Liver Function Tests

Dr. Abdulhussien Aljebory
Babylon university
College of Pharmacy
FUNCTIONS OF LIVER

Metabolic function

Excretory function

Synthetic function

Detoxification function

Storage function
CLASSIFICATION OF LIVER FUNCTION TESTS
Classification of LFT

- According to function of liver
  - Tests based on excretory function
  - Tests based on detoxification function
  - Tests based on synthetic function
  - Tests based on metabolic function
  - Determination of serum enzymes
I. Tests based on excretory function

1. Serum bilirubin
2. Urine bilirubin
3. Urine and faecal urobilinogen
4. Urine bile salts
5. Dye excretion tests
II. Tests b/o detoxification function

Hippuric acid test

Determination of blood ammonia
III. Tests b/o synthetic function

Plasma proteins

Prothrombin time
IV. Tests b/o metabolic function

- Tests related to CARBOHYDRATE metabolism
  - Galactose tolerance test
- Tests related to LIPID metabolism
  - Serum cholesterol
- Tests related to PROTEIN metabolism
  - Serum proteins
  - Aminoaciduria
V. Enzymes in diagnosis of liver disease

Serum transaminases
ALT
AST

Serum alkaline phosphatase
ALP
1. Serum bilirubin
2. Urine bilirubin
3. Urine and faecal urobinogen
4. Urine bile salts
5. Dye excretion tests
I. Tests based on excretory function

- Serum-Bilirubin
  - Total, conjugated and unconjugated

- urine
  - Bile pigments, bile salts and urobilinogen
1. Serum bilirubin

- Conjugated: 0.0 – 0.4 mg/dl
- unconjugated: 0.2 – 0.8 mg/dl
- Total: 0.2 – 1 mg/dl
Determination of Serum Bilirubin

• Serum bilirubin estimation is based on van den Berg’s diazo reaction.
• Diazo reagent consists of diazotized sulfanlic acid

Principle

• When a bilirubin in serum is allowed to react with a freshly prepared solution of VD Bergh’s diazo reagent, there will be formation of purple compound “azo-bilirubin
In all cases of jaundice, urine should be examined for the presence of bile pigments (bilirubin), bile salts and urobilinogen.

Fouchet’s test
1. Tests based on excretory function

URINE UROBILINOGEN

- Urobilinogen absent in obstruction to bile flow
- Ehrlich’s test
I. Tests based on excretory function

URINE BILE SALTS

- Obstruction in the biliary passages
- Hay’s test
Laboratory results

<table>
<thead>
<tr>
<th></th>
<th>S Bilirubin</th>
<th>U Urobilinogen</th>
<th>U Bilirubin</th>
<th>F Urobilinogen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conjugated</td>
<td>Unconjugated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>0.1-0.4mg/dl</td>
<td>0.2-0.7mg/dl</td>
<td>0.4mg/day</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40-280mg/day</td>
</tr>
<tr>
<td>Prehepatic</td>
<td>Normal</td>
<td>Increased</td>
<td>Increased</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Increased</td>
</tr>
<tr>
<td>Hepatic</td>
<td>Increased</td>
<td>Increased</td>
<td>N/Decreased</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Decreased</td>
</tr>
<tr>
<td>Posthepatic</td>
<td>Increased</td>
<td>Normal</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Trace to absent</td>
</tr>
</tbody>
</table>
### I. Tests based on excretory function

<table>
<thead>
<tr>
<th>Dye excretion test</th>
<th>Bromosulphthalein [BSP] test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nontoxic, almost exclusively excreted by the liver</td>
</tr>
<tr>
<td></td>
<td>5mg/kg body weight I.V</td>
</tr>
<tr>
<td></td>
<td>Serum level at 45min and 2hours</td>
</tr>
<tr>
<td></td>
<td>Less than 5% dye retained at the end of 45min</td>
</tr>
</tbody>
</table>
Tests b/o detoxification function

Hippuric acid test
- 6gm of sodium benzoate dissolved in 250ml water
- Collect urine for next 4 hour

Determination of blood ammonia
- Liver detoxicates ammonia to form urea
- Normal 40-70µg/100ml
Tests b/o synthetic function

- Liver is the main source of plasma proteins.
- Plasma proteins:
  - Albumin
  - Globulin (except γ)
- Blood clotting factors:
  - Prothrombin and factors V, VII and X.
Determination of serum albumin and globulin

Total serum protein = 6-8gm/dl

Serum albumin = 3.5-5.5gm/dl

Serum globulin = 2-3.5gm/dl

Albumin/globulin ratio = 1.2:1 to 2.5:1
Prothrombin time depends upon the presence of prothrombin and factors V, VII and X.

Deficiency causes prolonged time.
Tests b/o metabolic function

- Tests related to CARBOHYDRATE metabolism
  - Galactose tolerance test

- Tests related to LIPID metabolism
  - Serum cholesterol

- Tests related to PROTEIN metabolism
  - Serum proteins
  - Aminoaciduria
Enzymes in diagnosis of liver disease

• In liver cell injury, damage to the membrane of cells and organelles allows intracellular enzymes to leak into the blood.

• Where their elevated concentrations can be measured

**Serum transaminases**

**Serum alkaline phosphatase**
Enzymes in liver disease

Serum transaminases
AST or SGOT = <35U/L
ALT or SGPT = <40U/L

S. alkaline phosphatase
ALP = 3-13KA units/dl
ALP is normally excreted through bile
↑↑↑ In obstructive jaundice
Enzyme assays in differential diagnosis of Jaundice

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Prehepatic Jaundice</th>
<th>Hepatic Jaundice</th>
<th>Obstructive Jaundice</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT or AST</td>
<td>Usually normal</td>
<td>Marked increase 500-1500IU/L</td>
<td>Increased 100-300IU/L</td>
</tr>
<tr>
<td>ALP</td>
<td>Normal</td>
<td>Increased slightly &lt; 30KA/dl</td>
<td>Marked increase &gt;30KA/dl</td>
</tr>
</tbody>
</table>
Other enzymes

Serum γ-Glutamyl Transferase
- Normal range: 10-47IU/L

Serum 5’-Nucleotidase
- Normal range: 2-17IU/L

Serum Lactate Dehydrogenase
- Normal range: 70-240IU/L
اللهم أرحمي بعد التعب وأسعدني بعد الحزن وكافئني بعد الصبر