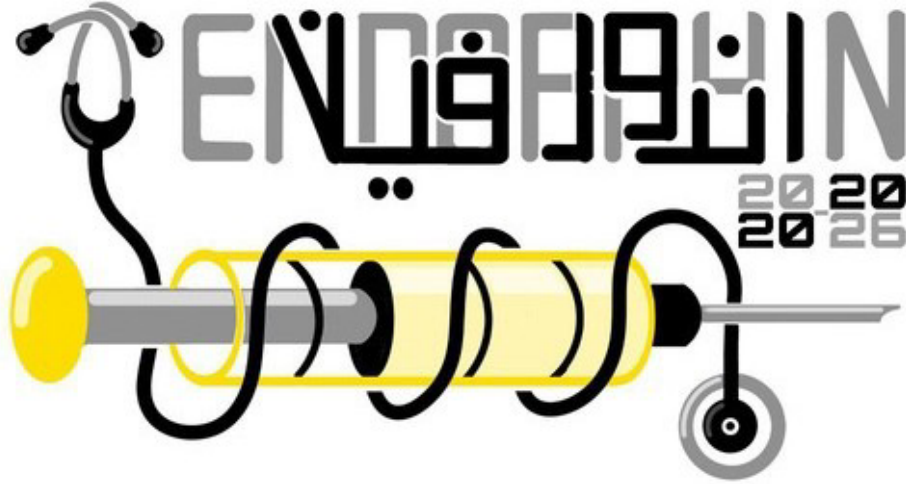


Anatomy



Sheet: 17

Lecture title: Liver

Date:

Done by: Huda Shehadeh

Edited by: Huda Shehadeh

If you come by any mistake (whether it be spelling , grammatical or scientific) while browsing this sheet, Kindly report it to Academic Team Facebook Account.



Liver

Dr. Refat AboGhazleh

Learning Objectives

At the end of the lecture, the student should be able to describe:

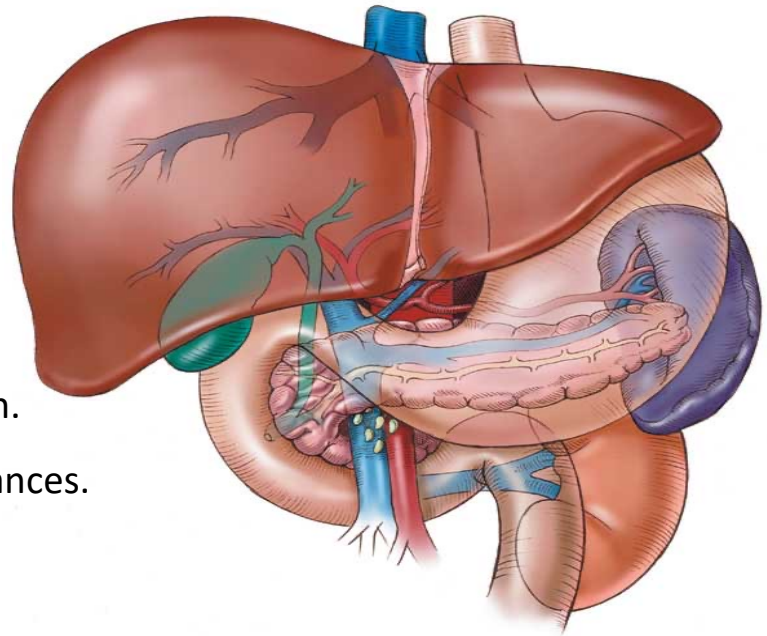
- Gross anatomy of the liver
- Location and surface anatomy of the liver.
- Relations of the liver.
- Peritoneal reflection, recesses, and ligaments of the liver.
- Surfaces, fissures, and lobes of the liver.
- Segmental anatomy of the liver.
- Blood supply, nerve supply and lymphatic drainage of liver.
- Clinical correlations.

Liver

- It is the **largest gland** in the body and has a wide variety of functions.
- Weighs approximately 1500 g (approximately 2.5% of adult body weight).
- It is **exocrine** (bile) & **endocrine** organ (Albumen, prothrombin & fibrinogen).

Function of the liver:

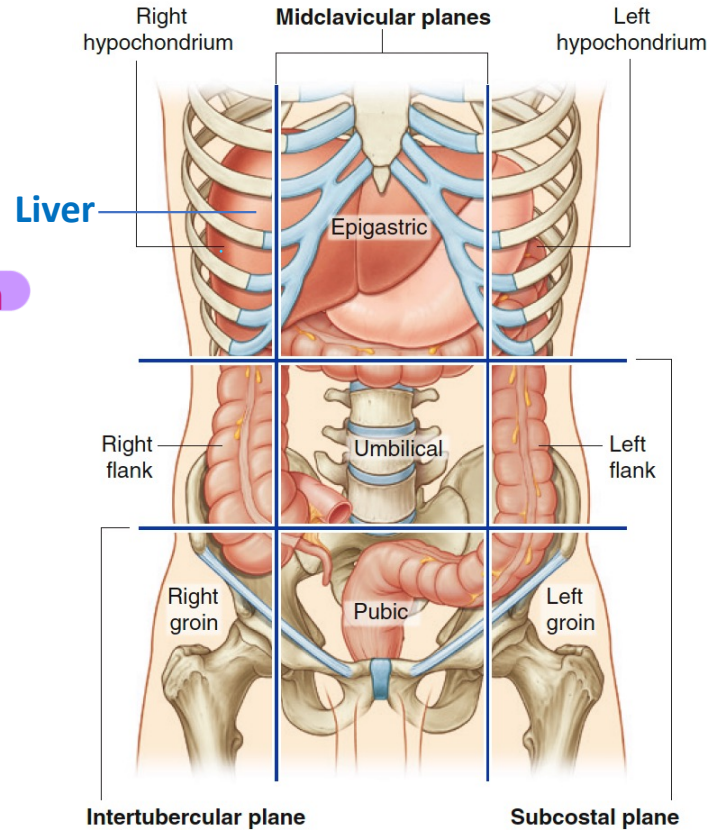
- Secretion of bile.
- Metabolism of carbohydrate, fat, and protein.
- Formation of heparin & anticoagulant substances.
- Detoxication.
- Storage of glycogen and vitamins.
- Activation of vitamin D.



Location of Liver

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- Inferior to diaphragm.
- It occupies right hypochondrium, epigastrum & extends to left hypochondrium.
- The greater part of the liver is situated under cover of the right costal margin.



Surface Anatomy of Liver

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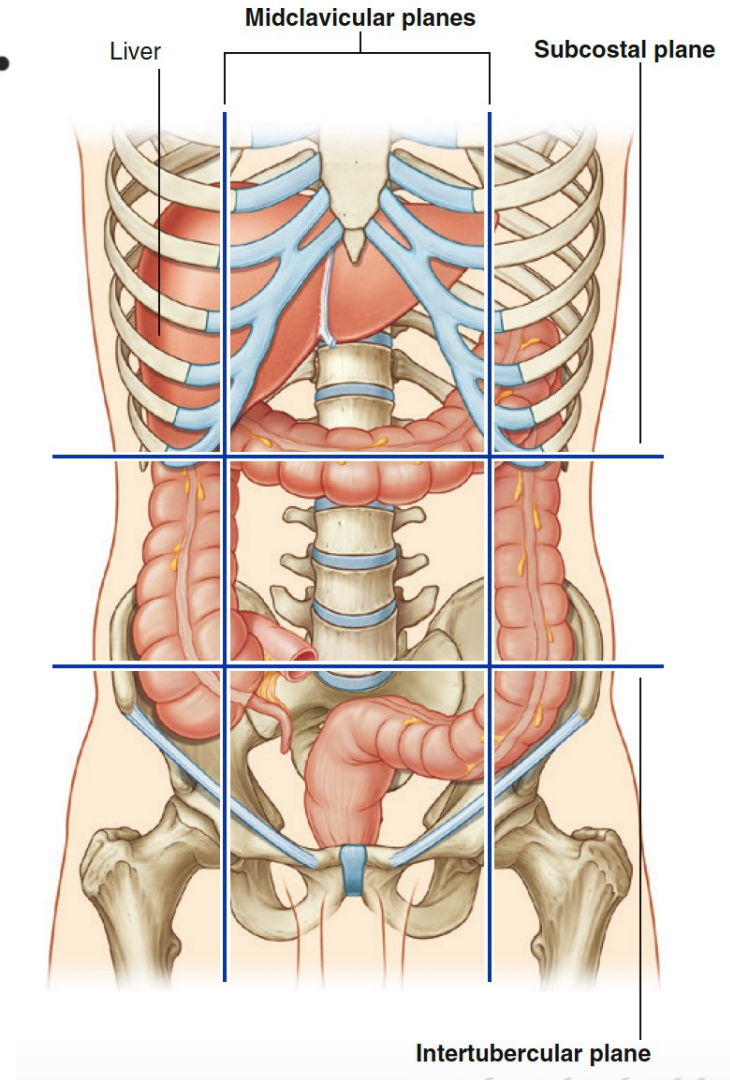
Upper border:

- A line extends from **right 5th rib in midclavicular line** to **left 5th intercostal space in midclavicular line**.

Inferior border:

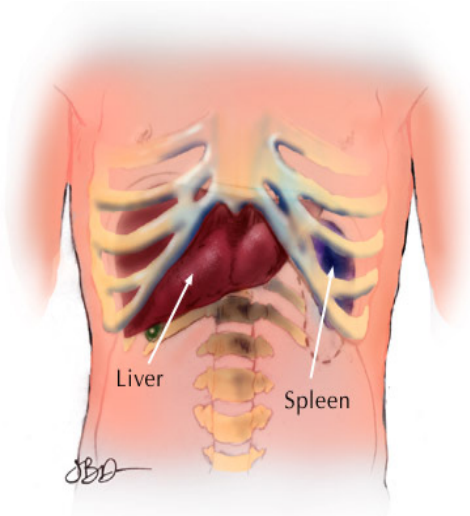
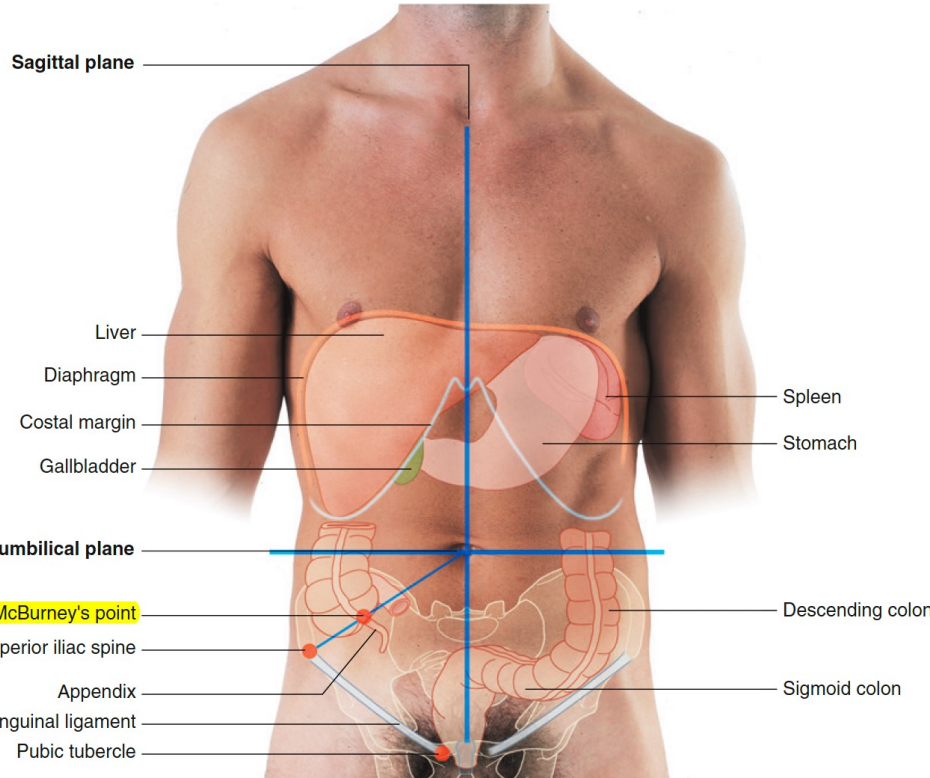
- From **right 10th rib in midaxillary line** to **left 5th intercostal space in midclavicular line**.

Crossing the **fundus of gall bladder** on **tip of 9th costal cartilage** in midclavicular line.



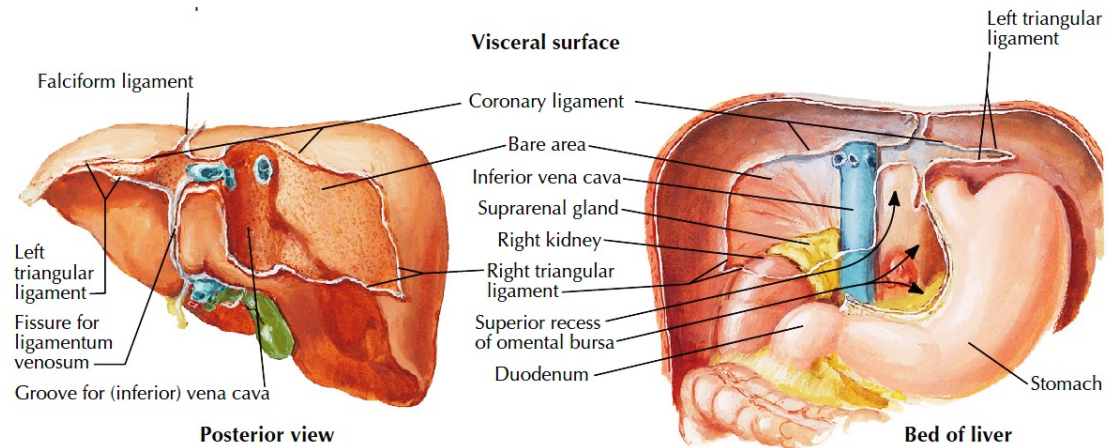
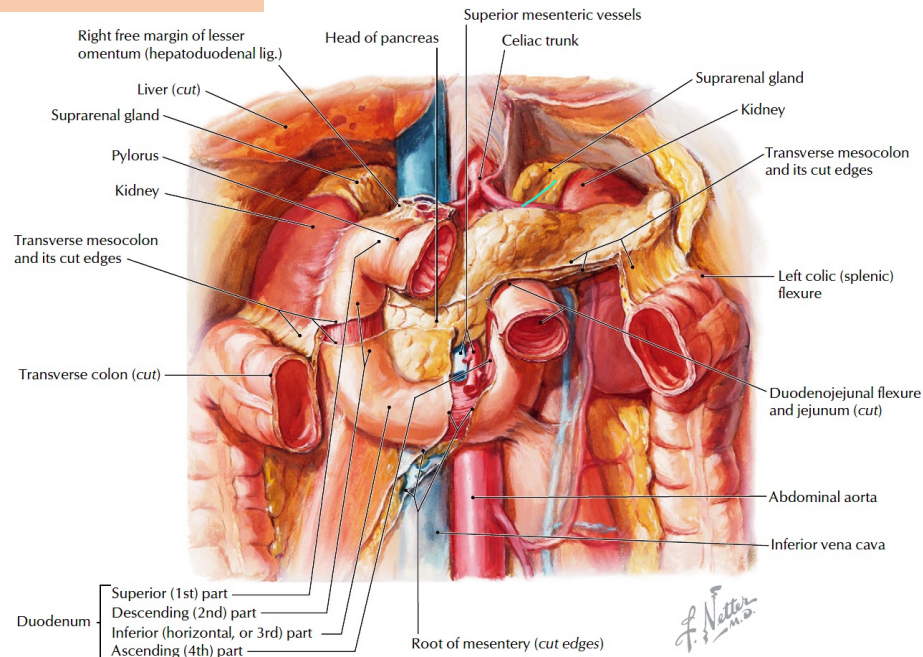
Relations of liver anteriorly:

- Diaphragm
- Rt & Lt pleura and lower margins of both lungs
- Costal cartilage
- Xiphoid process
- Ant. abdominal wall in the subcostal angle



Posterior relation of liver:

- Diaphragm
- Rt suprarenal gland
- Right Kidney
- Transverse colon (hepatic flexure)
- Duodenum
- Inferior vena cava
- Abd Esophagus
- Fundus of stomach



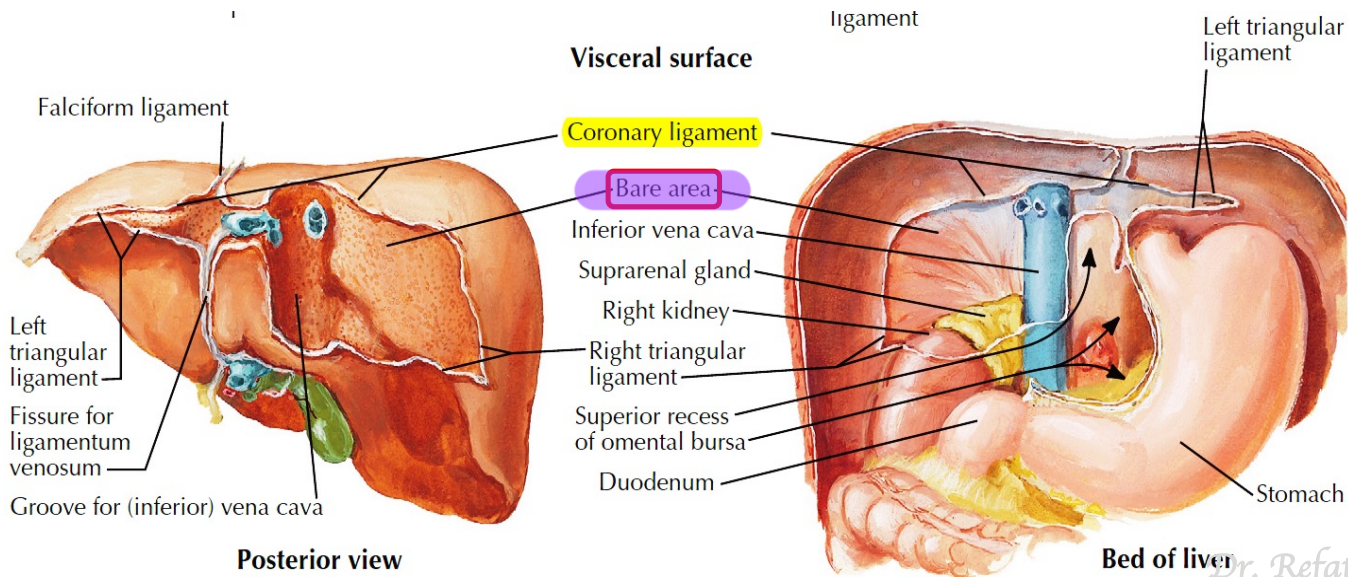
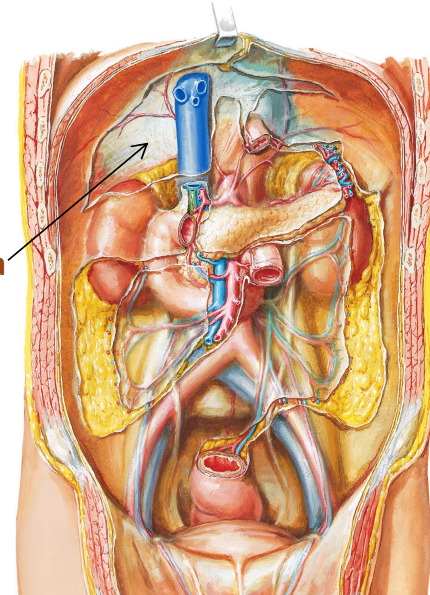
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Peritoneal Reflection

- The liver is completely surrounded by a **fibrous capsule** and covered by **peritoneum** (except the **bare areas**).
- The **bare area** of the liver is an area of the liver on the **diaphragmatic surface** where there is **no** intervening peritoneum between the **liver** and the **diaphragm**.

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bare area

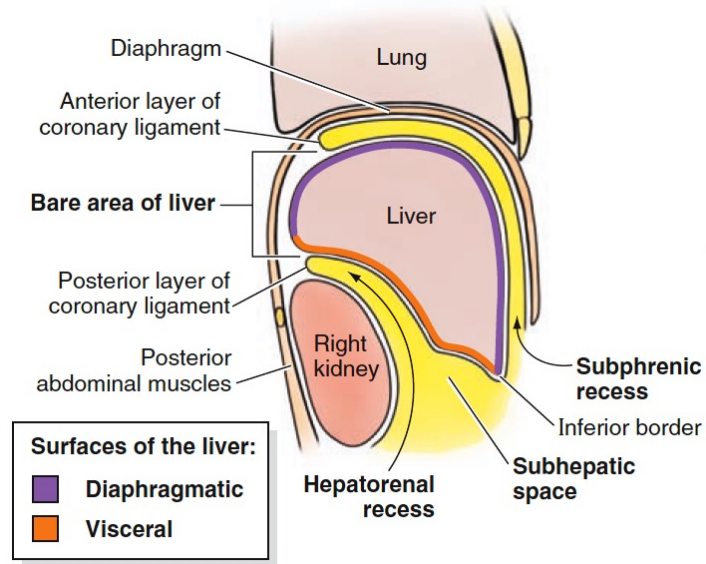


Peritoneal Reflection

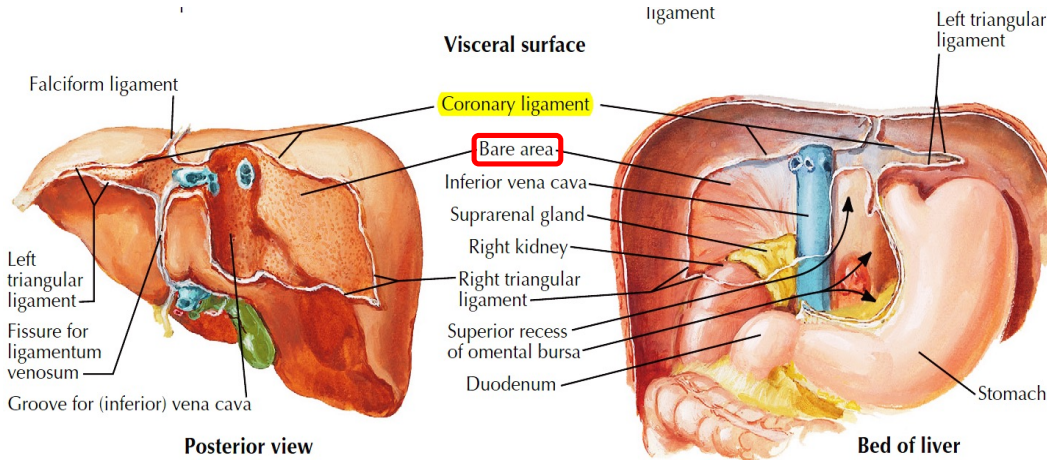
Boundaries of Bare area:

- **Anterior:** is indicated by a reflection of peritoneum-superior layer of **coronary ligament**.
- **Posterior:** Inferior layer of **coronary ligament**.
- **Laterally:** **Right and left triangular ligaments**.

Other bare areas include porta hepatis, fossa for gall bladder & grooves for IVC.



Right lateral view - schematic sagittal section



Coronary ligament:

Attaches the **liver** to the **diaphragm**.

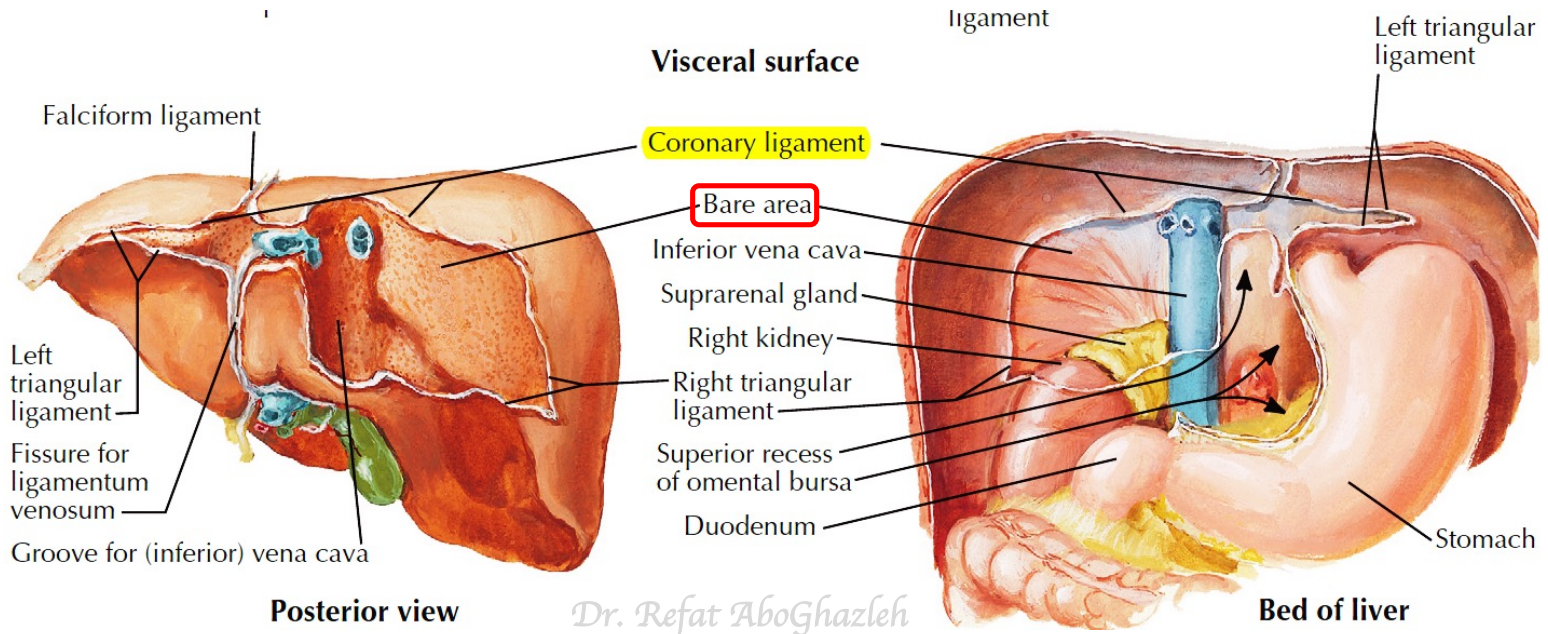
There are **two peritoneal ligaments** are parts of the coronary ligament:

1. Left triangular ligament:

It is between the **left lobe of the liver** and the **diaphragm**.

2. Right triangular ligament:

It is between the **right lobe of the liver** and the **diaphragm**.



Surfaces of Liver

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The liver has the following surfaces:

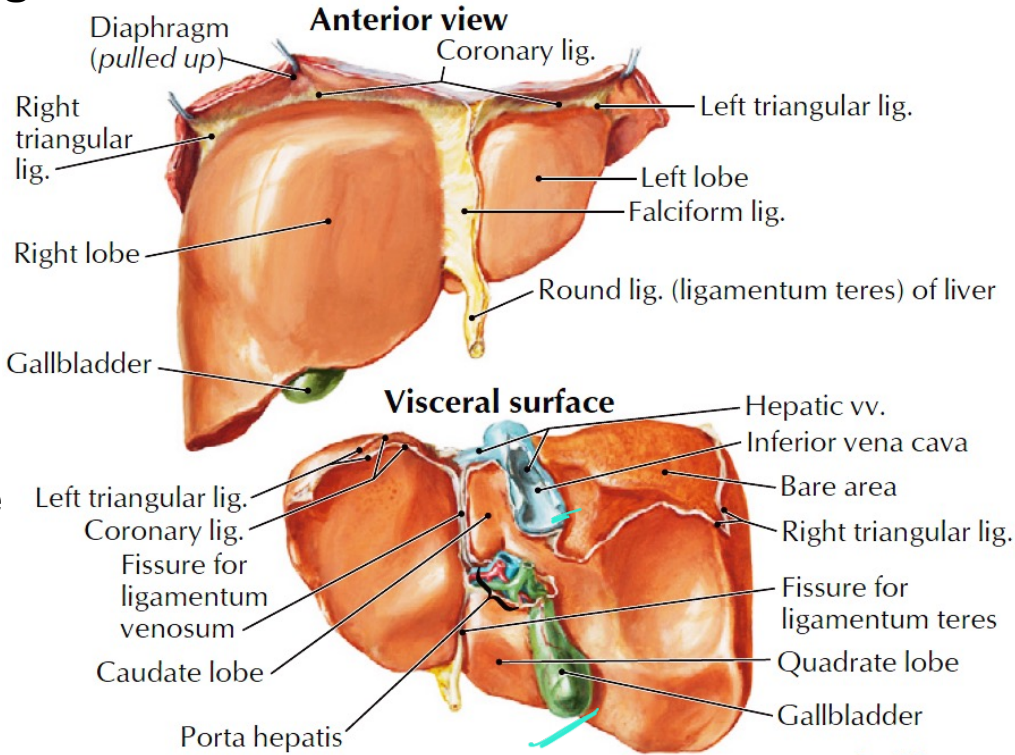
1. Diaphragmatic surface:

Convex (anterior, superior, and some posterior).

2. Visceral surface:

Relatively flat or even concave (posteroinferior).

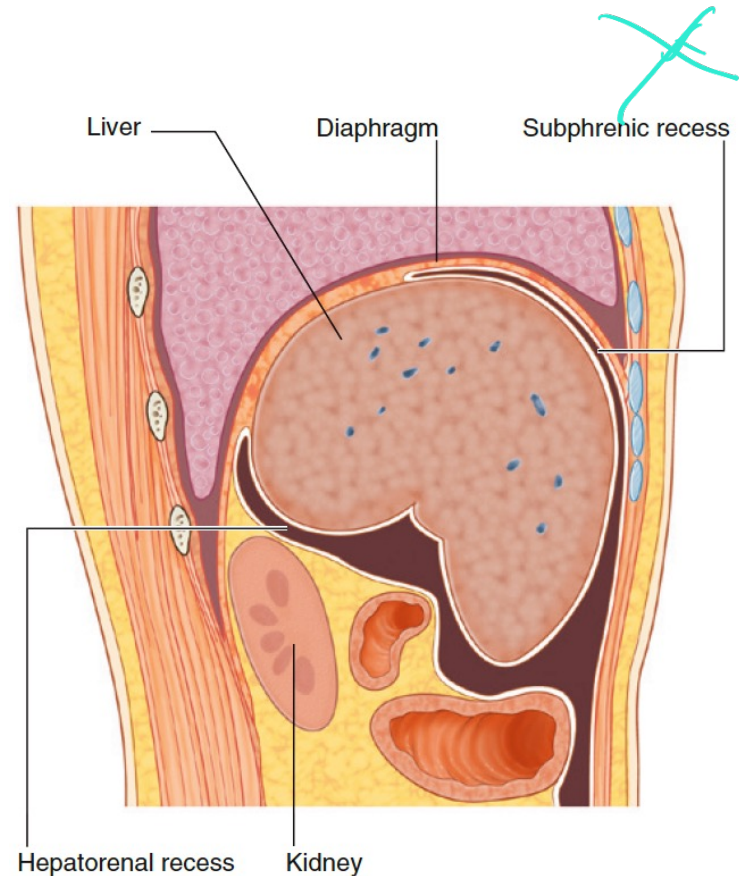
3. Right lateral surface (base of liver).



**One left end (apex of liver).

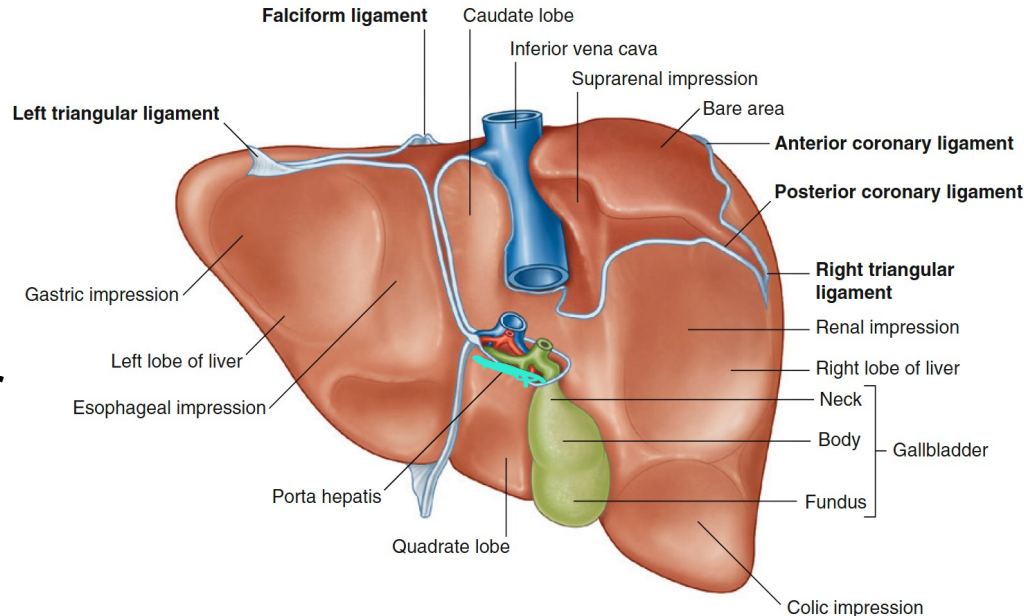
Diaphragmatic Surface

- It is the convex upper smooth surface, related to the concavity of the inferior surface of the diaphragm, which separates it from the **pleurae, lungs, pericardium, and heart**.
- Covered with **visceral peritoneum**, **except posteriorly** in the **bare area of the liver**, where it lies in direct contact with the diaphragm.



Visceral Surface

- It is the **posteroinferior surface**, related to abdominal viscera.
- It is covered with **peritoneum**, except at the **fossa for the gallbladder** and the **porta hepatis**.
- It bears multiple fissures and impressions from contact with other organs.



Fissures

Two sagittal oriented fissures, linked centrally by the transverse **porta hepatis**, form the letter **H** on the visceral surface.

□ **Right fissure**

formed:

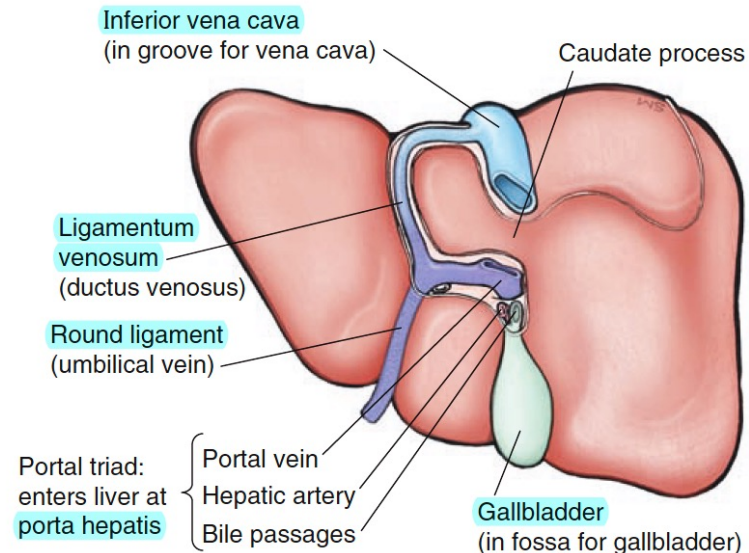
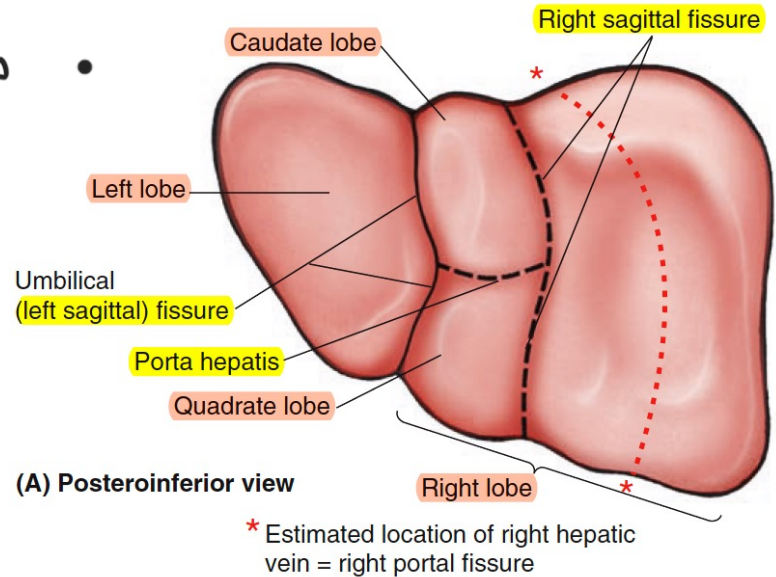
- **Anteriorly** by the **fossa for the gallbladder**.
- **Posteriorly** by the groove for the **inferior vena cava**.

□ **Left fissure**

formed:

- **Anteriorly** by the **fissure for the round ligament**
- **Posteriorly** by the **fissure for the ligamentum venosum**.

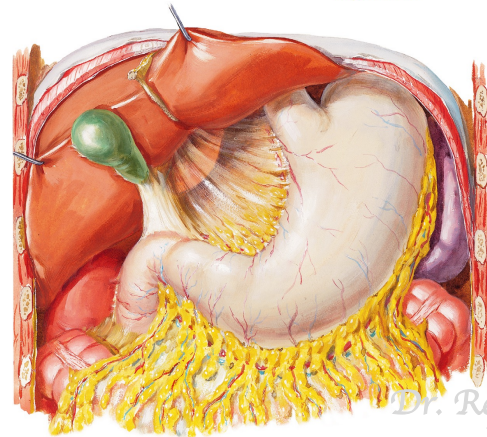
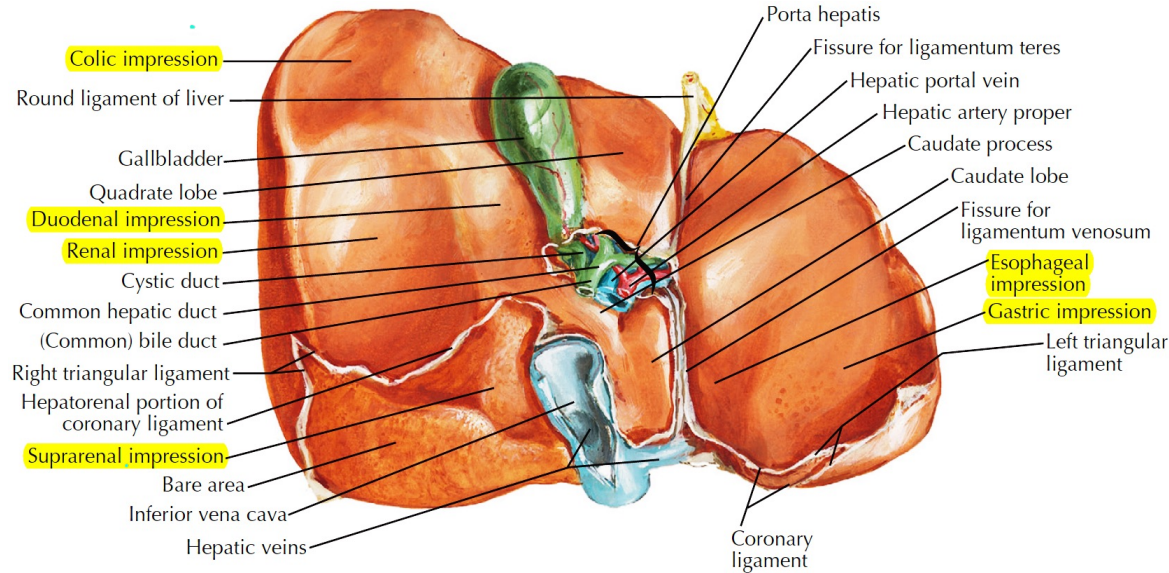
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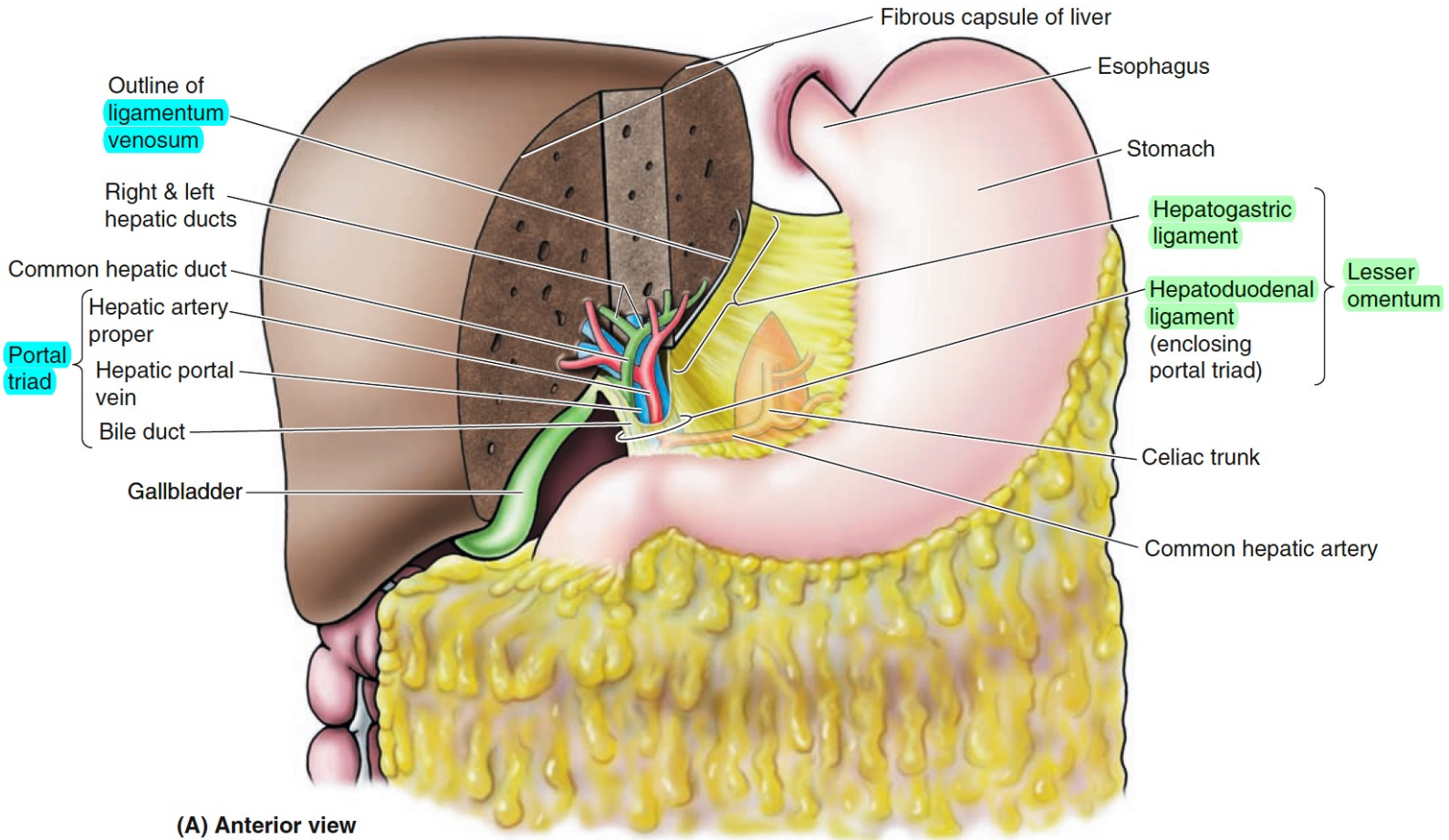
Relations of Visceral (Posteroinferior) Surface of Liver

The visceral surface is related to the:

1. Stomach
2. Esophagus
3. Lesser omentum
4. Gallbladder
5. Right colic flexure & Rt transverse colon.
6. Duodenum
7. Right kidney and right suprarenal gland



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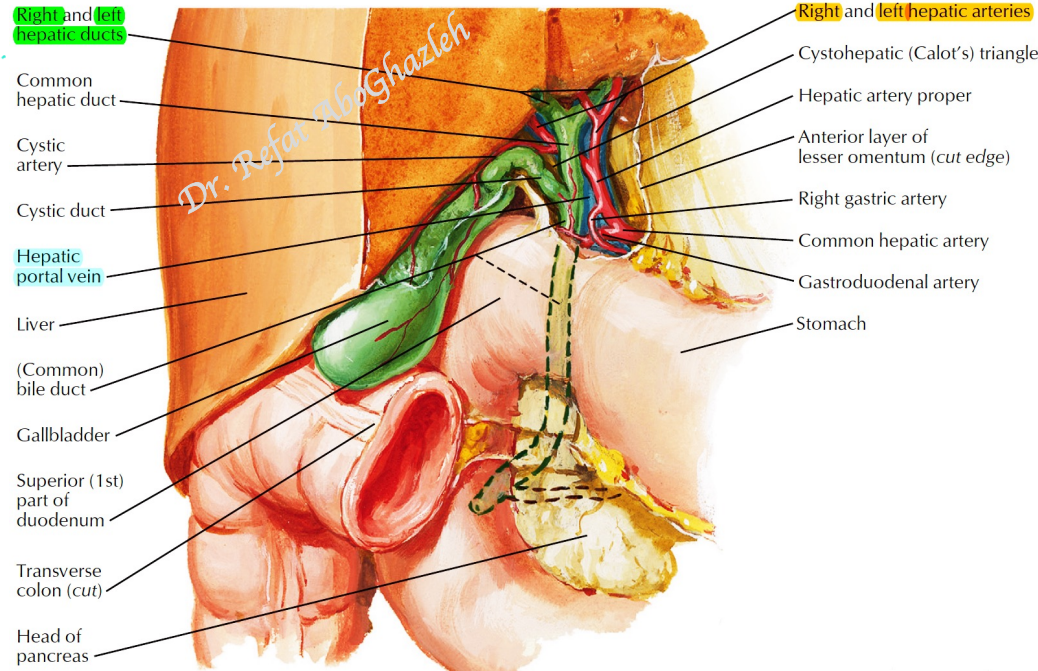


(A) Anterior view

Porta hepatis (Hilum of Liver)

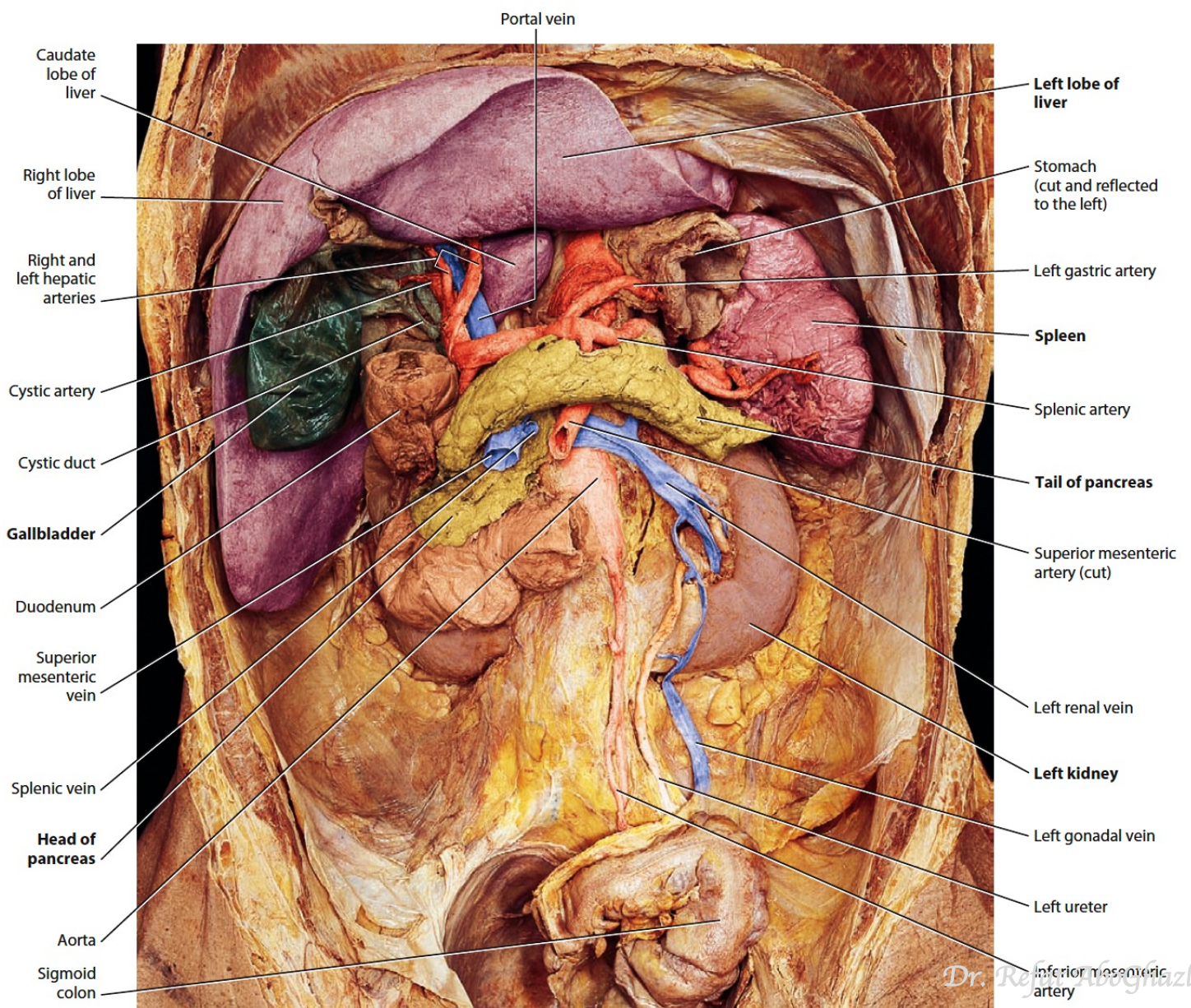
• مهم نظري وعملي

- It is found on the **posteroinferior surface**.
- It lies between the **caudate** and **quadrate lobes**.
- Lesser omentum attach to its margin.



Structures passing through the porta hepatis:

- Rt & Lt hepatic duct → **Anteriorly**.
- Rt & Lt Hepatic arteries surrounded by **lymphatic vessels** and **nerve plexus** → **Middle**.
- Portal vein → **Posteriorly**.

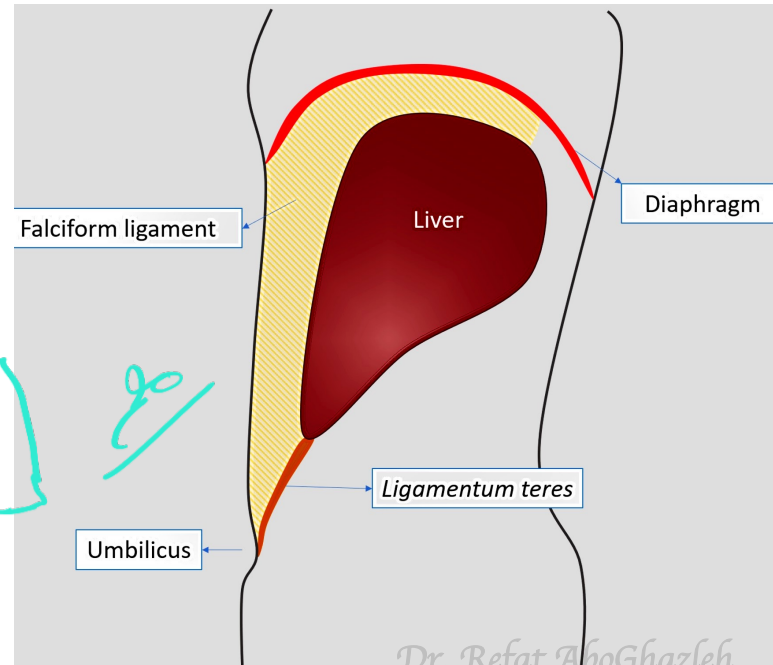
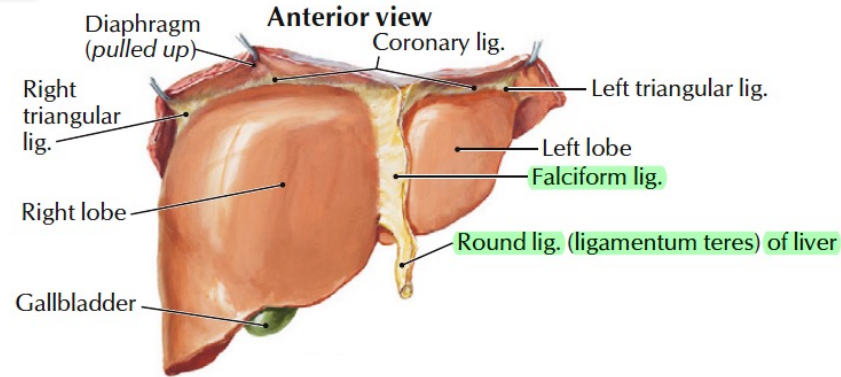


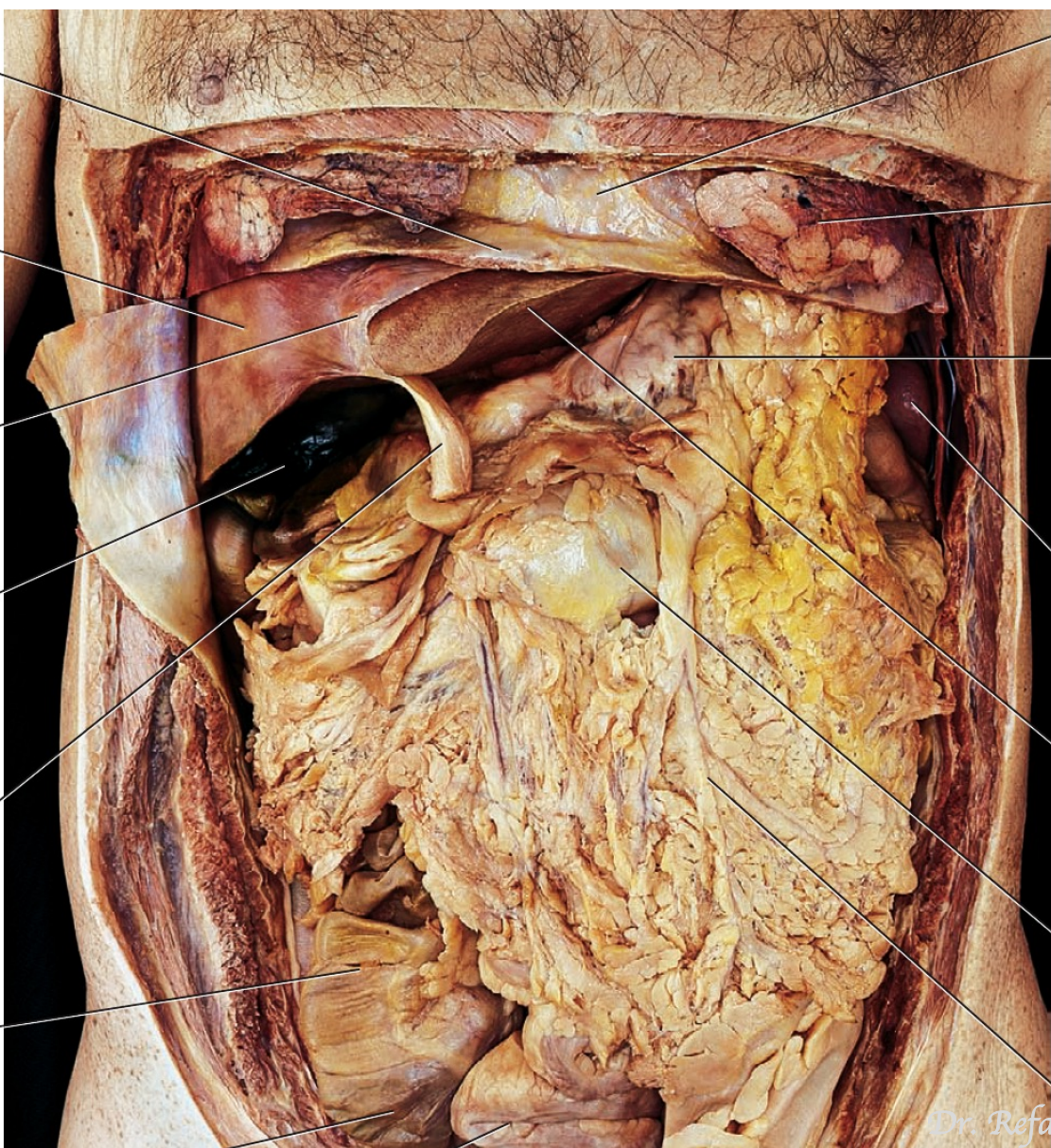
Ligaments of the Liver

Falciform Ligament

A sickle-shaped fold of peritoneum connects the **anterior abdominal wall** with the **liver** slightly to the right of the median plane.

- **Ant border:** Attached to under surface of diaphragm & Anterior Abd Wall.
- **Post border:** Attached to superior & anterior surfaces of liver
- **Free margin** connects the umbilicus to liver. It contains the **round ligament of the liver** (or Ligamentum teres) which is the remains of the **umbilical vein**.





Diaphragm

Fibrous pericardium

Right lobe of liver

Inferior lobe of left lung

Falciform ligament

Stomach

Gallbladder

Spleen

Round ligament of liver

Left lobe of liver

Ascending colon

Transverse colon

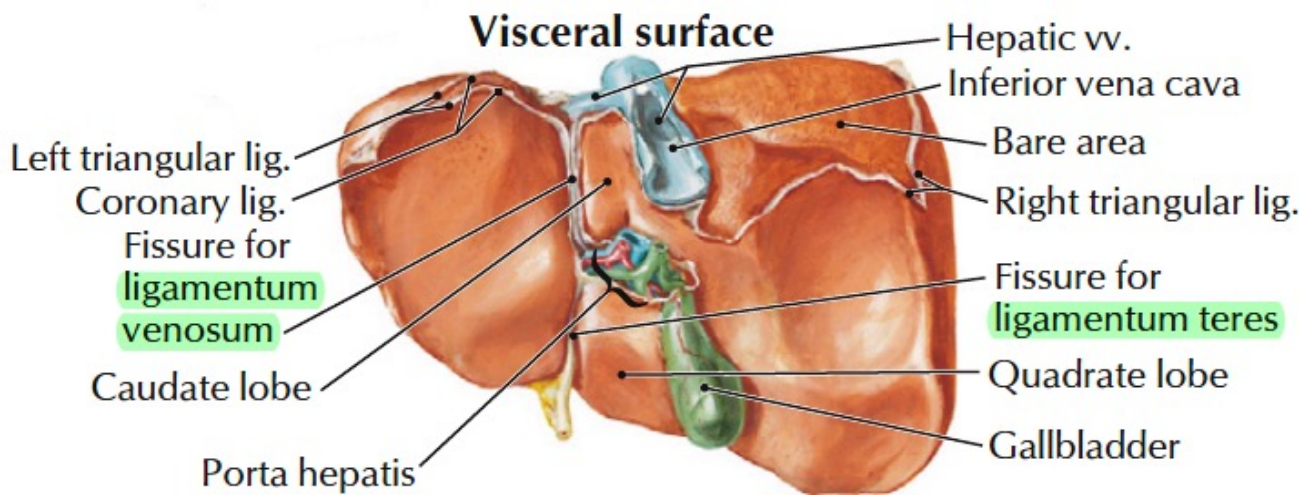
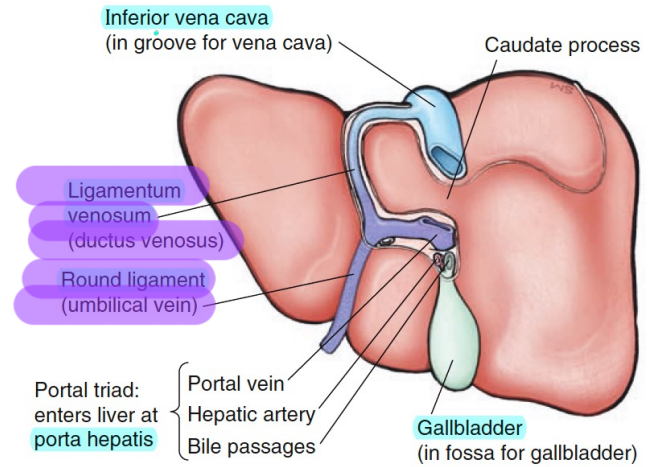
Greater omentum

Dr. Refat Al-Ghannam

Ligamentum venosum

Refat

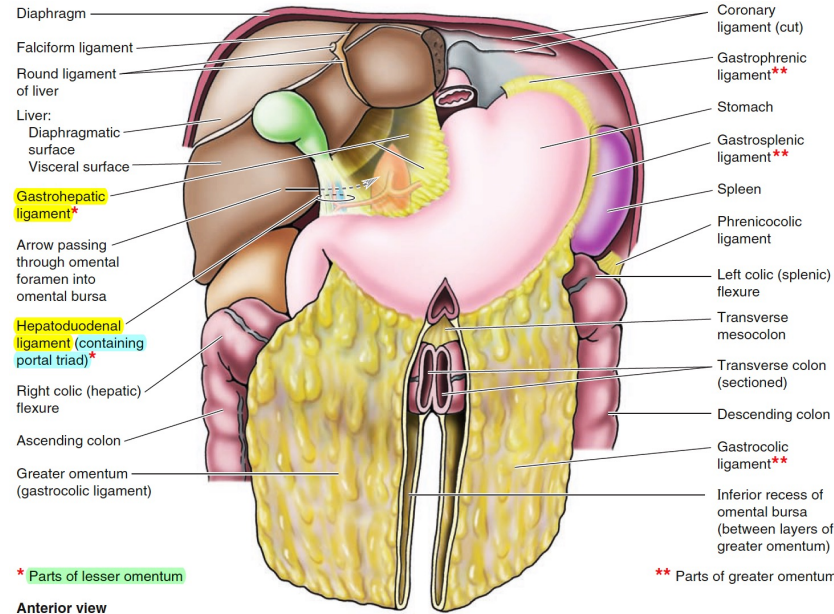
It is the fibrous remnant of the fetal **ductus venosus**, which shunted blood from the umbilical vein to the IVC, short-circuiting the liver.



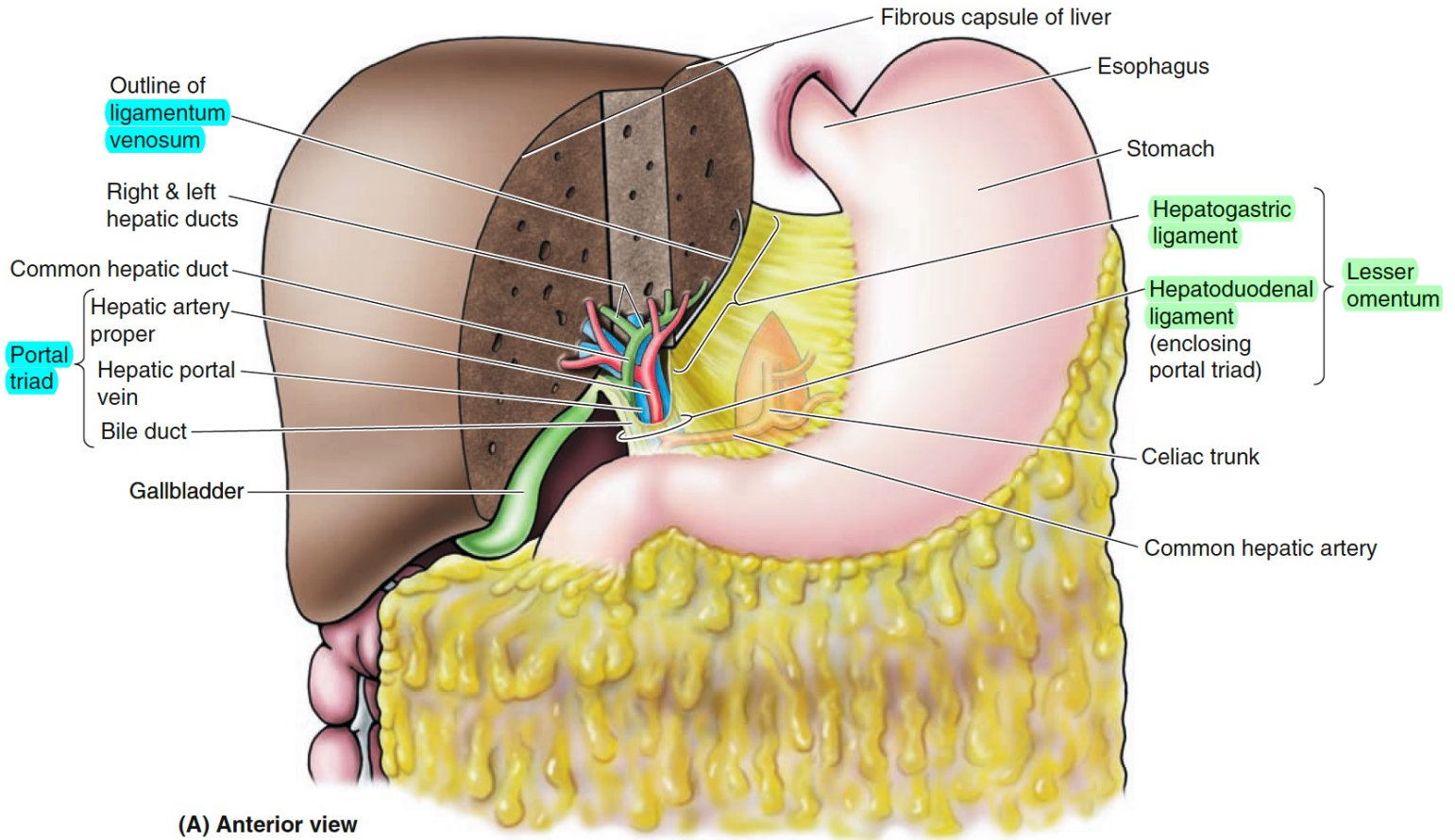
The **lesser omentum** connects the **lesser curvature of the stomach** and the **proximal part of the duodenum** to the **liver** (porta hepatis & fissure for ligamentum venosum).

The portions of **lesser omentum**:

- **Hepatogastric ligament:**
Connects **liver** (groove for the **ligamentum venosum**) to the **stomach**.
- **Hepatoduodenal ligament:**
Connects **liver** (**porta hepatis**) to the **duodenum**.
It is the thickened free edge of the lesser omentum, which conducts the **portal triad**: **bile duct, hepatic artery and portal vein**.

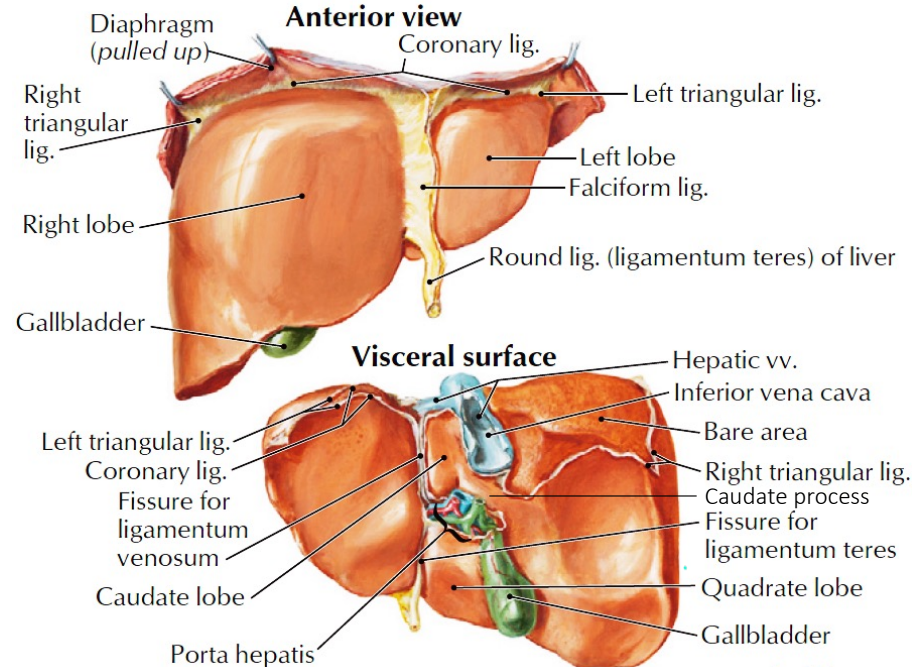


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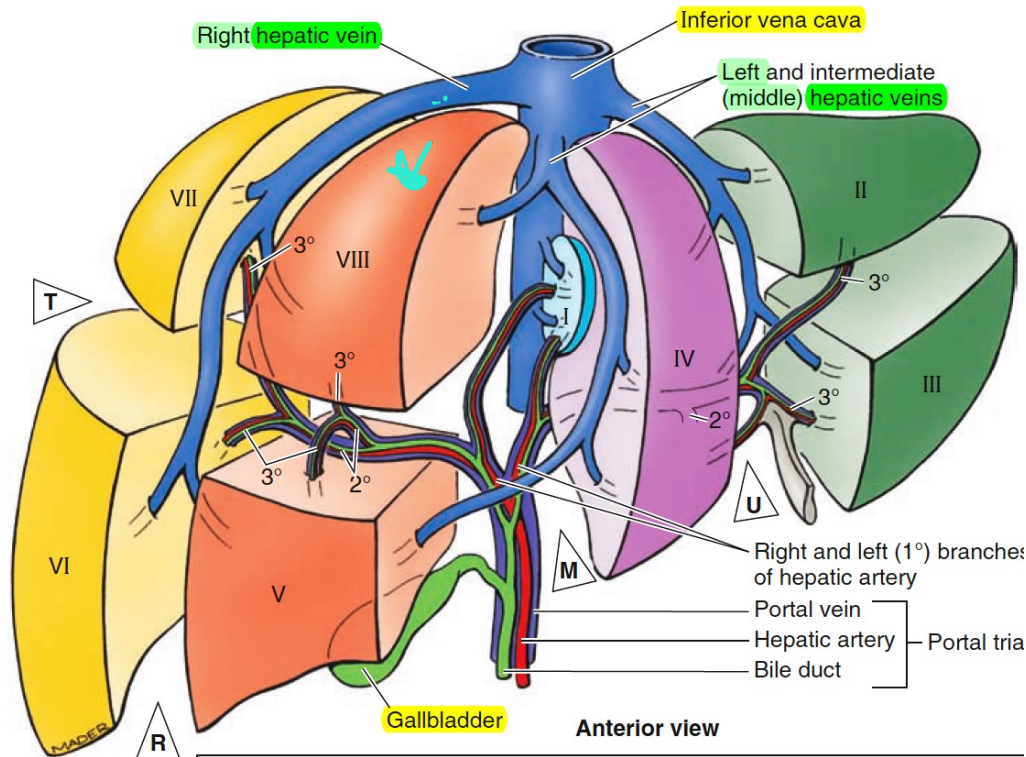
Lobes of the Liver

- The liver is divided into a large **right lobe** and a small **left lobe** by the attachment of the **falciform ligament**.
- The **right lobe** is further divided into a **quadrate lobe** and a **caudate lobe** by the presence of the:
 - Gallbladder,
 - Inferior vena cava,
 - Fissure for ligamentum teres,
 - Fissure for ligamentum venosum.
- The **caudate lobe** is connected to the right lobe by the **caudate process**.
- **Functionally**, the **quadrate** and **caudate lobes** are a part of the **left lobe** of the liver.



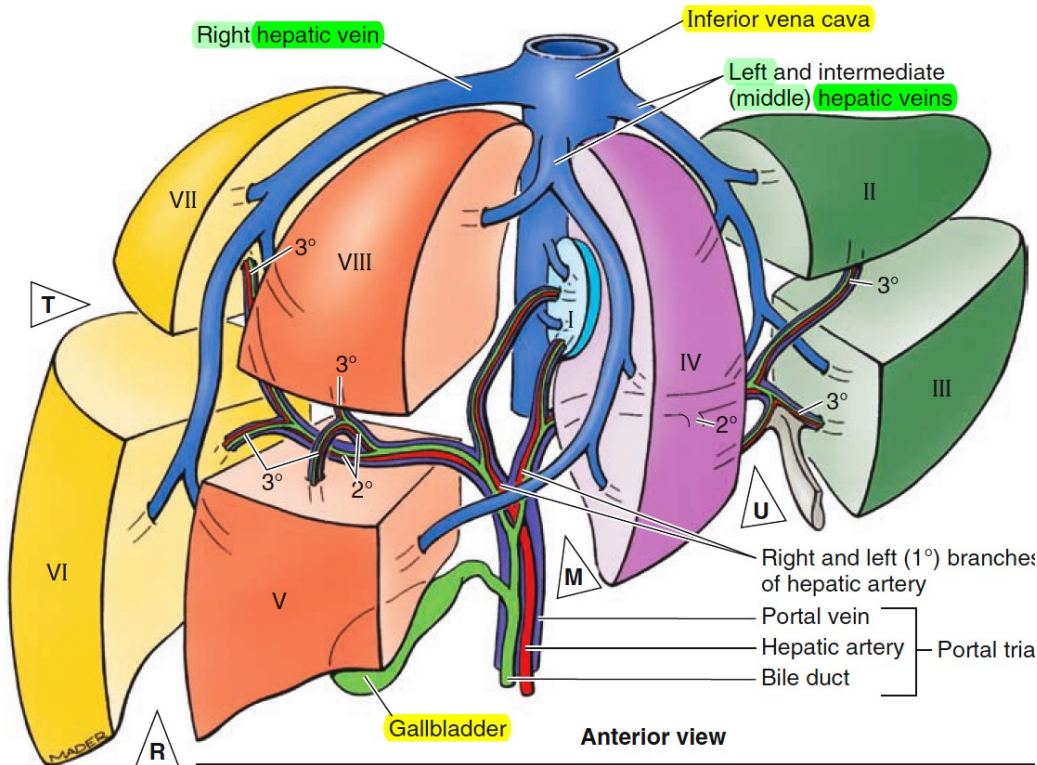
Right Lobe

- Largest lobe
- Occupies the right hypochondrium.
- Divided into **anterior** & **posterior** sections by the **right hepatic vein**.



Left Lobe

- Varied in size.
- Lies in the epigastric and left hypochondriac regions.
- Divided into **lateral** and **medial** segments by the **left hepatic vein**.



Caudate Lobe

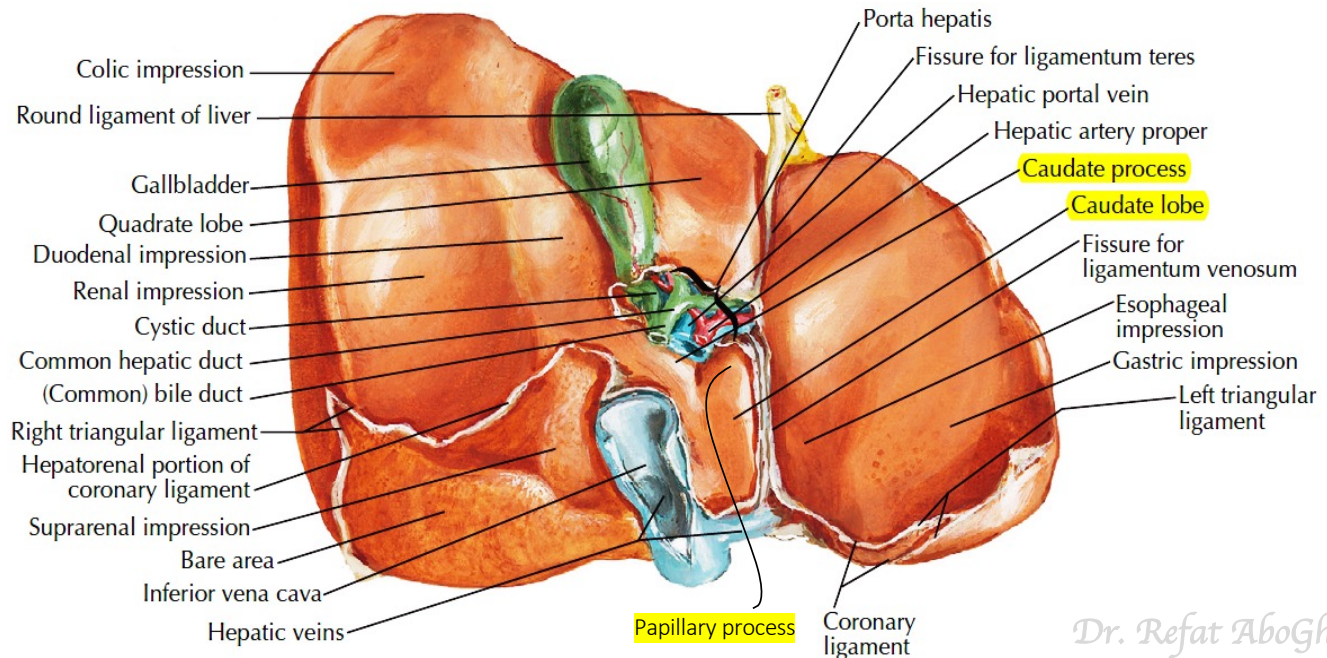
Located posteriorly and superiorly from the **right lobe**.

Relations of Caudate Lobe

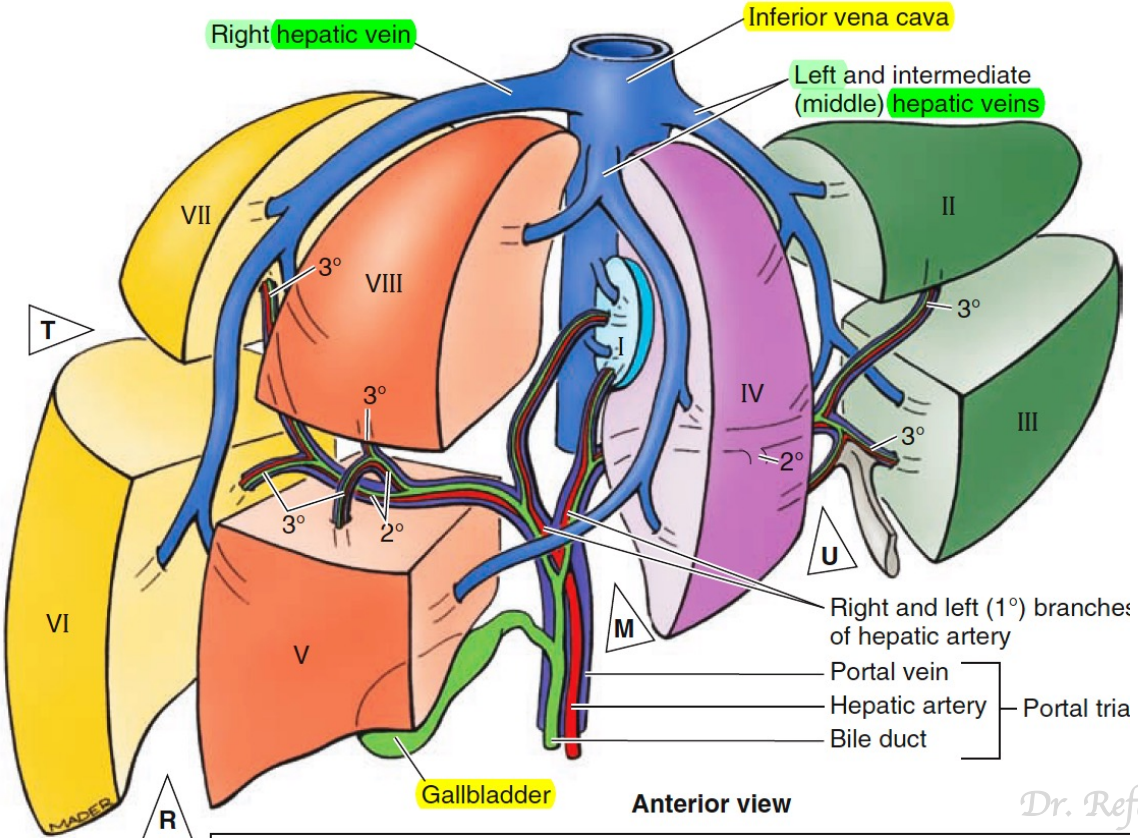
Two processes

- 1- Caudate process
- 2- Papillary process

- **Inferiorly** → the porta hepatis
- **The right** → the fossa for the inferior vena cava.
- **The left** → the fossa for the ligamentum venosum.



The **caudate lobe** may be considered a third liver; its vascularization is independent of the bifurcation of the portal triad (it receives vessels from both bundles) and is drained by one or two small hepatic veins, which enter directly into the IVC distal to the main hepatic veins.

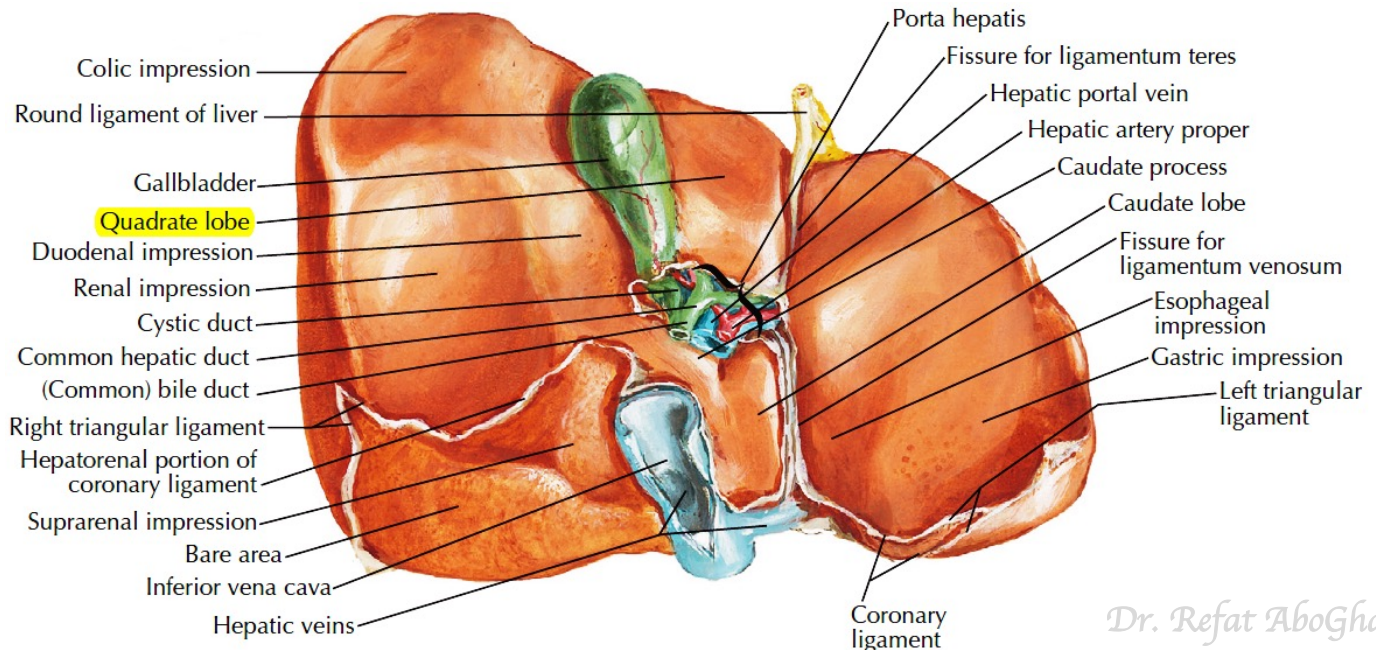


Quadrate lobe

Located on the anterior and inferior surface from the Right Lobe.

Relation

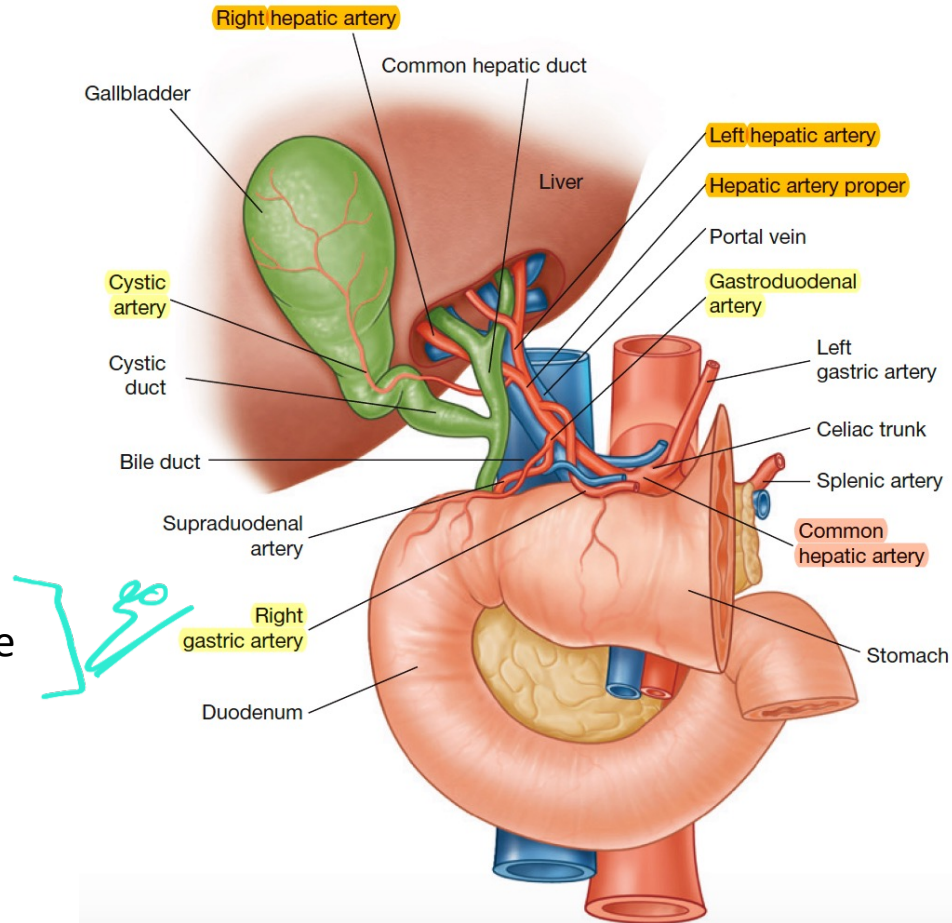
- Ant. → anterior margin of the liver.
- Sup. → porta hepatis.
- Rt. → fossa for the gallbladder.
- Lt → by the fossa for ligamentum teres.



Blood Circulation through the Liver

- The **hepatic artery** brings oxygenated blood to the liver.
- The **portal vein** brings venous blood rich in the products of digestion, which have been absorbed from the gastrointestinal tract.

The venous blood is drained by **hepatic veins** which drain into the **inferior vena cava**.



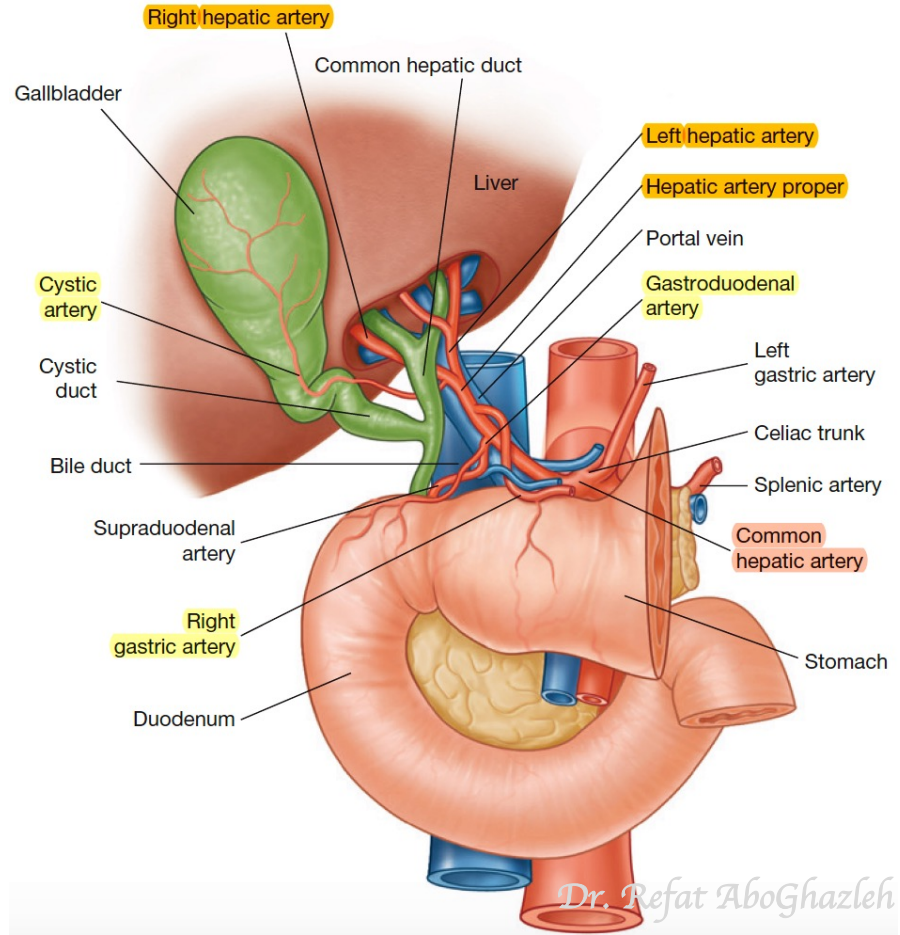
Arterial Supply of the Liver

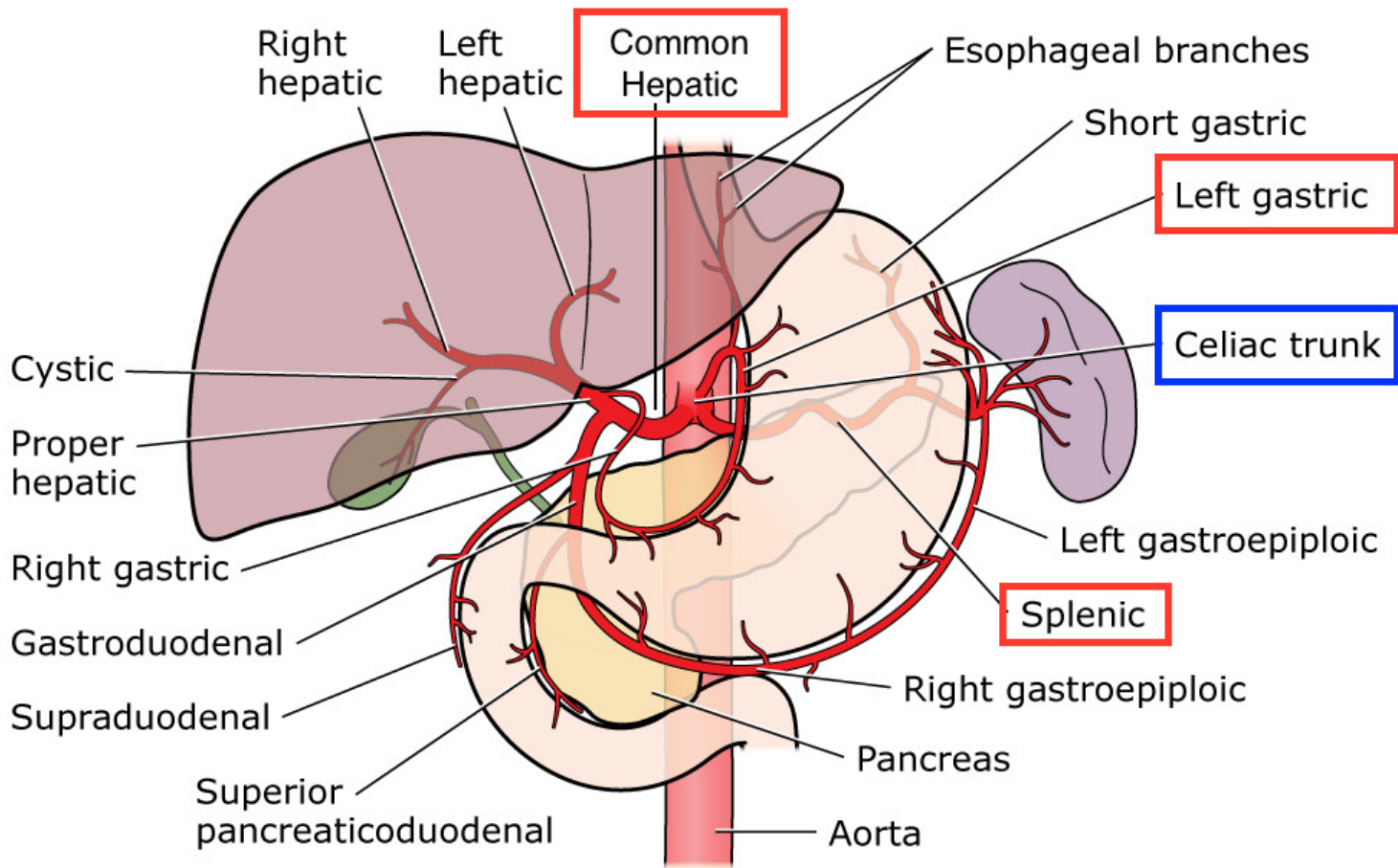
- **Celiac trunk** → **Common hepatic artery** → **Proper hepatic artery** → The **right** and **left hepatic arteries**; enter the **porta hepatis**.
- The **right hepatic artery** usually gives off the **cystic artery**, which runs to the **neck of the gallbladder**.

Remember:

The **hepatic artery proper** ascends toward the liver in the free edge of the lesser omentum.

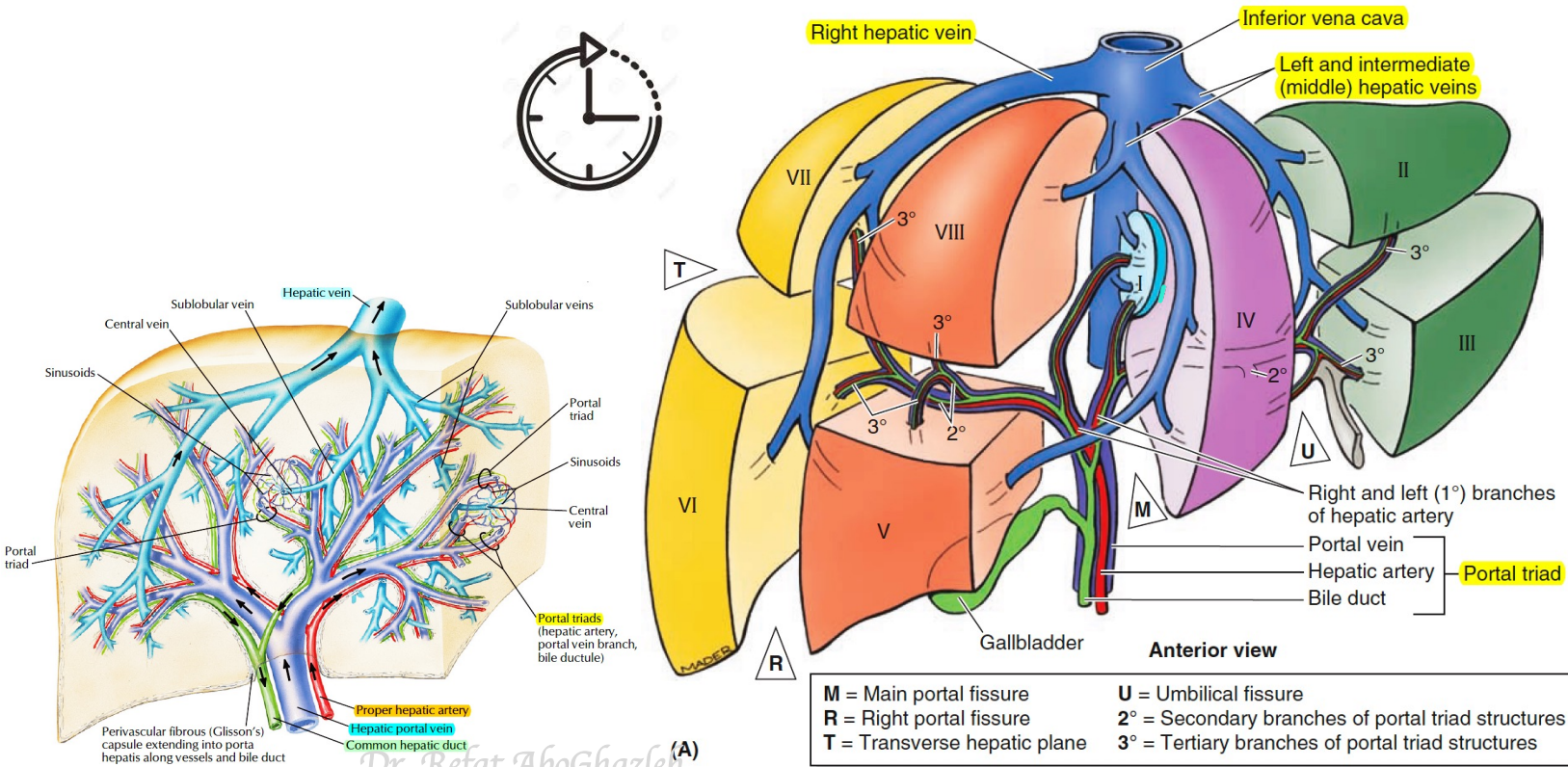
hepatic artery proper runs to the left of the bile duct and anterior to the portal vein, and divides into the **right** and **left hepatic arteries** near the porta hepatis.





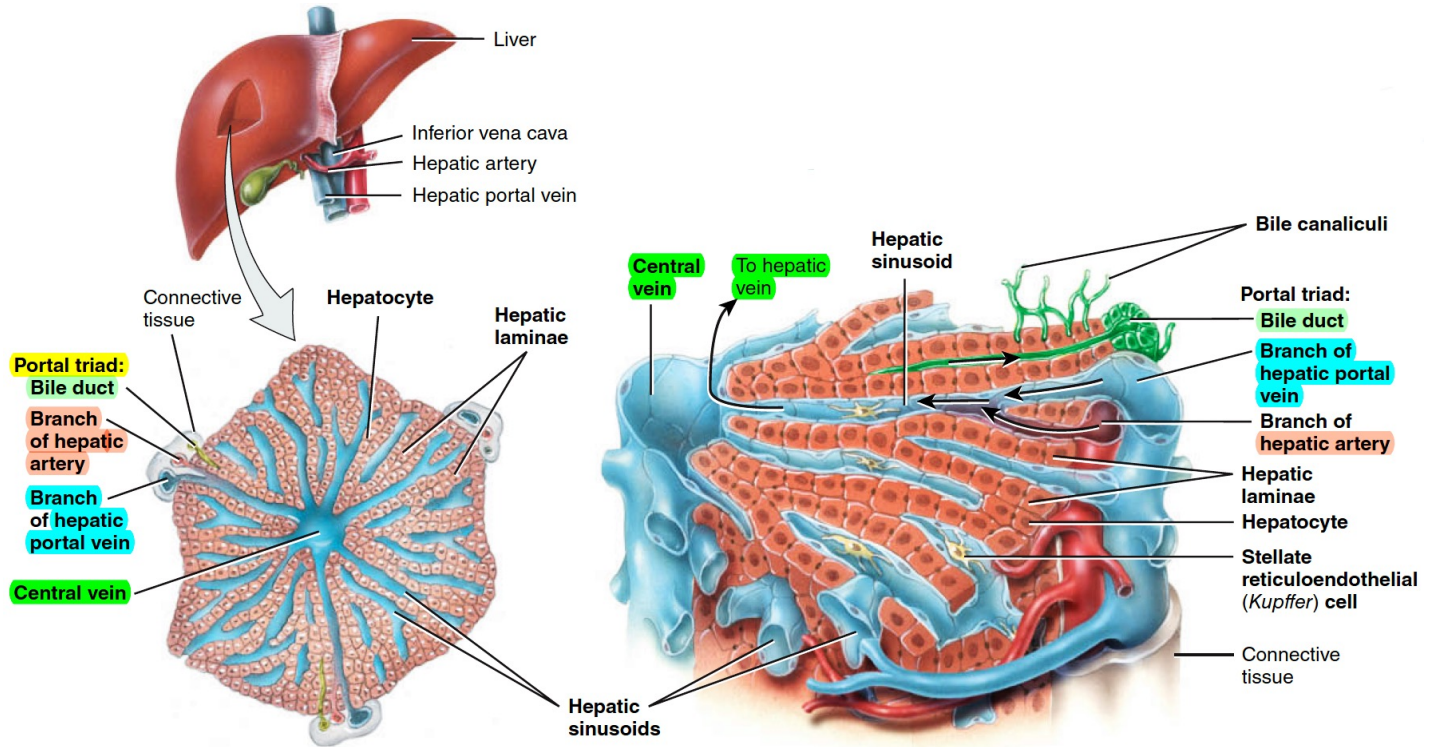
Vein Drainage of the Liver

- The **portal vein** divides into **right** and **left** terminal branches that enter the porta hepatis **behind the arteries**.
- The **hepatic veins** (three or more) emerge from the posterior surface of the liver and drain into the **inferior vena cava**.



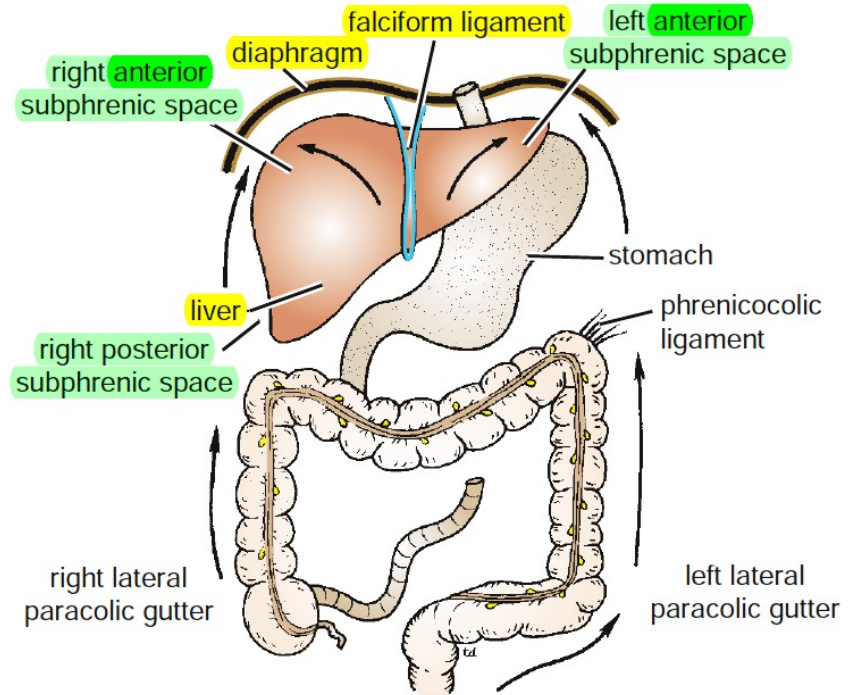
Liver Histology

- Lobules >> roughly hexagonal structures consisting of hepatocytes. Radiate outward from a **central vein**.
- At each of the six corners of a lobule is a **portal triad** (branches of hepatic artery, portal venule & tributary of bile duct).
- Between the hepatocytes are the liver sinusoids.



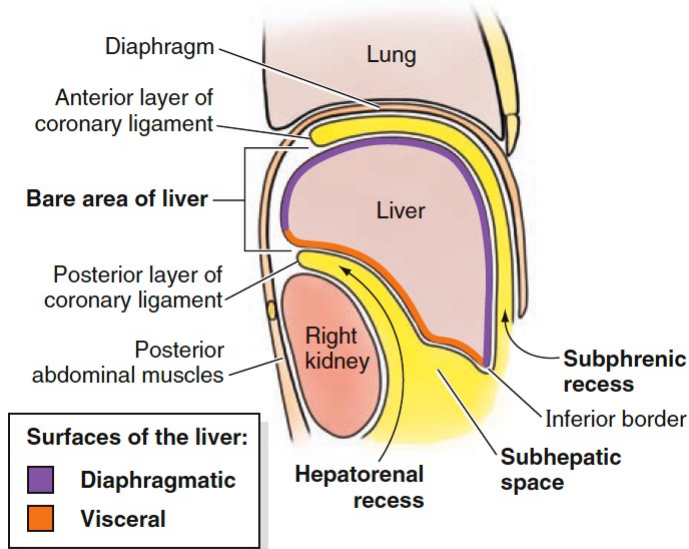
Subphrenic Spaces

The **right & left anterior subphrenic spaces** lie between the anterior and superior aspects of diaphragm and the liver, on each side of the **falciform ligament**.

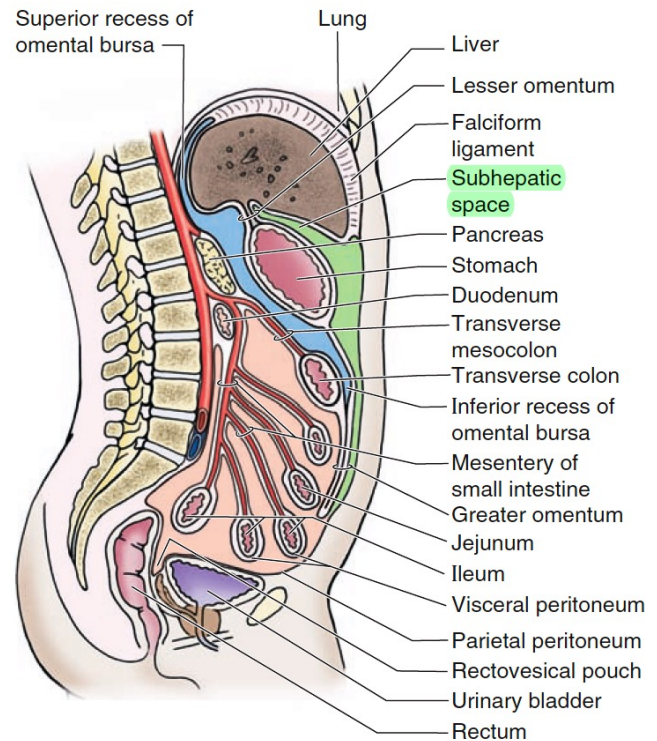


Arrows show normal direction of flow of the peritoneal fluid from different parts of the peritoneal cavity to the subphrenic spaces.

The **subphrenic spaces** and the **paracolic gutters** are **clinically important** because they may be sites for the **collection and movement of infected peritoneal fluid** (e.g. In case of **Perforation of a duodenal ulcer, rupture of the gallbladder, or perforation of the appendix**).



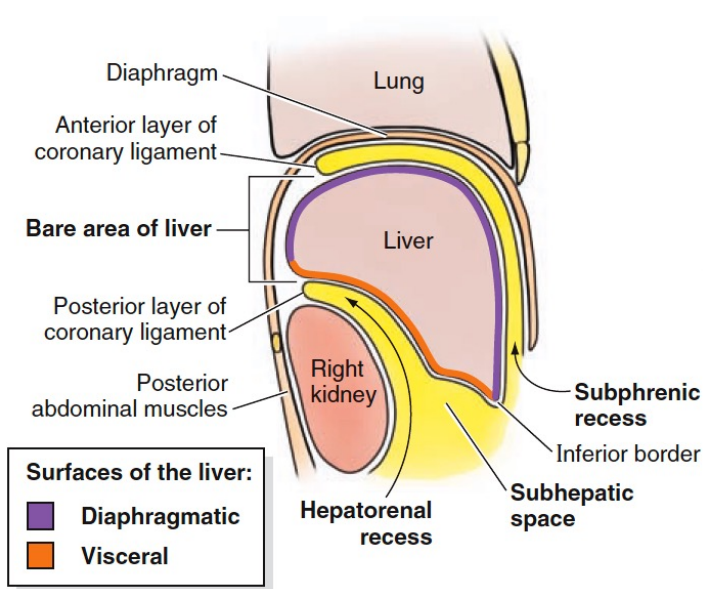
Right lateral view - schematic sagittal section



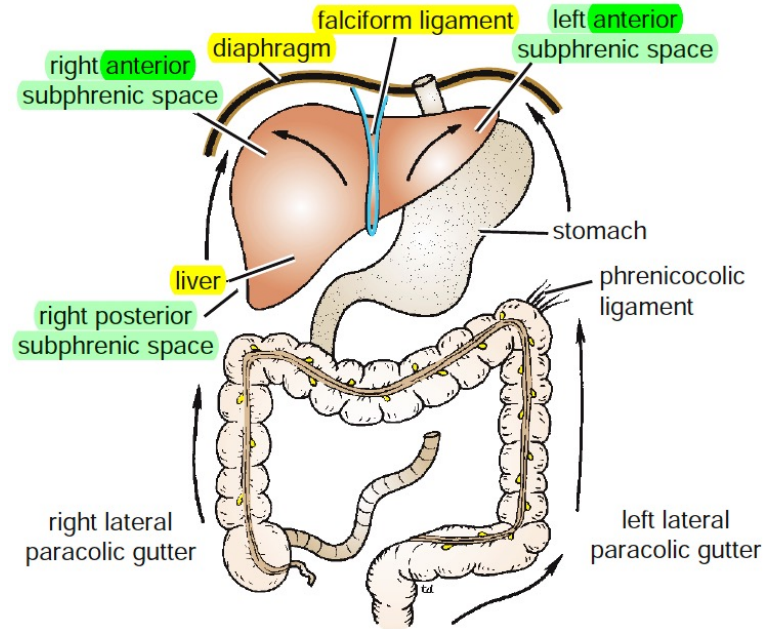
(A) Right lateral view

The portion of the **supracolic compartment** of the peritoneal cavity immediately inferior to the liver is the **subhepatic space**.

Hepatorenal recess (right posterior subphrenic space)



Right lateral view - schematic sagittal section



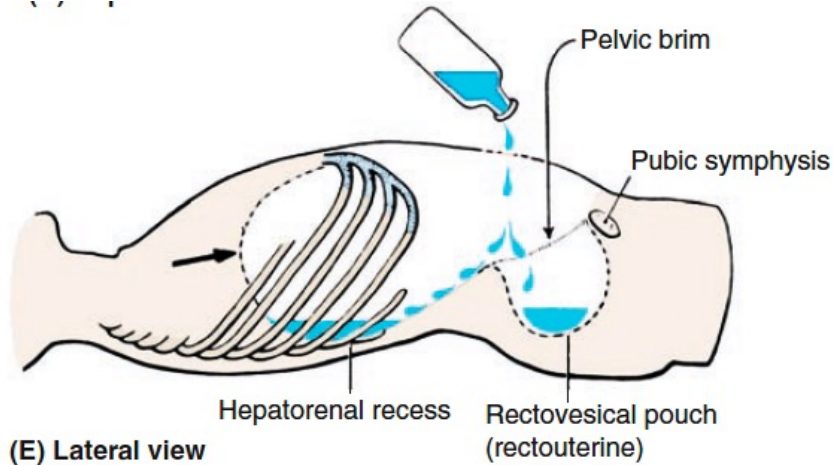
- The **hepatorenal recess** (hepatorenal pouch; Morison pouch) is the **posterosuperior extension** of the subhepatic space, **lying between the right part of the visceral surface of the liver and the right kidney and suprarenal gland.**
- Fluid draining from the **omental bursa** flows into this recess.
- The **hepatorenal recess** communicates anteriorly with the **right subphrenic recess.**

Subphrenic Abscesses

A common site for **pus** to collect is in the **right or left subphrenic recess or space**.

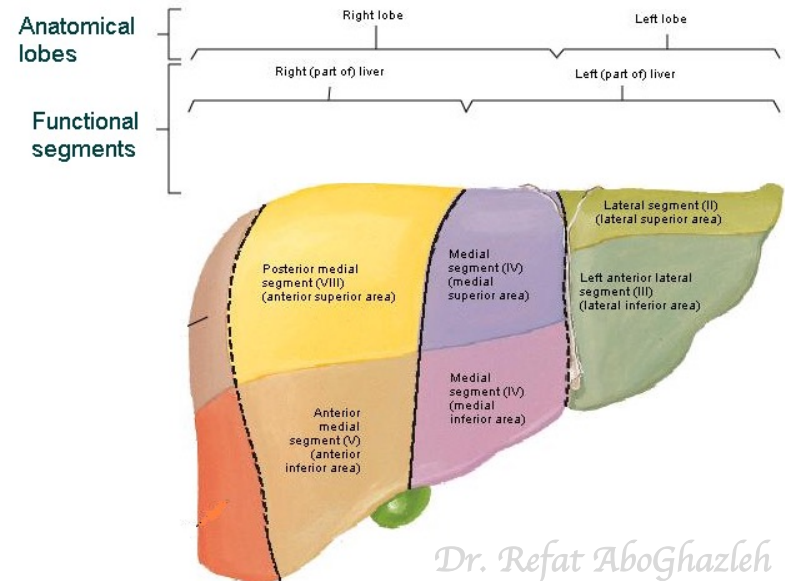
Subphrenic abscesses are more common on the **right side** because of the frequency of ruptured appendices and perforated duodenal ulcers.

Pus from a **subphrenic abscess** may drain into one of the **hepatorenal recesses**, especially when patients are bedridden.



Hepatic (Surgical) Segments of Liver.

- **Rt. & Lt. lobes anatomically** have no morphological significance, and they are Separated (externally) by ligaments (**Falciform lig**, **lig. Venosum**, & **Lig. teres**)
- True morphological and physiological division by a line extend from **fossa of gallbladder** to **fossa of IVC**
each has its own arterial blood supply, venous drainage and biliary drainage.
- No anastomosis between divisions.
- **3 major hepatic veins** → Rt, Lt, & middle.

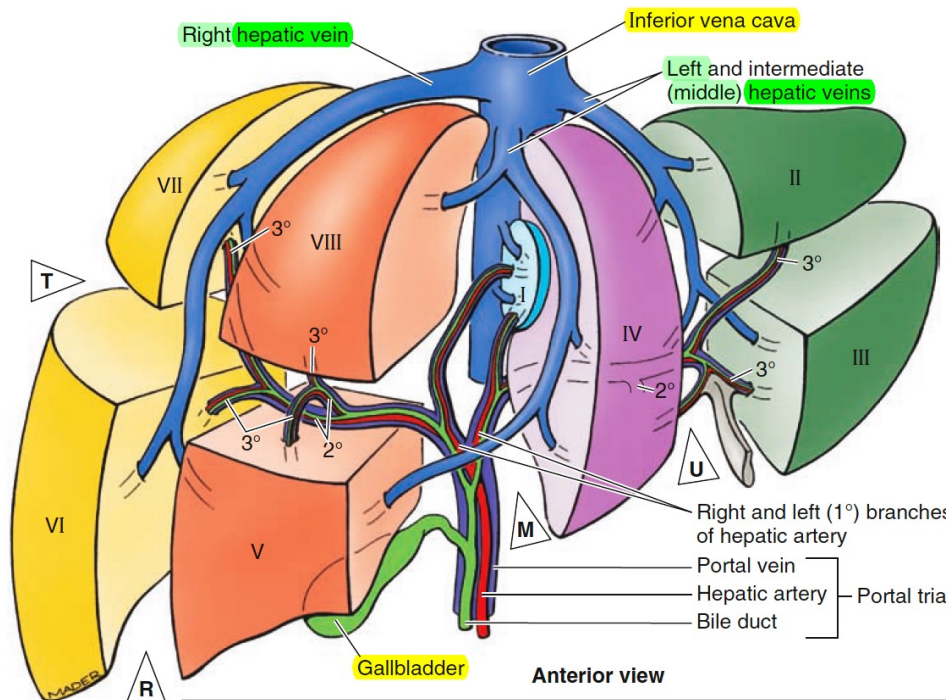


Clinically, segment-anatomy of the liver is important, especially with regard to liver resection for **metastatic disease**.

- The liver is divided by the **principal plane** which divides the organ into halves of approximately equal size.
- This imaginary line (**Cantlie line**) passes through the **gallbladder fossa** to the **inferior vena cava**.

✓ In this plane, middle hepatic vein is found!!

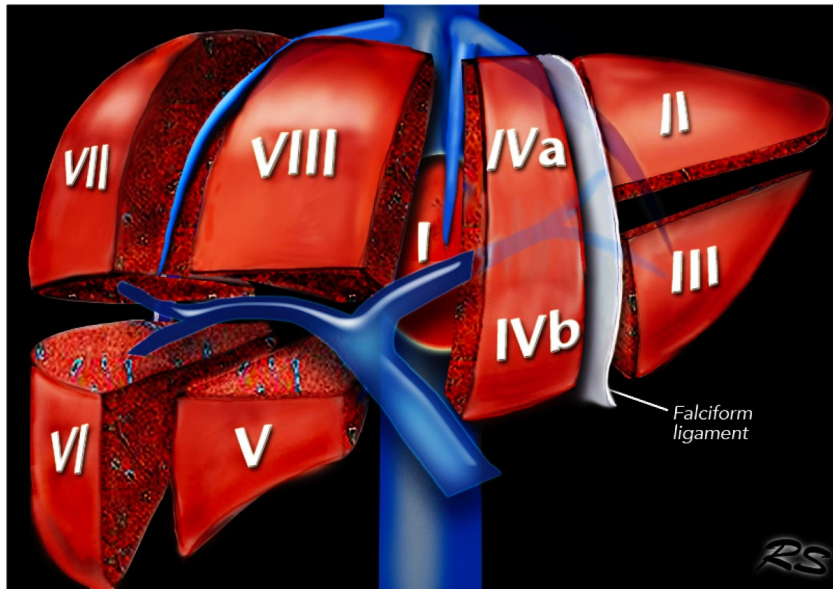
The traditional eight segments of the liver are related to the hepatic arterial, portal, and biliary drainage of these segments.



Surgical Segments of Liver, Cont.

The **caudate lobe** is defined as **segment I**, and the remaining segments are numbered in a **clockwise fashion** up to **segment VIII**.

From a **surgical perspective**, a **right hepatectomy** would involve division of the liver in the principal plane in which **segments V, VI, VII, and VIII** would be removed, leaving segments I, II, III, and IV.

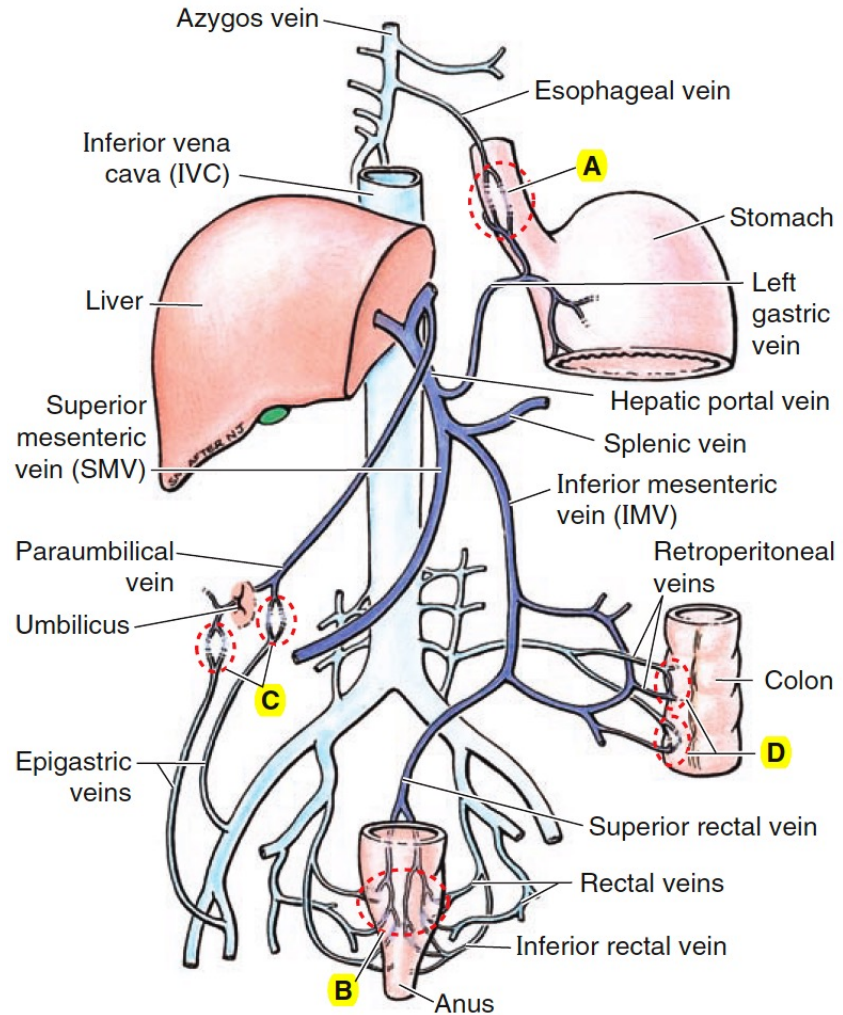


Portal-Systemic (Portacaval) Anastomoses

- It is a specific type of anastomosis that occurs between the **veins of portal circulation** and those of **systemic circulation**.
- In **portal hypertension**, these the anastomosis open and form venous dilatation called **varices**.

Sites of Anastomoses:

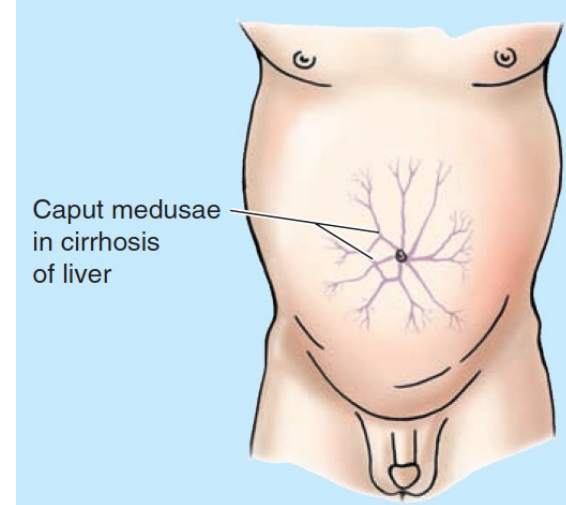
- A. Esophagus
- B. Anal canal
- C. Paraumbilical region
- D. Retroperitoneal
- E. Intrahepatic (Patent ductus venosus)



Caput medusae

In severe cases of portal obstruction, the **veins of the anterior abdominal wall** (normally **caval tributaries**) that anastomose with the **paraumbilical veins** (normally **portal tributaries**) may become **varicose** and look somewhat like small snakes radiating under the skin around the umbilicus.

This condition is referred to as **caput medusae**, a character in Greek mythology.



Lymphatic Drainage

- The liver produces a large amount of lymph—about 1/3 to 1/2 of all body lymph.
- The lymph vessels leave the liver and enter several lymph nodes in the porta hepatis.
- The efferent vessels pass to the **celiac nodes**.
- A few vessels pass from the bare area of the liver through the diaphragm to the **posterior mediastinal lymph nodes**.

Nerve Supply

- Sympathetic and parasympathetic nerves from the **celiac plexus**.
- The **anterior vagal trunk** gives rise to a large **hepatic branch**, which passes directly to the **liver**.

Thank You



YouTube

References

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