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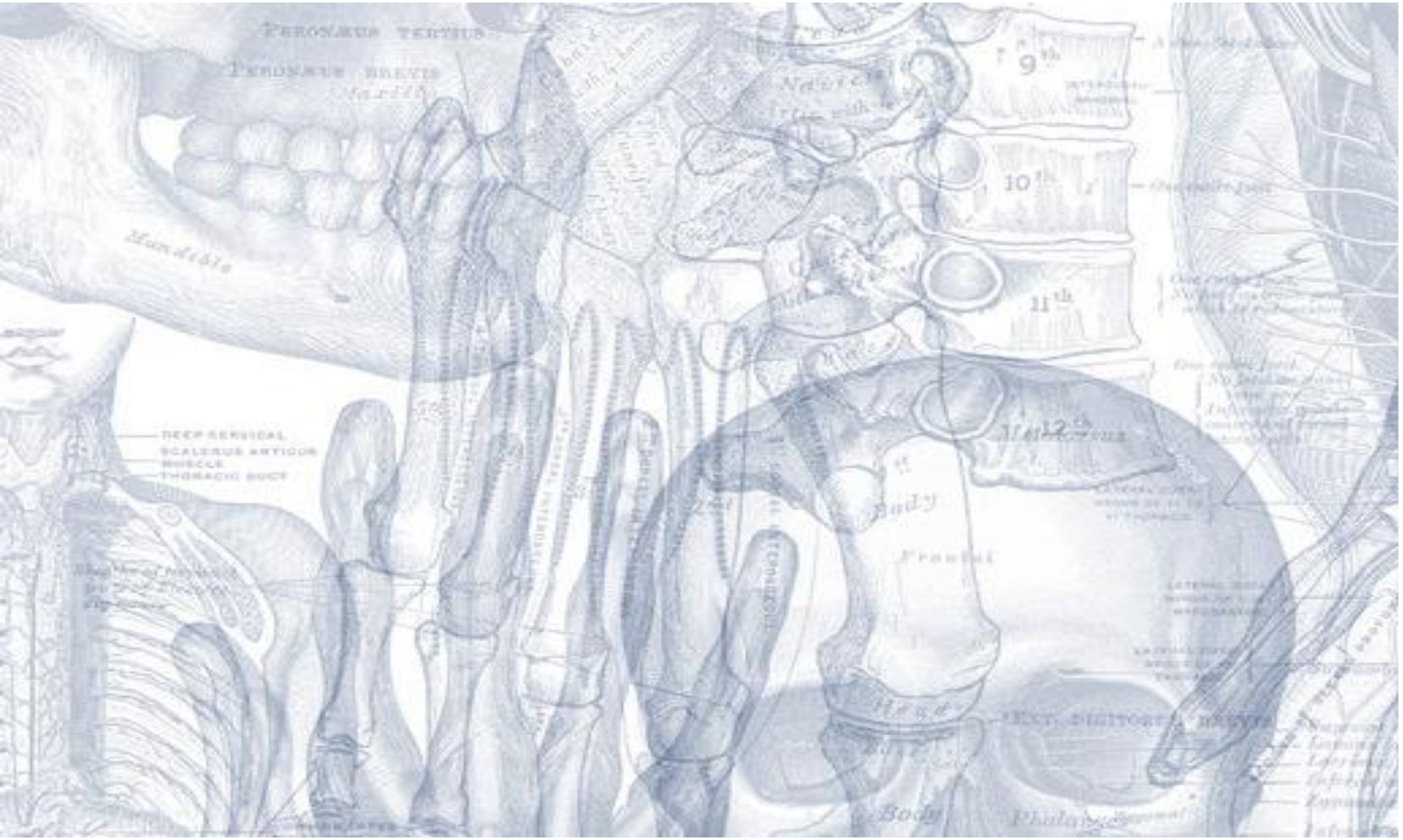


ANATOMY
TEAM 436

436
MEDICINE
KING SAUD UNIVERSITY

تمت المراجعة
شوق الأحمري & عبدالعزيز العنقري

Anatomy of Liver and Spleen

Please view our Editing File before studying this lecture to check for any changes.

Color Code

- **Important**
- **Doctors Notes**
- **Notes/Extra explanation**

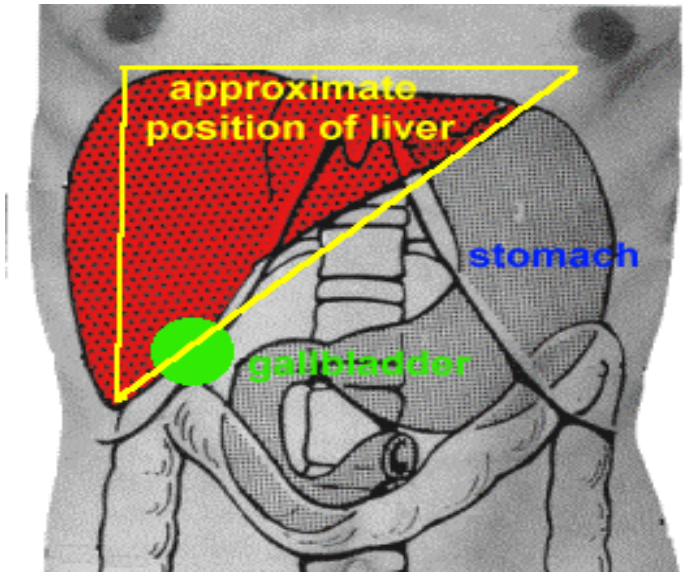
Objectives

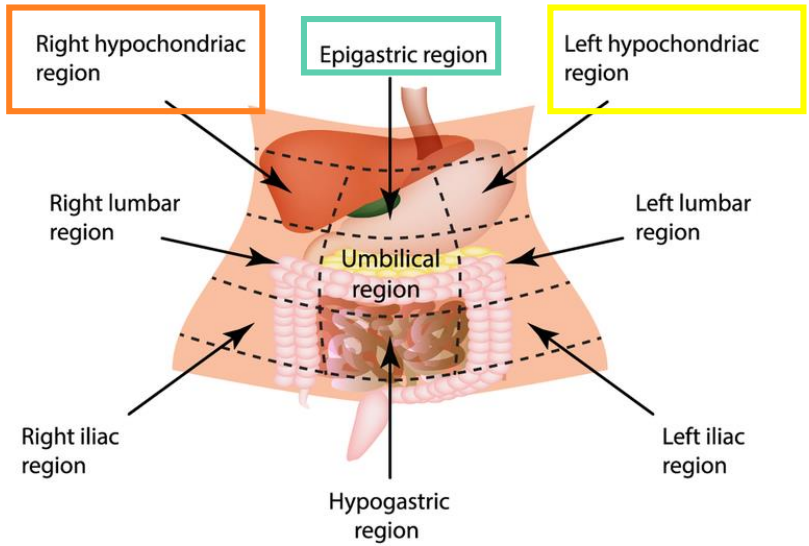
At the end of the lecture, the students should be able to:

- ✓ Location, subdivisions ,relations and peritoneal reflection of **liver**.
- ✓ Blood supply, nerve supply and lymphatic drainage of **liver**.
- ✓ Location, subdivisions and relations and peritoneal reflection of **spleen.**
- ✓ Blood supply, nerve supply and lymphatic drainage of **spleen.**

Liver

- The **largest gland** in the body.
- Weighs approximately 1500 g (approximately 2.5% of adult body weight).
- Lies mainly in the **right hypochondrium** and **epigastrium** and extends into the **left hypochondrium**.
- Protected by the thoracic cage and diaphragm, its greater part lies deep to **ribs 7-11** on the right side and crosses the midline toward the left below the nipple.
- Moves with the diaphragm and is located more inferiorly when on is erect (standing) because of gravity.





Liver
Relations

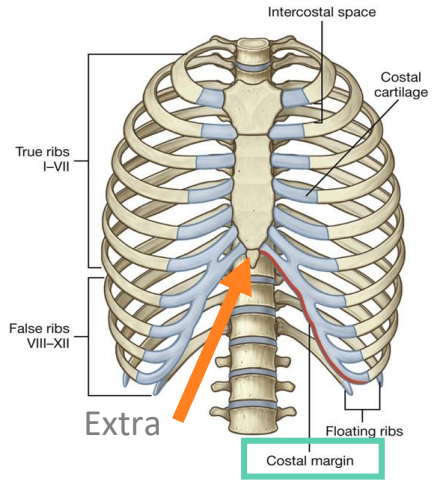
10:07

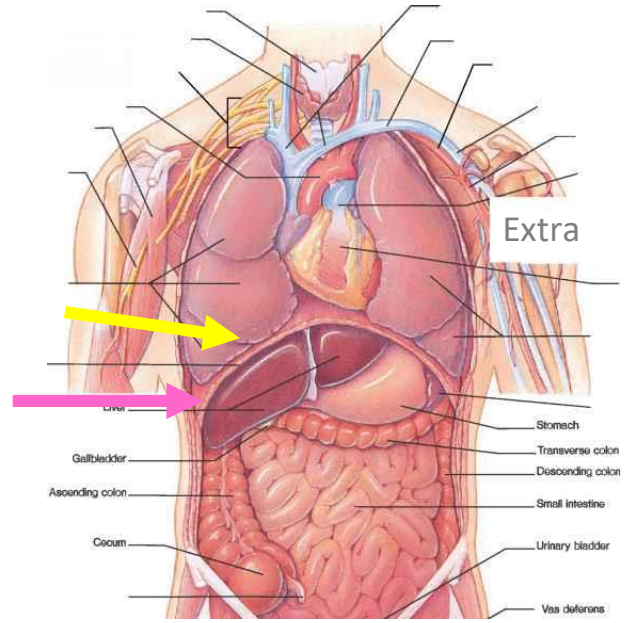
Anterior:

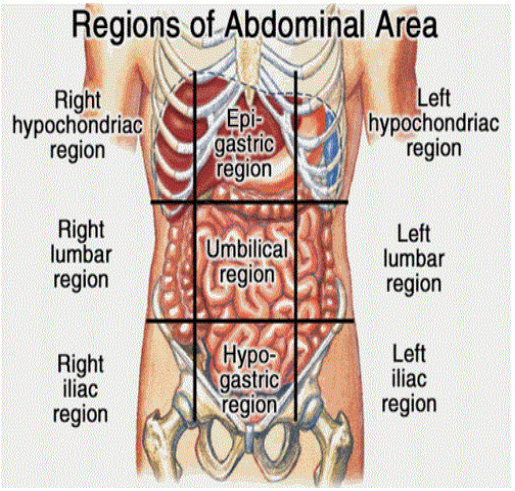
- Diaphragm
- Right & left pleura and lower margins of both lungs
- Right and left costal margins
- Xiphoid process
- Anterior abdominal wall in the subcostal angle

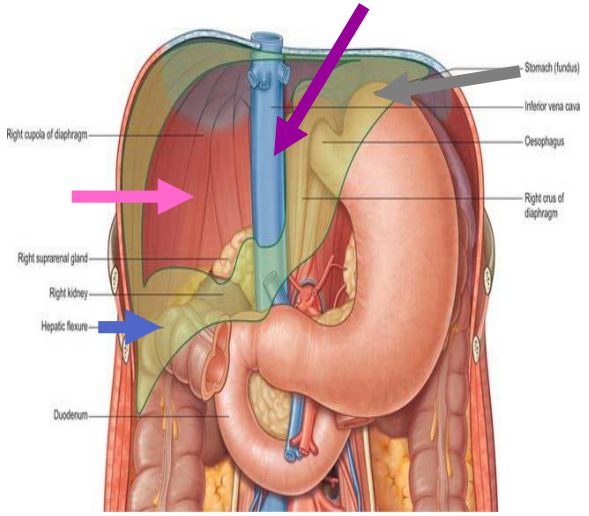
Posterior:

- Diaphragm
- Inferior vena cava
- Right kidney and right suprarenal gland
- Hepatic flexure of the colon
- Duodenum (beginning), gallbladder, esophagus and fundus of the stomach









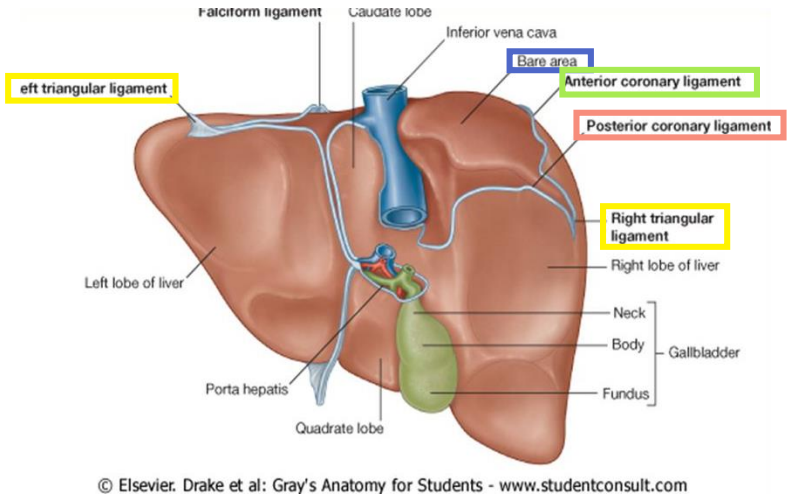
Liver

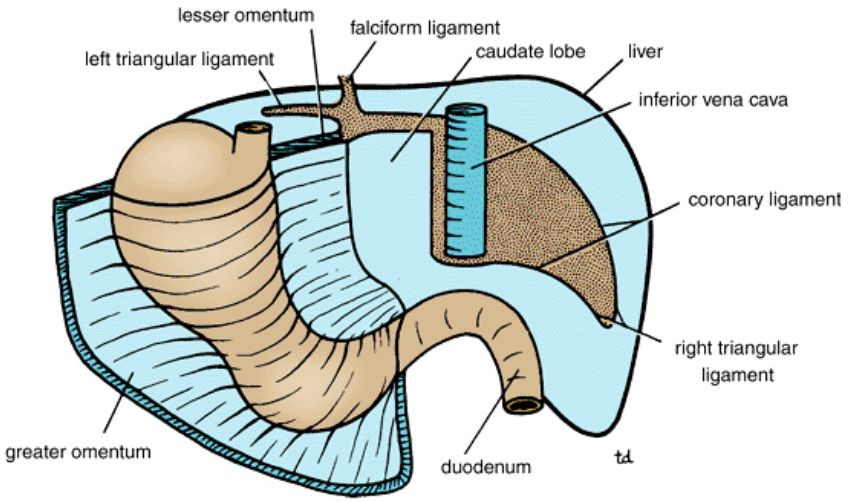
Peritoneal Reflection

- The liver is completely surrounded by a fibrous capsule and completely covered by peritoneum (except the bare areas).
- The **bare area** of the liver is a triangular area on the posterior (diaphragmatic) surface of right lobe where there is no intervening peritoneum between the liver and the diaphragm.
- Boundaries of Bare area:
  - *Anterior*: superior (anterior) layer of **coronary** ligament.
  - *Posterior*: inferior (posterior) layer of **coronary** ligament.
  - *Laterally*: right and left **triangular** ligaments.
- Other bare areas include:

Porta hepatis, fossa for gall bladder, & grooves for IVC

Posterior surface of liver

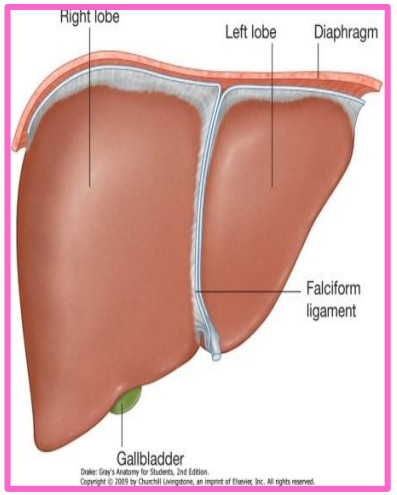


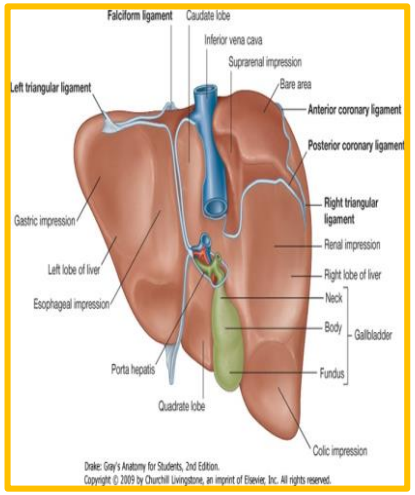


Liver
Surfaces

The liver has two surfaces:

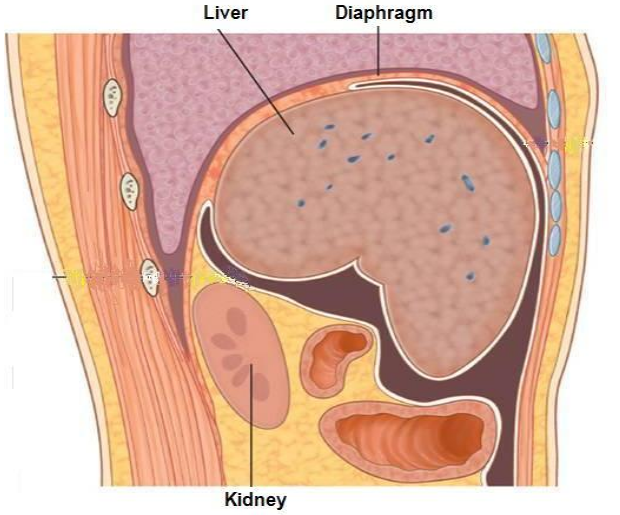
- A convex **diaphragmatic** surface (*Antero-superior*)
- A relatively flat or even concave **visceral** surface (*postero-inferior*)





Diaphragmatic Surface

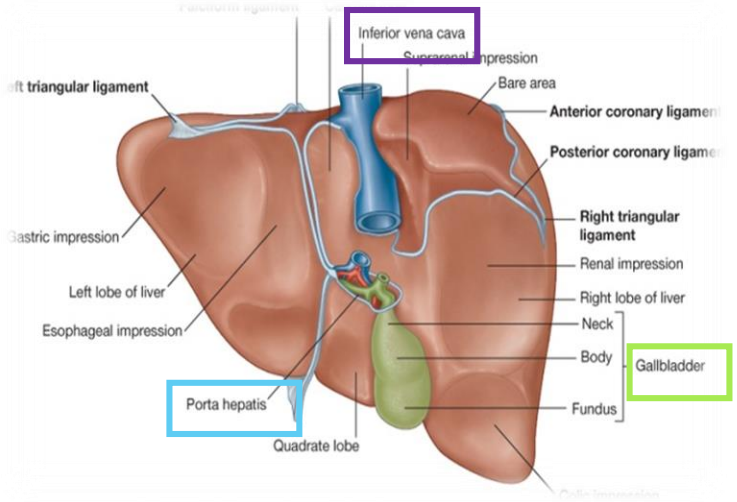
- The **convex** upper surface is smooth and molded to the undersurface of the domes of the diaphragm which separates it from the pleurae, lungs, pericardium, and heart.
- Covered with **visceral peritoneum**, **except posteriorly in the bare area of the liver**, where it lies in direct contact with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



Liver

Visceral Surface

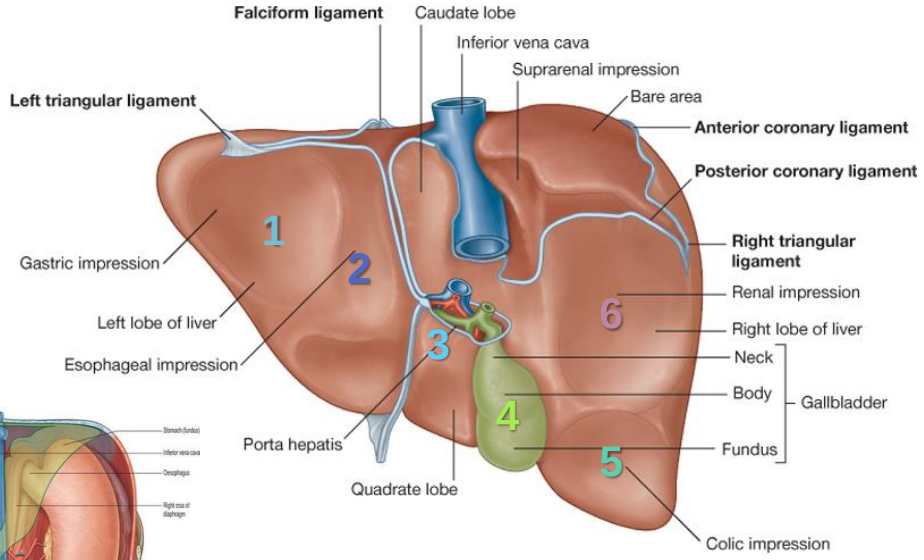
- It is the posteroinferior surface, related to abdominal viscera.
- It is covered with peritoneum, except at the fossa for the **gallbladder**, the **porta hepatis** and **IVC** groove.
- It bears multiple fissures and impressions for contact with other organs.

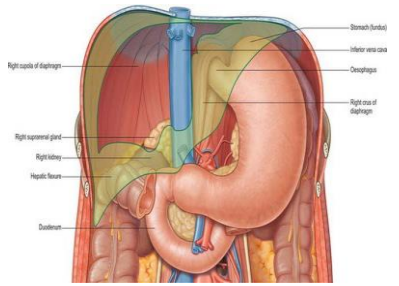


Relations of Visceral Surface of the Liver

The visceral surface is related to the:

1. stomach and duodenum
2. Esophagus
3. lesser omentum
   (along margin of porta hepatis)
4. gallbladder
5. right colic flexure
6. right kidney and right suprarenal gland





Liver
Ligaments

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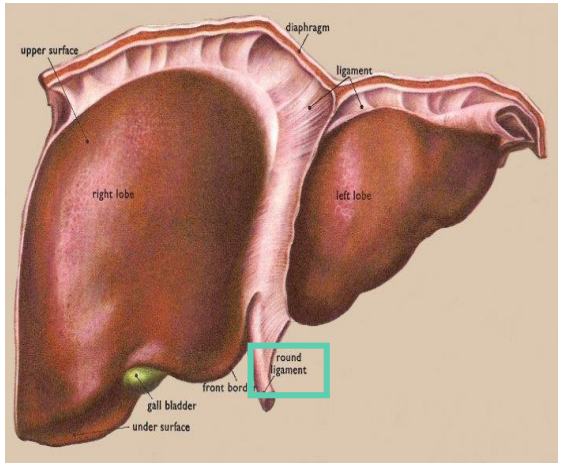
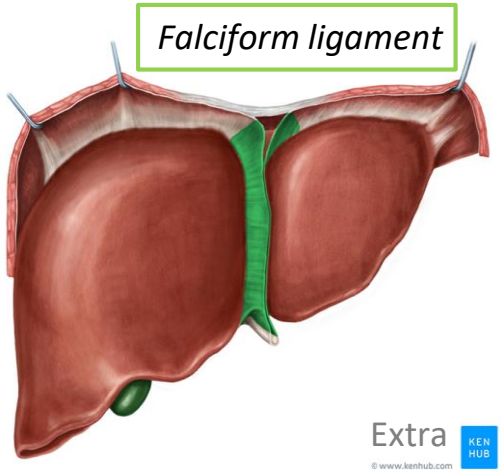
1. Falciform ligament

- It is a two-layered fold of the peritoneum, ascends from the umbilicus to the liver.
- **It connects the liver with the diaphragm and anterior abdominal wall & umblicus.**
- Its sickle-shaped free margin contains the **ligamentum teres** (round Ligament) of liver, the remains of the umbilical vein (oblitrated umbilical vein) , which carried oxygenated blood from the placenta to the fetus.

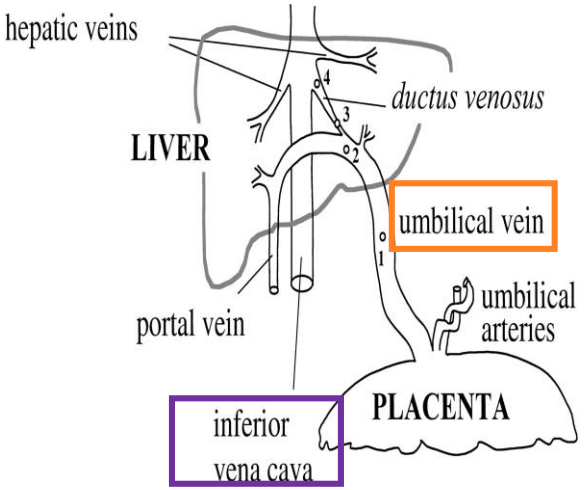


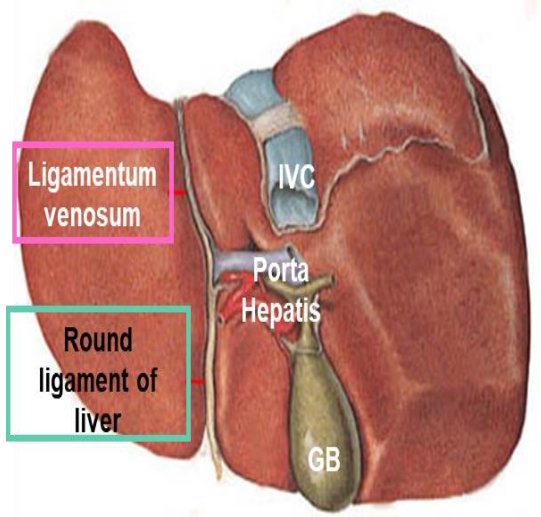


Extra

2. Ligamentum venosum

- It is the fibrous remnant of the fetal ductus venosus (oblitrated ductus venosus) , which shunted blood from the umbilical vein to the IVC, short circuiting the liver. في الجنين كان حلقة الوصل بينهم

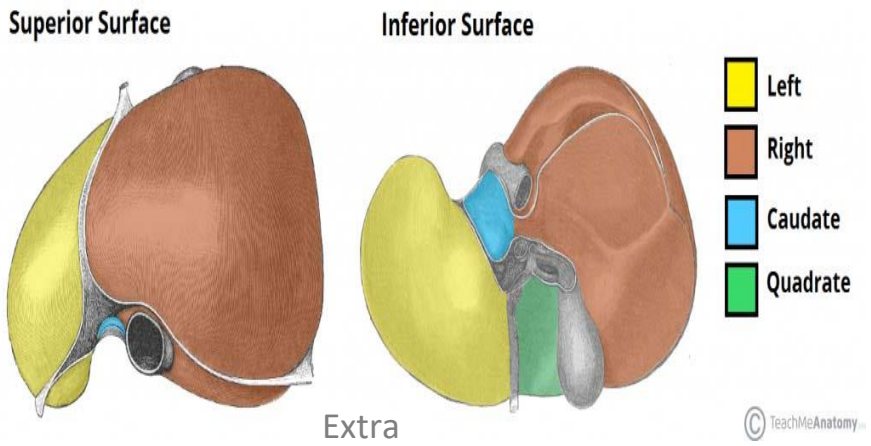


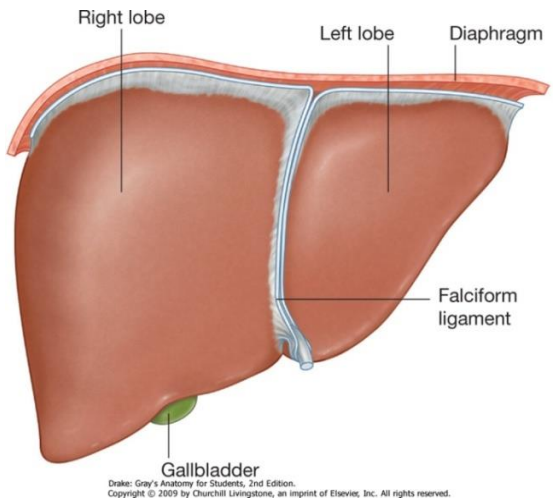


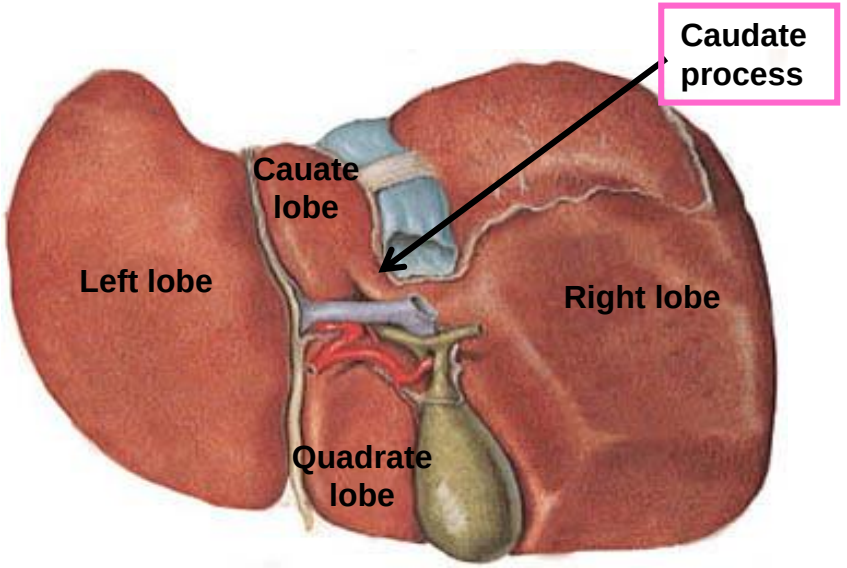
Liver
Lobes

- 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 (1) the **gallbladder**, (2) the fissure for the **ligamentum teres**, (3) the **inferior vena cava**, and (4) the fissure for the **ligamentum venosum**.
- The caudate lobe is *connected to the right lobe* by the **caudate process**.
- The **quadrate** and **caudate** lobes are a functional part of the **left** lobe of the liver.

The functional anatomy divides the liver into left and right lobes *based on their relation to the division of common hepatic duct, hepatic portal vein, and hepatic artery proper into right & left branches*, so the areas of the liver supplied by these branches constitute the functional left or right lobes. (*Only on the girls' slides*)

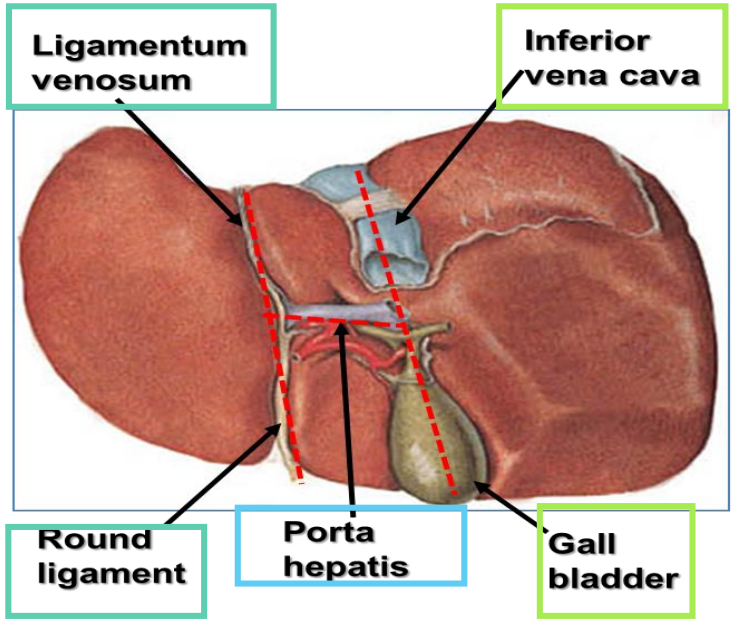






Fissures of The Liver

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



The Right Fissure , Formed :

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

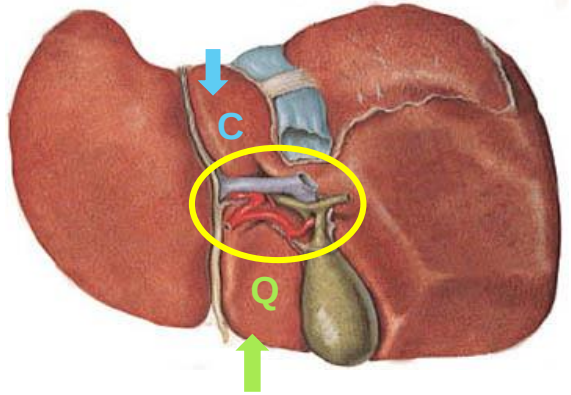
The Left Fissure , formed :

- Anteriorly: by the fissure for the **round ligament** (lig.teres*).
- Posteriorly : by the fissure for the **ligamentum venosum**.

*ligamentum teres

Porta Hepatis (Hilum of the Liver)

- A transverse fissure found on the posteroinferior surface and lies between the caudate and quadrate lobes.
- The upper part of the lesser omentum is attached to its margins.
- Structures passing through the porta hepatis include:
  - Right and left **hepatic ducts**.
  - Right and left branches of the **hepatic artery**
  - Right and left branches of the **portal vein**
  - Autonomic: Sympathetic and parasympathetic **nerve fibers**
  - A few **hepatic lymph nodes** lie here; they drain the liver and gallbladder and send their efferent vessels to the celiac lymph nodes.



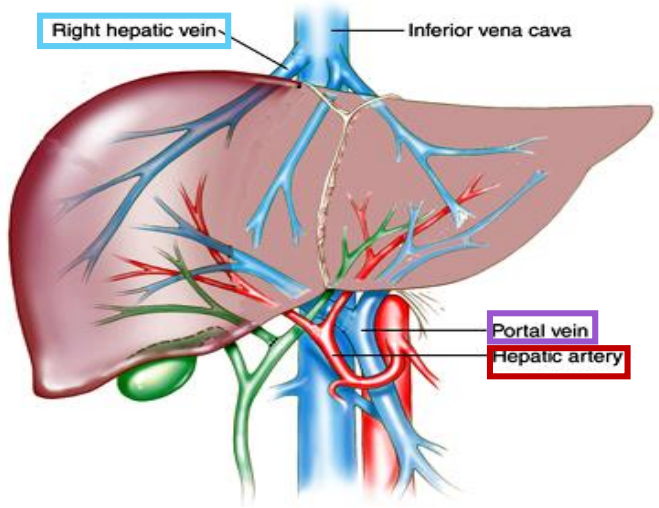
A useful mnemonic to help remember the order of structures in the porta hepatis from anterior to posterior is: DAVE

D: ducts (right and left hepatic duct branches)
A: arteries (right and left hepatic artery branches)
V: vein (portal vein)
E: epiploic foramen (of Winslow)

Liver
Blood Circulation

08:11

- The blood vessels conveying blood to the liver are the **hepatic artery** (30%) a branch of celiac trunk, and **portal vein** (70%).
- 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 to the liver.
- The *venous* blood is drained by **right** & **left hepatic veins** into the inferior vena cava



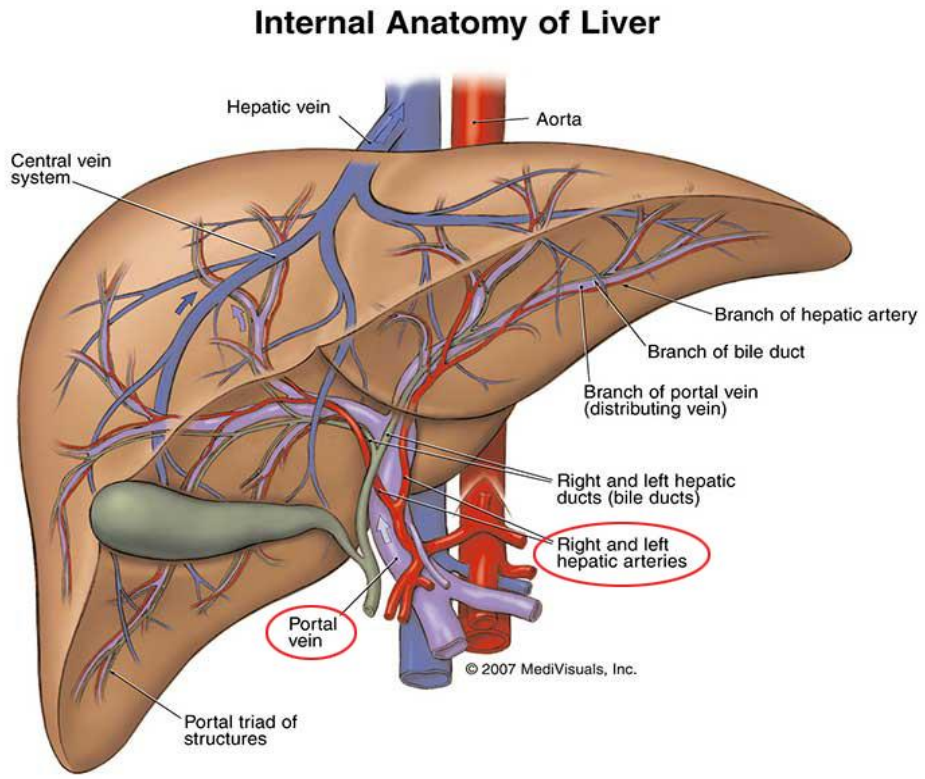
- The liver has dual blood supply: from the hepatic artery and portal vein.
- The venous drainage is into the hepatic vein.

Extra: the organs that are have dual supply are the liver, lungs, and liver.

Liver

Blood circulation

- At or close to the porta hepatis, the **hepatic artery** and **portal vein** terminate by *dividing into right and left* primary branches which supply the right and left parts of liver, respectively.
- Within the liver, the primary branches divide to give secondary and tertiary to supply the hepatic segments independently.
- The **hepatic veins**, are *intersegmental* in their distribution and function, draining parts of adjacent segments.
- **The attachment of these veins to the IVC helps hold the liver in position**. (The peritoneal ligaments and the tone of the abdominal muscles play a minor role in the support of liver).



The liver is held in its position by 3 things:

1. **Hepatic veins → main**!
2. Peritoneal ligaments
3. Abdominal muscles

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Liver

Supply

Lymph Drainage

- The liver produces a large amount of lymph—about one third to one half 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** mainly.
- A few vessels pass from the bare area of the liver through the diaphragm to the **posterior mediastinal lymph nodes**.

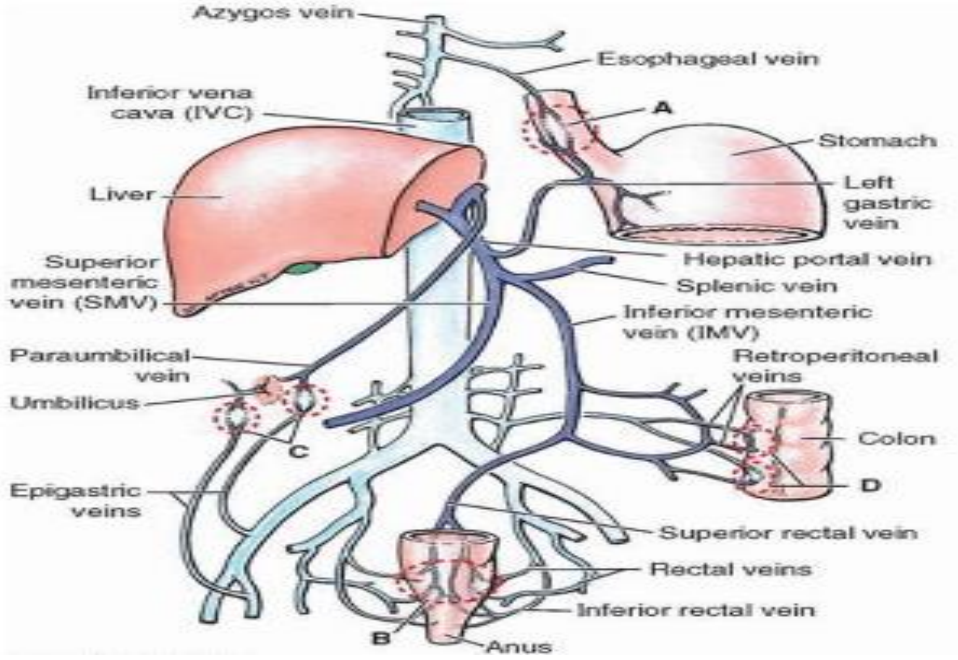
Nerve supply

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

Liver

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 hypertion, these anastomosis open and form venous dilatation called varices (الدوالي).
- Sites:
  A. **Esophagus (lower** third **part).**
  B. **Upper Anal canal** (immediately under rectum)**.**
  C. Paraumbilical region.
  D. Retroperitoneal.
  E. Intrahepatic (Patent ductus venosus) = rare.

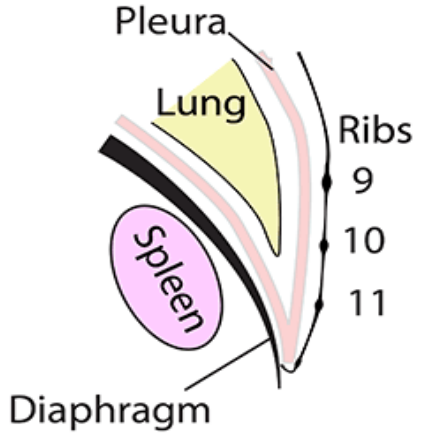


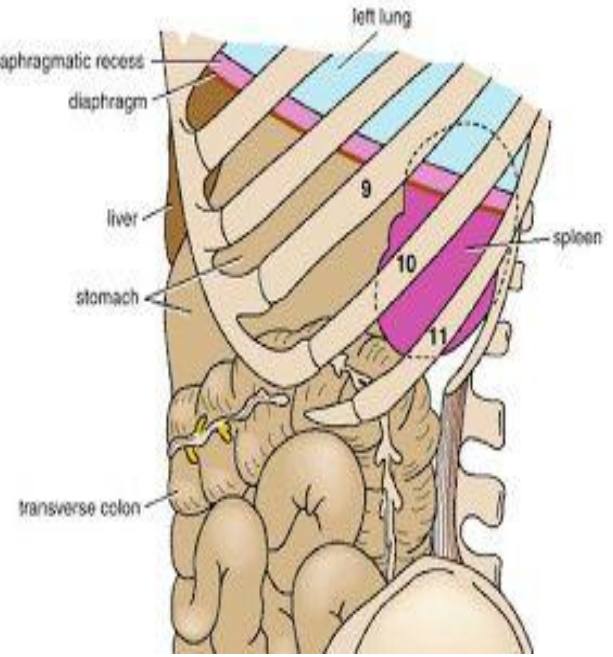
In portal hypertension (as from cirrhosis or hepatitis) the anastomosis areas dilate causing variant effects depending on the site, for example:

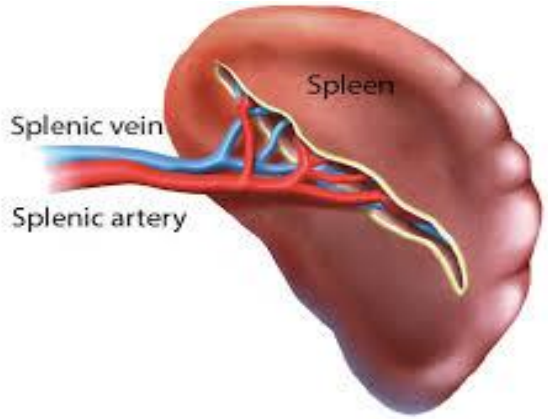
- Esophageal → causes esophageal varices and hematemesis (vomiting blood)
- Paraumbilical → causes caput medusa
- Upper anal canal → cause hemorrhoids (البواسير) when the dilation burst and bleed.

Spleen

- Largest single mass of **lymphoid tissue**
- **Located in** the left hypochondrium, **deep to 9, 10 & 11 ribs.** مهمة
- **Its Long axis lies** along **10th rib.**
- It is **separated from the ribs** by the **diaphragm** and the **costodiaphragmatic recess**(space in pleural cavity).
- Ovoid in shape with notched anterior border, while posterior border is round
- **Lower pole** extends forward as far as the **midaxillary line.**
- **Normal size spleen can not** be **palpated** on clinical examination. **(A healthy spleen is not palpable).**





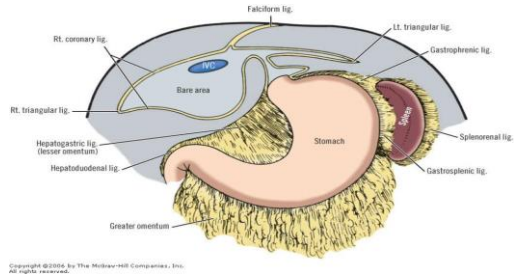


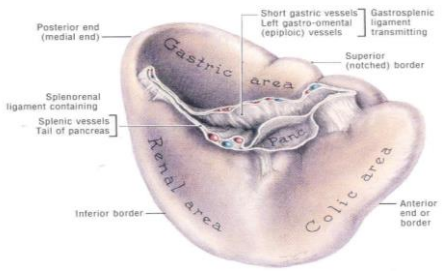
Spleen

14:28

Peritoneal Reflection / Ligaments

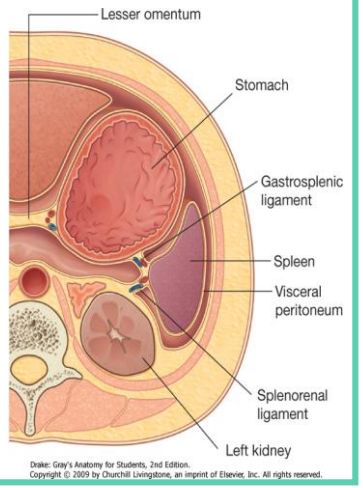
- Spleen is **completely** surrounded by **peritoneum**
- **EXCEPT** at the **hilum where its margins give attachement to** :
  - **Gastrosplenic ligament** to the **greater curvature** of **stomach** (carrying the short gastric and left gastroepiploic vessels)
  - **Lienorenal (splenorenal) ligament** to the **left kidney** (carrying the splenic vessels and the tail of pancreas).





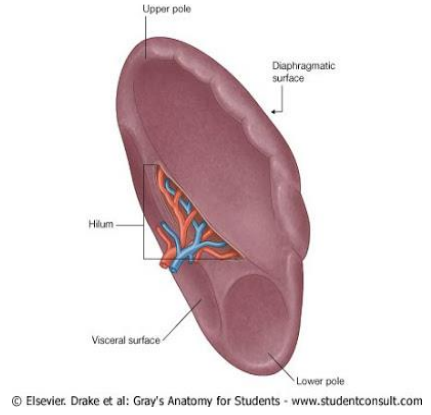
Surfaces:

- **Diaphragmatic surface:** is **convexly curved** to fit the concavity of the **diaphragm** and **curved** bodies of the adjacent **ribs**
- **Visceral surface**: related to viscera.



Borders:

- The **superior and anterior** borders are sharp.
- **Anterior** border is notched.
- The **posterior** (medial) and **inferior** borders are rounded.



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Spleen
Relations

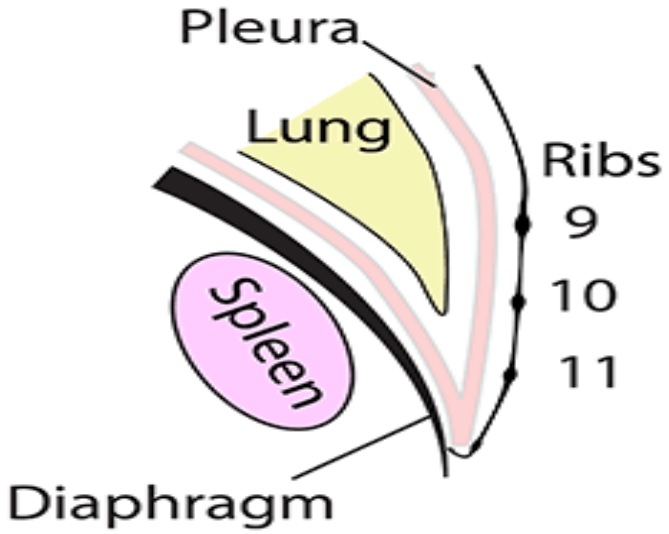
Note:
Left colic flexure = splenic flexure
Right colic flexure = hepatic flexure

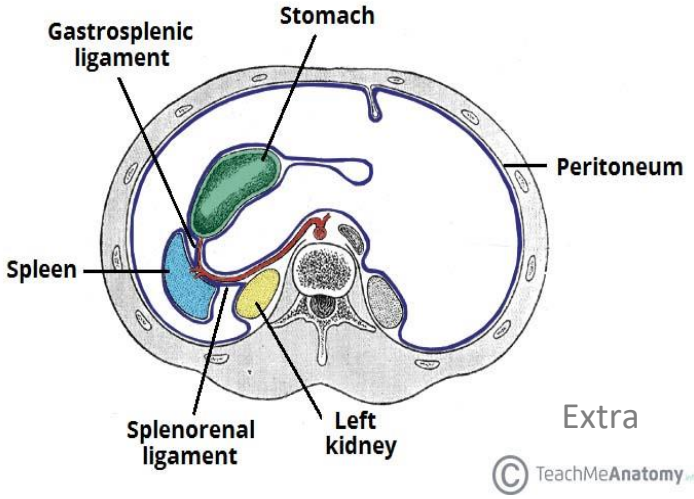
Anteriorly:
1. Stomach,
2. tail of pancreas,
3. left colic flexure &
4. left kidney

Posteriorly:
1. Diaphragm, that separates it from the left pleura (left costo-diaphragmatic recess),
2. left lung &
3. 9, 10 & 11 ribs.

Inferiorly:
1. Left colic flexure.

Medially:
1. Left kidney.





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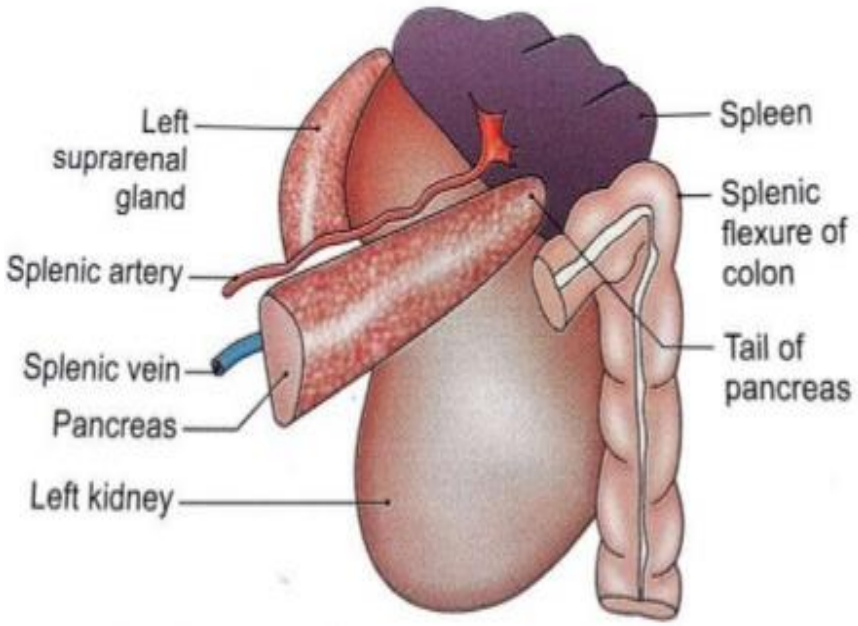
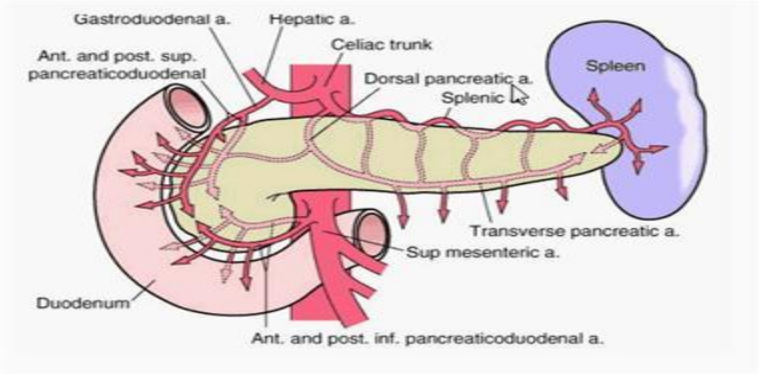
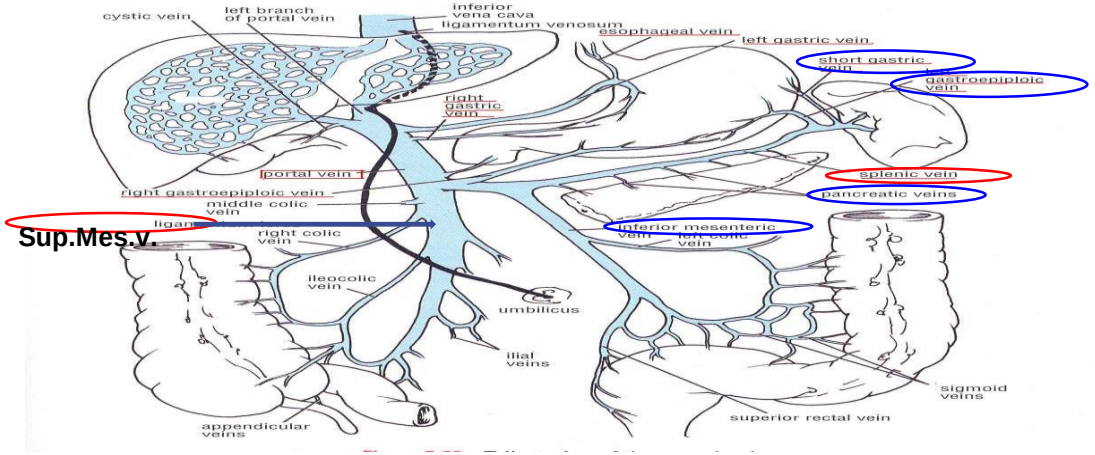


Spleen
Supply





- *Blood Supply :* **Splenic artery**
- Largest branch of the **celiac** artery
- Runs a **tortuous** (متعرج) **course*** along the upper border of the pancreas
- Passes within the lienorenal ligament
- Divides into 4-5 terminal branches, which enter the spleen at the hilus .
- The lack of anastomosis of these arterial vessels within the spleen results in the formation of vascular segments of the spleen with relatively avascular planes between them, enabling subtotal splenectomy**.

*Extra: there are 3 arteries that have tortuous course in the body: uterine, splenic and facial

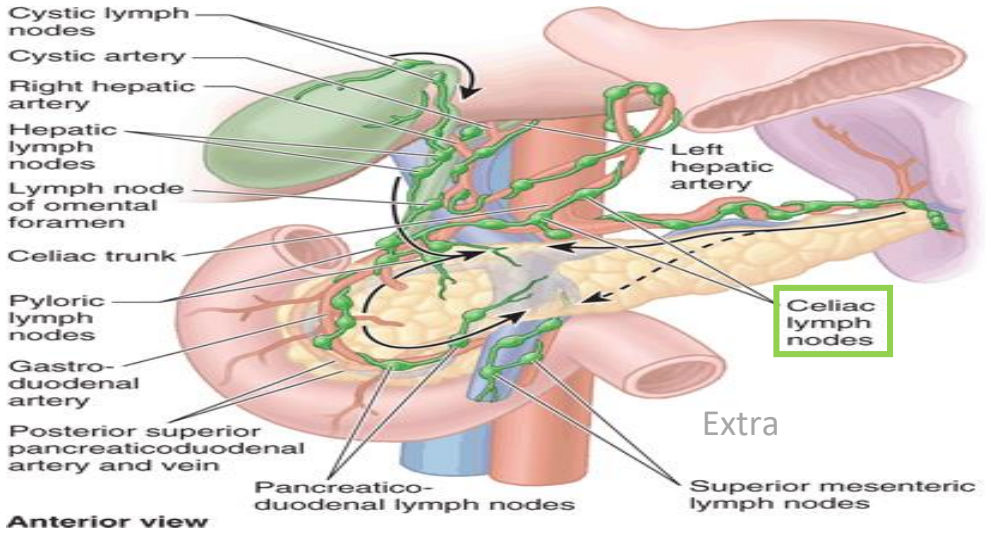
- *Venous Drainage:* **Splenic vein**
- Leaves the hilus
- Runs behind the tail & body of the pancreas
- **Reaches behind the neck of pancreas, where it joins the superior mesenteric vein to form the portal vein**
- Tributaries:
  1. Short gastric vein
  2. left gastroepiploic vein
  3. Pancreatic veins
  4. Inferior mesenteric vein

**كأنه في حددود بين كل قسم والثاني من حيث الشرايين فيسهل إزلة جزء لو احتاج الشخص لعملية

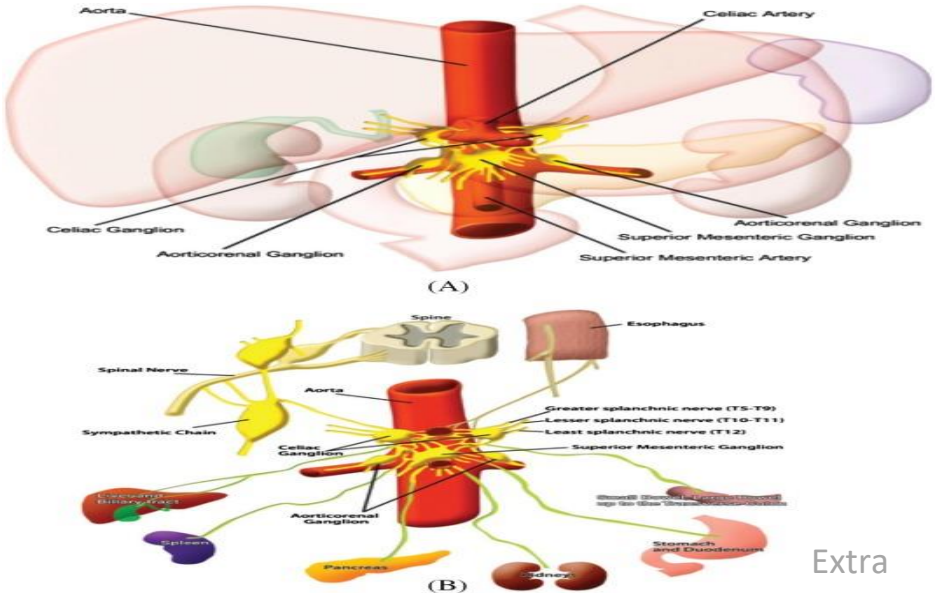
Spleen
Supply

- *Lymph Drainage*
- Lymphatics emerge from the hilus and drain into several nodes lying at the **hilum**
- Efferents from the hilar nodes pass along the course of splenic artery, and drain into the **celiac lymph nodes**

- *Nerve Supply*
- Derived from the **celiac plexus** (Innervation is purely **sympathetic**).
- Are distributed mainly along branches of the **splenic artery**, and are vasomotor in function.



Extra



Extra

SUMMARY

	Liver	Spleen
Location	Right & left hypochondrium and epigastrium	Left hypochondrium deep to 9&10&11ribs
Surfaces	• Convex diaphragmatic • Concave visceral	• Diaphragmatic(convex) • visceral
Borders	-	• Superior & anterior borders → sharp • Posterior & inferior → round
Blood supply	• Hepatic artery(carry oxygenated blood) • Portal vein (carry venous blood rich in nutrients) • R&L hepatic vein drain venous blood into IVC	Splenic artery & vein (splenic v joins superior mesenteric v to form portal v)
Nerve supply	• Sympathetic →celiac plexus • parasympathetic→ anterior vagal trunk	Purely **sympathetic** →celiac plexus
Lymphatic drainage	• Celiac nodes • Few vessels to posterior mediastinal lymph nodes	Celiac nodes

MCQ

1. Which one of the following play a major role in supporting of liver?
   A. Hepatic veins
   B. Hepatic artery
   C. Peritoneal ligament
   D. Tone of abdominal muscle

2. The main final lymphatic drainage of liver is :-
   A. Posterior mediastinal nodes
   B. Celiac nodes
   C. Superior mediastinal nodes
   D. Superior mesenteric nodes

3. The spleen is located in the left side deep to :-
   A. 7,8 and 9 ribs
   B. 10 rib
   C. 9,10 and 11 ribs
   D. None of above

4. The ligament that attached the hilum of spleen to the greet curvature of stomach :-
   A. Gastrosplenic ligament
   B. Lienorenal ligament
   C. Splenorenal ligament
   D. Gastrohepatic ligament

5. The left colic flexure is related to the spleen :-
   A. Anteriorly
   B. Posteriorly
   C. Medially
   D. Inferiorly

6. Which of the following artery has tortuous course :-
   A. Hepatic artery
   B. Splenic artery
   C. Superior mesenteric
   D. Inferior mesenteric

7. The portal vein is form by joining of :-
   A. Splenic vein and superior mesenteric artery
   B. Splenic vein and superior mesenteric vein
   C. Hepatic vein and superior mesenteric vein
   D. Superior and inferior mesenteric veins

Answers:

1: A, 2: B, 3: C, 4: A, 5: D, 6: B, 7: B

MCQ

8. The liver lies mainly in the :
   A. Right lumber region
   B. Left hypochondrium
   C. Right hypogastrium
   D. Right hypochondrium

9. Which of the following lies posterior to the liver :
   A. The body of the stomach
   B. The hepatic flexure
   C. The jejunum
   D. The splenic flexure

10. The lateral boundaries of the Bare area include :
   A. Superior triangular ligament
   B. Left coronary ligament
   C. Posterior triangular ligament
   D. Right triangular ligament

11. The convex upper surface of the liver is covered with visceral peritoneum except :
   A. Inferiorly in the fossa of the gallbladder
   B. Anteriorly in the IVC
   C. Superiorly in porta hepatis
   D. Posteriorly in bare area

12. Which of the following ligaments is a remain of the umbilical vein :
   A. Ligamentum venosum
   B. Ligamentum hepatis
   C. Ligamentum teres
   D. A&C

13. The functional part of the left lobe of the liver include :
   A. Caudate
   B. A&C
   C. Quadrate
   D. None of the above

Answers:

8: D, 9: B, 10: D, 11:D, 12: C, 13: B

SAQ

52 years old male , emigrated from Southeast Asia about 10 years ago, and has no specific complaints except fatigue. On examination you find little of note except that his liver edge is firm, is easily felt, and extends about 6 cm below the costal margin across much of the right upper quadrant.

1) What is the liver ?

- The largest gland in the body

2) where is it located ?

- Lies mainly in the right hypochondrium and epigastrium and extend into the left hypochondrium. Its gather part lies deep to 7- 11 right side ribs and crosses the midline toward the left nipple

3) what protects it ?

- It is protected by the thoracic cage and the diaphragm.

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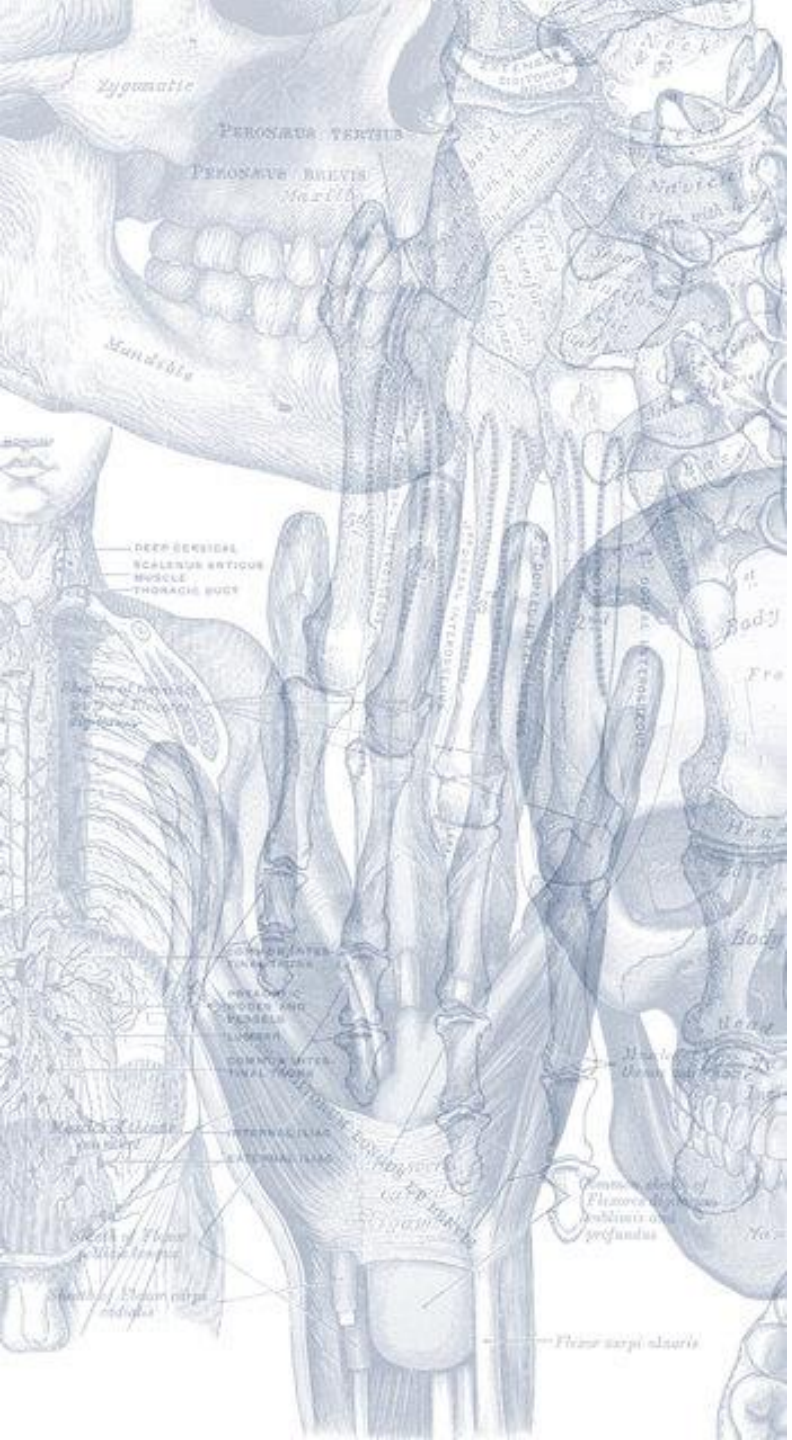
4) What is the site of portal-systemic anastomoses?

- Esophagus (lower part).
- Upper Anal canal.
- Paraumbilical region.
- Retroperitoneal.
- Intrahepatic (Patent ductus venosus).

5) What is the feature that enable subtotal splenectomy?

- Lack of arterial anastomoses



Leaders:

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Jawaher Abanumy

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Ashwaq Almajed

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Do'aa abdulfattah

Ghaida Alsaeed

Nada Aldakheel

Nourah Al Hogail

Nouf Aloqaili

Muneerah Alzayed

Sarah Alshamrani

Feedback

anatomyteam436@gmail.com

@anatomy436

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