

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Biliary and intestinal secretions

Dr. ARWA RAWASHDEH

أبي بلكمبي
Bile Salt هو

سلالة 15
إخفاقة متي

توتيب شرح السلالات

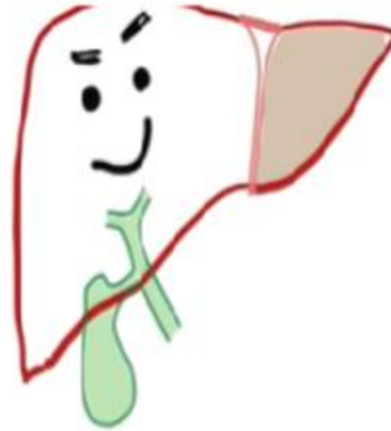
3, 4, 5, 6, 9, 8, 10, 7

بعدها طبيعي

11~17

Objectives

- Describe the components of bile and intestinal secretions
- Indicate the function of each component secreted in bile and intestinal juice in digestion
- Illustrate the regulation mechanisms involved in the secretion of bile and intestinal fluid



Good Stuff

(help absorb lipids)

Synthesized by: Hepatic Cells "Hepatocyte"

Stored in: Gall Bladder

Bile acids/salts

Bad Stuff

(Waste: dead RBCs)

Bilirubin

Composition of Bile

They are same in Component
but different in the concentration

مُحَلَّهُ زَادَ تَنَاسُخَ التَّرْسِيبِ
ما عدا ٢١ *

Water *

Bile salts

Bilirubin

Cholesterol

Fatty acids

Lecithin

Na⁺ *

K⁺

Ca⁺⁺

Cl⁻ *

HCO₃⁻ *

Liver Bile

97.5 g/dl

1.1 g/dl

0.04 g/dl

0.1 g/dl

0.12 g/dl

0.04 g/dl

145.04 mEq/L

5 mEq/L

5 mEq/L

100 mEq/L

28 mEq/L

Gallbladder Bile

92 g/dl

6 g/dl

0.3 g/dl

0.3 to 0.9 g/dl

0.3 to 1.2 g/dl

0.3 g/dl

130 mEq/L

12 mEq/L

23 mEq/L

25 mEq/L

10 mEq/L

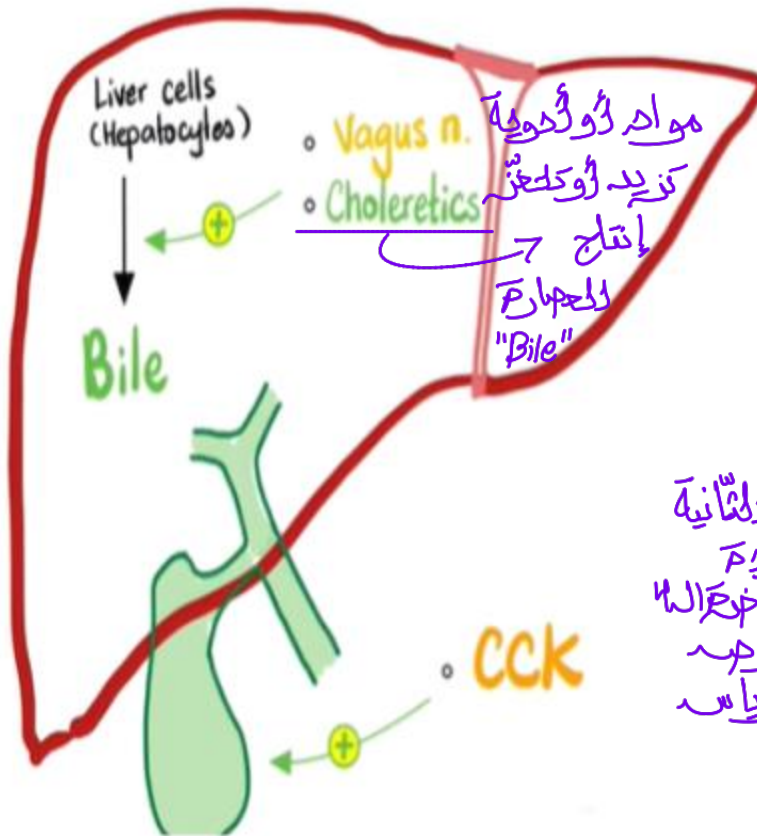
الماء أقله

الصوديوم أقله

الكالسيوم أقله

الكاربونات وأكسيد أقله

The liver & gall bladder



ما يدخل في bile

N.B.

Secretin



"خروج bile من G.B"

يخزن عن طريق وجود

ال fat في الأمعاء

المخيلة الثانية
موجود في المخاطية
بجوار
البنياس

- عن طريق ال Cholecystikin

- من خلال ال parasympathetic

عن طريق ال Vagus

زيادة ال Secretion

primary $\approx$ liver.

secondary $\Rightarrow$ Intestine.

Raw material: Cholesterol

- **1st Bile acids**: made (from cholesterol) in the liver: e.g. **cholic acid**, **chenodeoxycholic acid**.
- **2nd Bile acids**: made (from **1st Bile acids**) by **bacteria** in the **colon**: **deoxycholic acid**, **lithocholic acid**

- **Bile Salts**: **Conjugated 1st Bile acids** in the liver
-
- The diagram illustrates the conjugation of primary bile acids in the liver. On the left, **cholic acid** is shown with two arrows labeled 'Conjugated' pointing to **Glycine** and **Taurine**, which then lead to **Glycocholic acid** and **Taurocholic acid** respectively. On the right, **chenodeoxycholic acid** is shown with two arrows labeled 'Conjugated' pointing to **Glycine** and **Taurine**, which then lead to **Glycochenodeoxycholic acid** and **Taurochenodeoxycholic acid** respectively. A vertical label 'Conjugation' is placed between the two sets of reactions.

In order: **1st Bile acids** (in liver) $\xrightarrow[\text{Conjugation with Taurine, Glycine}]{\text{Conjugation}}$ **Bile Salts** (in liver) $\xrightarrow{\text{bacteria}}$ **2nd Bile acids** (in colon)

DIGESTION

- Simple Diffusion like **fructose**
- Facilitated Diffusion
- secondary Active Transport like **Glucose + Galactose**

Carbs

Salivary "Mouth"
Amylase

Pancreatic Amylase

Brush Border of Intestine

Intestinal
Maltase
Isomaltase
Lactase
Sucrase

Monosaccharides
Glucose
Galactose
Fructose
Primary 1st DSD بما يدعى
Na⁺/K⁺ pump = ٣:١

Proteins

Gastric Pepsin

The only Enzyme that act in low pH

Pancreatic
Trypsin
Chymotrypsin
Carboxypeptidase - COOH
Proteases

Activate Cascade

Intestinal
Aminopeptidase
Enteropeptidase
Dipeptidase

-NH₂ ٩.٩

Fat (TGLs)

Salivary "Mouth"
lipase

Pancreatic lipase
Colipase
Phospholipase
+ Bile Acids Micelles
esterase

"lipase + Bile"

Fatty Acids
2-Monoacylglycerols

Simple Chain of fatty Acid is absorbed by simple Diffusion "Doesn't need the above way"

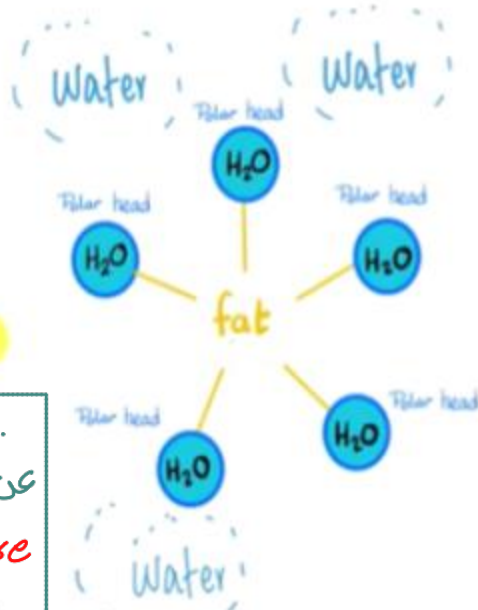
١) liver ٣) معالجة في B.G
٢) Pancreas ٤) Small intestine.
نتائج على امتصاص الـ Fat

لacteals من خلال الجدار الليغاري على وجه الخصوص يسمى lacteals في الـ Brush Border of S.I

Emulsification of fat

Bile Salts → ↓↓ Surface tension
 → Emulsify fat into small droplets.

Bile Salts function



Cholesterol ~ Bile A.
 عن طريقه

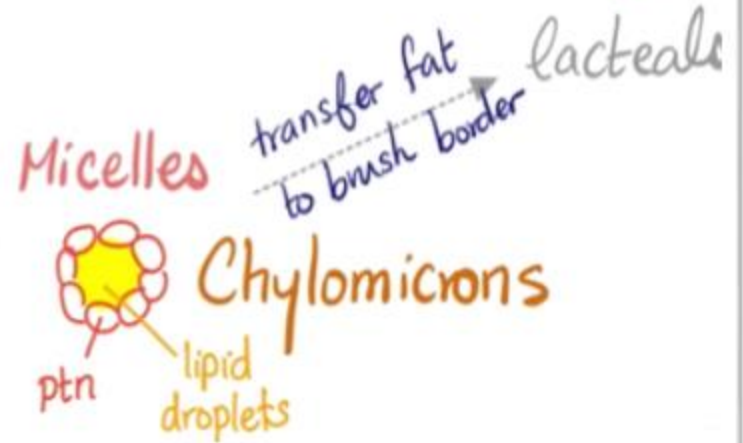
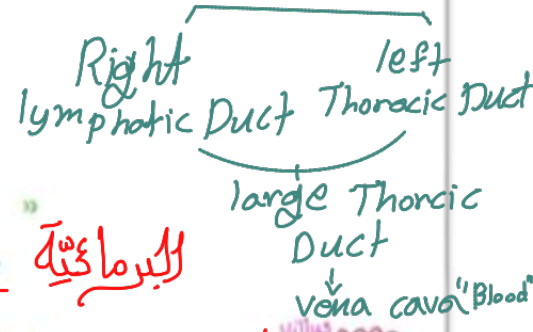
Cholesterol α -Hydroxylase
 ينشط في وجود تركيز عالي منه
 للـ Cholesterol، ويثبط وجود تركيز
 عالي منه للـ Bile Acid. يعني

Negative feedback
 الاسم الثاني للـ CYP7A1

Amphipathic البرمائية



Lacteals



Micelles ~ Chylomicrons
 في الـ Brush Border
 في الـ Lacteals

ليش بدنا Salt مش Acid, لأنه الـ Salt
 والمحتوى من الـ Acid, لذلك هي الأقوى في
 الارتباط مع الـ fat

Bile Acids

pKa = 6
 your pH = 7.4

Adding Glycine (or) Taurine $\rightarrow$ $\downarrow$ pKa
 exist predominantly in the
 fully ionized form
 better able to dissolve @ aqueous
 solution @ gut.

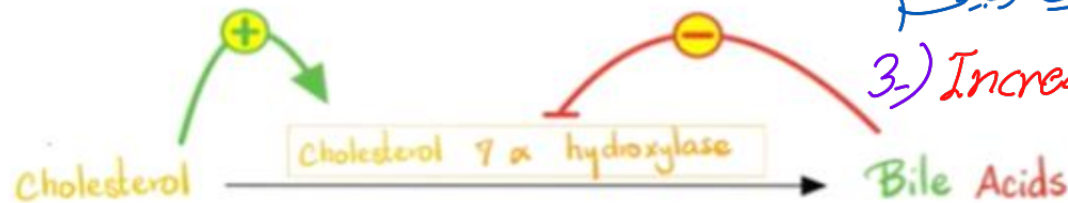
$\therefore$ Bile salts are better @ emulsifying fat than Bile Acids

Bile salts > Bile Acids

1) Breacking Down
 into small Droplet
 large Triglyceride into small fatty
 Droplet

2) Decreases Surface Tension
 "علفان الشحنة" في الـ ليبيد

3) Increased Surface
 Area



Your gut lumen is full of water, yet lipids are hydrophobic

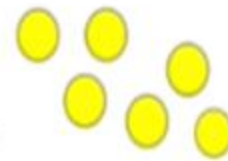
Get lumped together



difficult for lipase to access them

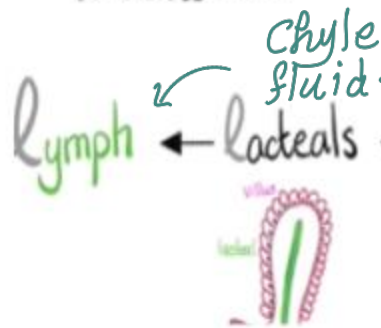
Emulsification

Via Bile salts



Emulsion Droplets
(↑ surface area)

Easily accessed by lipase



Chylomicrons



Micelle



FFAs

Bile Salts

breakdown

TGLs

with the help of Co-lipase

IRON YOUR CLOTHES

Then Fold them

Then Put them in the Closet



Duodenum

Jejunum

Terminal ileum

HCl

IRON , Ca^{++}

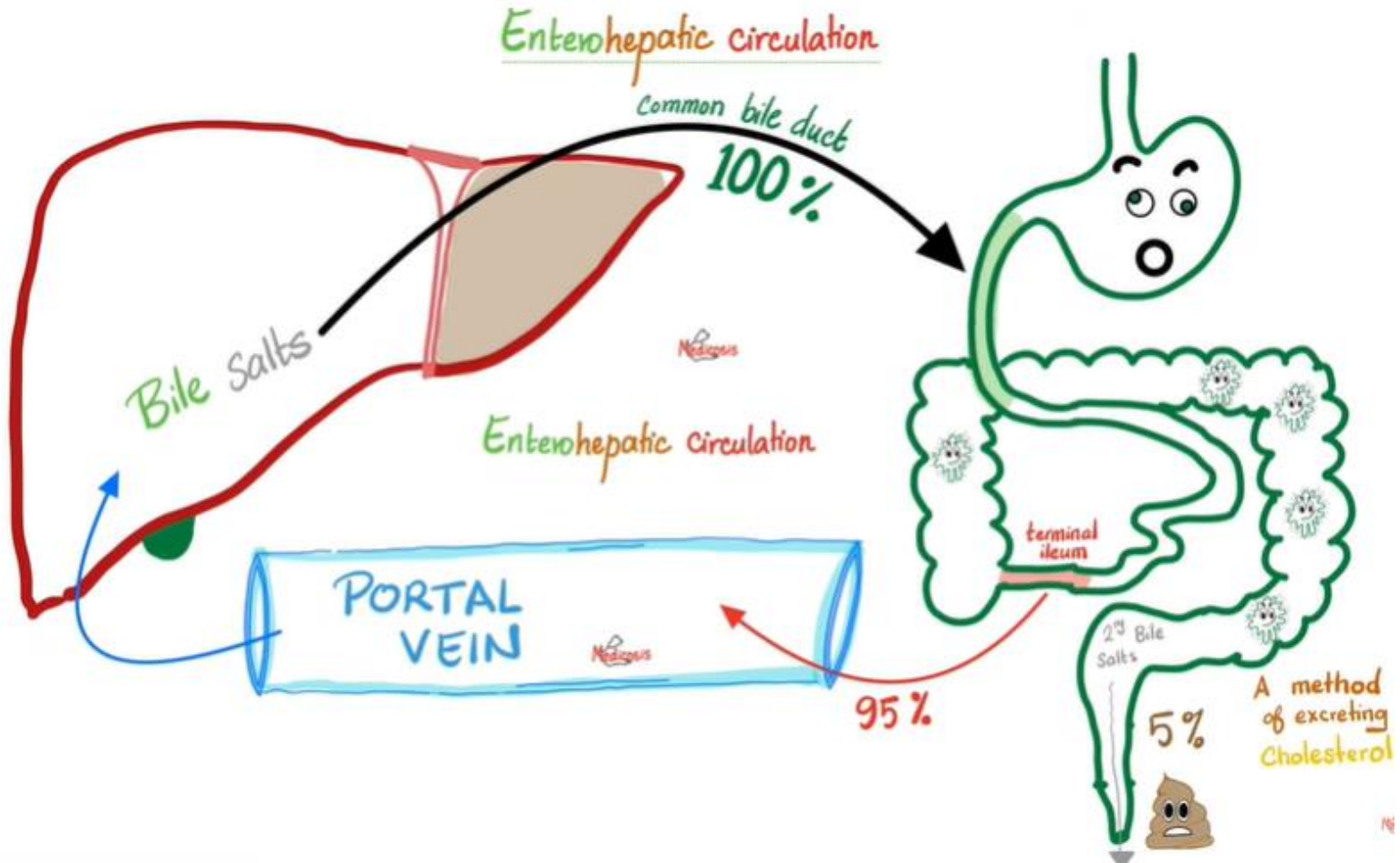
Folate (B_9)

Cobalamin (B_{12})

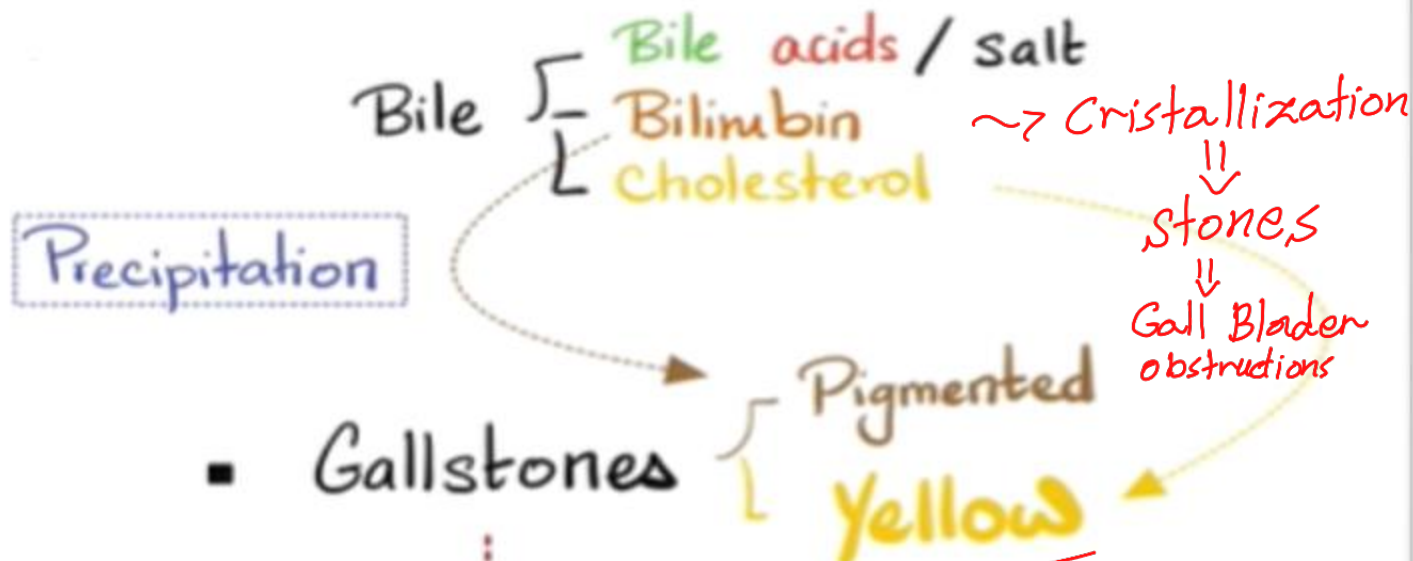
Bile Salts

الأمعاء

17-15 مره
يتمه



الطريقة الوحيدة
للتخلص
منه Cholesterol



Stuck @
cystic duct

Cholecystitis

Biliary
System

Bladder Inf.

التهاب

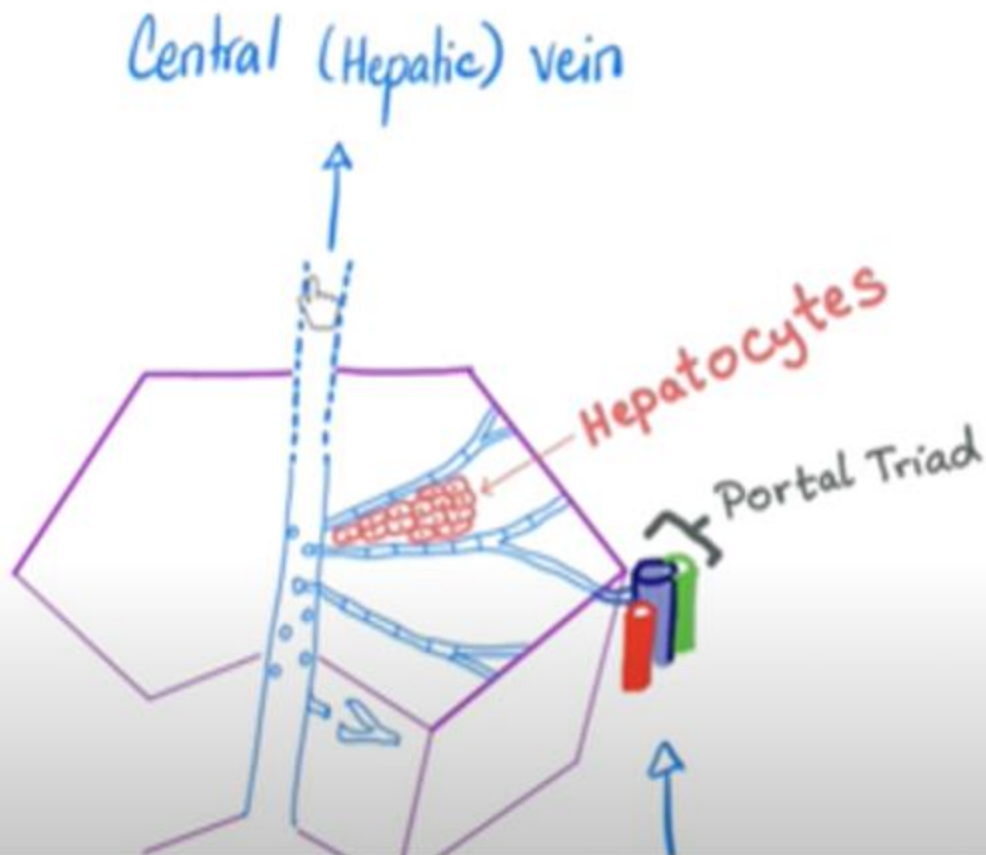
Cholesterol
in feces

تركيبة الدكتورة

هو موجود في الـ CBD
وليس في الـ GB

التهاب الـ CBD : Cholangitis
التهاب الـ GB : Cholecystitis

The Structure of the hepatic lobule



مکرت
Every Nodule
Appears as
Hexagon, At the
Edge we have
The portal
Triad...

LIVER FUNCTION TESTS

AST

Aspartate
aminotransferase

- Liver, heart, muscle

↑ in hepatitis, more specific etc.

ALT

Alanine
aminotransferase

- Liver

↑ in hepatitis, more specific for liver

ALP

Alkaline
phosphatase

- Liver (bile ducts), bone

↑ in cholestasis, bone disease, etc

GGT

Gamma-glutamyl
transferase

- Liver (bile ducts)

↑ in cholestasis, alcohol use, etc

الوجه الغالب $ALT > AST$
Except

* ALT is more specific for liver disease than AST

- If AST is high, while ALT is normal $\Rightarrow$ Think extrahepatic
"muscle"

في غارقة

عاليه

لكنه أقل

من ALT

Measure CPK

* In liver disease: $ALT > AST$

Alcohol Abuse except in alcoholic liver disease " $AST > ALT$ "

* High ALP & Normal GGT: extrahepatic e.g. bone " $\uparrow$ osteoblastic activity"

* Sudden $\uparrow$ in ALP & GGT $\Rightarrow$ Hepatocellular Carcinoma

Alcohol $\Rightarrow \uparrow \uparrow$ GGT $\leadsto$ Bile Duct

هو القاحل
فمن لا سوف *
GGT is significant to liver problems

" ما بلفي " " المرحه "

Clinical tie

Hemolysis
Increase turnover
"Break down RBCs"

1

Taundice, $\uparrow$ UCB & CB, $\uparrow\uparrow\uparrow$ AST & $\uparrow\uparrow\uparrow$ ALT

Unconjugated Conjugated

ALP: $\uparrow$ / N

liver حبراً
ارتخاؤه في الـ

ارتخاؤه
الـ ALT
المشكلة
في
liver
حبراً

Dx:- Hepatocellular Jaundice

2

Taundice, $\uparrow$ UCB & CB, $\uparrow\uparrow\uparrow$ AST & $\uparrow$ ALT

نفس النسبة

ALP: $\uparrow\uparrow\uparrow$, GGT $\uparrow\uparrow\uparrow$

المشكلة في Bile Duct

Dx:- Obstructive jaundice

3

مشكلة هضم كثير

epigastric pain radiating to the back, fever, $\uparrow\uparrow$ amylase, $\uparrow\uparrow$ lipase

Dx pancreatitis

ارتفاع الـ lipase
هو الجهد مشكلة
في البنكرياس

4

نفسه الاشياء = 2+4
بس الفرق
قيمة للزيادة

Virus

400 - 4,000 IU

Fever, RUQ pain, Jaundice, dark urine, $\uparrow\uparrow\uparrow$ ALT & $\uparrow\uparrow$ AST

ALP $\uparrow$,

" ALT > AST "

Virus

Dx: Hepatitis,