MED437
KING SAUD UNIVERSITY

ANATOMY
Team 437

Liver & Spleen

Lecture (8)

- Important
- Doctors Notes
- Notes/Extra explanation

{وَمَنْ يَتَوَكَّلْ عَلَى اللَّهِ فَهُوَ حَسْبُهُ}

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هذا العمل مبني بشكل أساسي على عمل دفعة ٤٣٦ مع المراجعة والتدقيق وإضافة الملاحظات ولا يغني عن المصدر الأساسي للمذاكرة

Objectives

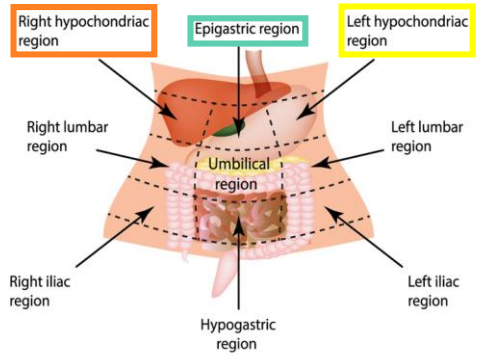
At the end of the lecture, students should be able to:

- ✓ **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

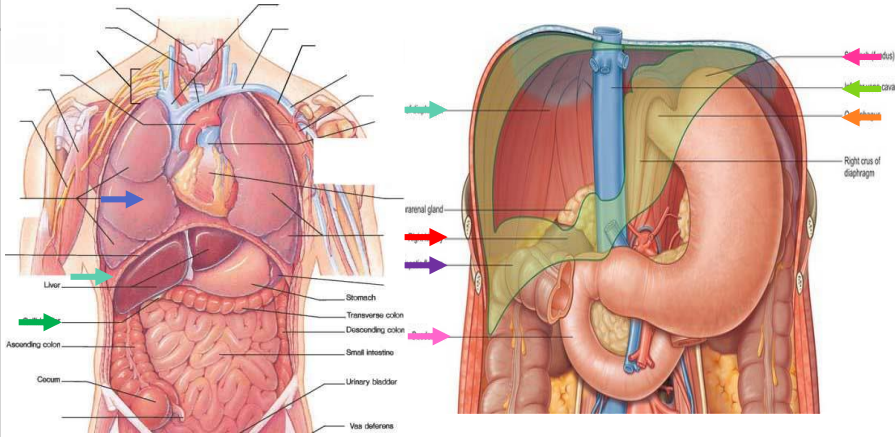
10:07

- 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** (when taking a biopsy from the liver it's taken from here) 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. Diaphragm is dome shape so it's seen anteriorly and posteriorly.



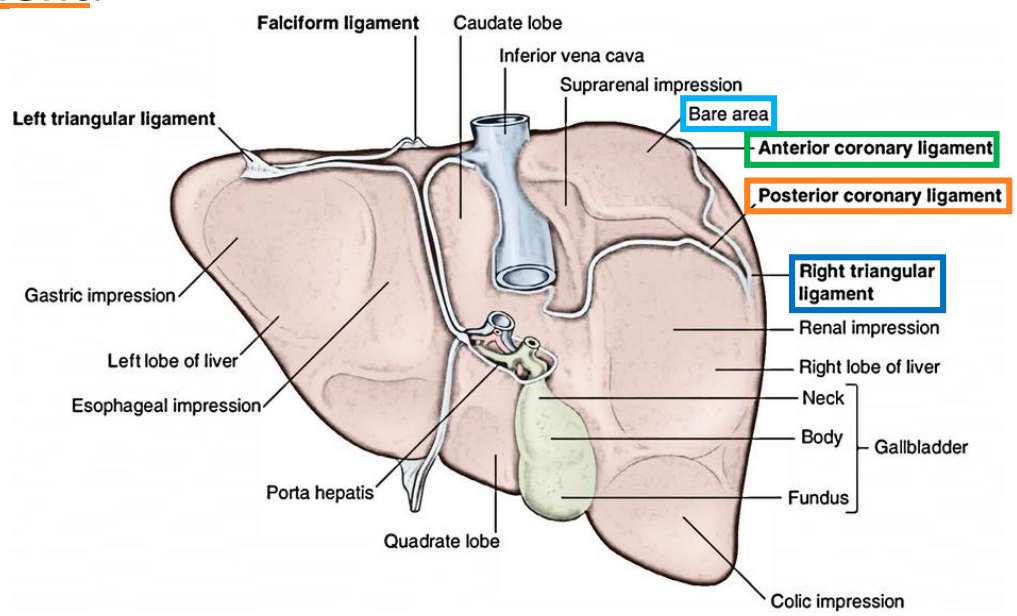
IMPOETANT IN OSPE

Anterior relation	Posterior relation
1. Diaphragm 2. Right & left pleura and lower margins of both lungs 3. Right & left costal margins 4. Xiphoid process 5. Anterior abdominal wall in the subcostal angle	1. Diaphragm 2. Inferior vena cava 3. Right kidney and right suprarenal gland 4. Hepatic flexure of the colon 5. Duodenum (1st part), gallbladder, esophagus (lower part) & 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 = **Partially** covered by **peritoneum**
- 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**.
  - Right: Right **triangular ligaments**.
  - Left : Groove for IVC
- Other bare areas include:
  Porta hepatis, fossa for gall bladder, & groove for IVC (left boundary of bare area)

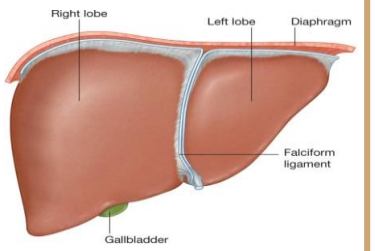


Liver
Surfaces

The liver has two surfaces:

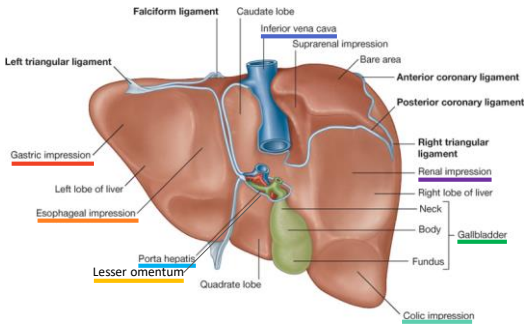
- A convex **diaphragmatic surface** (Antero-superior, right lateral & small area of posterior surface)
- A relatively flat or even concave **visceral surface** (postero-inferior)

Diaphragmatic Surface



- The **convex** upper, anterior & right lateral surface is smooth and molded to the undersurface of the **domes** of the **diaphragm** which separates it from the base of 2 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 (IMPORTANT)



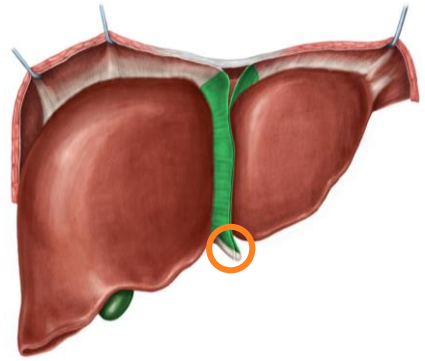
- It is the posteroinferior surface, related to abdominal viscera.
- It is covered with peritoneum, except at the fossa for the **gallbladder**, the **porta hepatis** and **IVC** groove.
- It bears multiple fissures and impressions for contact with other organs.
- **The visceral surface of the liver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

1- Stomach & duodenum (lower end)
2- Esophagus (lower end)
3- Lesser omentum (along margin of porta hepatis)
4- Gallbladder
5- Right colic flexure
6- Right kidney & right suprarenal gland

Liver
Ligaments

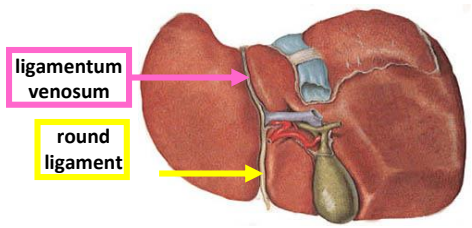
Falciform ligament

- 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.
- (Attached to the anterior abdominal wall and posteriorly to the anterior & superior border of the liver)
- 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 and nutrients from the placenta to the fetus.

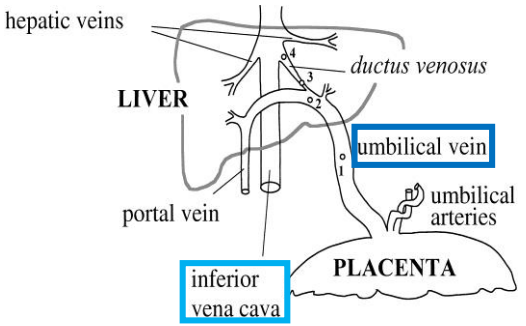


Ligamentum venosum

- It is the fibrous remnant of the fetal ductus venosus (oblitrated ductus venosus), which shunted blood from the umbilical vein to the IVC, in intrauterine fetal life short circuiting the liver.

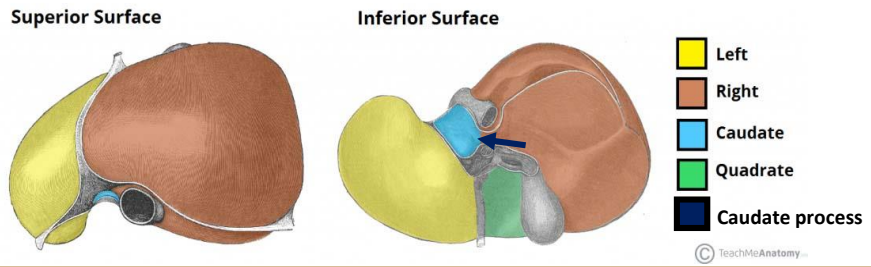


- In fetal circulation, 50% of the venous blood coming from the mother goes to the liver and 50% shunts directly to IVC by the ductus venosus.



Liver
Lobes

- The liver is divided into a large **right lobe** and a small **left lobe** (the difference in size is only anatomically not physiologically, since the caudate and quadrate lobes are functionally a part of the left lobe) by the attachment of the **falciform ligament** to anterior and superior surfaces.
- The right lobe is further divided into a **quadrate** lobe (interior) and a **caudate** (superior) 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**.(demonstrates the opening of the lesser sac from above)
- 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.



Liver
Fissures & Porta hepatis

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

Right Fissure
- Anteriorly: by the fossa for the **gallbladder**
- Posteriorly: by the groove for the **IVC**.

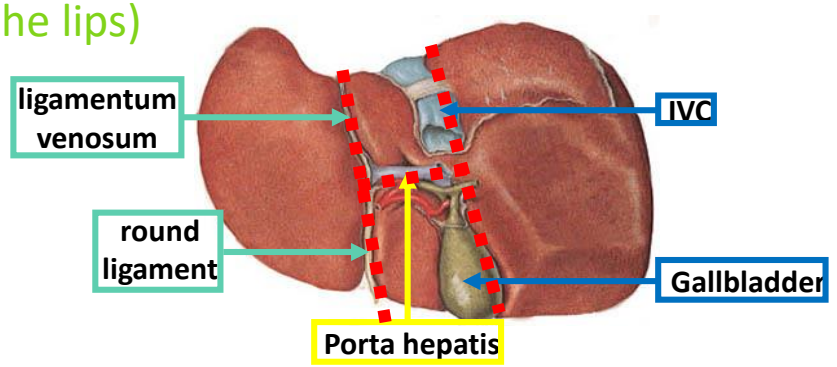
Left Fissure
- Anteriorly: by the fissure for the **round ligament** (ligamentum teres)
- Posteriorly: by the fissure for the **ligamentum venosum**.

- **Porta hepatis (Helium of the liver):** A transverse fissure found on the posteroinferior surface and lies between the **caudate** & **quadrate** lobes.

Sometimes the IVC runs in a tunnel inside the liver.

IMPOETANT

- The upper part of the lesser omentum is attached to its margins. (the lips)
- 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**
  - 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** **(final drainage)**.
- The 2 hepatic veins open in the posterior surface on the groove for IVC



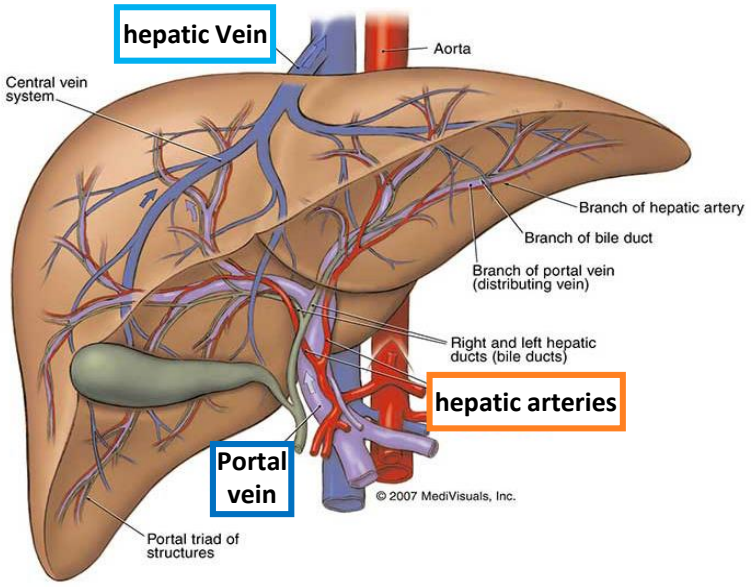
Liver
Blood Circulation

08:11

The liver is held in its position by 3 things:

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

- 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 **IVC**
- 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, and they open in the posterior surface on the groove for IVC.
- The attachment of the two hepatic 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).



Liver Supply

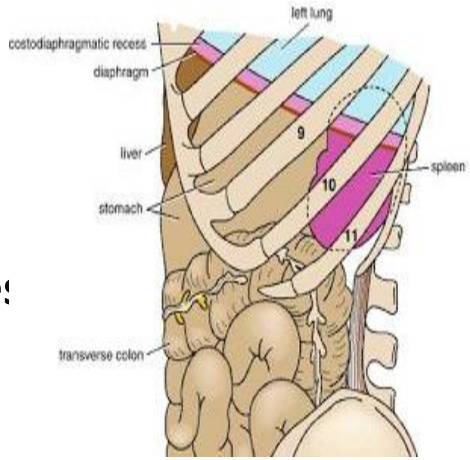
In portal hypertension (as from cirrhosis or hepatitis) the anastomosis areas dilate causing variant effects depending on the site, for example:

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

Lymph Drainage	• The liver produces a large amount of lymph—about <u>one third</u> to <u>one half</u> 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 **<u>celiac nodes</u>** mainly. • A few vessels pass from the bare area of the liver through the diaphragm to the **posterior mediastinal lymph nodes.**
Nerve supply	• **<u>Sympathetic</u>** from the **celiac plexus**. • **<u>Parasympathetic</u>** nerves: The **anterior vagal trunk** gives rise to a large <u>hepatic branch</u>, which passes directly to the liver.
Portal-systemic (portacaval) anstomoses IMPORTANT	• 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). • **<u>Sites</u>: -Esophagus (lower third part)** (either systemic to the azygos veins or portal to the left gastric vein) **-Upper Anal canal** (immediately under rectum, between the superior rectal vein and the middle & inferior rectal veins) -Paraumbilical region -Retroperitoneal -Intrahepatic (Patent ductus venosus)

Spleen

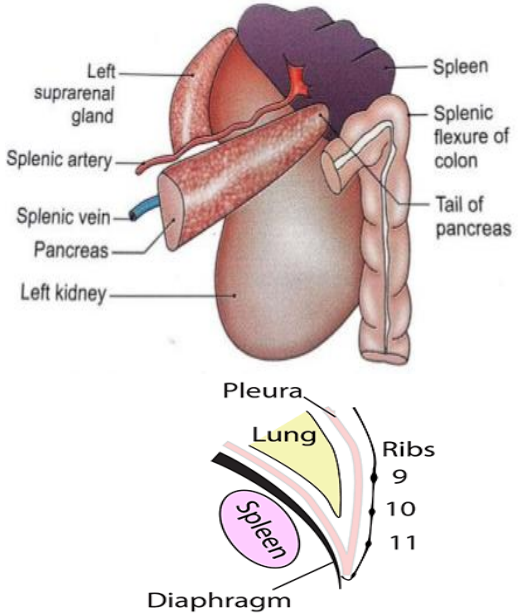
- Largest single mass of **lymphoid tissue** (embryologically formed by the dorsal mesogastrium by collection of scattered lymph nodes)
- **Located** in the left hypochondrium, **deep to 9, 10 & 11 ribs**.
- Its **Long axis** lies **along 10th rib**.
- It is separated from the ribs by the **diaphragm** and the **costodiaphragmatic rece** (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 Relation

REMEMBER!
Left colic flexure = splenic flexure
Right colic flexure = hepatic flexure

Anterior	Posterior
• Stomach • Tail of pancreas • Left colic flexure • Left kidney	• Diaphragm, that separates it from the left pleura (left costo-diaphragmatic recess) • Left lung • 9, 10 & 11 ribs
Medial	**Inferior**
Left kidney	Left colic flexure



IMPOETANT

Left colic flexure	Right colic flexure
Higher	Lower
Away from the middle line	
Develops from the **hindgut**	Develops from the **midgut**
Supplied by the **inferior mesenteric**	Supplied by the **superior mesenteric**
Acute angle (less than 90°)	**Right angle** (90°)

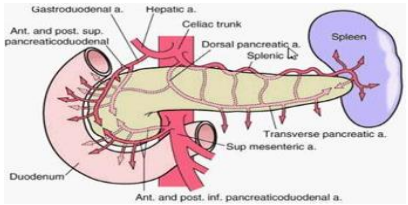
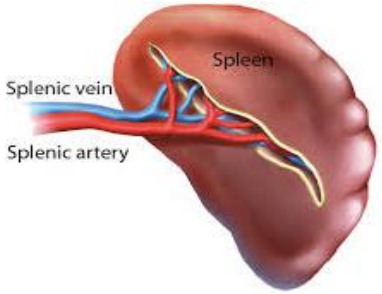
Spleen

Peritoneal Reflection | Ligaments	• Spleen is **completely** surrounded by **peritoneum** which passes from its **hilus** as:
	  • **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 care not to cut it in splenectomy).

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** & **anterior** borders are **sharp**. • **Anterior** border is **notched**. • The **posterior** (**medial**) & **inferior** borders are **rounded**.

Spleen
Supply

14:28

Blood supply (Splenic artery)	• **Largest** branch of the **celiac artery** • Runs a **tortuous** (متعرج) **course** (so when the stomach is full it won't collapse it will just elongate) 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. 
Venous Drainage (Splenic vein) IMPORTANT	• 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:** **Short gastric vein | left gastroepiploic vein | Pancreatic veins | Inferior mesenteric vein** 
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.

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

MCQs

(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

(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

Answers

(1) A
(2) B
(3) C
(4) A
(5) D

(6) B
(1) B
(8) D
(9) B
(10) D

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.

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

Good luck
Special thank for team436 ❤

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- References:
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  3. TeachMeAnatomy.com

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