



GI

Pathology

LEC no.1



Writer: بشار جادالله ، أحمد رشيد

Corrector: حمزة العبادي

Doctor: مها شوماف

Liver is a gland with specific functions .

Any malfunction in the liver will present with clinical symptoms, and these symptoms may can be specific for the liver disease or they can be common with other diseases ; and with experience you will be able to tell from these symptoms what the problems are. But for now, we need to know about the normal structure and functions of the liver

Liver

- **Function:**

1. **Metabolic: Glucose metabolism .**
2. **Synthetic: Albumin, clotting factors, enzymes and other substances.**
3. **Detoxification:(clearing of toxic materials): Drugs, hormones , NH₃.**
4. **Storage: Glycogen, Triglyceride , Fe, Cu, vitamins ..**
5. **Excretory: Bile which is synthesized in the liver**

So, any disease in the liver will affect one or more of these functions

- Net wt.: 1400 – 1600gm (2.5% of body wt)
- Blood supply:
Portal vein: 60 – 70%
Hepatic artery: 30 – 40%

Some diseases affect vasculature.

➤ **Microstructure**

➤ **Hexagonal lobules → 6 acini**

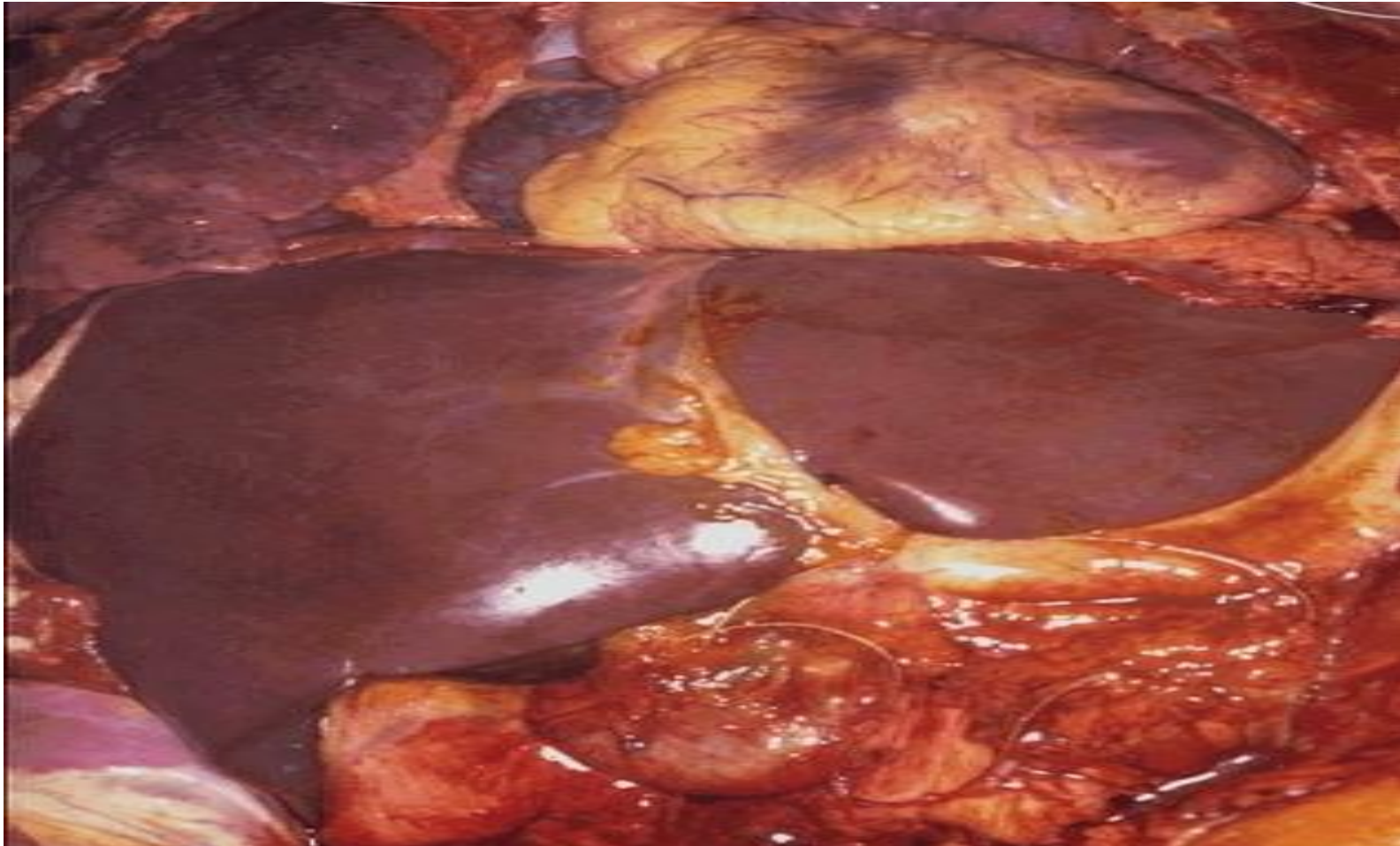
➤ **Acinus is divided into 3 zones:**

- **Zone 1: Periportal areas – closest to the vascular supply**
- **Zone 3: Pericentral area**
- **Zone 2: Intermediate bet. Zone 1&3**

Note: there is a pic at (slide 8) explains this zones.

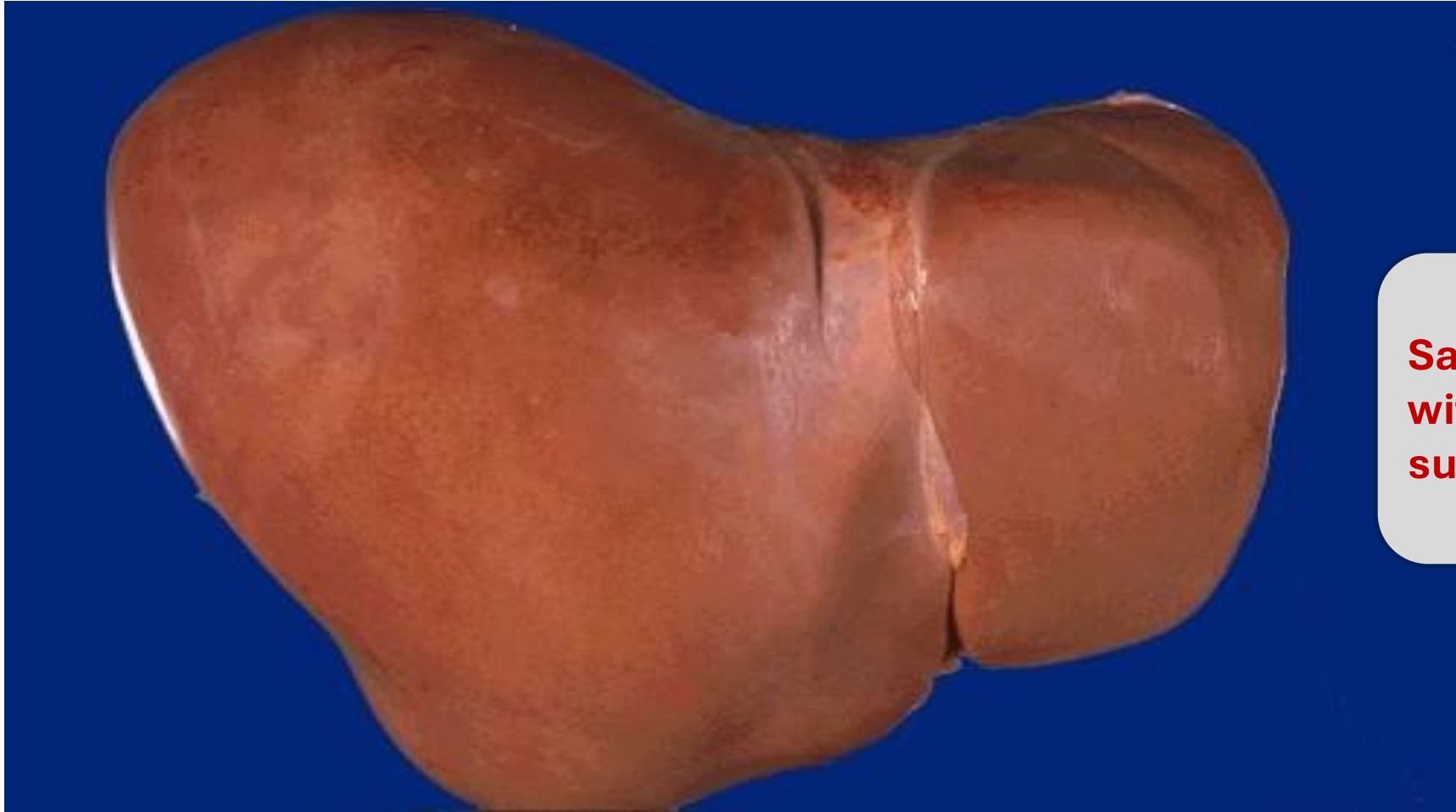
The structure of the liver is very important and unique. It is designed to carry out all the functions mentioned above. The functional unit of the liver is a hexagon. The localization of hepatocytes in the liver is important.

Normal liver



The normal liver has a smooth shiny surface and structures are well preserved. And it's brownish in color.

Normal liver

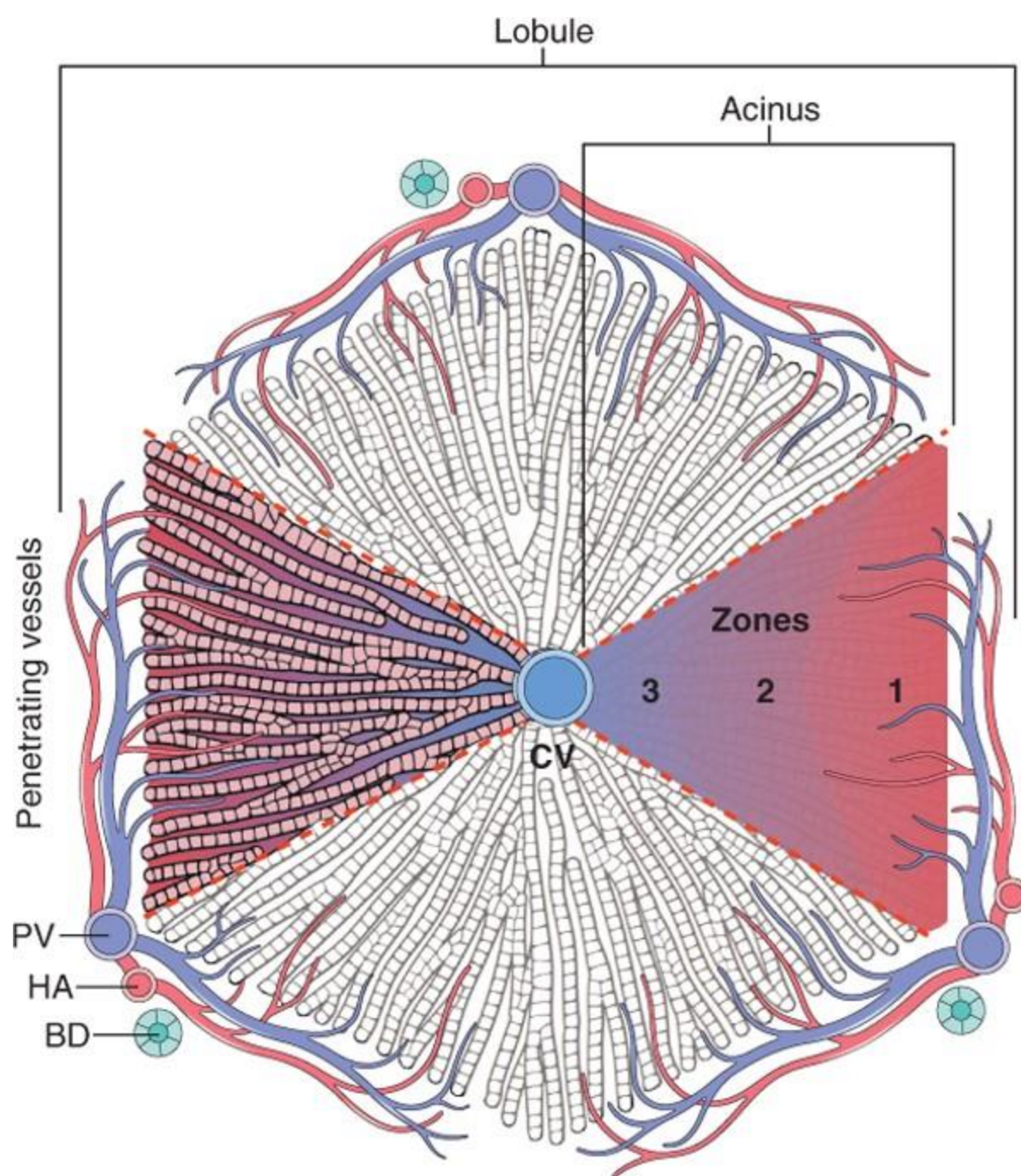


**Same thing here but
without the fat or
surrounding structures.**

Cross section of normal liver

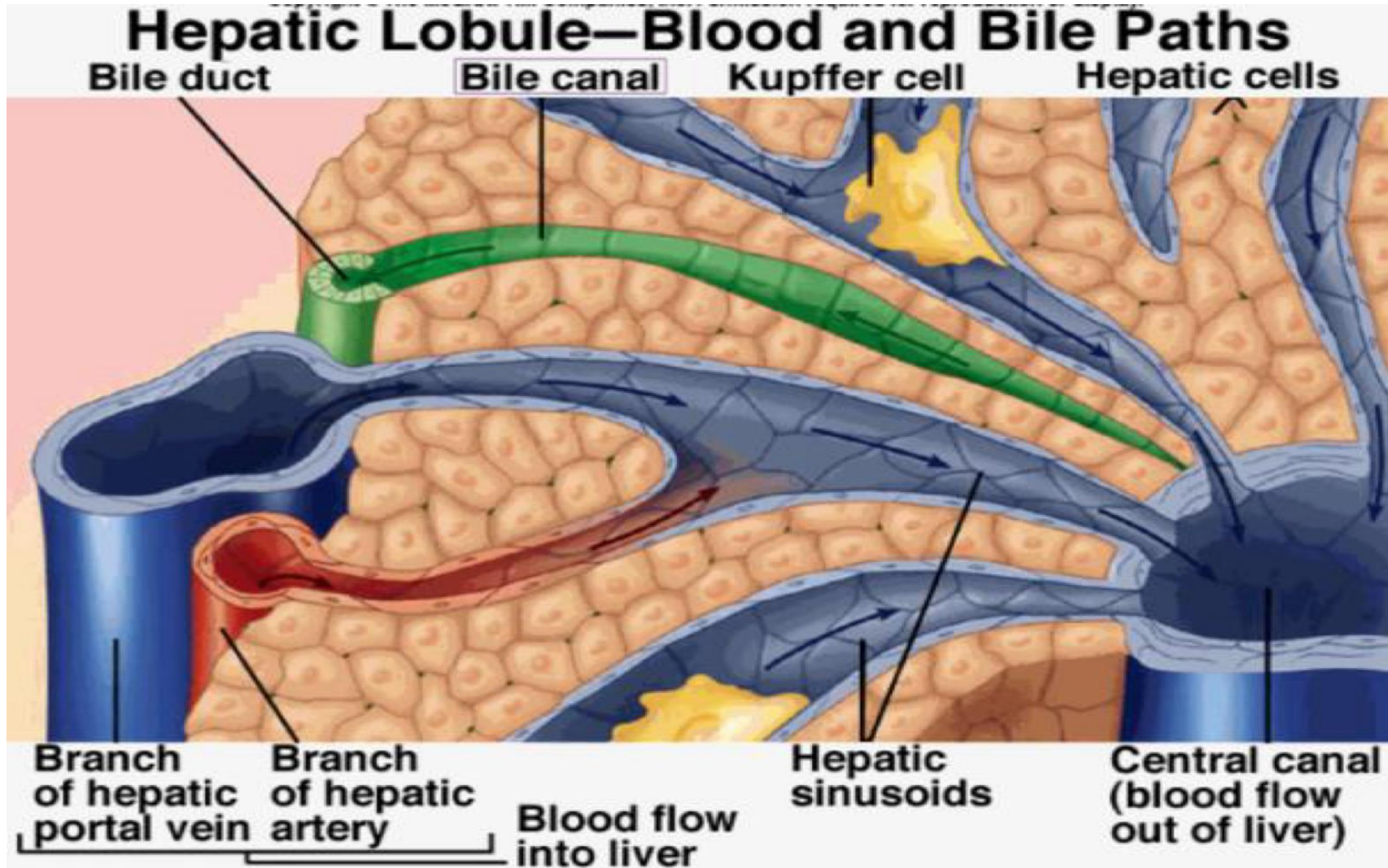


**Normal liver
parenchyma
and vessels**



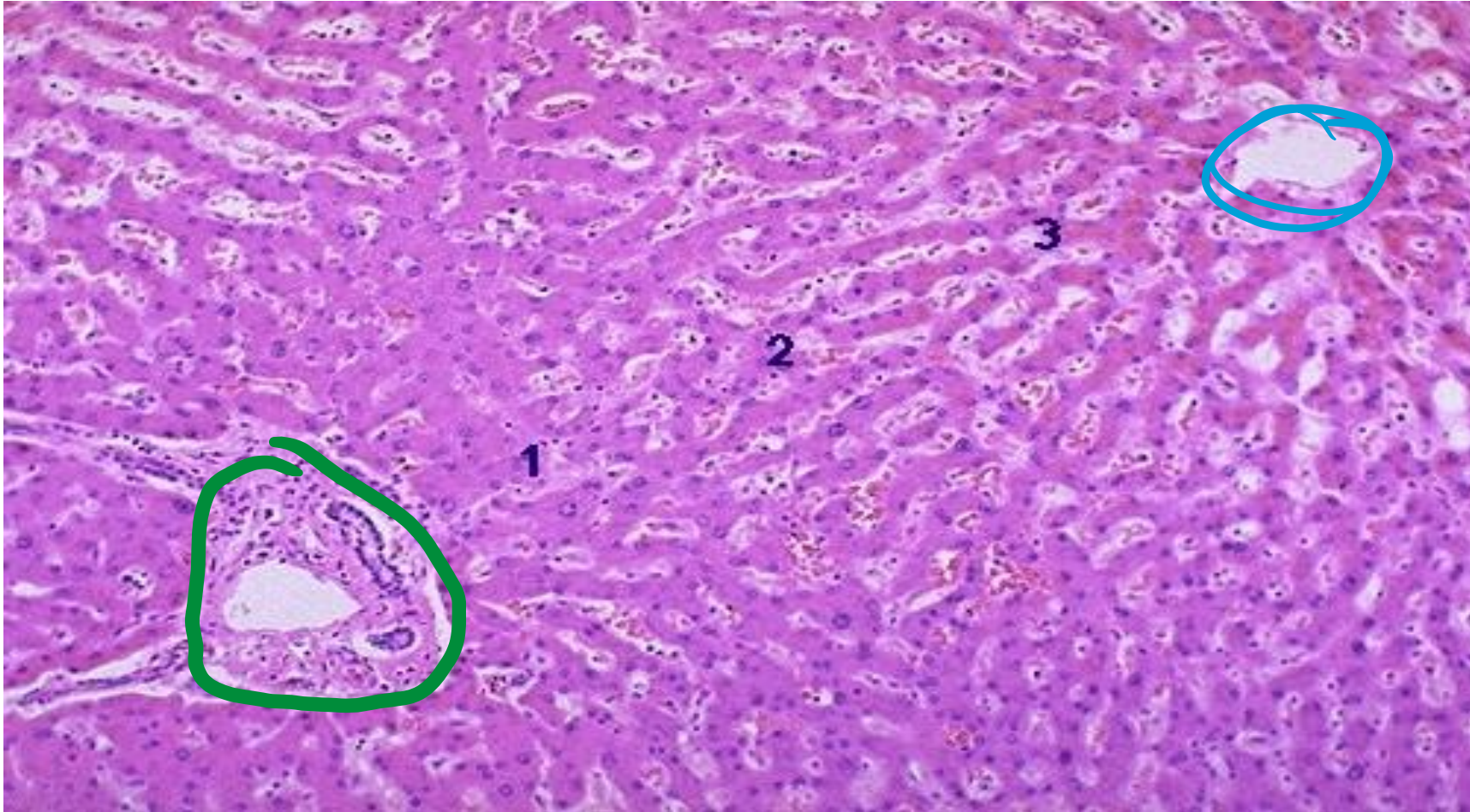
This is the hexagonal functional unit of the liver. It is composed of six triangles, each is called an acinus. There is a central vein in the middle of the hexagon. In each angle of the hexagon there is a portal vein, hepatic artery, and bile duct, and in between there is the hepatic parenchyma which is mainly composed of hepatocytes that are separated by sinusoids (vascular spaces lined by epithelial cells and contain Kupffer cells).

Additional picture:



Liver zones

Microscopic appearance of normal liver



Hepatocytes are arranged in lines that are one cell thick or sometimes two cell thick. More than that should be considered abnormal. You can see the central vein (in blue), and the portal (triad) area; containing the portal v, hepatic a, and bile duct (in green). The three zones are not separated by clear lines.

- **The parenchyma is organized into plates of hepatocytes.**
- **Hepatocytes are radially oriented around terminal hepatic vein (central v.)**
- **Hepatocytes show only minimal variation in the overall size, but nuclei may vary in size, number & ploidy esp. with advancing age**
- **Vascular sinusoids present bet. cords of hepatocytes**

In most liver diseases we need a biopsy to recognize the exact disease. Many diseases can share similar characteristics. Liver biopsies help in shortening our differential diagnoses. The patient also needs to be followed up to evaluate if the patient is responding to treatment, or if the disease is transforming to a chronic state. The biopsy could be a needle biopsy or wedge biopsy. The routine stain is H&E, but we can use other specialized stains if needed. Lab tests are also helpful in reaching diagnosis.

Hepatic injury

Manifestations of Hepatic injury

1. Inflammation (Hepatitis)

2. Ballooning degeneration:

-irregularly clumped cytoplasm showing large, clear spaces.

-Substances may accumulate in viable hepatocytes, including fat, iron, copper, and retained biliary material.

ballooning degeneration: swelling due to water entering the liver which is caused by hypoxia<<<<loss of oxygen<<<<reduced ATP production. Swelling can also be due to deposition of substances (fat, iron, copper, biliary material).

Inflammation is evident by seeing inflammatory infiltrate including acute (neutrophils) and chronic (lymphocytes). They indicate whether the injury is acute or chronic. So, the first indicator of injury is inflammation. It starts primarily within the portal areas, and depending on the severity, it can extend into the parenchyma. Spread of inflammation to parenchyma increases risk of the condition becoming chronic.

3-Steatosis (fatty change)

microvesicular:

ALD; (alcoholic liver disease)

Reye syndrome,

acute fatty change of pregnancy

macrovesicular:

DM,

obesity

-Hepatic steatosis, or fatty infiltration of the liver, is indeed a significant manifestation of various diseases.

-The deposition of fat within hepatocytes can occur in different forms, including small droplets within the cytoplasm (microvesicular) or larger droplets occupying the entire cytoplasm (macrovesicular). Both forms indicate an abnormal condition within the liver.

-While the outcome of the process may not differ significantly between microvesicular and macrovesicular fatty deposition, but the underlying causes can vary.

-Microvesicular fatty change is associated with specific conditions such as alcoholic liver disease, Reye's syndrome, and acute fatty liver of pregnancy.

-On the other hand, macrovesicular fatty change is more commonly linked to metabolic issues like diabetes, obesity, or other metabolic abnormalities related to fat metabolism.

fatty change

This is the cross section of liver involved by severe fatty infiltration.

You can see the difference in color because the fat is normally yellow in color.

It is greasy in consistency.

Chronicity of the condition can lead to additional gross features becoming apparent. For example, with prolonged fatty infiltration and associated inflammation, there may be changes in liver texture, such as nodularity or firmness, indicating fibrosis or cirrhosis. These gross features provide valuable information to clinicians during physical examination and can guide further diagnostic and management decisions.



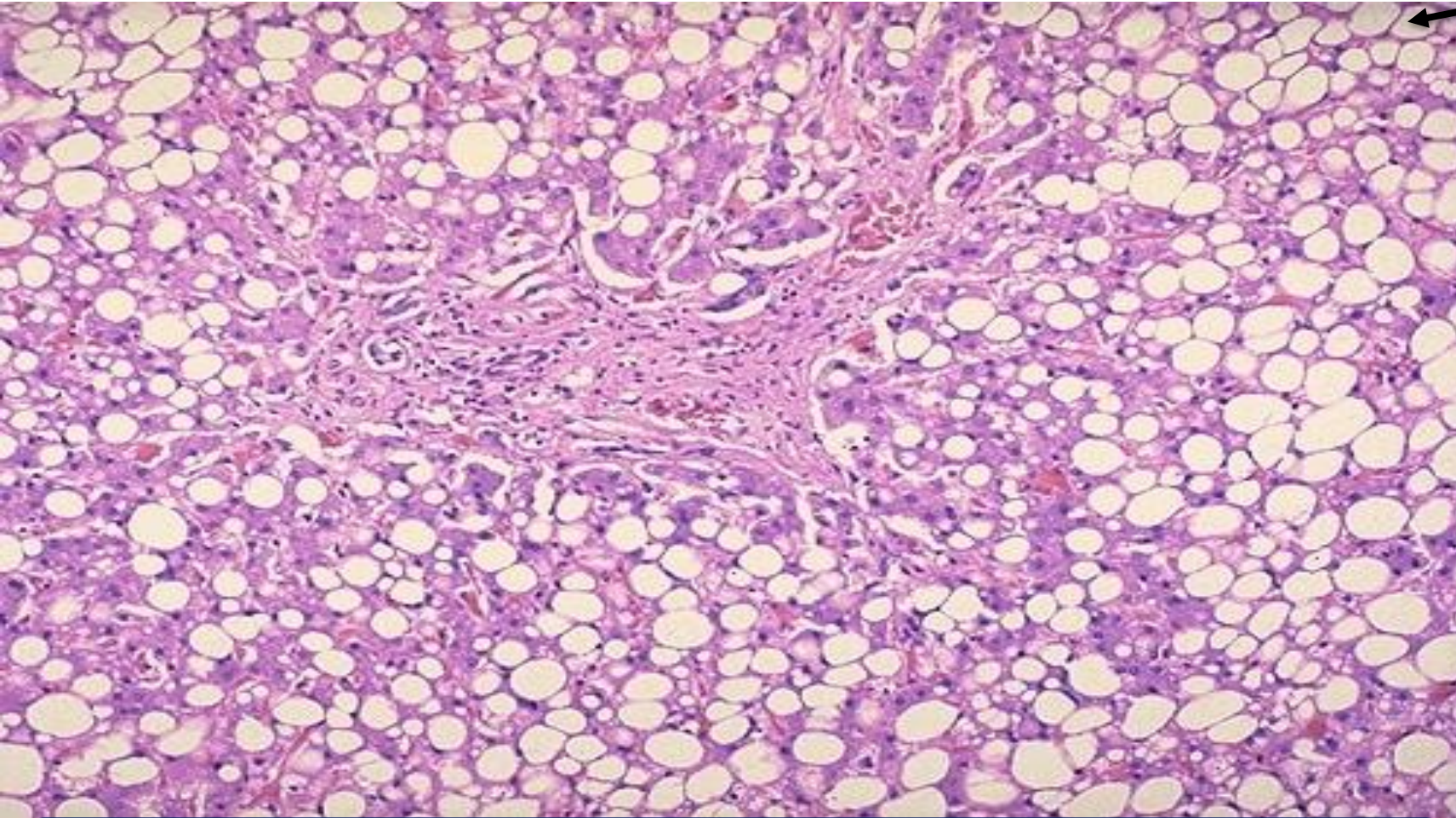
Fatty change of the liver is indeed a finding rather than a diagnosis in itself. It's a manifestation of various underlying conditions rather than a standalone disease. Once fatty infiltration of the liver is observed, it serves as a red flag prompting further investigation into the underlying cause or causes.

A fatty change, is not a diagnosis, okay? I mean, because the diseases that are associated with fatty infiltration of liver too many, a fatty infiltration is a finding.

After we see liver is involved by fatty infiltration, we have to go and look for the underlying cause,

okay? The underlying cause can be from different natures

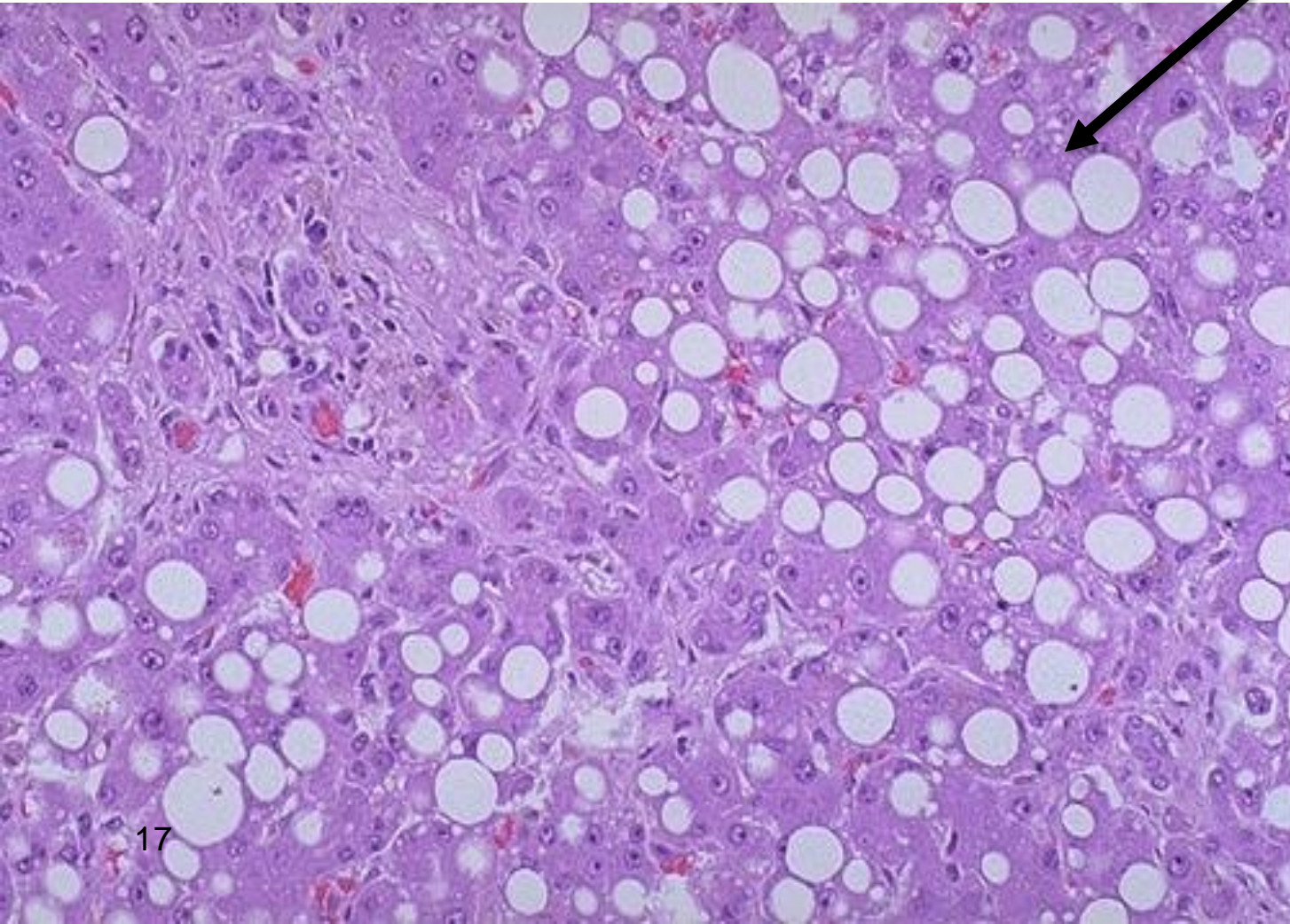
fatty change



The ballooning observed in the hepatocytes is due to the deposition of fatty material within them. In the image, the round spaces that appear empty are actually filled with fat. However, during the preparation of the slide, solvents are often used to remove the fat, resulting in the appearance of empty spaces.

You can see that the involvement is severe because almost all hepatocytes are filled with fat, with the cytoplasm expanded, particularly in the central area. The expansion of the central area indicates the possibility of fibrosis. Recognizing fibrosis is crucial in liver examination. Why? Because it may be associated with the development or progression of fibrosis.

This is a higher magnification of the liver tissue. You can observe the presence of numerous empty spaces resembling Swiss cheese. These empty spaces indicate extensive fat infiltration within the liver parenchyma.



4-Necrosis

-Depending on the type:

-coagulative

necrosis:around central v.

-Lytic(**liquefactive**)

necrosis.

-Councilman bodies.

-Depending on the

cause

Ischemic

Toxic

Other classifications of necrosis depend on the cause, which can either be ischemic, related to blood flow, or due to exposure to toxins.

Necrosis is correlated to severity , the presence of necrosis is a crucial indicator of severity, as it signifies cell death resulting from injury. Necrosis in the liver can arise from various causes, with two "primary" types being coagulative necrosis and liquefactive necrosis. -Liquefactive necrosis, also known as lytic necrosis, typically arises from infectious agents. -Coagulative necrosis is often associated with ischemia or reduced blood flow. -Initially, necrosis tends to occur around the central vein in the liver. -Lytic necrosis, however, can manifest at any site and is frequently linked with the formation of abscesses. When observing lytic necrosis or abscess development, infectious etiologies should be considered. In the liver, these may include bacterial or parasitic infections.



-Depending on type , necrosis also can manifest as individual cell death, a phenomenon known as Councilman bodies. These bodies indicate necrosis of hepatocytes, typically involving one or two cells. -- Under a microscope, these necrotic cells are characterized by several distinctive features:-

- 1- the cytoplasm appears more eosinophilic.**
- 2-the nucleus of these cells becomes irregular, pyknotic, or fragmented.**

-Councilman bodies can be seen in many different diseases, So it is important to look for and to see whether it presents or not like other findings.

- Depending on location

1- Centrilobular necrosis:

2- Mid zonal :

3- Periportal (peripheral):

interface hepatitis Focal:

-Piecemeal necrosis

-bridging necrosis

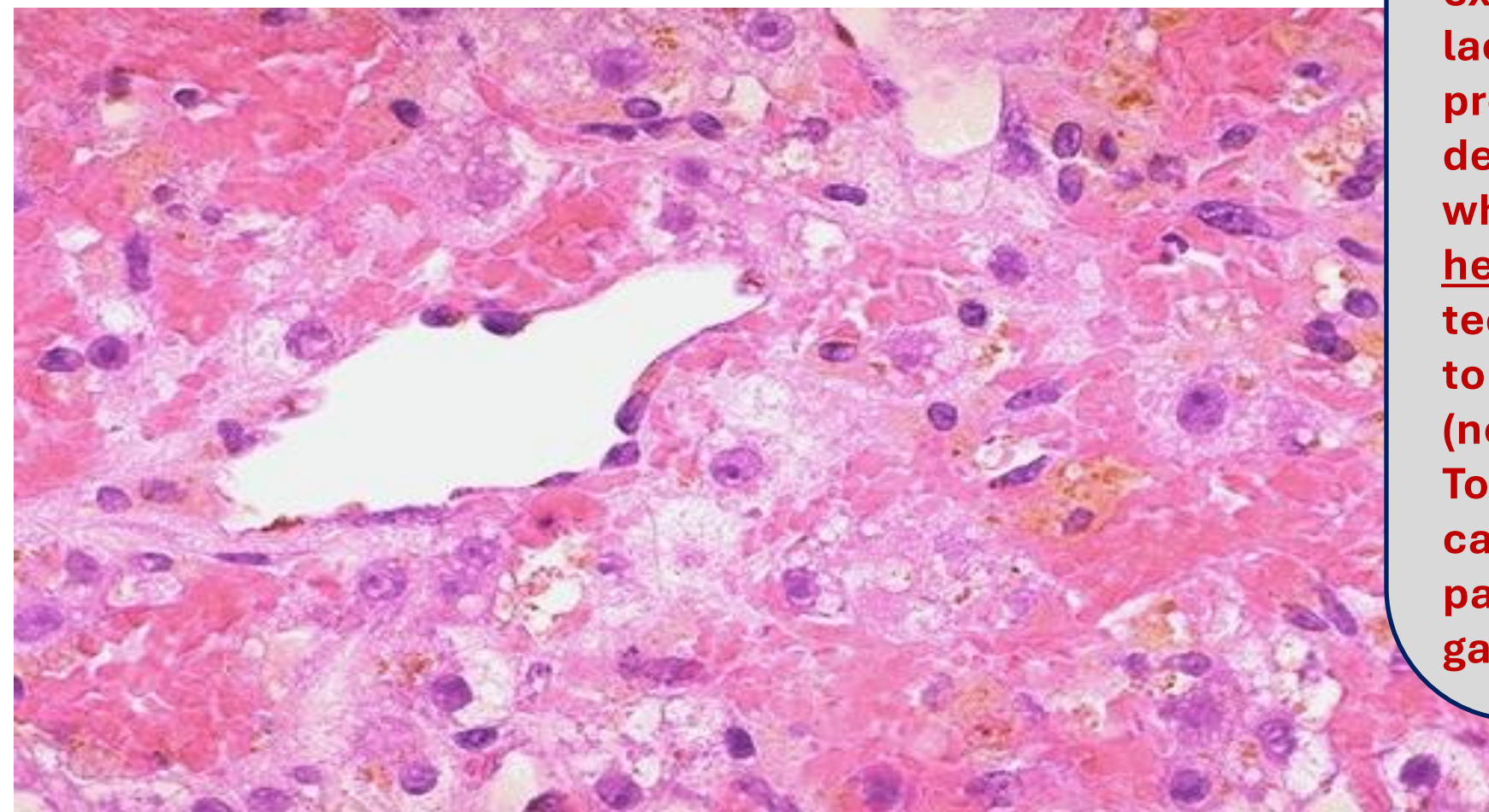
4- Diffuse:

massive & submassive necrosis

Depending on the affected site, necrosis can be categorized into centrilobular necrosis or peripheral necrosis. It may manifest as focal, midzonal, or diffuse necrosis. It's important to emphasize that these findings may not be present in all cases, particularly in severe instances. Early detection of these signs could aid in diagnosis and treatment.

Diffuse Necrosis: Necrosis that affects a large area or the entirety of the liver. It can be further classified into massive necrosis (involving a significant portion of the liver or whole liver) or submassive necrosis (a less extensive but still significant amount of necrosis).

Necrosis of liver



This figure for liver tissue exhibiting necrosis, where cells lacking nuclei are necrotic. The problem we got here is the deposition of bile material, which could potentially be hemosiderin. Special staining techniques are necessary to differentiate between the two (necrotic & bile material). To determine the underlying cause, we need to review the patient's medical history and gather additional information.

5-Regeneration

- evidenced by increased mitosis or cell cycle markers.
- the cells of the canal of Hering are the progenitor for hepatocytes & bile duct cells (oval cells).

A crucial feature of the liver is its remarkable ability to regenerate. Liver cells possess a significant capacity for regeneration, with regenerative cells being a part of the response to injury. This regenerative process is evidenced by the presence of mitosis in the liver.

In cases of liver failure, the organ can maintain its functionality, even when more than 90% of hepatocytes are damaged, due to its regenerative capacity.

6-Fibrosis:

- portal or periportal fibrosis.
- pericentral: around the central vein.
- pericellular fibrosis or fibrous tissue may be deposited directly within the sinusoids around single or multiple hepatocytes.
- bridging fibrosis

7-Cirrhosis:

Micronodular

Macronodular

8-Ductular proliferation:

السلام عليكم
هذا الفورم لكم لتزودونا بآرائكم فيما يخصّ تفریغات فريق طوقان
الافصى.
علماً أنّ الفورم لكافة المواد-

https://docs.google.com/forms/d/e/1FAIpQLSdN9YK7ry3f5EtqmJAzL1lqa9ogsCGEEVrFH9DfBd8IIAN1Eg/viewform?usp=sf_link

2 - أتدري ما حقُّ الله على عباده؟ قال : قلتُ اللهُ ورسوله أعلمُ ، قال : "حقُّ الله على عباده أن يعبدوه ولا يُشركوا به شيئاً " أتدري ما حقُّ العبادِ على الله إذا فعلوا ذلك؟ قال : قلتُ اللهُ ورسوله أعلمُ ، قال : "حقُّهم ألاَّ يعذبهم".

الراوي : معاذ بن جبل المحدث : ابن تيمية

المصدر : مجموع الفتاوى الصفحة أو الرقم : 1/23

خلاصة حكم المحدث : صحيح

3 - يا أبا بكرٍ ، للشِّركِ فيكم أخفى من ديبِ النَّمْلِ والذي نفسي بيده ، للشِّركِ أخفى من ديبِ النَّمْلِ ، ألا أدُّلك على شيءٍ إذا فعلته ذهب عنك قليله و كثيره ؟ قل : اللهم إني أعوذُ بك أن أشركَ بك وأنا أعلمُ ، وأستغفرُك لما لا أعلمُ

الراوي : معقل بن يسار المحدث : الألباني

المصدر : صحيح الأدب المفرد الصفحة أو الرقم : 551

خلاصة حكم المحدث : صحيح

هذا دعاءٌ فخذ بالأسباب وتوكل على الله عز وجل

تم تعديل سلايد رقم: ٢٣، ١٨، ١٢

V2

تم تعديل سلايد ٢٠

v3