

PATHOPHYSIOLOGY AND FUNCTIONS OF THE LIVER: A COMPREHENSIVE REVIEW

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Abstract: The liver is one of the most vital organs in the human body, playing a central role in metabolism, detoxification, and synthesis of essential proteins. Pathophysiological changes in the liver can result in a variety of disorders including cirrhosis, hepatitis, and hepatic failure. This article reviews the physiological roles of the liver and examines the key pathophysiological mechanisms underlying common liver diseases.

Keywords: liver, hepatology, liver function, pathophysiology, cirrhosis, detoxification, metabolism

1. Introduction

The liver, located in the upper right quadrant of the abdomen, is the largest internal organ in the human body. It performs more than 500 vital functions, including metabolism of carbohydrates, fats, and proteins, storage of glycogen and vitamins, detoxification of drugs and toxins, and production of bile. Understanding the pathophysiology of liver diseases is essential for developing effective treatments and for the early diagnosis of liver dysfunction.

2. Functions of the Liver

The liver carries out various physiological functions, which can be grouped into the following categories:

2.1 Metabolic Function

The liver regulates blood glucose levels by storing glucose as glycogen (glycogenesis) and releasing it when needed (glycogenolysis). It also plays a central role in lipid metabolism and synthesizes cholesterol and lipoproteins.

2.2 Synthetic Function

The liver synthesizes essential proteins such as albumin, clotting factors (fibrinogen, prothrombin), and transport proteins. Albumin helps maintain oncotic pressure, and clotting factors are vital for coagulation.

2.3 Detoxification

The liver neutralizes harmful substances including alcohol, drugs, and metabolic waste through enzymatic processes primarily involving the cytochrome P450 system.

2.4 Storage

It stores fat-soluble vitamins (A, D, E, K), vitamin B12, and iron in the form of ferritin.

2.5 Immunological Function

Kupffer cells, specialized macrophages in the liver, play a role in immune surveillance by removing pathogens and debris from the blood.

3. Pathophysiology of Liver Diseases

Disruption in liver function can lead to significant pathological changes:

3.1 Hepatitis

Inflammation of liver tissue, usually due to viral infection (e.g., hepatitis B, C), autoimmune reactions, or toxins. Chronic hepatitis may progress to fibrosis or cirrhosis.

3.2 Cirrhosis

A progressive condition characterized by fibrosis and architectural distortion of the liver. It leads to impaired blood flow, portal hypertension, and liver failure.

3.3 Non-Alcoholic Fatty Liver Disease (NAFLD)

A spectrum of liver damage ranging from simple steatosis to steatohepatitis, commonly associated with obesity, insulin resistance, and type 2 diabetes.

3.4 Liver Failure

Acute or chronic liver failure results in loss of metabolic and synthetic functions, causing jaundice, coagulopathy, hepatic encephalopathy, and multi-organ failure.

4. Conclusion

The liver is indispensable for maintaining metabolic homeostasis and immune defense. Pathophysiological alterations in the liver can have systemic consequences and are often progressive. Early detection and intervention are critical in managing liver diseases. Further research into molecular mechanisms and regenerative therapies holds promise for better clinical outcomes.

References

1. Hall, J.E., & Guyton, A.C. (2021). *Guyton and Hall Textbook of Medical Physiology*. Elsevier.
2. Kumar, V., Abbas, A.K., & Aster, J.C. (2020). *Robbins and Cotran Pathologic Basis of Disease*. Elsevier.
3. Friedman, S.L. (2020). Liver fibrosis — from bench to bedside. *Journal of Hepatology*, 72(5), 939–950.
4. Chalasani, N., Younossi, Z., Lavine, J.E., et al. (2018). The diagnosis and management of nonalcoholic fatty liver disease. *Hepatology*, 67(1), 328–357.