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COMPARISON OF STEATOSIS AND FIBROSIS STAGES IN NON-ALCOHOLIC FATTY LIVER DISEASE

Annotation. The major determinants negatively affecting life expectancy and quality of life in patients with NAFLD are related, on the one hand, to the progressive course of liver damage—from simple steatosis to steatohepatitis, fibrosis, cirrhosis, and hepatocellular carcinoma, often necessitating liver transplantation—and, on the other hand, to metabolic disturbances that significantly increase the risk of cardiovascular diseases. Therefore, assessment of NAFLD should focus not only on clinical and biochemical activity but also on the degree of liver fibrosis, which currently has high clinical relevance, although it is not always adequately evaluated in routine clinical practice.

Keywords: Non-alcoholic fatty liver disease (NAFLD), hepatic steatosis, liver fibrosis, fibrosis staging, steatosis grading, metabolic syndrome, chronic liver disease, non-invasive liver assessment.

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СРАВНЕНИЕ СТЕПЕНИ СТЕАТОЗА И ФИБРОЗА ПРИ НЕАЛКОГОЛЬНОЙ ЖИРОВОЙ БОЛЕЗНИ ПЕЧЕНИ

Аннотация. Основными факторами, негативно влияющими на продолжительность и качество жизни пациентов с НАЖБП, являются, с одной стороны, прогрессирующее течение поражения печени — от простого стеатоза до стеатогепатита, фиброза, цирроза и гепатоцеллюлярной карциномы, часто требующей трансплантации печени, а с другой стороны — метаболические нарушения, значительно повышающие риск сердечно-сосудистых заболеваний. Поэтому оценка НАЖБП должна учитывать не только клиническую и биохимическую активность, но и степень фиброза печени, которая в настоящее время имеет большое клиническое значение, хотя не всегда адекватно оценивается в рутинной практике.

Ключевые слова: Неалкогольная жировая болезнь печени (НАЖБП), печёночный стеатоз, фиброз печени, стадирование фиброза, оценка тяжести стеатоза, метаболический синдром, хронические заболевания печени, неинвазивная оценка печени.

Relevance. Non-alcoholic fatty liver disease (NAFLD) has emerged as one of the most significant public health challenges worldwide, affecting hundreds of millions of individuals across diverse populations. Its prevalence has been steadily increasing over the past decades, largely in parallel with the global rise in obesity, type 2 diabetes mellitus (T2DM), and metabolic syndrome. NAFLD is now recognized not merely as a hepatic manifestation of metabolic disorders but as a complex multisystem condition that contributes to increased morbidity and mortality beyond liver-related complications.

Early detection and accurate assessment of both steatosis grade and fibrosis stage are therefore of paramount importance. Evaluating the severity of steatosis allows clinicians to identify patients at risk for inflammatory progression,

whereas precise staging of fibrosis serves as a key predictor of long-term outcomes, including the development of cirrhosis and liver-related complications. Moreover, since NAFLD is closely intertwined with systemic metabolic disturbances, such as insulin resistance, dyslipidemia, and hypertension, its early recognition provides an opportunity to implement interventions aimed not only at the liver but also at overall cardiometabolic health.

From a clinical perspective, timely identification of patients with advanced fibrosis or high-grade steatosis can inform treatment decisions, including lifestyle modifications, pharmacotherapy, and, in severe cases, consideration for liver transplantation. Non-invasive diagnostic modalities, such as transient elastography and magnetic resonance imaging-based techniques, have become invaluable tools in the routine evaluation of NAFLD, enabling the monitoring of disease progression without the need for repeated invasive liver biopsies. Overall, understanding the full spectrum of NAFLD and the interrelationship between steatosis and fibrosis is essential for preventing complications, guiding effective patient management, and reducing the growing global burden of this chronic liver disease.

Aim. The study aims to compare the stages of steatosis and fibrosis in patients with NAFLD and to assess their clinical significance in predicting disease progression and associated metabolic risks.

Materials and Methods. A total of 120 patients diagnosed with NAFLD at the Andijan State Medical Institute were included in this study. All patients underwent clinical examination, laboratory testing, abdominal ultrasonography, and elastography for non-invasive assessment of liver fibrosis. Liver biopsy was performed in selected cases to confirm histopathological staging. Steatosis and fibrosis were graded according to established scoring systems (NAS and METAVIR). Statistical analysis was performed using SPSS software, with $p<0.05$ considered statistically significant.

Results. Among the studied cohort of 120 patients diagnosed with non-alcoholic fatty liver disease (NAFLD), the distribution of hepatic steatosis varied

considerably. Specifically, 45% of patients exhibited mild steatosis, characterized by minimal lipid accumulation in hepatocytes without significant inflammatory changes. This group generally demonstrated preserved liver function tests and a lower prevalence of metabolic risk factors. Moderate steatosis was observed in 35% of patients, in whom lipid accumulation affected a larger proportion of hepatocytes and was frequently accompanied by mild inflammatory infiltration and early hepatocellular injury. The remaining 20% of patients presented with severe steatosis, marked by extensive hepatocellular lipid deposition, pronounced inflammatory activity, and early histological signs suggestive of progression toward steatohepatitis.

Fibrosis staging, assessed through a combination of non-invasive elastography and histopathological examination when available, revealed that 50% of patients had no or minimal fibrosis (F0–F1), 30% had moderate fibrosis (F2), 15% presented with advanced fibrosis (F3), and 5% had cirrhosis (F4). The data indicate a continuum of fibrotic progression closely associated with the severity of steatosis. Statistical analysis demonstrated a significant positive correlation between the degree of steatosis and fibrosis stage ($r=0.62$, $p<0.01$), suggesting that higher lipid accumulation in hepatocytes is strongly linked to the advancement of fibrotic remodeling in the liver parenchyma.

Furthermore, patients with higher fibrosis stages (F2–F4) exhibited significantly elevated metabolic parameters compared to those with lower fibrosis (F0–F1). Specifically, body mass index (BMI) values were markedly higher, with a mean BMI of 32.4 kg/m² in the advanced fibrosis group versus 27.6 kg/m² in the mild fibrosis group. Fasting plasma glucose levels were also elevated, averaging 6.8 mmol/L compared to 5.4 mmol/L in patients with minimal fibrosis. Similarly, triglyceride levels demonstrated a progressive increase, with an average of 2.3 mmol/L in patients with severe fibrosis versus 1.5 mmol/L in those with F0–F1 fibrosis. These findings highlight a clear association between liver fibrotic progression and components of metabolic syndrome, including obesity, insulin resistance, and dyslipidemia.

In addition, the study observed that patients with severe steatosis and advanced fibrosis were more likely to present with coexisting comorbidities such as hypertension, impaired glucose tolerance, and elevated liver enzymes (ALT and AST). Ultrasonographic and elastographic measurements confirmed that liver stiffness increased proportionally with fibrosis stage, reinforcing the clinical utility of non-invasive assessment methods in monitoring disease progression. Overall, the results underscore that NAFLD is not a static condition but a dynamic process in which progressive steatosis and fibrosis are tightly interrelated and contribute to systemic metabolic disturbances.

Conclusion. The study demonstrates a clear correlation between steatosis severity and fibrosis stage in NAFLD patients. Accurate assessment of both parameters is essential for early intervention, risk stratification, and management of associated metabolic complications. Non-invasive methods, combined with histopathological confirmation when necessary, provide reliable tools for monitoring disease progression.

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