Liver Function Tests and Peritonial fluid examination .

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Objective of the lecture:

- For students to learn the laboratory tests requested in assessing the functional status of liver and the examination of the peritoneal fluid.

Format of the lecture.

1. Liver Function Tests

- Functions of the Liver
- Bilirubin metabolism
- Interpretation of LFTs
- Specific laboratory tests

2. Peritoneal Fluid Examination

- Laboratory investigations

Liver Function Tests (LFTs).

Functions of the Liver*.

1. **Conjugation** of bilirubin and its excretion into the biliary tract (**60% of its mass**).
2. **Centre** of metabolic activity for **carbohydrate**, **protein**, and **lipids**.
3. **Detoxification** of many metabolic products and toxic substances prior to excretion in the urine.
4. **Excretion** of many natural and foreign substances.

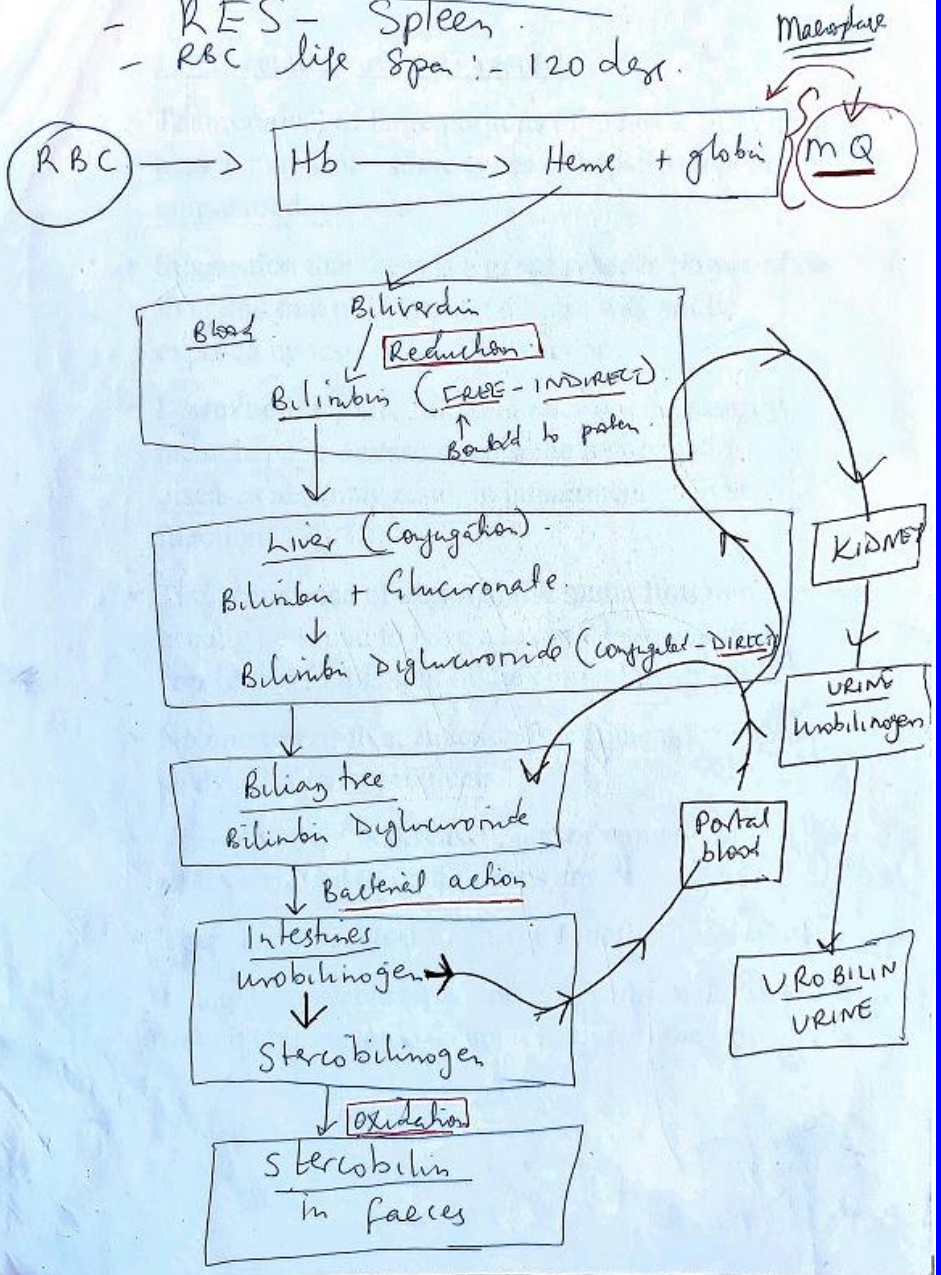
Bilirubin metabolism*.

- Essential for understanding of pathology in hepatic diseases.
- **Bilirubin** - breakdown product of Hemoglobin (Hb) in **Reticuloendothelial system (RES)** (Spleen).
- Is transported to liver (loosely) attached to **albumin.**
- In liver, is conjugated with **glucuronic acid** to form **bilirubin diglucuronide**, then excreted by liver into duodenum in **bile**.

Bilirubin metabolism pathway*.

Bilirubin Metabolism

- RES - Spleen
- RBC life span :- 120 days



Facts in interpretation of LFTs results*.

1. **Some** types of hepatic function remain **unimpaired** even when large portions of liver are removed.
   - Implying **Great reserve power** of the liver.
2. **Disturbed** hepatic function **not** necessarily hepatic disease.
3. **Rational basis** for **abnormal hepatic function** considered in the light of **clinical problem**.
4. **No single test of liver function** sufficient for clinical analysis of **most** diseases of the liver.

6. In liver disease **not** necessarily that **all** of liver functions impaired.
7. **No** test for "**liver function**" as a whole.
8. **Maybe** Possible to **extend** a conclusion drawn from a **single** test to appreciate liver function as a **whole** for particular diseases of liver.
9. **Selection** of tests(procedures) applicable to a **particular** clinical problem.

LFTs.

- Tests for:

i. Jaundice
ii. Bile pigment in urine
iii. Bile pigment in stool
iv. Carbohydrate metabolism
v. Protein metabolism

vi. Lipid metabolism

vii. Plasma proteins

viii. Clotting factors

ix. Plasma Enzymes

Jaundice*

- **Definition:**
- Detected clinically when plasma **Total bilirubin** is **> 2mg/100ml**.
- **Pathology**:
- **Causes:** (hemolysis, obstruction, damage to liver)

Tests:

1. Plasma **Total bilirubin** levels
2. Plasma **Conjugated bilirubin** levels

- Calculate **free bilirubin** levels

Bile pigments in urine*.

- Composition of bile pigment:

1. Bilirubin-free (**present/levels**)
2. Urobilinogen (**levels**)

Bile pigment in stool*.

1. **Bilirubin** levels (No free bilirubin in normal adults **but** in infants)
2. **Stercobilinogen** levels

Carbohydrate metabolism*.

- Determine **Plasma glucose** levels.
- Important changes **only** in **severe disease.**
- In **acute** necrosis of liver-**Hypoglycaemia**
- In **chronic** liver disease-**Hyperglycaemia**

Protein metabolism*.

- Significant changes **only** in **severe** liver disease.
- Test: **Plasma** and **urine amino acid** levels
- If **acute** and **massive** (acute hepatic necrosis):

➢ **Amino acids** levels in **Plasma** and **urine (Raised).**

Plasma proteins levels*.

Tests: **Plasma Total protein, albumin, and globulin levels**

In **chronic** and **severe** liver disease **impaired** albumin synthesis:

i. **Albumin levels (<3.0mg/dl)** indicate liver damage.

ii. **Decreased** levels of other proteins synthesised in Liver (**Total proteins**).

iii. **Increased plasma** Total **globulin** (**increased** in RES)

Clotting factors*

- **Decreased** Plasma levels in **extensive** parenchymal cell damage of:

i. **Fibrinogen**

ii. **Prothrombin .**

Plasma Enzymes*.

- **Enzyme** assays **(measurements)** in **plasma** used in three different ways for liver function:

i. **Enzymes synthesized in liver: Fall** in plasma activity when **hepatocellular damage**.

ii. **Enzymes synthesized in liver** but found in **bile**: **Rise** in plasma activity when there is **cholestasis**.

iii. **Cell active enzymes:** found in **high concentration in liver cells. Rise** or **fall** in plasma activity when **hepatocellular damage**.

Specific enzymes*.

i. **Cholinesterase.**

- Rarely used.

ii. **Serum Alkaline phosphatase**.

- **Rise** in activity by cholestasis.

iii. **Transaminases** (**aminotransferases**):

a) **Alanine transaminase (ALT),**

b) **Aspartate transaminase (AST).**

- **Raised levels** in acute hepatic Disease
- **Decreased levels** in chronic hepatic Disease

Lipid metabolism.

Tests:

- **Cholesterol test** (plasma **cholesterol** levels):

Decreased levels: **chronic** liver disease

Increased levels: **acute** liver disease

Choice of liver function tests (LFTs)*.

- **Single** LFT has **little** diagnostic value in isolation.
- Importance of **selection** of suitable tests.
- **Purpose** of the investigation determines choice of LFTs.

Frequent indications for LFTs:

i. Differential diagnosis of **jaundice**.

ii. Assessment of **residual function** in chronic liver disease (**monitoring**).

Tests for differential Diagnosis of jaundice*:

i. **Plasma tests:**

a) Total and conjugated bilirubin levels

b) Enzymes (Serum Alkaline phosphatase and Transaminases)

ii. **Urine tests**:

a) Bilirubin-free levels

b) Urobilinogen levels

For assessment of residual function in chronic liver disease:

Plasma tests:

i. Total bilirubin levels
ii. Total and differential plasma protein levels
iii. Enzymes (Transaminases, Serum Alkaline phosphatase).

Peritoneal fluid examination.*

- **Abdominal fluid**

- Normal volume: **< 100** ml of free fluid .
- Small **effusions** [abnormal fluid] (<500ml): difficult to detect.
- **Ascites:** Abnormal collection of fluid in peritoneal cavity.

- Peritoneal effusion classified as*:

i. **Exudate**.

ii. **Transudate**

Subclasses:

a) **Inflammatory transudate**

b) **Serous exudate**

Laboratory tests on peritoneal fluid

- Classes:

1. Macroscopic (Gross)
2. Microbiology/molecular
3. Chemical analysis
4. Hematology
5. Cytology

Fluid collction.

- By **paracentesis**.

Specific tests

i. **Colour**
ii. **Protein levels**
iii. **Glucose levels**
iv. **Specific gravity**
v. **Gram stain** and **culture**

vi. pH
vii. Peritoneal fluid amylase
viii. Peritoneal Lactate Dehydrogenase (LDH)
ix. Tuberculosis tests
x. Cytology
xi. Sterile Bile

Colour.

Normal: straw colored/clear.

Abnormal: cloudy, hemorrhagic, dark green

Protein levels:

>3g/dl or <3g/dl

Glucose levels:

(same as plasma or < 60mg/dl)

Specific gravity:

< 1.015 or > 1.015

Gram stain and culture*

- **If Peritonitis:**

1. Primary hematogenous peritonitis: **gram-positive** cocci,
2. Secondary peritonitis: **mixed flora** of **gram-negative** organisms.

- Gross appearance: **hemorrhagic or cloudy**
- Microscopic examination: **many leucocytes (**chiefly **neutrophils)**

pH :

- **Alkaline** for perforated peptic ulcers.

Peritoneal fluid amylase.

Raised levels **in:**

a) 90% pancreatitis.

b) Bowel necrosis

Tuberculosis tests*.

- **TB peritonitis** difficult to diagnose.
- **PF culture, ZN stain, fluorescent microscopy**: frequently **negative**
- **Open peritoneal biopsy :**

i. Culture of tissue for mTB

ii. Histo-pathology

iii. ZN staining-light microscopy

- **Molecular test (GeneXpert MTB/RIF (Ultra)- recommended.**

Peritonial fluid Lactate Dehydrogenase (LDH)

- **Raised** levels**:** in **Exudate**
- **Decreased** levels **:** in **Transudate**
- Disadvantage: **False positives**

Cytologic examination.

- PF smears and cell blocks.
- Investigating **malignancy** of peritoneum.

Sterile Bile

- **Dark green** viscid material
- High bilirubin concentration.
- If Present: rapidly **fatal.**

FIN