LIVER FUNCTION TESTS

CHAPTER-X

K. ANITA PRIYADHARSHINI
LECTURER
DEPT. OF PHARMACEUTICAL CHEMISTRY
SRM COLLEGE OF PHARMACY
Tests based on detoxification & excretory functions

- Serum bilirubin
- Urine bilirubin
- Blood ammonia
- Serum enzymes: AST, ALT, GGT, 5’Nucleotidase, ALP
Tests that measure Biosynthetic function of liver

- Serum Albumin
- Serum Globulins
- PT, INR
Serum Bilirubin

- Normal total serum bilirubin: 0.3 – 1.3 mg/dl
- Direct/conjugated bilirubin: 0.1 – 0.4 mg/dl
- Indirect/unconjugated bilirubin: 0.2 – 0.9 mg/dl

- Measured by Van Den Bergh method
- Bilirubin reacts with diazo reagent to produce coloured azo pigment. At pH 5 – pigment purple.
Serum Bilirubin

- Plasma bilirubin exceeds 1mg/dl – hyperbilirubinemia
- B/w 1-2 mg/dl – latent jaundice
- >2 mg/dl – yellowish discolouration of sclera, conjunctiva, skin, mucous mem resulting in jaundice.
<table>
<thead>
<tr>
<th></th>
<th>Unconj</th>
<th>Conj</th>
</tr>
</thead>
<tbody>
<tr>
<td>In water</td>
<td>insoluble</td>
<td>soluble</td>
</tr>
<tr>
<td>In alcohol</td>
<td>soluble</td>
<td>soluble</td>
</tr>
<tr>
<td>normal</td>
<td>0.2-0.9mg/dl</td>
<td>0.1-0.4mg/dl</td>
</tr>
<tr>
<td>In bile</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>In urine</td>
<td>Always absent</td>
<td>Normally absent</td>
</tr>
<tr>
<td>Absorption gut</td>
<td>Absorbed</td>
<td>Not absorbed</td>
</tr>
<tr>
<td>Diffusion into tissues</td>
<td>Diffuses – yellow colour</td>
<td>Doesn’t diffuse</td>
</tr>
<tr>
<td>Van den bergh</td>
<td>Indirect +</td>
<td>Direct +</td>
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</table>
Serum Bilirubin

- Elevation of unconjugated bilirubin – rarely d/t liver ds.
- Isolated rise of unconj.bilirubin (raised bilirubin but < 15% direct) – hemolytic disorders, genetic cond like criggler-najjar & gilbert’s syndrome.
- Conjugated hyperbilirubinemia – liver/biliary tract ds.
- Both elevated in most of liver ds.
Urine Bilirubin

- Unconjugated bilirubin – binds to albumin in serum & not filtered by kidneys
- Any bilirubin in urine is conjugated bilirubin, the presence of bilirubinuria – liver disease.
- In acute viral hepatitis – bilirubin appears in urine before urobilinogen/jaundice.
- Undiagnosed febrile illness, bilirubinuria – hepatitis
Blood Ammonia

- Produced – norm.protein met, by intestinal bact in colon
- Liver – detoxification – converting into urea which is excreted by kidneys.
- Pts with adv.liver.ds- significant muscle wasting contributes to hyperammononemia
- Used for detecting hepatic encephalopathy or hepatic synthetic fn.
Serum Enzymes – reflect damage to hepatocytes

- Aminotransferases (AST, ALT) – sensitive indicators of liver cell injury
- Helpful in recognizing hepatocellular ds such as hepatitis.
Aspartate Aminotransferase (SGOT)

Normal – 12 – 38U/L
2 Iso enzymes- cytoplasmic, mitochondrial
• Mild degree of tissue injury – cytoplasmic form in serum
• Severe injury – mitochondrial type in serum
• Significant elevation – MI
• Mod. elevation – liver ds
• AST – liver, cardiac muscles, skeletal muscle, kidneys, brain, pancreas, lungs, leucocytes, RBC in decreasing order.


Alanine Aminotransferase (SGPT)

- **Normal**: 7 – 41 U/L
- **ALT** found primarily in liver.
- **Upto 300U/L** – nonspecific, any type of liver disorder (CLD...cirrhosis/malignancy)
- **>1000U/L** – extensive hepatocellular damage (viral hepatitis, ischemic liver injury, toxin/drug induced liver injury)
- **Acute hepatocellular ds** – ALT > AST
Serum Enzymes – that reflect cholestasis

- 3 enzymes
- Alkaline Phosphatase
- 5’Nucleotidase
- Gamma glutamyl transpeptidase
Alkaline Phosphatase

- Normal: 40 – 125 U/L
- Iso enzymes
- **Alpha-1 ALP** – epithelial cells of biliary canaliculi, increased in obs.jaundice.
- Alpha-2 heat labile ALP – hepatic cells, increased in hepatitis
- Alpha-2 heat stable ALP – placental origin, normal pregnancy
- Pre Beta ALP – bone origin, increased in bone ds
- Gamma ALP – Intestinal cells, increased in Ul.colitis
Alkaline Phosphatase

- Elevation of liver derived ALP – not totally specific for cholestasis.
- < 3 fold rise can be seen in many types of liver ds (infective, alcoholic hepatitis, HCC)
- >4 times – cholestatic liver ds, infiltrative liver ds, bone ds with rapid bone turnover.
- In absence of jaundice/elevated aminotransferases – elevated ALP of liver – often early cholestasis less often infiltrative hepatic ds.
5’Nucleotidase

- Normal: 2 – 10 U/L
- Moderate elevated – hepatitis
- Highly elevated – biliary obs
- Unlike ALP, the level is unrelated with osteoblastic activity i.e., Unaffected by bone ds.
Gamma glutamyl transpeptidase

- Used in body for syn of glutathione
- 11 iso enzymes
- Seen in liver, kidney, pancreas, intestinal cells, prostate
- Normal: 9 – 58 U/L
- Slightly high normally in males d/t prostate
- Microsomal enzyme
- To detect alcohol abuse
GGT

- Rised even when other LFT are normal in alcoholics.
- GGT falls rapidly within few days after abstinence.
- Mod rise – inf. hepatitis, prostate Ca
- High rise – alcoholism, obs. jaundice, neoplasms of liver
Prothrombin Time, INR

- Normal: 11.5 – 12.5 sec
- Prolongation of PT by 2 sec/more – Abn
- PT – factors II, V, VII, X
- Half life 6 hrs – fac VII, 5 days – fibrinogen
- Rapid turnover – best measure of hep.syn.fn & helpful for diagnosis of ac.parenchymal liver ds.

PT prolonged – hepatitis, cirrhosis, vit K def (obs.jaundice, fat malabs)
Thank you