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Liver fibrosis assessment: The role of elastography and serum biomarkers in early diagnosis.

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Introduction

Liver fibrosis occurs in response to sustained liver injury from conditions such as chronic viral hepatitis, non-alcoholic fatty liver disease (NAFLD), alcohol abuse, and autoimmune hepatitis. If left unchecked, fibrosis can progress to cirrhosis, hepatocellular carcinoma (HCC), or liver failure.Traditionally, liver biopsy has been the gold standard for staging fibrosis. However, its invasive nature, potential for complications, and interobserver variability have led to a growing emphasis on non-invasive assessment tools. Among these, elastography techniques (like transient elastography) and serum-based biomarkers have gained significant traction for early diagnosis and monitoring [1].

Fibrosis results from the excessive accumulation of extracellular matrix (ECM) proteins, particularly collagen, in response to chronic liver injury. Hepatic stellate cells (HSCs), when activated by inflammatory stimuli, play a central role in ECM production. The fibrotic process is reversible in early stages, highlighting the importance of timely detection [2].

Elastography is a key non-invasive method for assessing liver fibrosis, with two primary techniques: Transient Elastography (FibroScan) and Magnetic Resonance Elastography (MRE). FibroScan, using vibration-controlled transient elastography (VCTE), measures liver stiffness in kilopascals (kPa) and correlates it with fibrosis stages (F0–F4); values above 12.5 kPa typically suggest cirrhosis. It is rapid (under 10 minutes), operator-independent, and widely validated for conditions such as viral hepatitis, non-alcoholic fatty liver disease (NAFLD), and alcoholic liver disease [3].

Its advantages include being painless, repeatable, and suitable for large-scale screening, with a strong negative predictive value for ruling out advanced fibrosis. However, it has limitations in obese patients and those with ascites, and its accuracy can be affected by hepatic inflammation or congestion. MRE, on the other hand, is more accurate—particularly in obese individuals—as it uses MRI to create a detailed visual map of liver stiffness. Though more expensive, MRE is increasingly favored in academic and specialized medical centers due to its precision**.** [4].

Non-invasive tools for assessing liver fibrosis offer several advantages, including accessibility, affordability, and utility in primary care settings, especially when combined with imaging to enhance diagnostic accuracy. However, they have limitations such as reduced reliability in intermediate fibrosis stages and susceptibility to comorbid conditions and lab variability. Leading liver societies like EASL and AASLD recommend using a stepwise approach, beginning with serum-based markers (e.g., FIB-4, APRI), followed by elastography (FibroScan or MRE) for patients at intermediate or high risk, with liver biopsy reserved for cases with discordant or unclear results. This algorithm minimizes unnecessary biopsies while ensuring prompt care for high-risk individuals [5].

Conclusion

Liver fibrosis is a silent yet progressive condition, and early diagnosis is key to halting its course. Non-invasive methods such as elastography and serum biomarkers offer safe, efficient, and cost-

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effective alternatives to liver biopsy. Their integration into clinical practice has revolutionized the management of chronic liver diseases. Continued research and technological refinement will further optimize their diagnostic power and clinical utility.

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