





Gastrointestinal Tract (GIT) Module 2nd Year MBBS(LGIS) Liver Function Tests & Jaundice

Presenter: Dr Nayab Ramzan Deptt of Biochemistry RMU Date: 18-03-25

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

Objectives:

- To cultivate critical thinking, analytical reasoning and problemsolving 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 of	Core	Horizontal	Vertical	Spiral
LGIS	Knowledge	Integration	Integration	Integration
No of MCQs	6-7	1-2	1	1

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Professor Umar Model of Integrated Lecture



Motto, Vision, Dream



- To impart evidence based research oriented medical education
- To provide best possible patient care
- To inculcate the values of mutual respect and ethical practice of medicine

Q1- Obstructive jaundice is best detected by

- a) Increased ALP
- b) Decreased ALP
- c) Increased AST
- d) Decreased AST
- e) Increased ALT
- Q2 -A 10 year old boy presented with increased bilirubin in urine & no urobilinogen, what is the underlying condition?
- a) Gilbert's Syndrome
- b) Hemolytic jaundice
- c) Viral hepatitis
- d) Obstructive jaundice
- e) Cirrhosis

Q3 The condition in which the color of sclera and skin become yellow is termed as:

- a) Jaundice
- b) Yellow fever
- c) Plague
- d) Congo fever
- e) Dengue Fever

Q4- The normal serum bilirubin (total) is:

- a) 2 mg/dl
- b) 0.2 0.6 mg/dl
- c) 0.2 0.8 mg/dl
- d) 0-0.2 mg/dl
- e) 4 mg/dl

Q5 -The clay color of feces in patients of hepatic jaundice is due to absence of:

- a) Bilirubin
- b) Urobilin
- c) Stercobilinogen
- d) Hemoglobin
- e) Biliverdin

6. What is the primary function of Alkaline Phosphatase (AP) in the liver?

a) Breakdown of glucose
b) Metabolism of fatty acids
c) Synthesis of bile acids
d) Degradation of
phospholipids
e) Catalyzes the hydrolysis of
phosphate esters in alkaline
conditions

- Q7. What happens to the ALT and AP levels in a person with liver cirrhosis?
- a) Both decrease
 b) Both increase
 c) ALT increases, AP
 decreases
 d) ALT decreases, AP
 increases
 - e) Both stay the same

Q8. Which of the following groups is most at risk and would benefit from routine LFT screening?

 a) Patients with a history of chronic alcohol use b) Patients with a family history of diabetes c) Patients with hypertension d) Patients on long-term corticosteroid therapy e) Patients with high cholesterol levels

- Q9. A patient diagnosed with cirrhosis insists on avoiding further liver function tests due to fear of a poor prognosis. What is the healthcare provider's ethical obligation in this situation?
- a) Respect the patient's decision and provide emotional support without further intervention
 - b) Educate the patient on the importance of LFTs for monitoring their condition and potential outcomes
 c) Perform the tests without the patient's consent to ensure proper treatment
 - d) Ignore the patient's fears and proceed with the tests regardless of their concerns
 - e) Inform the patient that no treatment will be available if they refuse the tests

- Q10. Which medication class is commonly used to manage portal hypertension in cirrhosis?
- a) Beta-blockers
 b) Diuretics
 - c) Antihistamines
 - d) Corticosteroids
 - e) Anticoagulants

- 1-a
- 2 d
- 3 a
- 4 c
- 5 c
- 6- e
- 7 b
- 8-a
- 9 b
- 10 a

Learning Objectives

At the end of this session students should be able to

- Discuss indications & classification of Liver Function Tests (LFTs).
- Describe causes and biochemical parameters of different types of Jaundice.
- Correlate with the clinical conditions
- Practice the principles of bioethics in the related scenario
- Apply strategic use of A.I in the given scenario
- Read relevant research articles related to the Hepatic Cirrhosis

Interactive Session

A 58-year-old male presents with a 2-month history of gradual yellowing of the skin and eyes, fatigue, and swelling in the abdomen and legs. He has a long history of alcohol use and reports a recent increase in difficulty eating due to early satiety. Liver function tests reveal elevated ALT, AST, and bilirubin, with a markedly increased alkaline phosphatase. Imaging shows a nodular liver texture, consistent with hepatic cirrhosis.



Indications of LFT's (Liver Function Tests)



Classification of LFT's



ALT	Vs	AST
Alanine transaminase		Aspartate transaminase
Liver Cytosol	Site	Liver, Heart, Skeletal muscle Cytosol, Mitochondria
5-40 U/L	Normal reference Range	5-35 U/L
Severe viral hepatitis, Toxic hepatitis	Marked increase (300-1000 U/L)	Severe viral hepatitis, Toxic hepatitis
Biliary tract obstruction, Alcoholic hepatitis	Mild to moderate increase (50-100 U/L)	Alcoholic hepatitis, Chronic active hepatitis, Hepatic metastasis.
	Non hepatic condition	Myocardial infarction, Skeletal muscle disorders

ALP- Alkaline Phosphatase

Isoenzymes	Site	% of Total	Condition
Alpha-1 ALP	Epithelial cells of biliary canaliculi.	10	Obstructive jaundice
Alpha-2 (Heat Labile)	Hepatic cells.	25	Hepatic disease
Alpha-2 (Heat stable)	Placental origin	1	Pregnancy
Pre-beta	Bone	50	Bone diseases
Gamma	Intestinal cells	10	Ulcerative colitis

Jaundice

- Jaundice (or icterus) refers to "the yellowish discoloration of skin, nail beds, sclerae and mucous membranes, caused by bilirubin deposition, secondary to increased bilirubin levels in the blood (hyperbilirubinemia)."
- Equilibrium between bilirubin production & clearance is disturbed.
- Not a disease, jaundice is usually a symptom of an underlying disorder.





Metabolism of Bilirubin



Serum Bilirubin Levels

- Blood bilirubin levels are:
 - Normally ≤1 mg/dl.
 - Jaundice is seen at 2 to 3 mg/dl.

	Normal
Serum total bilirubin	<1mg/dL
Serum conjugated bilirubin	0.1 to 0.4mg/dL
Serum unconjugated bilirubin	0.2-0.7mg/dL
Urine bilirubin	Absent
Urine urobilin	0.4mg/day
Fecal stercobilin	40-280mg/day
Urine bile salts	Absent

Core Knowledge Conjugated Vs Unconjugated Bilirubin

Difference	Conjugated Bilirubin	Unconjugated Bilirubin Water-insoluble and lipid-soluble	
Chemical composition	Water-soluble and less lipid- soluble		
Solubility in water	Soluble in water	Not soluble in water	
Transport in blood	Transported in the blood in a free form	Transported in the blood bound to albumin	
Processing in the liver	Already processed and ready for elimination from the body	Processed in the liver by being conjugated with glucuronic acid to form conjugated bilirubin	
Ability to pass through the blood-brain barrier	Cannot pass through the blood- brain barrier	Can pass through the blood-brain barrier and cause neurotoxicity	
Urinary excretion	Excreted in the urine	Not excreted in the urine	
Color	Does not contribute to yellow coloration	Responsible for the yellow color of bruises and jaundice	
Clinical Significance Typically elevated in conditions such as obstructive jaundice and biliary atresia Typically elevated in conditions		Typically elevated in conditions such as hemolytic anemia and Gilbert's syndrome 20	

Classification of Jaundice



Prehepatic/Hemolytic Jaundice

- Extensive hemolysis
- Bilirubin is produced faster than can be conjugated.
- Elevated blood UCB levels -(Unconjugated Hyperbilirubinemia), causing jaundice
- Increased Urobilinogen entering the Enterohepatic Circulation
- Increased Urinary Urobilinogen
- CB, urobilinogen, stercobilin, and urobilin levels are at higher side of normal ranges
- In hemolytic jaundice, only UCB levels are abnormally high in blood



Hepatocellular Jaundice

- **Damage to liver cells** (e.g patients with cirrhosis or hepatitis)
- Unconjugated Hyperbilirubinemia due to decreased conjugation.
- Increased urinary Urobilinogen causing dark urine & pale, clay-colored stools
- Elevated plasma ALT & AST levels
- **Conjugated hyperbilirubinemia** due to intrahepatic cholestasis & regurgitation
- Abnormally elevated blood levels of both UCB and CB



Core Knowledge Posthepatic/Obstructive Jaundice

- Obstruction of the Common Bile Duct (Extrahepatic Cholestasis).
- Tumor or Bile Stones causing blockage of bile duct & prevention of CB passage to intestine.
- Symptoms of GI pain, nausea & pale, clay colored stools.
- **Conjugated Hyperbilirubinemia** due to CB regurgitation
- Excretion of CB in Urine (which darkens over time) i.e Urinary bilirubin.
- Absent Urinary Urobilinogen



Jaundice Overview

	Tests	Prehepatic	Hepatocellular	Posthepatic
Jaundice		Low(+)	Marked(++ to +++)	Marked(++ to +++)
Blood	UCB	Elevated	Elevated	Normal
	CB	Normal	Elevated	Elevated
	ALT	Normal	Marked Increase	Moderate increase
	AST	Normal	Marked Increase	Moderate increase
	ALP	Normal	↑(2–3 times Normal)	↑↑(10-12 times Normal)
Urine	Bile Pigment(CB)	Absent	Present(++)	Present(+++)
	Bile salts	Absent	Present(+)	Present(++)
	Urobilinogen	Present	Present (early) Decreased(Obstruction)	Absent
Feces	Stercobilin	Present	Present / decreased	Absent

Horizontal Integration Anatomical/Physiological Aspects of LFTs & Jaundice

- Metabolism major role in
 - Carbohydrate, Lipid & Protein metabolism
 - Bile metabolism & enterohepatic circulation
- Coagulation
- Heme & Xenobiotic metabolism
- Storage / Blood reservoir
- Endocrine functions
- Immune & inflammatory response



Vertical Integration

Clinical Correlates

Hepatic Cirrhosis





Healthy liver

Cirrhotic liver

Hepatic Cirrhosis - Biochemical changes



Spiral Integration

Family Medicine

Management of Hepatic Cirrhosis

- Lifestyle: Maintain a low-salt diet, manage weight and abstain from alcohol.
- **Medications:** Diuretics for ascites, beta-blockers for variceal bleeding, lactulose for hepatic encephalopathy.
- Surveillance: Regular screening for varices, liver function, and hepatocellular carcinoma.
- **Complications:** Manage ascites (paracentesis), SBP (antibiotics), and consider liver transplant.
- Patient Education: Inform about complication signs and the importance of adherence to treatment.

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
- Discuss the necessity of a healthy lifestyle & treatment plan. This requires clear communication and understanding of risks and benefits.
- Additionally, the physician must respect patient's privacy and confidentiality throughout the diagnostic and treatment process

Spiral Integration

Artificial Intelligence

Role of AI in Hepatic 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 complications of Hepatic Cirrhosis in susceptible populations

Research Article

Liver cirrhosis: An Overview

Nadia Moustafa, Manal Abdul-Hamid Mohamed, Rasha Rashad Ahmed, Rehab Nady July 2016 <u>Merit Research Journal of Medicine and Medical Sciences</u> 4(7):329-343

Identification and characterization of cell populations contributing to the myofibroblastic pool and production of extracellular matrix (ECM) in liver fibrosis, as well as the increasing knowledge about natural course, many of the intricate cellular and molecular mechanisms underlying liver fibrogenesis and its progression, and contributions of the genetic regulation, inflammatory and immuno-mediators, neuroendocrine factors, and oxidative stress, have provided important data upon which the design of effective and targeted antifibrotic pharmacological strategies, aiming at halting the progression to decompensated cirrhosis or even reversing the liver fibrogenesis, can be based.

How To Access Digital Library

Steps to Access HEC Digital Library

- a) Go to the website of HEC National Digital Library
- b) On Home Page, click on the INSTITUTES
- c) A page will appear showing the universities from Public and Private Sector and other Institutes which have access to HEC National Digital Library HNDL
- d) Select your desired Institute
- e) A page will appear showing the resources of the institution
- f) Journals and Researches will appear
- g) You can find a Journal by clicking on JOURNALS AND DATABASE and enter a keyword to search for your desired journal

Learning Resources

- Lippincott Illustrated Reviews 8th Edition, Chap 21, pages 316 317
- Harper's Illustrated Biochemistry 32nd Edition, Chap 31 & 48, pages 305, 313 – 315 & 242
- Google images

THANK YOU