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NON-ALCOHOLIC FATTY LIVER DISEASE (NAFLD): ETIOLOGY, CLINICAL FEATURES, DIAGNOSIS, TREATMENT AND PREVENTION

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Abstract. Non-Alcoholic Fatty Liver Disease (NAFLD) is one of the most prevalent chronic liver disorders worldwide, strongly associated with metabolic syndrome and obesity. This review summarizes current understanding of NAFLD pathogenesis, diagnostic methods, and therapeutic options, highlighting recent advances and future perspectives in disease management.

Key words: NAFLD, non-alcoholic fatty liver disease, metabolic syndrome, obesity, diagnosis, treatment, liver fibrosis, inflammation.

INTRODUCTION

Non-Alcoholic Fatty Liver Disease (NAFLD) encompasses a spectrum of liver conditions characterized by excessive fat accumulation in hepatocytes in the absence of significant alcohol consumption. NAFLD has emerged as a leading cause of chronic liver disease globally, particularly in developed countries where obesity and metabolic syndrome are highly prevalent [1].

The disease spectrum ranges from simple steatosis to non-alcoholic steatohepatitis (NASH), which may progress to fibrosis, cirrhosis, and hepatocellular carcinoma (HCC) [2].

NAFLD is often considered a hepatic manifestation of systemic metabolic dysfunction, and its increasing incidence poses a significant public health challenge. Despite advances in understanding NAFLD, many aspects of its pathogenesis and optimal management remain incompletely understood [3].

The aim of this study is to comprehensively review current knowledge on the pathogenesis, diagnosis, and treatment of NAFLD, emphasizing recent clinical research and emerging therapeutic strategies.

MATERIAL AND METHODS

This review is based on a systematic analysis of peer-reviewed articles published from 2015 to 2024, retrieved from PubMed, Scopus, and Web of Science databases. Search terms included “NAFLD,” “non-alcoholic fatty liver disease,” “diagnosis,” “treatment,” “metabolic syndrome,” and “liver fibrosis.” Articles selected comprised original research, clinical trials, systematic reviews, and clinical guidelines. Emphasis was placed on studies that provided significant insights into disease mechanisms, diagnostic innovations, and treatment outcomes.

RESULTS AND DISCUSSION

The pathogenesis of NAFLD is multifactorial and complex. It is largely driven by insulin resistance, which leads to increased lipolysis and free fatty acid influx into the liver, promoting hepatic steatosis [4]. The “multiple-hit” hypothesis suggests that besides fat accumulation, oxidative stress, mitochondrial dysfunction, inflammatory cytokines, and gut microbiota alterations contribute to hepatocellular injury and inflammation [5]. Genetic predispositions, such as polymorphisms in the PNPLA3 and TM6SF2 genes, have also been implicated in disease susceptibility and progression [6].

Clinical Presentation and Diagnosis

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Most patients with NAFLD are asymptomatic or have nonspecific symptoms like fatigue or mild right upper quadrant discomfort. Laboratory findings often reveal mild elevations in alanine aminotransferase (ALT) and aspartate aminotransferase (AST), but these are neither sensitive nor specific for diagnosis [7]. Imaging modalities such as ultrasound, controlled attenuation parameter (CAP) via FibroScan, and magnetic resonance imaging (MRI) techniques are routinely employed for detecting hepatic steatosis [8]. Liver biopsy remains the gold standard for diagnosing NASH and assessing fibrosis but is invasive and not practical for routine use [9].

Treatment Approaches

Currently, lifestyle modifications, including weight loss through diet and physical activity, remain the cornerstone of NAFLD management. A 7-10% reduction in body weight is associated with histological improvement in liver inflammation and fibrosis [10]. Pharmacological therapies are evolving; insulin sensitizers such as pioglitazone and antioxidants like vitamin E have shown efficacy in selected patients [11]. Novel agents targeting various pathogenic pathways—such as FXR agonists (obeticholic acid), GLP-1 receptor agonists, and anti-fibrotic drugs—are under clinical investigation [12].

Complications and Prognosis

NAFLD is strongly associated with increased risk of cardiovascular disease, type 2 diabetes mellitus, and liver-related morbidity [13]. Progression to cirrhosis and hepatocellular carcinoma occurs in a subset of patients, necessitating regular monitoring. Early identification and comprehensive management of metabolic risk factors are essential to improve long-term outcomes [14].

Future Perspectives

Emerging biomarkers and non-invasive diagnostic tools promise to improve disease stratification and monitoring. Integration of personalized medicine approaches considering genetic and metabolic profiles may optimize treatment efficacy. Ongoing research into gut-liver axis modulation and novel therapeutics holds promise for more effective NAFLD management [15].

CONCLUSION

NAFLD is a prevalent and complex liver disease closely linked to metabolic disorders. While lifestyle modification remains the mainstay of treatment, advances in pharmacotherapy and diagnostic techniques are improving patient outcomes. Continued research is vital to fully elucidate disease mechanisms and develop targeted therapies to halt disease progression and reduce associated comorbidities.

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