



Anatomy Team
MED 439

Revised & Approved



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Liver & Spleen

GNT Block

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Don't forget to check the [Editing File](#)

Color index:

Content
Male slides
Female slides
Important
Doctors notes

Extra information, explanation

Objectives

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

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



DEFINITION

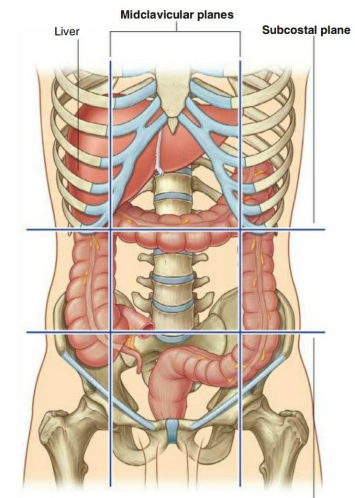
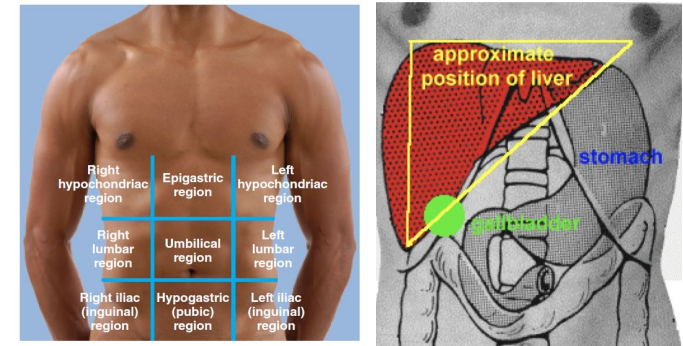
It is the largest gland in the body. It weighs approximately 1500g. (approximately 2.5% of adult body weight)

SURFACE ANATOMY

It occupies the whole right hypochondrium, a part of the epigastrium and a part of the left hypochondrium. Its lower border lies along the right costal margin and crosses the abdomen one hand breadth below the xiphoid process.

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.



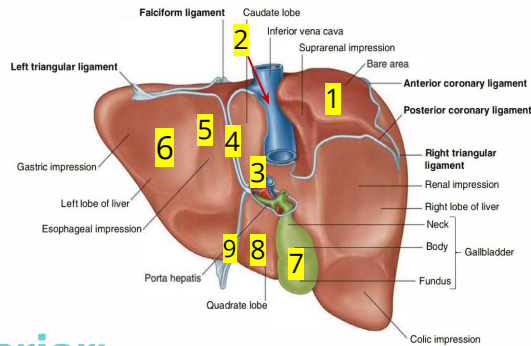
Relations of Liver (surfaces of the liver)

Posterior:

Related to diaphragm, right kidney, hepatic flexure of the colon, /duodenum, gallbladder, inferior vena cava, esophagus and fundus of the stomach.

The posterior formed of (from right to left):

- 1. Bare area:** triangular area related to diaphragm
- 2. Groove for IVC**
- 3. Caudate lobe:** related to diaphragm, projects downwards to form a process separating IVC from porta hepatis & forming upper boundary of epiploic foramen.
- 4. Fissure for ligamentum venosum** (obliterated ductus venosus)
- 5. Esophageal notch.**
- 6. Gastric impression:** related to fundus of stomach.



Anterior:

Diaphragm, right & left pleura and lower margins of both lungs, right and left costal margins, xiphoid process, and anterior abdominal wall in the subcostal angle. The diaphragm separates it from pleurae and lungs (below xiphoid process)

Superior:

related to diaphragm separating it from:

- pericardium & heart (in the middle)
- pleurae and lungs (on each side)



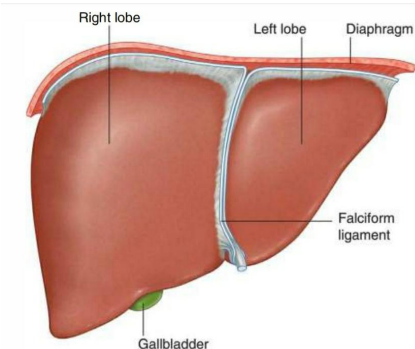
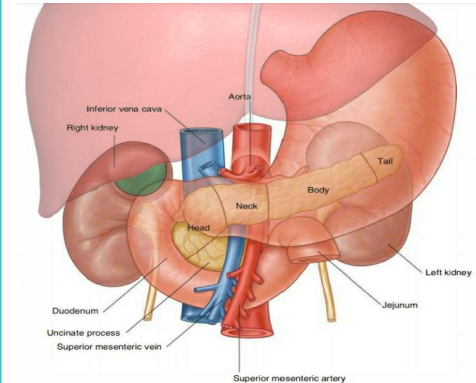
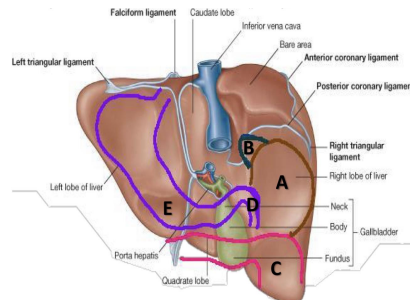
Inferior:

Formed of (from right to left):

- 7. Gallbladder fossa.**
- 8. Quadrate lobe:** related to pylorus, 1st part of duodenum & transverse colon.
- 9. Fissure for ligamentum teres** (obliterated left umbilical vein).

• Related to the following viscera:

- Right kidney.
- Right suprarenal gland.
- Right colic flexure.
- 2nd part of duodenum.
- Body of stomach.



Liver

Liver according its relations, the liver is divided into:

DIAPHRAGMATIC SURFACE (Convex)

includes superior, anterior & most of posterior 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.

VISCERAL SURFACE (Concave)

includes inferior & a part of posterior surface.
- It is the posteroinferior surface, related to abdominal viscera.

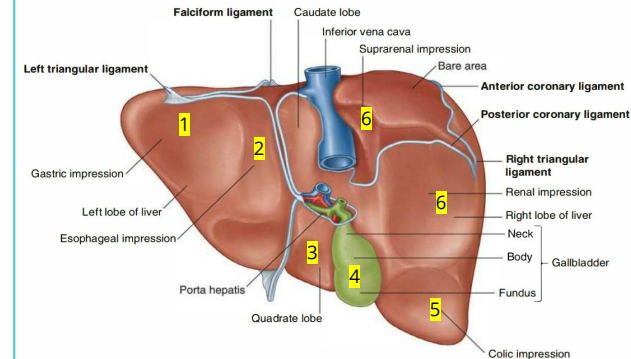
- It is covered with peritoneum, except at the fossa for the gallbladder, the porta hepatis and IVC groove.

- It bears multiple fissures and impressions for contact with other organs.

comes in OSPE

Relations of Visceral Surface of the Liver:

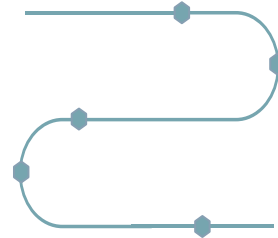
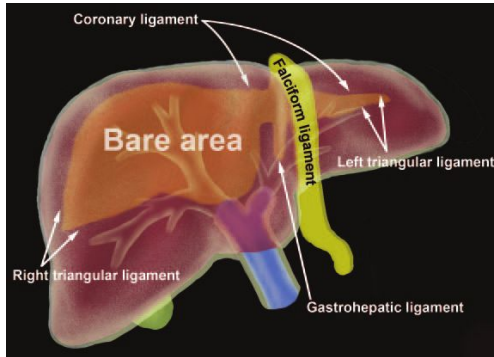
1. Stomach.
2. Esophagus
3. lesser omentum
4. gallbladder
5. right colic flexure
6. right kidney and right suprarenal gland.
7. Duodenum.



Peritoneal Reflection.

This slide was only found in female slides

The liver is surrounded by a fibrous capsule and completely covered by Peritoneum (except the bare areas).



of the liver is triangular area on the posterior surface of right lobe where there is no intervening peritoneum between the liver and the diaphragm.

Boundaries of Bare area:

Anterior:
superior layer of
coronary ligament.

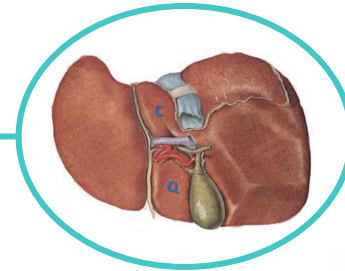
Posterior:
inferior layer of
coronary ligament

Laterally:
right and left triangular
ligaments.

Other bare areas include: porta hepatis; fossa for gallbladder & grooves for IVC.

Porta hepatis (HILUM OF THE LIVER):

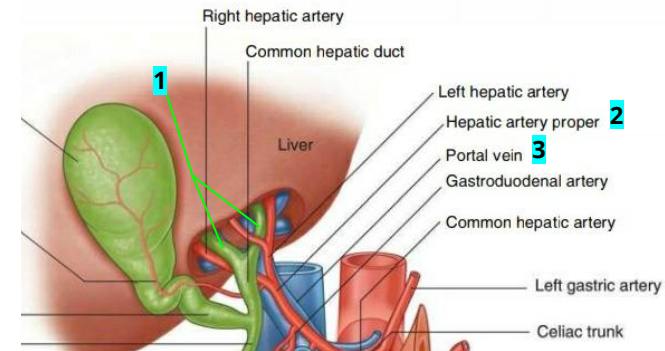
A transverse fissure found on the posteroinferior surface and lies between the **caudate** and **quadrate** lobes.



The upper part of lesser omentum is attached to its margins.

Structures passing through it include:

1. Right and left hepatic ducts.
2. Right and left branches of the hepatic artery proper.
3. Right and left branches of the portal vein.
4. Sympathetic (derived from celiac plexus) and parasympathetic (derived from anterior vagal trunk) nerve fibers.
5. A few hepatic lymph nodes draining the liver and gallbladder and sending their efferent vessels to the celiac lymph nodes.

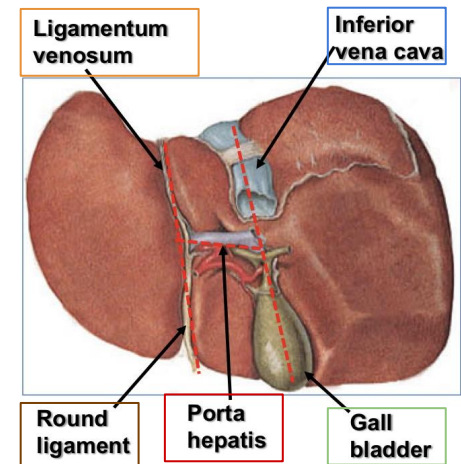


Fissures of liver (Important)

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

- The left fissure is the continuous groove formed:
Anteriorly by the fissure for the **round ligament** (lig.teres).
Posteriorly by the fissure for the **ligamentum venosum**.
- The right fissure is the continuous groove formed:
Anteriorly by the fossa for the **gallbladder**.
Posteriorly by the groove for the **inferior vena cava**.

In female slide only



Ligaments of The Liver



1) In the diaphragmatic surface

Falciform

A triangular fold of peritoneum formed of two layers (right & left)

It connects the liver with the diaphragm and anterior abdominal wall & umbilicus.

Anterior border: attached to diaphragm.

Posterior border: attached to anterior & superior surfaces of liver.

Lower Sickle-shaped free border: extending from liver to umbilicus & enclosing **ligamentum teres** (round ligament) & **paraumbilical veins**.

Right & Left Triangular *

*Explanation is only in males slides

the right triangular ligament.*

To the right of falciform ligament, the peritoneum is reflected from the diaphragm to the upper surface of the liver **to form the anterior coronary ligament** (continuous with right layer of falciform ligament).

The peritoneum then covers: anterior & inferior surfaces then becomes **reflected** to the front of right kidney to form the **posterior coronary ligament**.

➤ Both layers meet to form the **right triangular ligament**.

the left triangular ligament*

To the left of falciform ligament, the peritoneum is reflected from the diaphragm to the upper surface of the liver **to form the anterior layer of left triangular ligament** (continuous with left layer of falciform ligament).

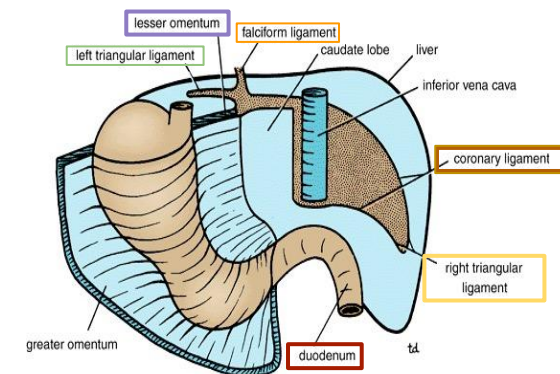
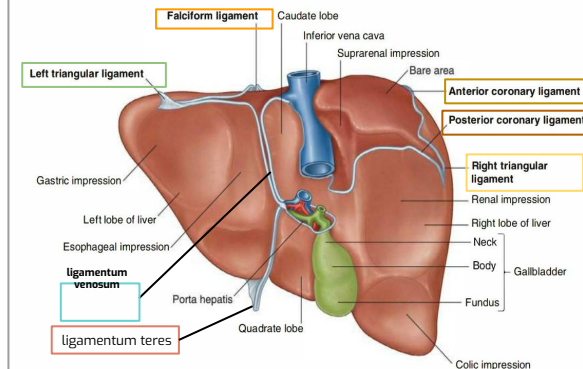
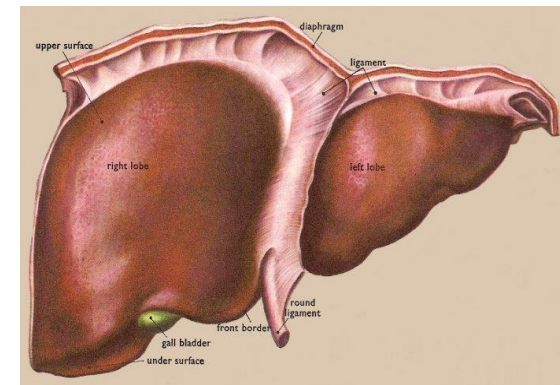
The peritoneum then covers: anterior, inferior & posterior surfaces & is **reflected** to the diaphragm to form the posterior layer of left triangular ligament.

➤ Both layers meet to form the **left triangular ligament**.

Lesser Omentum (Hepatogastric & Hepatoduodenal)*

It is attached to the margins of porta hepatis & fissure for **ligamentum venosum**.

It extends to lesser curvature of stomach & upper border of 1st inch of 1st part of **duodenum**.



* : Males slides only

Ligaments of The Liver

2) In the visceral surface

Ligamentum venosum

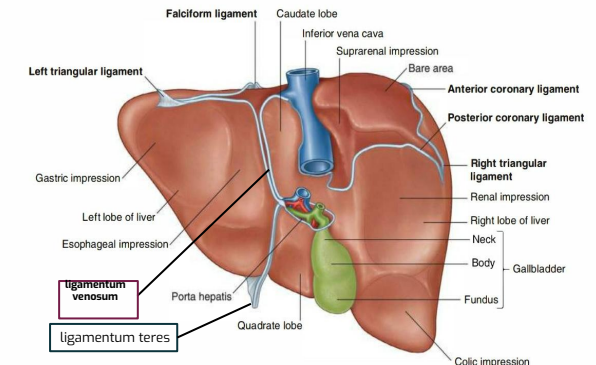
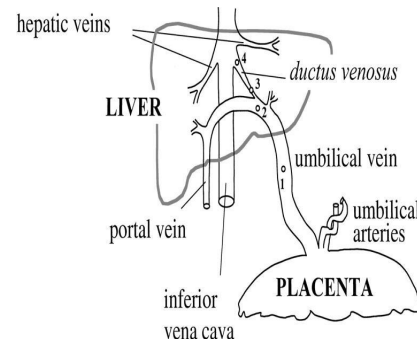
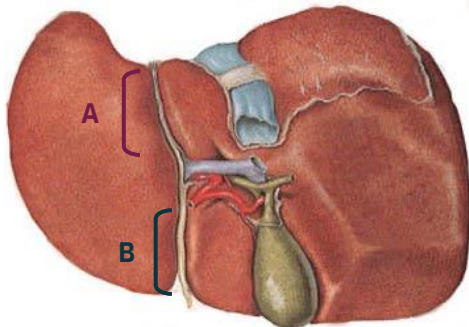
A

- It's the **fibrous remnant of the fetal obliterated ductus venosus**.
- Originally connects IVC with left branch of portal vein.
- which shunted blood from the umbilical vein to the left branch of portal vein to the IVC.

Ligamentum teres (round Ligament) of liver

B

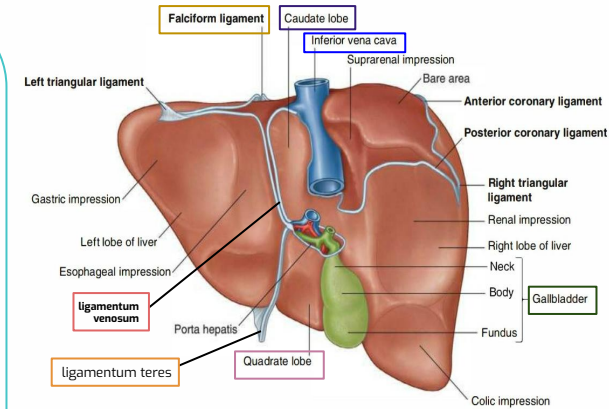
- It's the **remains of the obliterated left umbilical vein**.
- Originally joins the branch of portal vein.
- Which carries oxygenated blood from the placenta to the fetus.



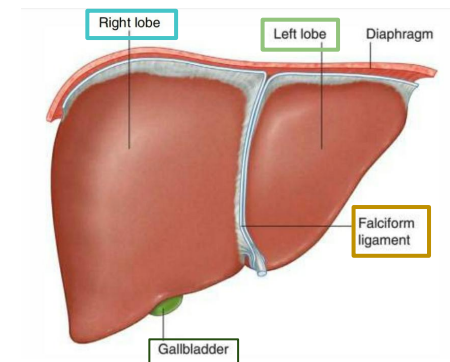
Lobes of The Liver

Anatomical Division

- The liver is divided into a **smaller left** & a **larger right** lobe
- The **right** lobe is further divided into a **quadrate** lobe and a **caudate** lobe by the presence of the
 - gallbladder
 - the **inferior vena cava**
 - **Anteriorly:** **Falciform ligament**
 - **Posteriorly:** Fissure for **ligamentum venosum**
 - **Inferiorly:** Fissure for **ligamentum teres**
- The **caudate** lobe is connected to the **right** lobe **by** the caudate process.



Caudate & quadrate lobes
Anatomically, Functionally
| |
Part of right lobe. Left lobe



Functional Division

- **Divided Into a nearly equal left & right lobe based on** the (areas of supply of)(their relation to the division of) common hepatic duct, hepatic portal vein, and hepatic artery proper into right & left branches
- the liver is functionally divided by a plane passing through groove for IVC & gallbladder fossa.
 - So in this division, areas of the liver supplied by these branches constitute the functional left or right lobes.
 - the **caudate** & **quadrate** lobes are included into the left lobe because they are supplied by left branches of hepatic artery & portal vein. (Mentioned by female's Dr)

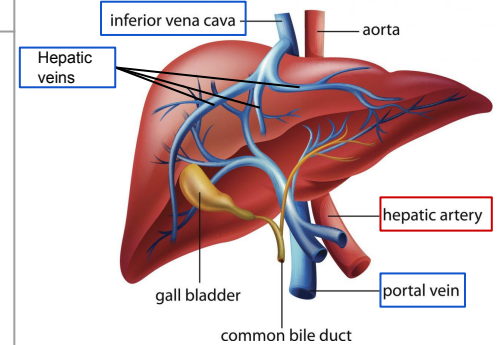
Liver Supply

Arterial

- **Hepatic Artery (30%)** a branch of celiac trunk : brings oxygenated blood to the liver.

Venous Drainage

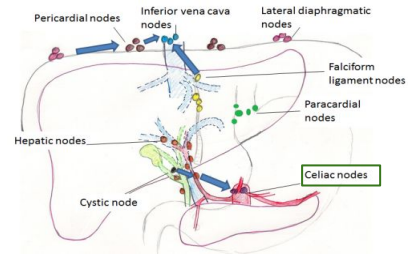
- **Portal vein (70%)**: brings venous blood rich in the products of digestion, which have been absorbed from GIT to the liver.
- ALL BLOOD PASS TO HEPATIC SINUSOIDS.
- Blood leave the liver through **hepatic veins** to the IVC.
- The caudate lobe is a (physiologically) independent part of the liver, supplied by the right and left hepatic artery and portal vein. Blood from the caudate lobe drains directly into the vena cava. It is also known as the lobule of Spiegel.



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**.
- A few vessels pass from the bare areas of the liver through the diaphragm to the **posterior mediastinal lymph nodes** (along esophagus and thoracic aorta)

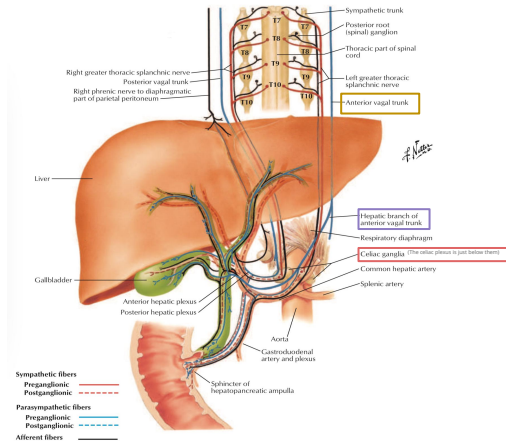
*The picture is EXTRA



Nerve Supply*

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

*The picture is EXTRA



Blood Circulation through the Liver



1

At or Closer 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 functional lobes of liver, respectively.

2

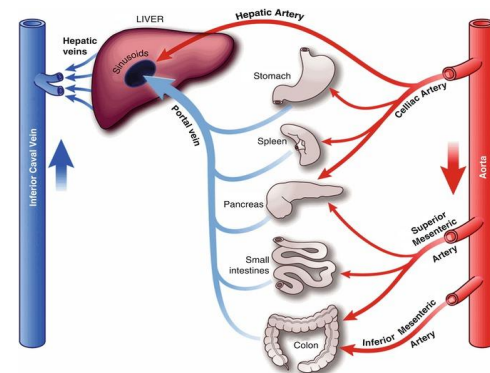
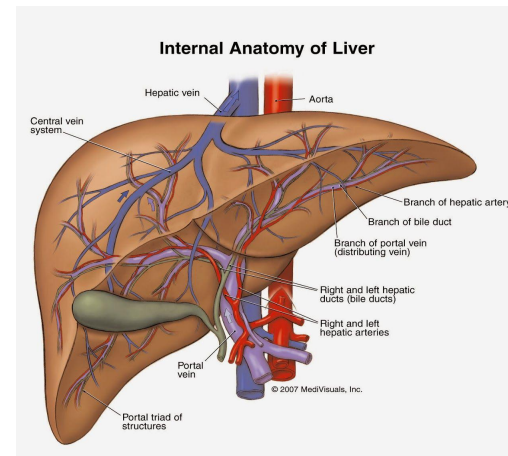
Within the liver, the primary branches divide to give **secondary and tertiary** to supply the hepatic segments independently.

3

The hepatic veins, are **intersegmental** in their distribution and function, draining parts of adjacent segments. They also **have NO extrahepatic course** (suspending the liver to the IVC). They are considered as the **main support of the liver**.

N.B.

Additional (minor) support: peritoneal folds (ligaments), surrounding organs and tone of the **anterior** abdominal wall muscles.

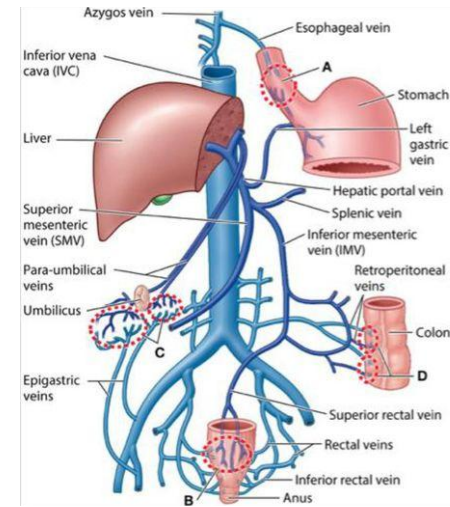


Portal- systemic (portacaval) anastomosis

It is a specific type of anastomosis that occurs between the veins of portal circulation and those of systemic circulation. In portal hypertension (e.g. in liver cirrhosis), these anastomosis open and form venous dilatation called **varices**.

Sites:

1. Lower part of Esophagus (Varices)
2. Upper Anal canal (Hemorrhoids or piles)
3. Para Umbilical region (Caput Medusae)
4. Retroperitoneal (Asymptomatic)
5. Intrahepatic (Patent ductus venosus). remember that it should fibrose & become ligamentum venosum

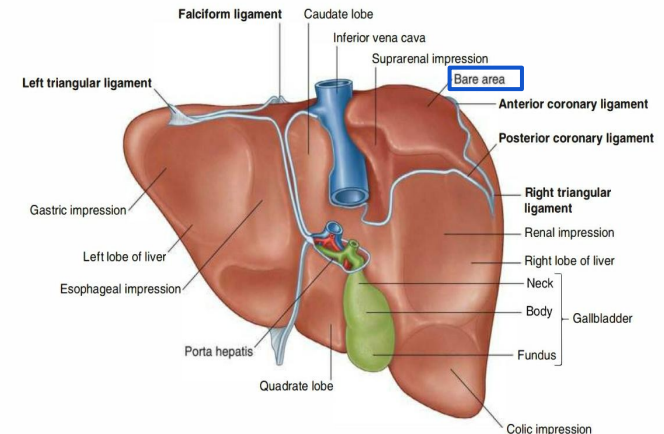


The bare areas of the liver

A **Triangular area** on the posterior surface of right lobe where there is no intervening peritoneum between the liver and the diaphragm. Its sides are anterior & posterior coronary ligaments. Its base is groove for IVC. Its apex is right triangular ligament.

N.B.: Other bare areas:

groove for IVC, gallbladder fossa, porta hepatis, fissure for ligamentum venosum.



Spleen

Location

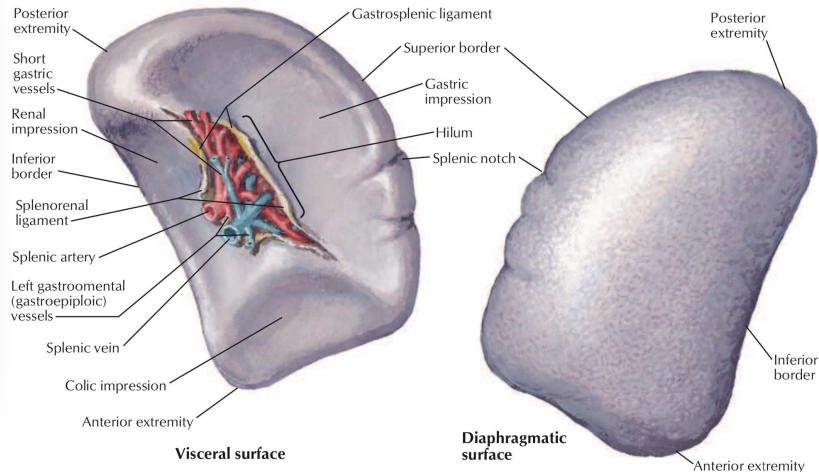
- in the left hypochondrium deep to **9,10 & 11 ribs** , Its Long axis lies along 10th rib
- Its medial end lies one and half inches from the spine of T10
- Its lateral end lies behind mid-axillary line
- It is separated from the ribs by the diaphragm and the costodiaphragmatic recess (space in pleural cavity).

Shape

- Ovoid in shape with notched anterior border.
- Lower pole extends forward as far as the midaxillary line.
- Largest single mass of lymphoid tissue.

Size

- The "odd" spleen rule (1-3-5-7-9-11)**: The spleen is 1 inch (thickness), 3 inches (breadth), 5 inches (length), (weighs) 7 ounces, and lies between the 9th and 11th ribs.
- "Clenched fist"
- Normal size spleen can not be palpated on clinical examination.



Surfaces

Diaphragmatic
Posterior

Visceral
Anterior

is outer convexly curved to fit the concavity of the diaphragm and curved bodies of the adjacent ribs

Inner concave related to viscera

Borders

Superior and anterior

Posterior and inferior

They are sharp
Anterior border is notched

They are rounded

Ends (in males slides)

Narrow end

Broad end

Directed upward, backward and medially

Directed downward, forward and laterally

Ligaments of the spleen: (Peritoneal covering)

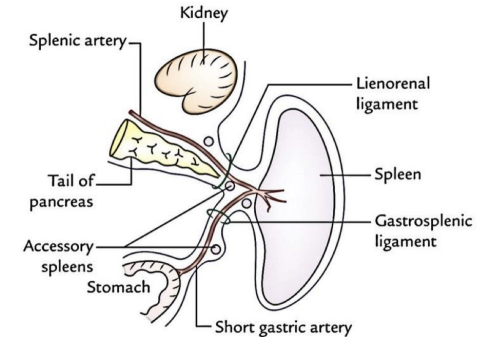
Spleen is completely surrounded by peritoneum EXCEPT at the hilum where its margins give attachments to :

Lienorenal ligament (splenorenal)

Attached the left kidney (carrying the **splenic vessels and the tail of pancreas**)

Gastrosplenic ligament

Attached to the greater curvature of stomach (carrying the **short gastric and left gastroepiploic vessels**)



Relations of the spleen: OSPE

Anterior

- 1) Stomach (just below the upper border)
- 2) tail of pancreas (between hilum and left colic flexure)
- 3) left colic flexure (above the broad end)
- 4) left kidney (just above lower border)

Posterior

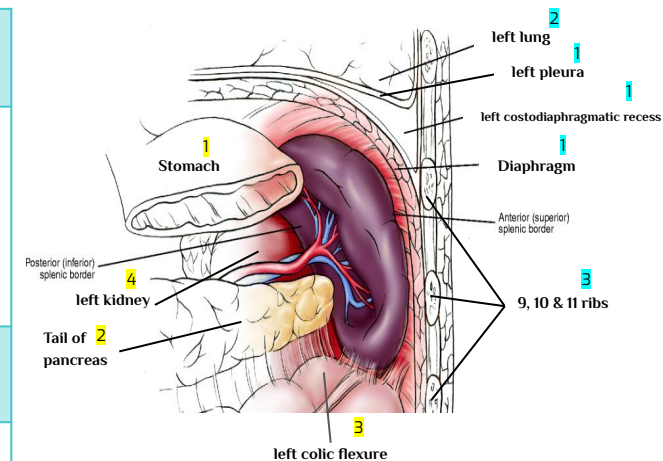
- 1) Diaphragm, that separates it from the left pleura (left costodiaphragmatic recess)
- 2) left lung
- 3) 9, 10 & 11 ribs.

Medially

- 4) Left kidney

Inferior

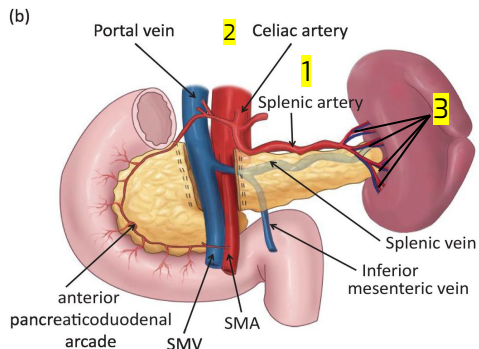
- 3) Left colic flexure



Spleen supply

Arterial Supply

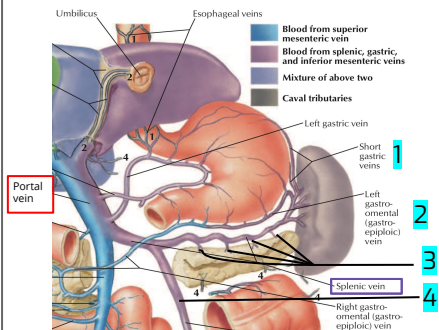
1. Splenic artery is the largest branch of the **2. celiac artery**
 → Runs a tortuous course along upper border of the pancreas (behind the stomach)
 → Passes within the lienorenal ligament
 → Divides into **3. four-five terminal branches**.
 → which enter the spleen at the hilus (end artery) The lack 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.



Venous Drainage

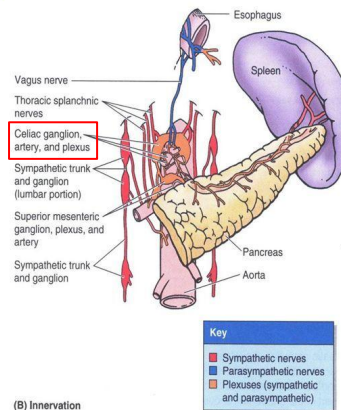
Splenic vein
 ↓
 Leaves the hilus
 ↓
 Runs behind the tail & body of the pancreas
 ↓
 Reaches **behind the neck of pancreas**, where it joins the **superior mesenteric vein** to form the **portal vein**.

- Tributaries:
1. Short gastric vein
 2. left gastroepiploic vein
 3. Pancreatic veins
 4. Inferior mesenteric vein



Nerve Supply

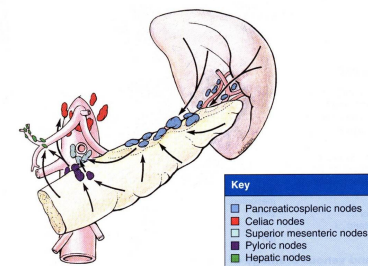
Derived from the **celiac plexus** (Innervation is purely sympathetic).
 Are distributed mainly along branches of the splenic artery and are vasomotor in function.



(B) Innervation

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**.



MCQ

Q1: the greater part of liver lies at the level :

A: ribs 7-11

B: costal cartilage 7-11

C: rib 12

D: T12

Q2: which of the following related to the liver anteriorly :

stomach

B: psose major

C: abdominal wall

D: spleen

Q3: Which one of the following is included into the inferior surface of the liver?

A: Groove for inferior vena cava.

B: Caudate lobe

C: Quadrate lobe

D: Fissure for ligamentum venosum

Q4: Which one of the following parts of the liver is devoid of peritoneum?

A: Fissure for ligamentum teres

B: Groove for inferior vena cava

C: Caudate lobe

D: Quadrate lobe

Q5: Which of one the following structures is found on the free margin of Falciform ligament?

A: Lesser Omentum

B: Ligamentum venosum

C: Ligamentum teres

D: Greater Omentum

Q6: Which of the following structures is related to the obliterated ductus venosus?

A: Lesser Omentum

B: Ligamentum venosum

C: Ligamentum teres

D: Greater Omentum

Answer key:
1 (A) , 2 (C) , 3 (C) , 4 (B) , 5 (C) , 6 (B)

MCQ

Q7: One of the major structures supporting the liver is:

A: Hepatic veins

B: Peritoneal ligaments

C: Abdominal muscles

D: Surrounding organs

Q8: The liver sympathetic nerve supply is through:

A: Posterior vagal trunk

B: Gastric plexus

C: Anterior vagal trunk

D: Celiac plexus

Q9: The left colic flexure is related to the spleen :

A: laterally

B: Medially

C: Posteriorly

D: Anteriorly

Q10: The ligament that attaches the hilum of spleen to the left kidney :

A: Gastrosplenic ligament

B: Splenorenal ligament

C: Gastrohepatic ligament

D: none

Q11: the largest branch of the celiac artery?

A: Splenic artery

B: left gastric artery

C: common hepatic artery

D: none

Q12: Which one of the following is related to the spleen?

A: Left suprarenal gland

B: Stomach

C: Body of pancreas

D: Descending colon

Answer key:

7(A) , 8(D) , 9(D) , 10(B) , 11(A) , 12(B)

SAQ

Q1: mention one relation of the liver from each side (posterior,anterior,superior,inferior)

Q2: List the sites of portal anastomosis.

Q3:Explain the lymphatic drainage of the liver

Answers

1:
posterior: Groove for IVC
anterior:right & left pleura
inferior:Quadrante lobe
superior:pericardium &heart (in the middle)

2 :
A. Lower part of Esophagus (Varices)
B. Upper Anal canal (Hemorrhoids or piles)
C. Paraumbilical region (Caput Medusae)
D. Retroperitoneal (Asymptomatic)
E. Intrahepatic (Patent ductus venosus).

3 :

- 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.

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- Ghaida Alassiry
- Joud Alnujaidi
- May Barakah
- Norah Alasheikh
- Nouf Alsubaie
- **Raghad Alasiri**
- Raghad Soaeed
- Sarah Almuqati
- Sarah Alqahtani
- Shaden Alsaiedan
- Shahad Almezel
- **Shayma Alghanoum**
- Sumo Alzeer
- Abdulaziz Alghulighah
- Abdulaziz Alkraidia
- Abdulaziz Alrabiah
- Abdulaziz Alsuhaim
- Ahmed Alkhayatt
- Bader Alrayes
- Basel Fakeeha
- Faisal Alotaibi
- Hadi Alhemsy
- Hesham Alsqabi
- Mohammed Aldehaim
- Mohamed Alquhidan
- Mubarak Alanazi
- Osama Alharbi
- Saad Aldohaim
- Saleh Algarni