





Gastrointestinal Tract (GIT) Module 2nd Year MBBS(LGIS) Histology of Liver



Presenter: Dr. Maria Tasleem (Assistant Professor) Date: 11-03-25

Prof. Umar's Model of Teaching Strategy Self Directed Learning Assessment Program

Objectives : To cultivate critical thinking, analytical reasoning, and problem-solving competencies.

To instill a culture of self-directed learning, fostering lifelong learning habits and autonomy.

How to Assess?

➤Ten randomly selected students will be evaluated within the first 10 minutes of the lecture through 10 multiple-choice questions (MCQs) based on the PowerPoint presentation shared on Students Official WhatsApp group, one day before the teaching session.

➤ The number of MCQs from the components of the lecture will follow the guidelines outlined in the Prof. Umar model of Integrated Lecture.

Component	Core	Horizontal	Vertical	Spiral
of LGIS	Knowledge	Integration	Integration	Integration
No. of MCQs	6-7	1-2	1	1

Professor Umar Model of Integrated Lecture



Learning Objectives

At the end of this session students should be able to

- Discuss in detail the histological organization of liver
- Explain the structure of liver lobule, portal triads & hepatic acinus and its functional importance
- Discuss histological features and bio-physiological aspects of hepatocytes.
- Explain Hepatic cords, central vein, portal triad, hepatic venules, hepatic arterioles, bile duct & liver sinusoids
- Discuss the blood supply of the liver.
- Describe clinical aspects of liver on histological grounds e.g jaundice, cirrhosis & fatty liver

Interactive Session ALCOHOLIC LIVER DISEASE

Alcoholic liver disease condition in which long-term excessive alcohol consumption damages the liver, leading to inflammation, scarring, and even cirrhosis of the liver tissue.



A known case of **Liver Cirrhosis** due to **chronic alcoholism** went for few laboratory tests. The tests revealed **deranged PTT** (prothrombin time) and **hypoalbuminemia.** With your knowledge of Liver histology explain the cause of these deranged lab tests.

Liver-Gross Anatomy

- Largest organ of the body
- Largest gland
- Location
- Receives blood from:
 - Portal vein
 - Hepatic artery
- Drains to IVC



Horizontal Integration

Bio-physiological Aspects of Liver

- Liver produces most of the body's circulating plasma proteins e.g
- Albumin- involved in regulating plasma volume and tissue fluid balance
- Lipoproteins- VLDL, HDL and LDL that are involved in transport of triglycerides from the liver to other organs
- ➢glycoproteins, which include proteins involved in iron transport such as haptoglobin, transferrin
- Prothrombin and fibrinogen, important components of the blood-clotting cascade

Horizontal Integration

Bio-physiological Aspects of Liver

- Liver stores and converts several vitamins
- ➢vitamin A (retinol), an important vitamin in vision. Night blindness and multiple skin disorders are related to vitamin A deficiency
- ➢vitamin D, converted into its active metabolite. Deficiency could lead to rickets and other disorders of bone mineralization.
- ➢vitamin K, deficiency is associated with hypoprothrombinemia and bleeding disorders.

Horizontal Integration

Bio-physiological Aspects of Liver

- Liver degrades drugs and toxins
- Involved in many other metabolic pathways
- Bile production is an exocrine function of the liver
- The endocrine-like functions of the liver are represented by its ability to modify the structure and function of many hormones like vitamin D, growth hormone, thyroxine

Blood Supply of Liver

- Portal vein 75% (nutrient rich)
- Hepatic artery 25% (oxygen rich)



Blood Supply of Liver



Blood Supply of Liver



Histology of liver

- Histologically, structural components of liver include
- Stroma
- Parenchyma
- Sinusoids
- Perisinusoidal spaces



Lobulation

Three ways to describe the histological structure of liver

- Classic hepatic lobule
- Portal lobule
- Liver acinus

Classic Hepatic Lobule

- Based on the distribution of portal vein & hepatic artery
- Emphasizes the endocrine function of hepatocytes
 - Central vein at center
 - Portal triads at periphery
- Area near portal triad well supplied by oxygen & nutrients
- Area near central vein not well supplied

a CLASSIC HEPATIC LOBULE Drains blood from the portal vein and the hepatic artery to the hepatic or the central vein



Portal Lobule

- Triangular area
- Three central veins
- Portal triad at center
- Consists of tissues draining bile into bile duct
- Emphasizes the hepatocytes exocrine function



Liver Acinus

- Diamond shaped area
- Two portal triads
- Two closest central veins
- Based on nature of blood supply & O₂ gradient
- **ZONE 1** nearest arteriole- most O₂ & nutrients, oxidative metabolism
- ZONE III –near central vein – least O₂ & nutrients, glycolysis, lipid formation, ischemic necrosis
- **ZONE I**I intermediate range





Identify the Hepatic Lobules



Stroma

- Connective tissue
 (Glisson's) capsule
- Thick at hilum
- Blood vessels & ducts surrounded by CT
- Reticular fibers surround
 & supports liver cells & sinusoids



Sinusoids

- Dilated veins with incomplete basement membrane
- Supported by reticular fibers
- Cells:
 - Endothelial cells- fenestrated
 without diaphragm
 - Kupffer cells (macrophages) present within sinosuoids
 - Metabolize aged erythrocytes,
 - Digest bacteria



Perisinusoidal spaces

- A subendothelial space
- Present between hepatocytes & sinosuoids
- Microvilli of hepatocytes project into the space
- Fat storing (Ito) cells that stores Vit. A present here
- Space continuous with sinusoids





Parenchyma

- Parenchyma includes hepatocytes
 Hepatocytes
- Polyhedral cells 20-30µm
- Eosinophilic
- Large nucleus /binucleate
- Bile canaliculi
- Hepatocyte surfaces related to:
 - Perisinosoidal space
 - Adjacent hepatocyte
 - Bile canaliculi



Parenchyma

Nucleus

- Prominent nucleolus
- Disperse chromatin
- Polyploidy

Cytoplasm

- Glycogen-lacey appearance
- Fat-spherical vacuoles
- Ribosomes & RERbasophilia
- SER
- Mitochondriaeosinophilic
- Lysosomes
- Golgi complex
- Peroxisomes



Parenchyma

Fine structure of hepatocytes

- Rough endoplasmic reticulum protein synthesis
- Smooth endoplasmic reticulum oxidation, methylation
 - Conjugation of bilirubin to gluronate bilirubin glucoronide
 - Synthesis of bile acids

• Golgi apparatus – near nucleus

- Formation of lysomes
- Secretion of proteins, glycoproteins, lipoproteins into plasma
- Lysosomes –turnover & degradation of organelles
- Mitochondria
- Peroxisomes
 - Important for oxidation of excess fatty acid
 - Breakdown of hydrogen peroxide
 - Breakdown of purines to uric acid
 - Synthesis of cholestrol, bile acids & some lipids for myelin
- Drug inactivation –by enzyme glucuronyle transferase



Biliary Tree





Liver Cirrhosis

- Occurs late in chronic liver disease
- Histological findings include excessive connective tissue, fibrosis in perisinusoidal spaces due to proliferation of fibroblasts and Ito cells
- Metabolic exchange between hepatocytes and sinusoids is interfered
- Can result in clotting disorders, hypoalbuminemia and other medical problems



Fatty Liver Disease

- Reversible condition
- Large lipid droplets accumulate abnormally in hepatocytes called steatosis
- Alcoholism, obesity
- Progressive inflammation of liver called steatohepatitis



Jaundice

- When bilirubin glucuronide is not formed or not excreted properly various diseases characterized by Jaundice occur
- Neonatal hyperbilirubinemia jaundice in newborn
- Underdeveloped smooth ER
- Treatment blue light exposure
- Unconjugated bilirubin transformed into water soluble photoisomer that can be excreted by kidneys

Malignant Tumors

- Mostly derived from hepatocytes or cholangiocytes of hepatic ducts
- Pathogenesis associated with viral hepatitis B,C and cirrhosis

Spiral Integration

Family Medicine

Management of Liver Cirrhosis

- Review the patient's clinical presentation, medical history, and diagnostic test results
- The most crucial step in managing liver cirrhosis due to alcoholism is complete **abstinence from alcohol**.
- Management of Complications
- Nutritional Support, Malnutrition is common in patients with liver cirrhosis. Encourage the patient to follow a well-balanced diet
- Schedule **regular follow-up visits** to monitor the progression of liver disease
- Offer **counseling and support services** to address the emotional and psychological challenges
- Medication Management

Ethical Considerations

- From an ethical standpoint, the scenario raises considerations regarding **patient autonomy**, **informed consent**, and **confidentiality**
- •The physician must ensure that patient fully understands her diagnosis, treatment options, and potential implications
- Additionally, the physician must respect patient's privacy and confidentiality throughout the diagnostic and treatment process

Role of AI in Liver Cirrhosis Management

- Al can potentially aid in **enhancing diagnostic** accuracy and efficiency.
- AI-powered decision support systems can also help clinicians in selecting appropriate treatment modalities
- Al-driven predictive models may help anticipate the risk of disease occurrence in susceptible populations

Spiral Integration

Research Article

Natural history of histologically proven alcohol-related liver disease: A systematic review

Parker R, Aithal GP, Becker U, Gleeson D, Masson S, Wyatt JI, Rowe IA, <u>https://doi.org/10.1016/j.jhep.2019.05.020</u>

Alcohol-related hepatic steatohepatitis requiring admission to hospital is the most dangerous subtype of ALD. Alcohol-related steatosis is not a benign condition as it is associated with significant risk of mortality.

Learning Resources

- Junqueira's Basic Histology 14th Edition, Chapter 15, pages 301-309
- Histology , A text and Atlas by Michael H.Ross 7th Edition, Chapter 17, pages 572-584
- DiFiore's Atlas of Histology with Functional Correlations 11th Edition, Chapter 11, pages 240-245
- Google images

THANK YOU