



ARTICLE METADATA

Article History

Received:	26 July 2026
Revised:	23 August 2026
Accepted:	20 September 2026
Published:	03 October 2026

Corresponding Author

Hina Ehsan

Demonstrator, Physiology Department,
Bakhtawar Amin Medical and Dental
College, Multan.

Email: hinaehsan.hi@gmail.com

Keywords: Advanced Liver Fibrosis,
Chronic Hepatitis C, INR-to-Platelet
Ratio.

DOI: [10.64911/yhzt5k98](https://doi.org/10.64911/yhzt5k98)

Quick Response (QR) Code



Journal of Pak International Medical College (JPIMC)
An International Peer-Reviewed Journal

Scan to read this article.
on our website

Open Access



Original Article

Predictive Value of the INR-to-Platelet Ratio (INPR) for Advanced Liver Fibrosis in Patients with Chronic Hepatitis C Infection

Hina Ehsan¹, Romana Mehewish², Durre Sadaf Khan³, Yousra Abdur Razzaq⁴, Fatima Hafeez⁵, Shahid Hameed⁶

1. Demonstrator, Physiology Department, Bakhtawar Amin Medical and Dental College, Multan
2. Assistant Professor, Physiology Department, Bakhtawar Amin Medical and Dental College, Multan
3. Assistant Professor of Hematology, Pathology Department, Bakhtawar Amin Medical and Dental College, Multan
4. Demonstrator, Physiology Department, Bakhtawar Amin Medical and Dental College, Multan
5. Senior Demonstrator, Pathology Department, Bakhtawar Amin Medical and Dental College, Multan
6. Assistant Professor, Physiology Department, Bakhtawar Amin Medical and Dental College, Multan

Abstract

Objective: To assess the suitability of the International Normalized Ratio, INR-to-platelet ratio (INPR) as a marker to help identify advanced stages of hepatic fibrosis in patients with chronic hepatitis C infection.

Methodology: This cross-sectional study was conducted in the Department of Hematology, Pathology, Bakhtawar Amin Medical and Dental College, Multan, during Sep 2025 and March 2026. 96 patients were diagnosed with HCV infection. Participants underwent a series of diagnostic tests, including liver parenchymal biopsy, shear wave elastography (SWE), and blood tests to determine the INPR. The principal outcome was the assessment of advanced fibrosis (>F3), determined using the METAVIR scoring system. We also performed endoscopic follow-up to document the presence or absence of esophageal varices. We analyzed the collected data using the Statistical Package for the Social Sciences (SPSS) version 25.0.

Results: Participants had a mean age of 50 ± 15.6 years, with males accounting for 64.5% and females for 35.5% of the cohort. Advanced hepatic fibrosis was present in 56 patients (58.3%). INPR demonstrated good discriminatory ability, with sensitivity of 84%, specificity of 74%, PPV of 82.5%, and NPV of 76.9%. By comparison, GPR exhibited comparatively lower diagnostic accuracy.

Conclusion: INPR is a potentially valuable non-invasive indicator for assessing advanced liver fibrosis in individuals with chronic HCV infection. Its practicality and simple application could facilitate bedside risk stratification and potentially reduce reliance on invasive liver biopsy.

How to Cite: Ehsan H, Mehewish R, Khan DS, Razzaq YA, Hafeez F, Hameed S. Predictive Value of the INR-to-Platelet Ratio (INPR) for Advanced Liver Fibrosis in Patients with Chronic Hepatitis C Infection. J Pak Int Med Coll. 2026;3(3):120-124.

Introduction

Globally, Hepatitis C Virus (HCV) Infection Illustrates A Prominent Health Concern Across the World. Approximately 1.75 Million New Cases Are Documented Each Year. An Estimated 6% of the Pakistani population is affected by This Condition, Emphasizing Its Considerable Impact on Public Health.¹ Chronic Hepatitis C Causes Various Hepatic Complications Such as Fibrosis, Liver Cirrhosis, Decompensated Liver Disease, And Hepatocellular Carcinoma. Therefore, to reduce complications, Rapid Diagnosis and management are required.² Typically, Hepatic Biopsy Has Been Recognized As Definitive Method For Evaluating The Severity Of Hepatic Fibrosis And Inflammation. In Contrast, There Is Increasing Need Of Non-Surgical Diagnostic Interventions Due To Various Complications Of Biopsy Such As High Risk Of Infections, Bleeding And Accidental Damage To Surrounding Organs During Procedure.³ Due To Hepatic Biopsy Restriction, Various Non-Surgical Methods Have Been Established Such As Shear Wave Elastography (Swe), Transient Elastography (Te) And Magnetic Resonance Elastography (Mre). These Radiographic Techniques Have Shown Strong Diagnostic Accuracy In Determining The Stage Of Fibrotic Changes In Liver In A Non-Surgical Manner.^{4,6} Regardless Of Their Benefits, These Procedures Are Still Incredibly Challenging. These Include Financial Burden, Inconsistency In Reporting Among Observers, And Limited Accessibility In Rural Areas. Therefore, Research Focus Has Moved To Detecting Non-Surgical Biomarkers And Grading Systems That Can More Accurately Evaluate Fibrotic Changes In Hepatocytes. Among These Non-Invasive Procedures, The Fibrosis-4 Score (Fib-4) And Aspartate Transaminase To Platelet Ratio Index (APRI) Received Recognition. These Grades With Gpr, Are Commonly Used To Assess The Hepatic Fibrotic Changes In Chronic Hepatitis B Patients.^{7,9} In The Absence Of Liver Biopsy And Advanced Radiological Procedures, the World Health Organization (WHO) Has Approved the Use of a Non-Surgical Grading System to Identify Hepatic Cirrhosis.¹⁰ Ding R Et Al. Conducted significant research comparing the diagnostic reliability of IMPR with APRI, Fib-4, and GPR in patients with chronic HBV. The results showed that IMPR outperformed other indices in Detecting Significant and Advanced Fibrosis, with a Test Sensitivity of 67%, an Exclusion Rate of 75%, and a Diagnostic Precision of 71%. Additionally, In Detecting Cirrhosis (>F4), Inpr achieved 68% Sensitivity, 87.07% Specificity, and 81% Diagnostic Performance.¹¹ Notwithstanding These Encouraging Findings, The Role Of Inpr In Diagnosing Advanced Fibrosis And Cirrhosis Among Individuals With Chronic Hcv Infection Is Still Not Established. Thus, this research aimed to determine the utility of INPR as a marker of advanced hepatic fibrosis in a Pakistani Cohort With Chronic Hepatitis C Virus Infection. Establishing Inpr As A Non-Invasive, Bedside Parameter, This Study Aims To Provide Clinicians With A Practical Marker That Could Possibly Eliminate The Requirement For Surgical Liver Biopsies And Decrease Dependence On Expensive Imaging Techniques For The Assessment Of Advanced Hepatic Fibrosis.

Material and Methods

This Cross-Sectional Study Was Conducted In The Department Of Hematology, Pathology, Bakhtawar Amin Medical And Dental College, Multan, During Sep 2025 And March 2026. The Study Included Individuals Aged 18 to 60 years diagnosed with hepatitis C; PCR confirmed the diagnosis. Participants Were Excluded If They Are Under Or Over Age, Co-Infection With Hepatitis B Or Hiv, Had Missing Data, Did Not Give Consent Or Have Decompensated Liver Disease, Autoimmune Hepatitis, Alcoholic Liver Disease, Non-Alcoholic Fatty Liver Disease, Metabolic Liver Diseases, Wilson's Disease, Hemochromatosis, Cholestatic Liver Diseases, As Well As Those Diagnosed With Hepatocellular Carcinoma Or Serious Comorbidities. The Diagnosis For Compensated Cirrhosis Included Ultrasound Evidence Of Heterogeneous Liver Echotexture, Nodular Liver Margins, Splenomegaly With A Size Above 12 Cm, And Portal Vein Dilatation >12 Mm. We Exclude Individuals With Coexisting Chronic Hepatic Conditions, Such As Hepatitis B, Autoimmune Hepatitis, Alcoholic Liver Disease, Non-Alcoholic Fatty Liver Disease, Metabolic Liver Diseases, Wilson's Disease, Hemochromatosis, Cholestatic Liver Diseases, As Well As Those Diagnosed With Hepatocellular Carcinoma Or Serious Comorbidities. Hepatic Fibrosis Was Evaluated Using Two Modalities: Shear Wave Elastography (SWE), With Fibrosis Staged From F0 to F4 according to kPa measurements,¹² and histological assessment using the METAVIR scoring system.¹³ INR was computed by the formula $[\text{INR} \div \text{Platelet Count} (\times 10^9/\text{L})] \times 100$, According To Previously Published Methods.¹¹ Ultrasonographic Criteria Were Used to Verify Further the Diagnosis of Compensated Cirrhosis, With Three Or More Predefined Sonographic Features Supporting The Diagnosis Of Cirrhosis. The Principal Outcome Was The Assessment Of Advanced Fibrosis (>F3), Determined Using The Metavir Scoring System. Endoscopic Follow-Up Was Also Performed To Document The Presence Or Absence Of Esophageal Varices. All Study Procedures Were Conducted In Accordance With The Ethical Principles Of The Declaration Of Helsinki. Participant Confidentiality And Privacy Were Strictly Maintained Throughout The Data Collection Process. The Institutional Review Board Approved the Study Before It Began. Before enrollment, We Obtained Written Informed Consent from All Participants After They Were Fully Informed About the Study's Aim And Procedures. We statistically analyzed the data using SPSS Version 25.0. Univariate And Multivariate Logistic Regression Models Were Undertaken To Assess The Relationship Between Diagnostic Parameters And Advanced Hepatic Fibrosis. Optimal Threshold Values Were Determined To Maximize The Ability Of These Non-Invasive Indices To Distinguish Patients According To The Advanced Stages Of Liver Fibrosis. This Comprehensive Approach, Encompassing Data Collection, Ethical Conduct, and Statistical Analysis, Enhanced the Capability and Validity of the Findings, Providing Meaningful Evidence on the Non-Invasive Evaluation of Liver Fibrosis in Patients with Chronic Hepatitis C Infection.

Results

This Control-Case Study Will Comprise A Total Of 96 Patients Suffering From Chronic Hepatitis C. The Mean Age of All Positive Cases of Hepatitis C Virus Was 48.5 Years, Comprising 64.5 Percent Males And 35.5 Percent Females. Mean Hemoglobin Was 11.2 G/dL, with a Total Leucocyte Count and Mean Platelet Count of $4.8 \times 10^9/L$ and $70 \times 10^9/L$, Respectively. Mean Value Of Inr Was Found To Be 1.2 With The Total Bilirubin And Alp Being 1.5 Mg/Dl And 171 Iu/L Respectively. The Study Participants' Liver Enzyme Levels, Including Aspartate Transaminase (Ast) And Alanine Transaminase (Alt), Averaged 50.7 Iu/L And 42.5iu/L, Respectively, With Gamma Glutamyl Transpeptidase (Ggt) At 69.4 Iu/L. The Child-Pugh score classified 62% of participants in Class A and 38% in Class B, Indicating Varying Degrees Of Liver Function Within The Study. The Meld Score Averaged 11.2, And Shear Wave Elastography (Swe) Results Showed That 42% Of Participants Had F4 Fibrosis. We observed significant differences in multiple clinical and laboratory parameters when comparing participants with fibrosis $\leq F2$ with those with Advanced Fibrosis ($\geq F3$). Comparison Of Participants With No Or Mild-To-Moderate Fibrosis ($\leq F2$) And Those With Advanced Fibrosis ($\geq F3$) Demonstrated Significant Differences In Several Key Parameters. Age, Total Leukocyte Count, Platelet Count, Inr, Total Bilirubin, Ast, Alt, And Ggt Showed Statistically Significant Variation Between The Groups. The advanced fibrosis group had higher mean INR, Total Bilirubin, AST, and ALT Levels, Consistent With Increasing Hepatic Injury And Functional Impairment. (Table 2). Participants with Advanced Fibrosis Had Markedly Elevated Gpr and Inpr Values, With Mean Levels Of 1.76 and 2.4, respectively, compared with 0.58 and 1.3 among participants with no fibrosis. The Observed Differences Suggest That Both Ratios May Have Value in Evaluating the Extent of Liver Fibrosis. (Table 2).

Table 1. Baseline Characteristics of Study Participants

Characteristics	Mean $\pm$ SD or n (%)
Age (years)	50.0 $\pm$ 15.6
Aspartate transaminase (AST) (IU/L)	57.7 $\pm$ 34.2
Alanine transaminase (ALT) (IU/L)	42.2 $\pm$ 17.6
Alkaline phosphatase (IU/L)	171.0 $\pm$ 153.0
Hemoglobin (g/dL)	11.2 $\pm$ 1.2
Gamma-glutamyl transferase (GGT) (IU/L)	72.0 $\pm$ 51.3
Total leukocyte count ($10^9/L$)	4.8 $\pm$ 3.4
Platelet count ($10^9/L$)	70.0 $\pm$ 35.0
Total bilirubin (mg/dL)	1.5 $\pm$ 3.2
International normalized ratio (INR)	1.2 $\pm$ 0.6
Child-Turcotte-Pugh score	
A	62%
B	38%
MELD score	11.2 $\pm$ 4.0
Shear wave elastography (SWE)	
F1 fibrosis	13 (13%)
F2 fibrosis	27 (28%)
F3 fibrosis	13 (14%)
F4 fibrosis	43 (45%)
Esophageal varices	71.2%
Fibrosis on liver biopsy	63.4%
GGT-to-platelet ratio (GPR)	0.69 $\pm$ 1.20
INR-to-platelet ratio (INPR)	1.7 $\pm$ 1.3

Values are presented as mean $\pm$ standard deviation (SD) or frequency (n) and percentage (%). AST, aspartate transaminase; ALT, alanine transaminase; GGT, gamma-glutamyl transferase; INR, international normalized ratio; MELD, Model for End-Stage Liver Disease; SWE, shear wave elastography; GPR, GGT-to-platelet ratio; INPR, INR-to-platelet ratio.

Table 2. Comparison of Study Parameters Between Patients Without Fibrosis ($\leq F2$) and Those With Advanced Fibrosis ($\geq F3$)

Parameters	No Fibrosis ($\leq F2$) (n=40)	Advanced Fibrosis ($\geq F3$) (n=56)	pvalue
Age (years)	48.5 $\pm$ 6.5	52.0 $\pm$ 7.0	<0.01
Aspartate transaminase (AST) (IU/L)	42.62 $\pm$ 8.5	48.3 $\pm$ 16.02	0.001
Alanine transaminase (ALT) (IU/L)	38.65 $\pm$ 17.0	47.9 $\pm$ 17.05	≤ 0.001
Gamma-glutamyl transferase (GGT) (IU/L)	49 $\pm$ 16	101 $\pm$ 81	≤ 0.001
Total bilirubin (mg/dL)	0.96 $\pm$ 0.4	2.47 $\pm$ 1.8	≤ 0.001
Albumin (g/dL)	4.51 $\pm$ 0.5	2.76 $\pm$ 0.64	0.020
Hemoglobin (g/dL)	12.4 $\pm$ 4.3	9.32 $\pm$ 0.83	0.35
Platelet count ($10^9/L$)	84.7 $\pm$ 44.2	57.35 $\pm$ 34.4	0.01
Total leukocyte count ($10^9/L$)	5.14 $\pm$ 2.2	4.92 $\pm$ 3.92	0.025
INR	1.1 $\pm$ 0.12	1.4 $\pm$ 0.16	≤ 0.001
Creatinine (mg/dL)	0.9 $\pm$ 0.2	1.19 $\pm$ 0.25	0.30
Splenic stiffness	29.2 $\pm$ 13.4	56.1 $\pm$ 22.8	0.017
MELD score	9.7 $\pm$ 3.0	11.4 $\pm$ 3.2	0.054
GPR	0.58 $\pm$ 0.35	1.76 $\pm$ 1.7	≤ 0.001
INPR	1.3 $\pm$ 0.7	2.4 $\pm$ 1.5	≤ 0.001

Values are presented as mean $\pm$ standard deviation (SD). INR, international normalized ratio; MELD, Model for End-Stage Liver Disease; GPR, gamma-glutamyl transferase-to-platelet ratio; INPR, INR-to-platelet ratio. We considered $p < 0.05$ statistically significant.

Table 3. Diagnostic Accuracy of the INR-to-Platelet Ratio (INPR) and GGT-to-Platelet Ratio (GPR)

Variable	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Diagnostic Accuracy
INPR	84.0%	74.0%	82.5%	76.9%	80.2%
GPR	78.0%	66.7%	77.2%	69.2%	74.0%

Diagnostic performance is expressed as sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy. INPR, INR-to-platelet ratio; GPR, gamma-glutamyl transferase-to-platelet ratio.

Discussion

In Hepatological Practice, Managing Chronic Hepatitis C (HCV) Remains a Significant Clinical Challenge, Underscoring the Need for Ongoing Monitoring to Prevent Complications Related to the Progression of Hepatic Fibrosis. Liver Biopsy Remains The Traditionally

Considered Standard For The Assessment And Staging Of Hepatic Fibrosis; However, Its Invasive Procedure And Potential Complications Limit Its Routine Clinical Application.¹⁴ Consequently, These Limitations Have Driven The Research Been Directed Toward Development Of Non-Invasive Methods That Can Accurately Identify And Stage Advanced Liver Fibrosis. Radiological modalities such as transient elastography, Shear Wave Elastography, and magnetic resonance elastography have shown promising diagnostic accuracy for detecting advanced fibrosis.^{4,6} However, their clinical applicability is often limited by high cost, reliance on specialized expertise for interpretation, and Limited Access, Particularly In Resource-Limited Settings. Non-invasive serum indices, including APRI, Fib-4, and GPR, Have Been Widely Investigated For Predicting Liver Fibrosis, with Varying Diagnostic Accuracy.¹⁵⁻¹⁷ Although Non-Invasive, The Diagnostic Accuracy Of These Markers For Evaluating Complex Fibrosis Has Varied Considerably Among Studies, Limiting Their Clinical Application.¹⁸ Previous findings by Liang et al. Identified INR and platelet count as important prognostic markers in chronic HBV infection, Suggesting Their Effectiveness In Predicting Cirrhosis.¹⁹ The Findings Of Kayadibi Et Al. Further highlighted the diagnostic significance of platelet counts for detecting fibrosis as an important biochemical marker in patients with HCV infection.²⁰ Ding Et Al. Highlighted The Potential Utility Of The Inr-To-Platelet Ratio In Assessing The Diagnostic Accuracy Of Hepatic Fibrosis Among Individuals With Chronic Hbv Infection.¹¹ This Study Assessed The Potential Role Of The Inr-To-Platelet Ratio For Fibrosis Evaluation In A Pakistani cohort with chronic HCV, Which Represents An Important Cause Of Cirrhosis Locally. The Findings Revealed Significantly Elevated Splenic Tissue Stiffness, INR, and INPR levels in patients with advanced fibrosis. In contrast, Albumin And Platelet Counts Were Significantly Lower, corroborating observations in chronic HBV infection (Ding et al.). These comparable findings suggest that the INR-to-platelet ratio may apply broadly across different viral etiologies of liver disease. Nevertheless, although the ratio shows good discriminative ability based on AUROC, its suboptimal specificity is an Important Limitation, Similar to that seen with Other Non-Invasive Fibrosis Markers. Previous comparative evidence has indicated the superior diagnostic accuracy of GPR over conventional non-invasive indices, including APRI, For The Detection Of Liver Fibrosis In Chinese Patients With Chronic Hepatitis B Infection. ^{Khan Rty Et Al. supported 21,22. Similar Findings.} In A Pakistani Cohort, providing evidence for the usefulness of GPR in identifying advanced fibrosis associated with chronic HCV infection.²³ Our findings contribute further evidence strengthening the diagnostic accuracy of the INR-to-platelet ratio; however, Its Diagnostic Specificity Remained Suboptimal, paralleling the performance of GPR. Despite These Findings, Several Limitations Should Be Acknowledged. The Design May Be Subject to Selection Bias, and Findings from a Single, Specific Cohort May Not Readily Generalize to the Broader Population. Moreover, The Relatively Small Sample Size Limits The Robustness And External Validity Of The Results. Accordingly, well-designed multicenter prospective studies with larger, more diverse cohorts are needed to establish the reliability and clinical applicability of the INR-to-platelet ratio. Another Limitation Is The Absence Of A Comparative Analysis Between The Inr-To-Platelet Ratio And Widely

Validated Non-Invasive Indices Such As Apri And Fib-4. Including These Comparisons Would Have Facilitated A More Comprehensive Assessment Of Its Relative Diagnostic Performance Within The Broader Framework Of Liver Fibrosis Evaluation.

Conclusion

The INR-to-platelet ratio (INPR) showed potential as a practical, easily derived marker for the non-invasive assessment of advanced liver fibrosis in chronic HCV infection. However, broader clinical acceptance requires confirmation through well-designed prospective studies with larger, more diverse patient populations.

Ethical Approval

Ethical approval for this study was obtained from the Institutional Review Board/Ethics Committee prior to commencement. Written informed consent was obtained from all participants, and confidentiality was maintained throughout.

Funding

This study received no external funding. The research used available institutional resources.

Conflict of Interest

The authors declare that they have no competing interests or conflicts of interest related to this study.

Authors' Contributions

Hina Ehsan: Conceptualization, study design, supervision, data interpretation, manuscript drafting, critical revision, final approval, and accountability for all aspects of the work.

Romana Mehwish: Methodology, data collection, data curation, statistical analysis, data interpretation, manuscript drafting and revision, final approval, and accountability for all aspects of the work.

Durre Sadaf Khan: Study supervision, methodology, interpretation of findings, critical review of the manuscript, final approval, and accountability for all aspects of the work.

Yousra Abdur Razzaq: Data collection, literature review, data curation, manuscript revision, final approval, and accountability for all aspects of the work.

Fatima Hafeez: Data analysis, literature review, manuscript drafting and revision, interpretation of findings, final approval, and accountability for all aspects of the work.

Shahid Hameed: Study supervision, critical review of the manuscript, interpretation of findings, final approval, and accountability for all aspects of the work.

All authors: Reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work in accordance with ICMJE authorship criteria.

References

1. Ishtiaq A, Shah S, Iftikhar S, Baig-Ansari N. Relationship of FIB-4 index with transient elastography in chronic hepatitis C patients having APRI ≥ 0.5 - ≤ 2 in a resource-limited setting in Pakistan. *J Family Med Prim Care*. 2020;9(11):5564-73. doi:10.4103/jfmprc.jfmprc_1294_20.
2. Akhtar S, Nasir JA, Usman M, Sarwar A, Majeed R, Billah B. The prevalence of hepatitis C virus in hemodialysis patients in Pakistan: a systematic review and meta-analysis. *PLoS One*. 2020;15(5). doi:10.1371/journal.pone.0232931.
3. European Association for the Study of the Liver. EASL recommendations on treatment of hepatitis C: final update of the series. *J Hepatol*. 2020;73(5):1170-218. doi:10.1016/j.jhep.2020.08.018.
4. Wei H, Jiang HY, Li M, Zhang T, Song B. Two-dimensional shear wave elastography for significant liver fibrosis in patients with chronic hepatitis B: a systematic review and meta-analysis—*Eur J Radiol*. 2020;124:108839. doi:10.1016/j.ejrad.2020.108839.
5. Liu K, Qin M, Tao K, Liang Z, Cai F, Zhao L, et al. Identification and external validation of the optimal FIB-4 and APRI thresholds for ruling in chronic hepatitis B-related liver fibrosis in tertiary care settings. *J Clin Lab Anal*. 2021;35(2). doi:10.1002/jcla.23640.
6. Rungta S, Kumari S, Deep A, Verma K, Swaroop S. APRI and FIB-4 performance to assess liver fibrosis against predefined FibroScan values in chronic hepatitis C virus infection. *J Family Med Prim Care*. 2021;10(11):4082-8. doi:10.4103/jfmprc.jfmprc_666_21.
7. Yongpisarn T, Thimphithaya C, Laoveeravat P, Wongjarupong N, Chaiteerakij R. Non-invasive tests for predicting liver outcomes in chronic hepatitis C patients: a systematic review and meta-analysis. *World J Hepatol*. 2021;13(8):949-68. doi:10.4254/wjh.v13.i8.949.
8. European Association for the Study of the Liver. EASL Clinical Practice Guidelines on non-invasive tests for evaluation of liver disease severity and prognosis - 2021 update. *J Hepatol*. 2021;75(3):659-89. doi:10.1016/j.jhep.2021.05.025.
9. Li M, Wan S, Wu X, Lin Y, Wu B. Diagnostic performance of elastography on liver fibrosis in antiviral treatment-naïve chronic hepatitis B patients: a meta-analysis. *Gastroenterol Rep (Oxf)*. 2022;10. doi:10.1093/gastro/goac005.
10. Sapmaz FP, Büyükturan G, Sakin YS, Kalkan IH, Atasoy P. How effective are APRI, FIB-4, FIB-5 scores in predicting liver fibrosis in chronic hepatitis B patients? *Medicine (Baltimore)*. 2022;101(36). doi:10.1097/MD.00000000000030488.
11. Goel A, Rewari BB, Sharma M, Konath NM, Aggarwal R. Seroprevalence and burden of hepatitis C virus infection in WHO South-East Asia Region: a systematic review. *J Gastroenterol Hepatol*. 2022;37(6):964-72. doi:10.1111/jgh.15827.
12. Moosavy SH, Eftekhari E, Davoodian P, Nejatizadeh A, Shadman M, Zare S, et al. AST/ALT ratio, APRI, and FIB-4 compared to FibroScan for the assessment of liver fibrosis in patients with chronic hepatitis B in Bandar Abbas, Hormozgan, Iran. *BMC Gastroenterol*. 2023;23(1):145. doi:10.1186/s12876-023-02780-w.
13. Gür-Altunay D, Yürük-Atasoy P. How successful are APRI and FIB-4 scores in predicting liver fibrosis in chronic hepatitis B patients? *Infect Dis Clin Microbiol*. 2023;5(4):332-40. doi:10.36519/idcm.2023.276.
14. Mooneyhan E, Qureshi H, Mahmood H, Tariq M, Maqbool NA, Anwar M, et al. Hepatitis C prevalence and elimination planning in Pakistan, a bottom-up approach accounting for provincial variation. *J Viral Hepat*. 2023;30(4):345-54. doi:10.1111/jvh.13802.
15. Bui HH, Nguyen STB, Phan ST, Nguyen KM, Nguyen CD. Evaluating M2BPGi as a marker for liver fibrosis in patients with chronic hepatitis B. *Dig Dis Sci*. 2023;68(12):4407-17. doi:10.1007/s10620-023-08143-5.
16. Qureshi H, Alam E, Dharejo Z, Mahmood H. Prevalence of hepatitis and HIV in Pakistan. *East Mediterr Health J*. 2024;30(10):689-97. doi:10.26719/2024.30.10.689.
17. Zeng S, Liu Z, Ke B, Zhang Y, Wang Q, Tan S. The non-invasive serum biomarkers contribute to indicating liver fibrosis staging and evaluating the progress of chronic hepatitis B. *BMC Infect Dis*. 2024;24:638. doi:10.1186/s12879-024-09465-z.
18. Kim MN, An J, Kim EH, Kim G, et al. Vibration-controlled transient elastography for significant fibrosis in treatment-naïve chronic hepatitis B patients: a systematic review and meta-analysis. *Clin Mol Hepatol*. 2024;30(Suppl). doi:10.3350/cmh.2024.0371.
19. El-Kassas M, Elakel W, Elsharkawy A, Asem N, Abu-Elfath A, Mostafa A, et al. Comparison of different noninvasive scores for assessing hepatic fibrosis in a cohort of chronic hepatitis C patients. *Sci Rep*. 2024;14:29544. doi:10.1038/s41598-024-79826-w.
20. World Health Organization. Guidelines for the prevention, diagnosis, care and treatment for people with chronic hepatitis B infection. Geneva: World Health Organization; 2024.
21. Liguori A, Zoncapè M, Casazza G, Easterbrook P, Tsochatzis EA. Staging liver fibrosis and cirrhosis using non-invasive tests in people with chronic hepatitis B to inform WHO 2024 guidelines: a systematic review and meta-analysis. *Lancet Gastroenterol Hepatol*. 2025;10(4):332-49. doi:10.1016/S2468-1253(24)00437-0.
22. Elsabaawy M, Eissa M, Shaban A, et al. Validation of albumin platelet product as a non-invasive fibrosis staging tool in patients with chronic HCV-related liver disease. *Sci Rep*. 2025;15:20265. doi:10.1038/s41598-025-07456-x.
23. Liaquat RA, Haq MU. APRI and FIB-4 performance to assess liver fibrosis against predefined FibroScan values in chronic hepatitis C virus infection. *Prof Med J*. 2025;32(5). doi:10.29309/TPMJ/2025.32.05.8915.