BG Pulse Journal USA
ISSN:1947-2536 http://www.bgpulseusa.com/index.php/bg
BG PULSE JOURNAL

HISTOLOGICAL STRUCTURE AND PATHOLOGY OF THE LIVER

Teshayev Mukhriddin
A Lecturer At Asia International University

Introduction

The liver is the largest gland in the human body and performs numerous vital functions, including metabolism, detoxification, protein synthesis, bile production, and storage of energy reserves. The complex histological organization of the liver ensures the proper execution of these functions. Various harmful factors such as viruses, toxins, alcohol, metabolic disorders, and autoimmune reactions can cause pathological changes in the liver. Therefore, studying the histological structure of the liver is essential for understanding liver diseases and improving diagnostic and therapeutic approaches.

1. Anatomical and Histological Structure of the Liver

1.1. General Structure of the Liver

The liver is located in the upper right quadrant of the abdominal cavity and weighs approximately 1.5–2 kg in adults. It is covered externally by a connective tissue capsule known as Glisson's capsule. Anatomically, the liver is divided into right and left lobes.

Histologically, the liver consists of:

- **Parenchyma** — hepatocytes
- **Stroma** — connective tissue, blood vessels, lymphatic vessels, and nerves

1.2. Structural and Functional Unit of the Liver

The main structural and functional unit of the liver is the **hepatic lobule (lobulus hepatis)**.

Classical Hepatic Lobule

The classical hepatic lobule has a polygonal shape with a central vein located in the center. At the periphery, portal areas or portal triads are present.

The portal triad contains:

- A branch of the portal vein
- A branch of the hepatic artery
- A bile duct
- Lymphatic vessels

Blood flows from the periphery toward the central vein through hepatic sinusoids.

1.3. Hepatocytes

Hepatocytes are the principal functional cells of the liver. They are polygonal cells with one or two nuclei and abundant cytoplasm rich in organelles.

Their cytoplasm contains:

- Mitochondria
- Rough endoplasmic reticulum
- Golgi apparatus
- Glycogen granules
- Lipid droplets

Functions of Hepatocytes

Hepatocytes perform numerous metabolic and synthetic functions, including:

- Protein synthesis
- Albumin production
- Synthesis of coagulation factors
- Bile formation
- Detoxification of harmful substances

1.4. Hepatic Sinusoids and Kupffer Cells

Hepatic sinusoids are specialized capillary channels that carry mixed blood from the portal vein and hepatic artery.

The sinusoidal wall contains:

- Endothelial cells
- Kupffer cells
- Ito (stellate) cells

Kupffer Cells

Kupffer cells are liver macrophages responsible for:

- Phagocytosis of microorganisms
- Removal of damaged erythrocytes
- Participation in immune responses

Ito Cells

Ito cells are located in the space of Disse and are involved in:

- Storage of vitamin A
- Development of hepatic fibrosis

2. Physiological Functions of the Liver

The liver performs several important physiological functions.

2.1. Metabolic Functions

The liver regulates:

- Carbohydrate metabolism
- Lipid metabolism
- Protein metabolism

2.2. Detoxification Function

The liver detoxifies:

- Drugs
- Toxic substances
- Alcohol
- Metabolic waste products

2.3. Bile Production

The liver produces bile, which:

- Emulsifies fats
- Facilitates digestion and absorption

3. Liver Pathology

3.1. Hepatitis

Hepatitis is an inflammatory disease of the liver.

Types of Hepatitis

- Viral hepatitis
- Autoimmune hepatitis
- Toxic hepatitis

Histological Features

- Hepatocyte necrosis
- Lymphocytic infiltration
- Sinusoidal dilation

3.2. Fatty Liver Disease (Steatosis)

Steatosis is characterized by the accumulation of fat droplets in hepatocytes.

Causes

- Obesity
- Diabetes mellitus
- Alcohol abuse

Microscopic Features

- Cytoplasmic vacuoles
- Peripheral displacement of nuclei

3.3. Liver Cirrhosis

Cirrhosis is a chronic progressive liver disease characterized by fibrosis and regenerative nodules.

Histological Changes

- Excessive collagen deposition
- Distortion of normal liver architecture
- Formation of regenerative nodules

Clinical Manifestations

- Portal hypertension
- Ascites
- Jaundice

3.4. Hepatic Necrosis

Necrosis refers to the death of hepatocytes.

Types

- Coagulative necrosis
- Liquefactive necrosis

Causes

- Viral infections
- Toxic agents
- Ischemia

3.5. Liver Tumors

Benign Tumors

- Hepatic adenoma
- Hemangioma

Malignant Tumors

- Hepatocellular carcinoma

Histological Characteristics

- Cellular polymorphism
- Increased mitotic activity
- Invasive growth

4. Mechanism of Hepatic Fibrosis

During fibrosis, Ito cells become activated and produce excessive collagen fibers.

As a result:

- Blood circulation becomes impaired
- Hepatocytes are damaged
- Cirrhosis may develop

5. Diagnostic Methods in Liver Pathology

5.1. Liver Biopsy

Liver biopsy is one of the most important methods for histological examination and diagnosis of liver diseases.

5.2. Histological Staining Methods

Hematoxylin and Eosin (H&E)

Used for general tissue examination.

Masson's Trichrome Stain

Used for identifying fibrosis and collagen fibers.

PAS Reaction

Used to detect glycogen and glycoproteins.

6. Modern Research Methods

Modern methods used in the study of liver pathology include:

- Immunohistochemistry
- Electron microscopy
- Molecular biology techniques
- PCR diagnostics

These methods improve the accuracy of diagnosis and understanding of disease mechanisms.

Conclusion

The liver is one of the most important organs in the human body due to its diverse metabolic and detoxification functions. Its complex histological structure ensures the proper functioning of these processes. Various pathological conditions lead to structural and functional changes in liver tissue. Understanding liver histology and pathology is essential for early diagnosis, prevention, and effective treatment of liver diseases.

References

1. Junqueira L.C., Carneiro J. *Basic Histology*. McGraw-Hill Education.
2. Ross M.H., Pawlina W. *Histology: A Text and Atlas*.
3. Kumar V., Abbas A.K., Aster J.C. *Robbins Basic Pathology*.
4. Gartner L.P. *Color Atlas of Histology*.
5. Cotran R.S. *Pathologic Basis of Disease*.
6. Mescher A.L. *Junqueira's Basic Histology: Text and Atlas*.
7. Young B., O'Dowd G., Woodford P. *Wheater's Functional Histology*.