82% were male. Based on FIB-4, 33 patients had scores <1.45, 25 had intermediate scores (1.45–3.25), and 42 had scores >3.25. All patients with FIB-4 >3.25 were diagnosed with cirrhosis on FibroScan, while those with low scores (<1.45) had no cirrhosis. Mean FibroScan values increased across fibrosis stages (4.88 kPa in F0–F1, 8.9 kPa in F2, 10.6 kPa in F3, and 45.83 kPa in F4), showing strong correlation with FIB-4 scores ($p < 0.001$). **Interpretation & conclusions:** FIB-4 and FibroScan both demonstrated significant correlation with fibrosis stage in ALD patients. FIB-4 offers a simple, cost-effective screening tool, while FibroScan provides more precise staging. Combined use of these methods can reduce reliance on liver biopsy and enable early identification of patients with advanced fibrosis or cirrhosis.

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INTRODUCTION

Alcohol-associated liver disease (ALD) is the most common cause of cirrhosis worldwide and ranks among the top ten causes of death. ALD is defined by daily alcohol intake ≥30 grams for men and ≥20 grams for women, along with liver damage [(1)]. Alcohol is the third leading global risk factor for premature death and disability [(2)]. Liver fibrosis and its progression to cirrhosis pose serious global health concerns. Alcohol cessation improves survival at all ALD stages [(3)]. Cirrhosis involves fibrous tissue replacing liver parenchyma, resulting in complications like portal hypertension and liver failure [(4)]. Liver biopsy is the diagnostic gold standard but is invasive, costly, time-consuming, and carries risks like hemorrhage or biliary injury. Its accuracy is limited by sampling variability, with small specimens representing just 1/50,000th of liver volume [(5)]. Due to these limitations, non-invasive methods such as the AST to platelet ratio index (APRI), FIB-4, FibroScan, and MR elastography have gained prominence. These alternatives offer ease of use, minimal risk, outpatient suitability, and allow for repeated assessment.

However, their accuracy may be lower in detecting intermediate fibrosis stages [(6)]. FIB-4 uses age, AST, ALT, and platelet count to estimate fibrosis. It is accessible and provides moderate diagnostic accuracy, especially in identifying advanced fibrosis. FIB-4 is calculated as:

$$\text{FIB-4} = (\text{Age} \times \text{AST}) / (\text{Platelet} \times \sqrt{\text{ALT}})$$

A score <1.45 has a 90% negative predictive value for advanced fibrosis, while a score >3.25 has 97% specificity and 65% positive predictive value [(7)]. The WHO recommends cut-offs of ≤1.45 (low) and ≥3.25 (high), with predictive values of 94.7% and 82.1%, respectively [(8)]. FibroScan, based on transient elastography, measures liver stiffness using shear wave velocity [(9)]. It provides immediate results and evaluates a much larger liver volume than biopsy. It is simple, non-invasive, and suitable for bedside or outpatient use, though its availability is limited to higher-tier centers due to cost [(10)]. While FibroScan is reliable, certain conditions—acute liver injury, heart failure, postprandial status—can overestimate stiffness [(11)]. Other factors affecting accuracy include obesity,

ascites, and operator skill. It has shown ~90% sensitivity/specificity for cirrhosis and 70–80% for fibrosis [12]. FIB-4 is affordable and easy to use but may be affected by factors unrelated to fibrosis. FibroScan offers more direct fibrosis assessment but requires specialized equipment and expertise. Used together, FIB-4 and FibroScan provide a complementary, reliable approach for evaluating liver fibrosis in ALD patients. The objective of this study is to analyze the effectiveness of FIB-4 and FibroScan in assessing liver fibrosis in alcoholic liver disease.

AIM AND OBJECTIVE OF THE STUDY

- To study liver fibrosis using FIB-4 in alcoholic liver disease.
- To compare FIB-4 with fibroscan in alcoholic liver disease.

MATERIALS AND METHODS

Permission & Study Setting: Necessary approvals were obtained from the Ethical Committee and Research Review Board of RNT Medical College, Udaipur. This prospective, observational, and cross-sectional study was conducted on 100 patients of alcoholic liver disease in the Department of Medicine and Gastroenterology after ethical approval.

Study Population & Criteria: The study included diagnosed ALD patients aged above 18 years who provided written informed consent. Exclusion criteria included patients who did not consent, HIV-positive individuals, and those with other liver diseases (NAFLD, HBV, HCV). The final sample population was determined based on these criteria.

Methodology: ALD patients were included after consent. FIB-4 scores (cut-offs: 3.25) predicted severe fibrosis/cirrhosis. Liver stiffness was measured via FibroScan.

Statistical Analysis: Descriptive analysis used mean ± SD and proportions. The Chi-square test assessed associations. FIB-4 sensitivity/specificity were compared to FibroScan.

RESULTS AND OBSERVATIONS

The majority of patients were aged 46–60 years (61%), with a mean age of 52.74 years (Figure 1). Most were male (82%) (Figure 2). The most common duration of alcohol consumption was 11–20 years (83%), with a mean of 16.13 years.

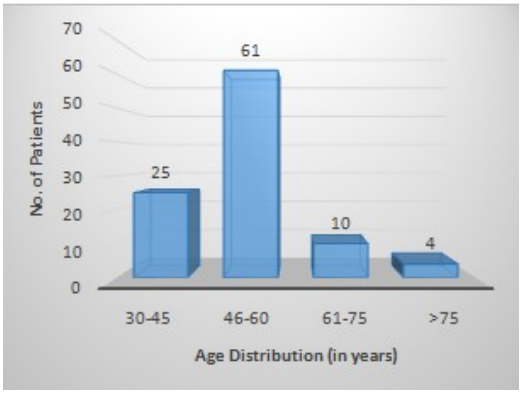

Figure 1. Distribution of patients according to age

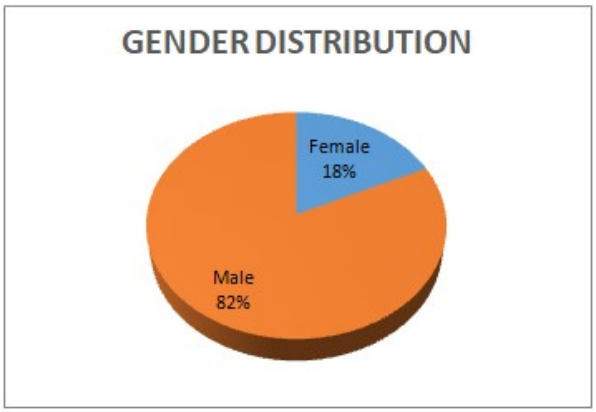

Figure 2. Distribution of patients according to age.

Hematological parameters showed significant variation with fibrosis stage (Table 1). Hemoglobin levels were lowest in cirrhosis (8.98 g/dL), compared to no fibrosis (11.18 g/dL) and significant fibrosis (11.56 g/dL), with a statistically significant difference ($p < 0.001$). WBC counts showed a decreasing trend (from 6.79 to 5.54 $\times 10^9$/L), though this was not statistically significant ($p = 0.17$). Platelet counts were significantly reduced in cirrhosis (106.84 $\times 10^9$/L) versus no fibrosis (273.91 $\times 10^9$/L) and significant fibrosis (194.22 $\times 10^9$/L), with $p < 0.001$. Random blood sugar (RBS) levels did not differ significantly ($p = 0.68$).

Liver function tests also varied significantly (Table 1).

- Total bilirubin increased with fibrosis severity: 1.25 mg/dL (no fibrosis), 1.71 mg/dL (significant fibrosis), and 2.2 mg/dL (cirrhosis), $p < 0.0001$.
- Direct bilirubin rose from 0.9 to 1.64 mg/dL ($p < 0.0001$).
- Indirect bilirubin was higher in cirrhosis (0.58 mg/dL) versus others ($p < 0.0001$).
- SGOT increased significantly from 63.24 IU/L (no fibrosis) to 189.44 IU/L (cirrhosis), $p < 0.0001$.
- SGPT showed no significant difference ($p = 0.4$).
- FIB-4 scoring revealed that among 100 patients:
- 33 had scores <1.45 (no significant fibrosis),
- 25 had intermediate scores (1.45–3.25),
- 42 had scores >3.25 (suggesting cirrhosis), with a mean FIB-4 score of 5.36 (Table 2).
- Stage-wise distribution of FIB-4 scores showed:
- In Stage F0–F1: 33 patients had scores <1.45, 16 had intermediate scores, 8 had scores >3.25.
- In Stage F2: 8 had intermediate scores and 4 had scores >3.25.
- In Stage F3: 6 patients had scores >3.25.
- In Stage F4: All 25 patients had scores >3.25 (Table 3).

Correlation of FIB-4 scores with FibroScan findings demonstrated that among patients with FIB-4 scores indicating no significant fibrosis, 44% had mild to moderate fibrosis, and none had cirrhosis. Conversely, all patients with scores suggesting significant fibrosis (FIB-4 >3.25) showed cirrhosis on FibroScan (Table 4).

DISCUSSION

In our study, the majority of patients (57%) had no fibrosis, while 18% had significant fibrosis and 25% were diagnosed with cirrhosis.

Table 1. Haematological , Biochemical and liver function parameters Across Different Stages of Liver Fibrosis

Parameter	No Fibrosis		Significant Fibrosis		Cirrhosis		P-Value
	Mean	SD	Mean	SD	Mean	SD	
HGB	11.18	1.41	11.56	2.89	8.98	1.29	<0.001
WBC	6.79	3.42	6.25	1.004	5.54	1.7	0.17
PLT	273.91	73.87	194.22	48.2	106.84	28.9	<0.001
RBS	135.56	35.63	142.66	27.07	135.28	24.85	0.68
Total Bilirubin	1.25	0.49	1.71	0.94	2.2	0.98	<0.0001
Direct Bilirubin	0.9	0.39	1.4	0.99	1.64	0.91	<0.0001
Indirect Bilirubin	0.35	0.17	0.3	0.11	0.58	0.21	<0.0001
SGOT	63.24	73.05	101	32.68	189.44	100.52	<0.0001
SGPT	42.28	65.18	47.83	11.79	59	27.61	0.40

Table 2 :Distribution of Patients Based on FIB-4 Scores

FIB-4	No. of Patients	Percentage
Not Significant (<1.45)	33	33
Intermediate (1.45-3.25)	25	25
Likely Cirrhosis (>3.25)	42	42
Total	100	100
Mean±SD	5.36±6.33	

Table 3. FIB-4 Index Distribution Across Different Stages of Liver Fibrosis

FIB-4	Stage (F0-F1)		Stage (F2)		Stage (F3)		Stage (F4)	
	No. of Patients	Percentage	No. of Patients	Percentage	No. of Patients	Percentage	No. of Patients	Percentage
No Significant (<1.45)	33	57.89	0	0.00	0	0	0	0
Intermediate (1.45-3.25)	16	28.07	8	66.67	0	0	0	0
Likely Cirrhosis (>3.25)	8	14.04	4	33.33	6	100	25	100
Total	100	175.44	12	100.00	6	100	25	100

Table 4. Comparison of FIB-4 and Fibro scan Results

FIB-4	Fibroscan			
	Mild to Moderate		Cirrhosis	
	No. of Patients	Percentage	No. of Patients	Percentage
Not Significant	33	44	0	0
Significant	42	56	25	100
Total	75	100	25	100

Among the 100 patients, 33 had FIB-4 scores <1.45 indicating no significant fibrosis, 25 had intermediate scores (1.45–3.25), and 42 had scores >3.25 suggestive of cirrhosis. The mean FIB-4 score was 5.36. Naik B B *et al.* [13] reported that 12% had no fibrosis, 32% had intermediate scores, and 56% had likely cirrhosis. Other studies noted lower mean or median values, such as Rungta S *et al.* [14] (median 1.36), Amernia B *et al.* [15] (mean 1.45 ± 1.27), Cioarca-Nedelcu R *et al.* [16] (median 1.8), and Hama R A *et al.* [17], who found 80% had scores <1.45 and only 4% had scores >3.25. FibroScan readings in our cohort correlated with disease severity, showing rising stiffness values with advancing fibrosis stages: 4.88 kPa for F0–F1, 8.9 kPa for F2, 10.6 kPa for F3, and 45.83 kPa for F4. In comparison, Naik B B *et al.* [13] reported that 78% of patients were in stage F4, while Rungta S *et al.* [14] showed a broader distribution with 47.7% in F0–F1 and 25% in F4. Amernia B *et al.* [15] found 7.3% in F4 and Cioarca-Nedelcu R *et al.* [16] reported 46% in F4. Zeng X *et al.* [18] and Sawaf B *et al.* [19] also presented varying fibrosis stage distributions in their respective cohorts. In our analysis, FIB-4 scores aligned with fibrosis staging. Among F0–F1 patients, 33 had scores <1.45, 16 had intermediate scores, and 8 had scores >3.25. In F2, 8 had intermediate scores and 4 had scores >3.25. In F3, all 6 had scores >3.25, and in F4, 25 patients had scores suggestive of cirrhosis. Naik B B *et al.* [13] observed that all patients with FIB-4 <1.45 were in F0–F1, while scores >3.25 were confined to F4. Chrostek L *et al.* [20] found mean FIB-4 scores of 4.21, 6.47, and 10.77 in no fibrosis, significant fibrosis, and cirrhosis respectively ($p < 0.001$).

Hama R A *et al.* [17] reported that while most FIB-4 <1.45 scores were in F0–F3, 33.3% of F4 patients also had normal scores; intermediate scores were more common in F4 (40%). Lastly, we found that among those with low FIB-4 scores (<1.45), 33% had mild to moderate fibrosis and none had cirrhosis. In contrast, 56% of patients with high scores (>3.25) had cirrhosis. Naik B B *et al.* [13] found similar trends and reported a significant association (chi-square = 7.927, $p = 0.005$). Rungta S *et al.* [14] confirmed the diagnostic value of FIB-4 with AUCs of 0.753 for ≥F2 and 0.851 for F4 ($p < 0.0001$), indicating strong correlation with fibrosis severity.

CONCLUSION

Our study demonstrates a strong correlation between FIB-4 scores and FibroScan values with the histological stages of liver fibrosis. A significant proportion of patients with high FIB-4 scores (>3.25) and elevated FibroScan readings were found to have advanced fibrosis or cirrhosis, confirming the diagnostic reliability of these non-invasive tools. These findings are consistent with previous studies, reinforcing the utility of FIB-4 and FibroScan in stratifying liver fibrosis stages, particularly in resource-limited settings where liver biopsy may not be feasible. Early identification of patients with significant fibrosis or cirrhosis using these tools can aid in timely intervention and improved clinical outcomes.

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