



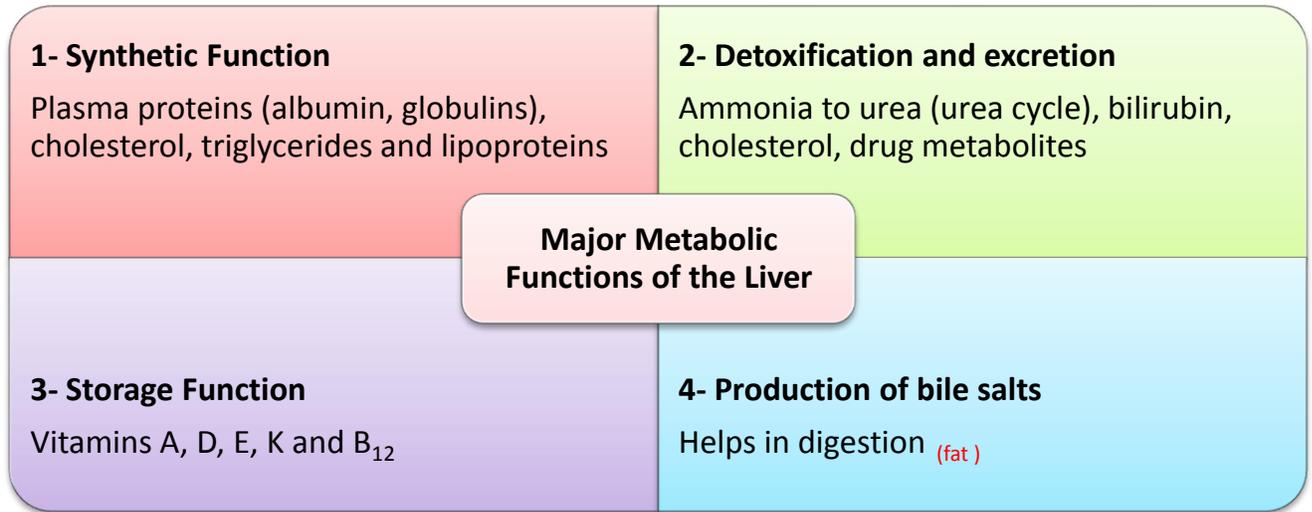
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Some example of liver dysfunction

- ⊙ **Hepatocellular disease** (any disease from simple Jaundice to liver cancer)
- ⊙ **Cholestasis** (**obstruction** of bile flow)
- ⊙ **Cirrhosis**
- ⊙ **Hepatitis**
- ⊙ **Jaundice**
- ⊙ **Liver cancer**
- ⊙ **Steatosis (fatty liver)**
- ⊙ **Genetic Disorders**
 - **Hemochromatosis (iron storage)**

bile flow : liver → gallbladder → intestine

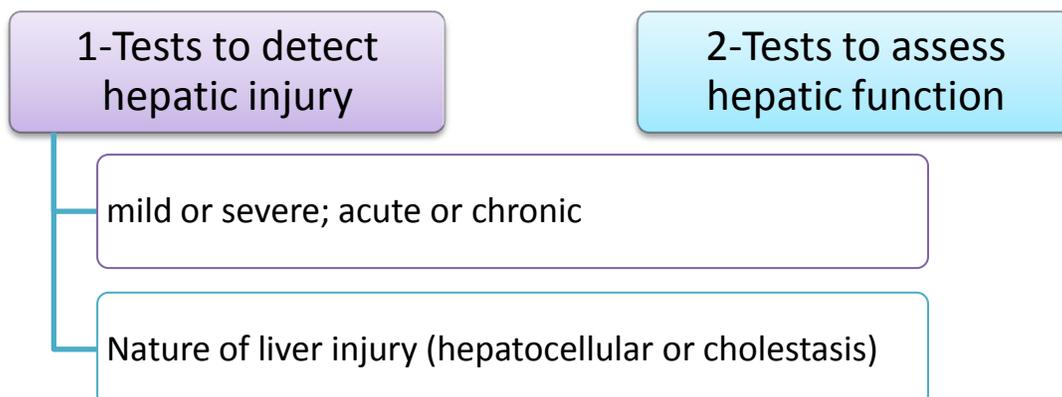
Liver Function Tests:

Also called (liver chemistry test)

- ⊙ **Noninvasive methods for screening of liver dysfunction**
- ⊙ **Help in identifying general type of disorder**
- ⊙ **Assess severity and allow prediction of outcome**
- ⊙ **Disease and treatment follow up**

That means it is doesn't give us specific disease BUT explain the **dysfunction b/c of what !? ..**

Broadly classified as :



Classification of LFTs:

Group I: Markers of liver dysfunction	Group II: Markers of hepatocellular injury	Group III: Markers of cholestasis
<ul style="list-style-type: none"> • Serum bilirubin: total and conjugated • Urine: bile salts and urobilinogen • Total protein, serum albumin and albumin/globulin ratio • Prothrombin Time (time of clott formation) 	<ul style="list-style-type: none"> • Alanine aminotransferase (ALT) • Aspartate aminotransferase (AST) • (involve in the glycogenesis in the liver) • ALT to oxaloacetate + glutamate • AST to pyruvate + glutamate 	<ul style="list-style-type: none"> • Alkaline phosphatase (AKP) • γ-glutamyl transferase (GGT)

Limitations of LFT

- Normal LFT values **do not always** indicate **absence** of liver disease
 - Liver has very **large** reserve capacity
- **Asymptomatic people may have abnormal LFT results**
 - Diagnosis should be based on **clinical examination**

Liver has very **large** reserve capacity.. when part of it is affected the rest take it 's function ..

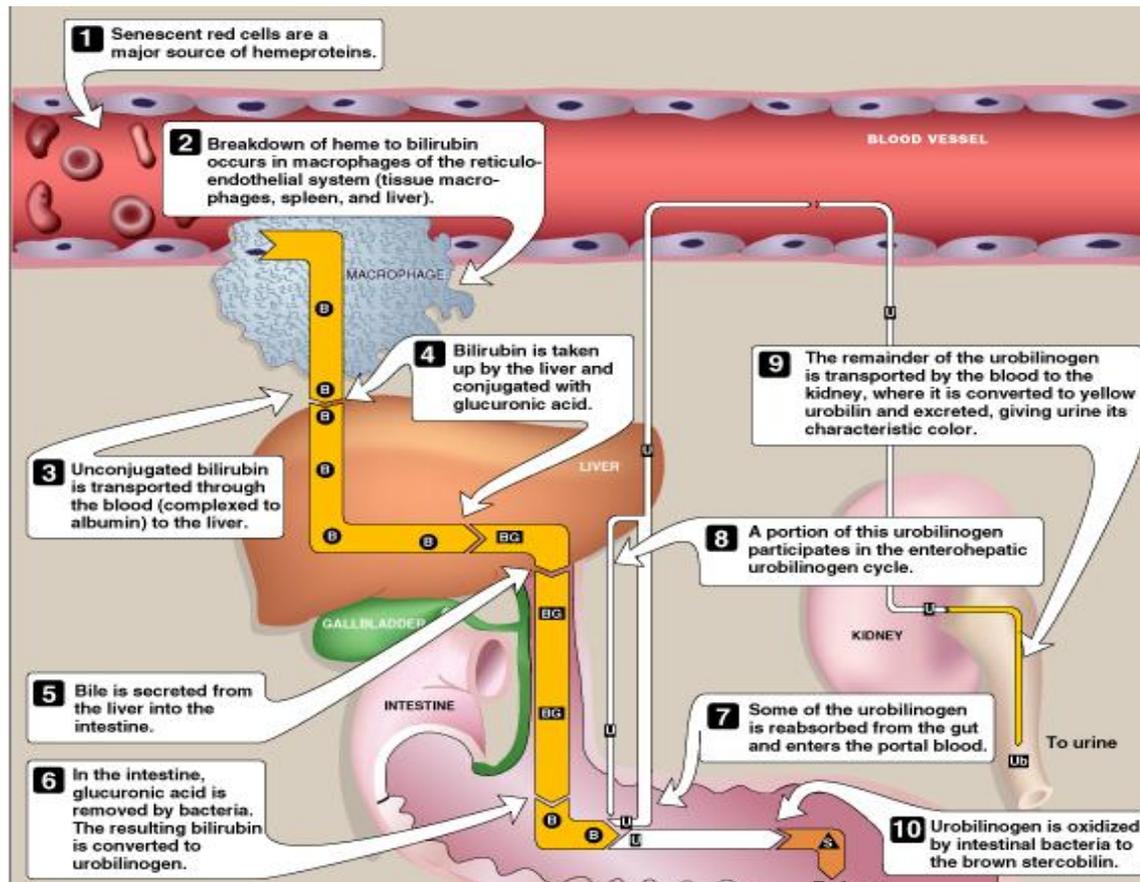
Common serum liver chemistry tests:

Liver chemistry test	Clinical implication of abnormality
Alanine aminotransferase	Hepatocellular damage
Aspartate aminotransferase	Hepatocellular damage
Bilirubin	Cholestasis, impaired conjugation, or biliary obstruction
Alkaline phosphatase	Cholestasis, infiltrative disease, or biliary obstruction
Prothrombin time	Synthetic function
Albumin	Synthetic function
γ -glutamyltransferase	Cholestasis or biliary obstruction
Bile acids	Cholestasis or biliary obstruction

Group I: Markers of liver dysfunction

Bilirubin:

- A byproduct of red blood cell breakdown
- It is the yellowish pigment observed in jaundice
- High bilirubin levels are observed in gallstones, acute and chronic hepatitis



Serum bilirubin levels

Normal	Unconjugated/free/indirect (bilirubin-albumin complex)	Conjugated/direct	Latent jaundice (without symptoms)	Jaundice
0.2 to 0.8 mg/dL	0.2 to 0.7 mg/dL	0.1 to 0.4 mg/dL	Above 1 mg/dL	Above 2 mg/dL

Bilirubin levels and jaundice:

Class of Jaundice	Type of Bilirubin raised	Causes
Pre-hepatic or hemolytic	Unconjugated	Abnormal red cells; antibodies; drugs and toxins; thalassemia Hemoglobinopathies (Gilbert's, Crigler-Naajjar syndrome)
Hepatic or Hepatocellular	Unconjugated and conjugated	Viral hepatitis, toxic hepatitis, intrahepatic cholestasis
Post-hepatic (out of the liver)	Conjugated	Extrahepatic cholestasis; gallstones; tumors of the bile duct, carcinoma of pancreas

Urinary urobilinogen(UBG) and urine bile salts:

bile salts from cholesterol

- ❖ Most UBG is metabolized in the large intestine, a fraction is excreted in urine (less than 4 mg/day)
- ❖ Normally bile salts are NOT present in urine
- ❖ Obstruction in the biliary passages causes leakage of bile salts into circulation leading to its excretion in urine

Albumin IS not specific to liver b/c when pt. have malnutrition

↓ Albumin !

It doesn't give you any information in acute condition b/c when cells damage Albumin still there (20) days !

- The most abundant protein synthesized by the liver
- Normal serum levels: 3.5 to 5g/dL
- Its synthesis depends on the extent of functioning liver cell mass
- Longer half-life of 20 days
- Its levels decrease in all chronic liver diseases

Serum Albumin:

- Normal serum levels: 2.5 to 3.5g/dL
- a and b-globulins mainly synthesized by the liver
- They constitute immunoglobulins (antibodies)
- High serum g-globulins are observed in chronic hepatitis and cirrhosis:
 - IgG in autoimmune hepatitis
 - IgA in alcoholic liver disease

Serum Globulin:

- Normal A/G ratio: 1.2/1 – 1.5/1
- Globulin levels increase in hypoalbuminemia as a compensation

• when **Albumin** ↓ **Globulin** ↑

Albumin to globulin (A/G) ratio:

Prothrombin Time (PT):

- ❖ Prothrombin: synthesized by the liver, a marker of liver function
- ❖ Its half-life is 6 hrs. (indicates the present function of the liver)
- ❖ PT is prolonged only when liver loses more than 80% of its reserve capacity
- ❖ Vitamin K deficiency also causes prolonged PT
- ❖ Dosage of vitamin K does not affect PT in liver disease

To be sure that the cause IS \uparrow PT b/c of liver not vit K \rightarrow give the pt. vit K

Group II: Markers of hepatocellular injury**Aspartate aminotransferase (AST):**

- Normal range: 8 – 20 U/L
- A marker of hepatocellular damage - not specific to liver found in cardiac ms ..etc
- High serum levels are observed in chronic hepatitis, cirrhosis and liver cancer

Alanine aminotransferase (ALT):

- More liver-specific than AST
- Normal range (U/L):
 - Male: 13-35
 - Female: 10-30
- High serum levels are observed in acute hepatitis (300-1000U/L)
- Moderate elevation is observed in alcoholic hepatitis (100-300U/L)
- Minor elevation is observed in cirrhosis, hepatitis C and non-alcoholic steatohepatitis (NASH) (50-100U/L)
- Appears in plasma many days before clinical signs appear
- A normal value does not always indicate absence of liver damage
- Obese but otherwise normal individuals may have elevated ALT levels

Group III: Markers of cholestasis

Alkaline phosphatase (ALP)

- A non-specific marker of liver disease
- Produced by bone osteoblasts (for bone calcification)
- Normal range: 40 – 125 U/L - normal ↑ in children
- Moderate elevation observed in:
 - Infective hepatitis, alcoholic hepatitis and hepatocellular carcinoma
- High levels are observed in:
 - Extrahepatic obstruction (obstructive jaundice) and intrahepatic cholestasis
- Very high levels are observed in:
 - Bone diseases

γ-glutamyltransferase (GGT)

- Used for glutathione synthesis
- Normal range: 10 – 30U/L
- Moderate elevation observed in:
 - Infective hepatitis and prostate cancers
- GGT is increased in alcoholics despite normal liver function tests
 - **Highly sensitive in detecting alcohol abuse**