

Digestive System

University of Jordan
Faculty of Medicine
Batch of 2013-2019



Slide Sheet Handout Other

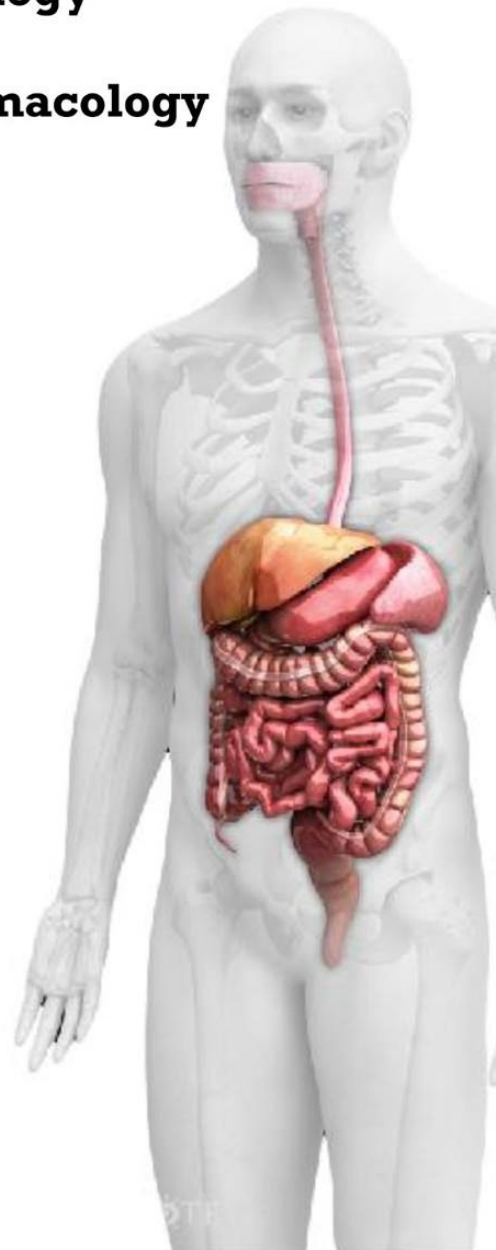
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Sheet #: 10

Done by: Tasneem Suhail

Date:

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Pancreas and Spleen

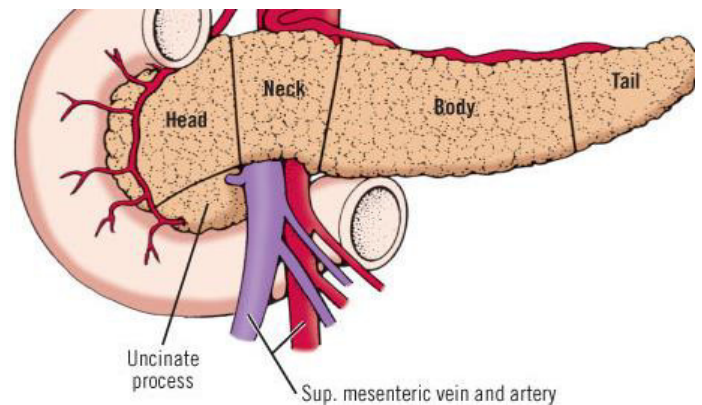
الأجزاء المظلمة أو المخطوط تحتها باللون الأصفر في الصور هي الأجزاء التي تم ذكرها، إلى حد ما. المعلومات التي تدرج تحت نفس العضو حاولت قدر الإمكان إنه تكون مع بعضها، لذلك فالتسلسل هنا يختلف عن تسلسل المعلومات في التسجيل. لكل منا غاية في دراسته للطب، فلنتفقد ما بين الفينة والأخرى ولنجعلها نبيلة.؛
"واستعن بالله ولا تعجز."

Pancreas (the doctor said that there will be questions on it, so pay attention)

- *It begins at the left side, from the hilum of spleen.
- *There is an impression on the visceral surface of the spleen for the tail of the pancreas.
- *The pancreas is divided into four parts: tail, body, neck, head and the uncinete process of pancreas.

-Uncinate process: Anterior to it, there is the superior mesenteric vessels.

- *Superior mesenteric artery: its origin is behind the pancreas, but it cross in front of the uncinete process and the horizontal part of the duodenum.

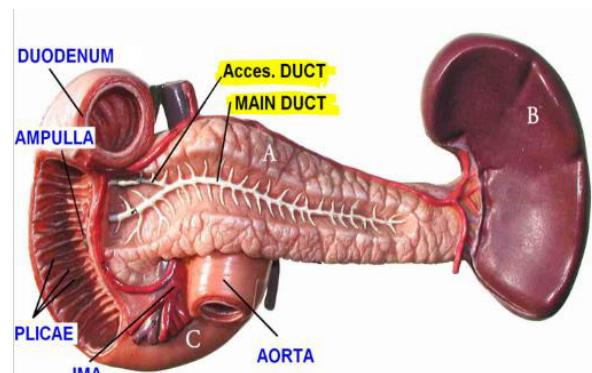


Anatomical position:(in the slide not mentioned in the lec.)

Epigastric, left upper hypochondrium region.

Pancreatic ducts:

- 1- Main pancreatic duct joins the common bile duct in the ampulla



and opens in the major duodenal papillae.

- 2- Accessory pancreatic duct (in case of having it) opens at the minor papilla, 1-inch above the major papillae.

In the slide not mentioned:

The main duct: Begins in the tail and runs the length of the gland, receiving numerous tributaries on the way. It opens into the second part of the duodenum at about its middle.

Accessory duct: When present, drains the upper part of the head. frequently communicates with the main duct.

Note: There is a variation among individuals regarding the common bile and main pancreatic ducts:

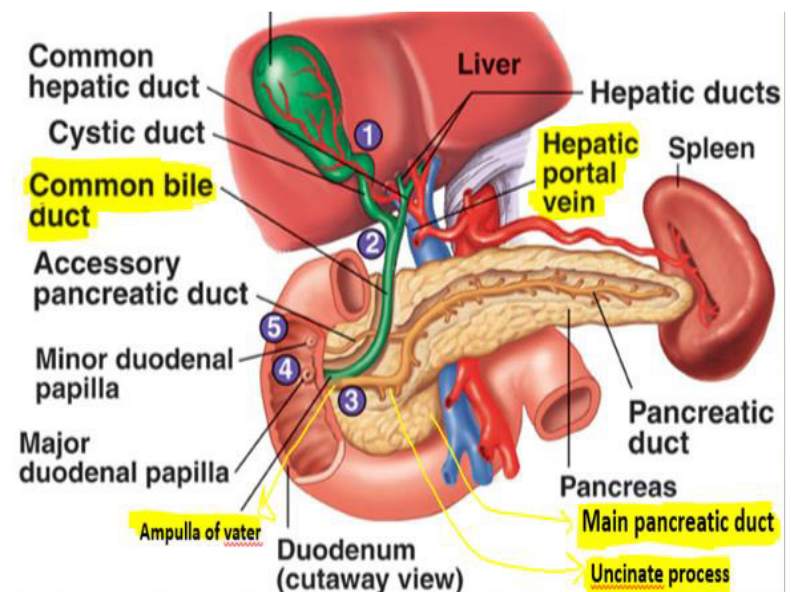
1-They may join to make main hepato-pancreatic duct before the ampulla of Vater with one sphincter.

2-They may meet at the ampulla of Vater.

3-They may have separate openings (common bile duct opens separately from the main pancreatic duct; each one has its one sphincter and opens alone).

Do not forget that the portal vein, hepatic artery and common bile duct cross behind the pancreas then through the head of pancreas. The bile duct opens in the ampulla of Vater after joining the main pancreatic duct.

The picture shows the relation of the head of pancreas in the concavity of the duodenum.

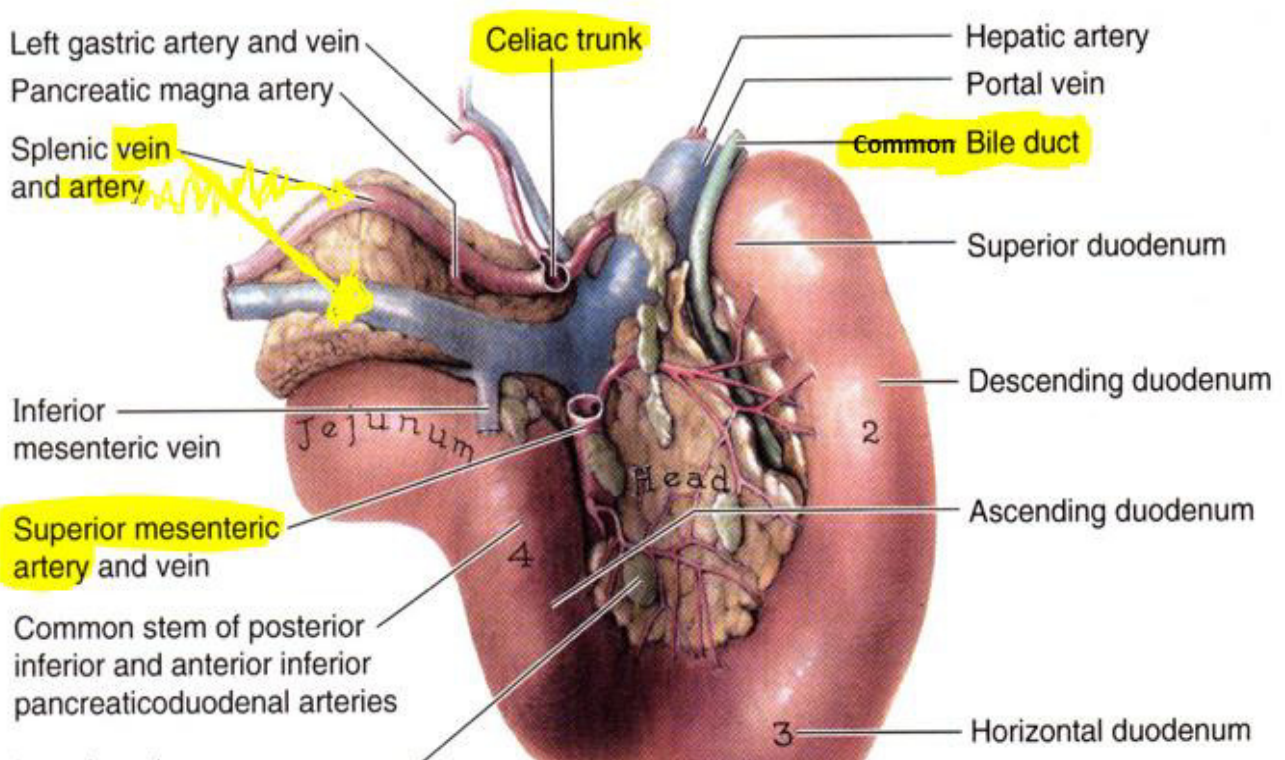


Common relations of pancreas

Anteriorly:

Transverse colon, its mesocolon, lesser sac and stomach.

Posteriorly:



1- **Bile duct** (which is behind the **head** of pancreas).

2- Anterior to the bile duct is the **portal vein**.

3- **Splenic vein** (behind the **body** of pancreas, and **behind the neck** of pancreas it meets the superior mesenteric and they form the portal vein), while the splenic artery lies on the upper border of pancreas (it is a tortuous artery related posteriorly to the stomach bed).

- 4- Origin of the **superior mesenteric artery**. (Posterior to the pancreas but it crosses in front of the uncinata process).

In the slide not mentioned in the lec.:
Exocrine part → Pancreatic juice.
Endocrine part → Insulin, glucagon and somatostatin

- 5- Left Psoas muscle
6- Left Suprarenal gland

Posterior to the kidney and the hilum of spleen.

Other posterior relations mentioned in the slide but not mentioned by the doctor: IVC, aorta, left kidney, hilum of the spleen.

*The head of pancreas lies within the concavity of the duodenum.

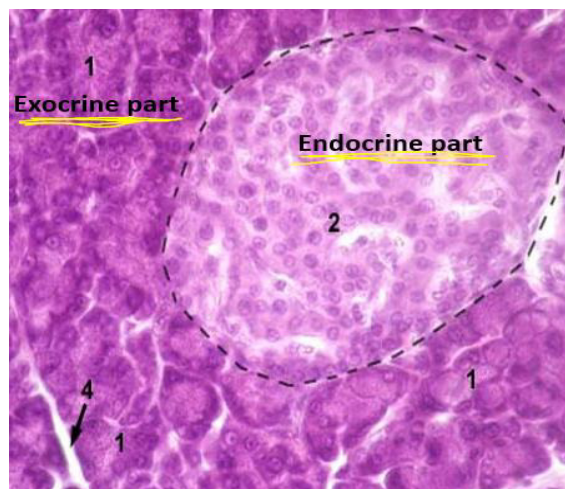
*The common bile duct runs posterior to the first part of the duodenum then posterior to the head, and then pierces the medial side of the second part of the duodenum.

*The Celiac trunk is found **above** the superior border of the pancreas, while the splenic artery runs **on** the superior/upper border of the pancreas.

The pancreas is a mixed gland :

↳ Islet of Langerhans:

- Endocrine part.
- It consists of alpha, beta, Gama and delta cells.
- Using the light microscope we can see that alpha cells and beta cells have different locations due to



their different sizes. Alpha cells are located peripherally, while the beta cells are found at the center.

-It secretes glucagon and insulin.

✎ Pancreatic Acini:

- Exocrine part

-Characterized by the polarity of its cells; the apex contains zymogenic granules (enzymes in it), and the base is basophilic.

-It has intercalated ducts (all of them open into the pancreatic duct).

-No striated duct.

Keep in mind that at the neck of the pancreas the portal vein is formed, and that the Uncinate process crosses the superior mesenteric vessels.

Important landmark:

Superior mesenteric vessels (*we repeated it a lot*): origin is behind the pancreas, but cross in front of the uncinat process.

*The uncinat process extends to the left side behind the superior mesenteric vessels.

The posterior surface of the pancreas is related to the posterior abdominal wall; so posterior to it we can find the inferior vena cava, the aorta and the splenic vein (which behind the neck joins the superior mesenteric to form the portal vein).

-The splenic artery is a branch from the celiac trunk and it is tortuous, (goes to the hilum of spleen and divides into 4-5 branches).

*Why it is tortuous? Because when the stomach is distended, it will press on the artery, and the artery has to be tortuous to be able to elongate. Other tortuous arteries include the uterine artery, which is tortuous in order to be able to elongate during pregnancy, and the facial artery.

-Inferior mesenteric vein accompanies the artery and terminates in the splenic vein.

Parts of the pancreas: Head, Neck, Body, Tail

BODY OF PANCREAS

- The body of the pancreas runs upward to the left across the midline.
- It is triangular; if we take a cross section we'll find three surfaces and three borders.

In the slide not mentioned in the lec.

*The Head:

- It is disc shaped
- lies within the concavity of the duodenum
- A part of the head extends to the left behind the superior mesenteric vessels and is called the Uncinate process.

*The Neck:

- It is the constricted portion of the pancreas connects the head to the body.
- It lies in front of the beginning of the portal vein the origin of the

One of the things that the doctor repeated a lot:

1-The transverse and mesocolon are attached to the anterior border of the body of the pancreas.

2-The splenic artery passes on the upper border.

Borders of the body of pancreas:

- Anterior
- Superior
- Posterior/inferior

-Anterior

-Superior/upper

Very important landmarks.

- ✚ **The superior border** is blunt, narrow and sharp. Above it runs the celiac artery. Also from the celiac trunk, the hepatic and splenic arteries arise and are found at the superior border.

In the slide: **The superior border is** Blunt and flat to the right. Narrow and sharp to the left near the tail. It commences on the right in the omental tuberosity. In relation with 1- The celiac artery 2- Hepatic artery 3- The splenic artery runs toward the left in a groove along this border.

- ✚ **The anterior border** is important because it receives the mesocolon, which is formed of two layers: one passes over the inferior surface and one ascends upward with the liver.

In the slide: **The anterior border:**
-separates the anterior surface from the inferior surface
-along this border the two layers of the transverse mesocolon diverge from one another; one passing upward over the anterior surface, the other backward over the inferior surface.

- ✚ **The Inferior border** separates the posterior surface from the inferior surface (and that's why we call it posterior border sometimes). The superior mesenteric vessels emerge under its right extremity.

Surfaces of body of pancreas:

-Anterior surface:

- Is covered by peritoneum from the posterior wall of the lesser sac.
- Tuber omental (embryonic term) is where the anterior surface joins the neck of pancreas.

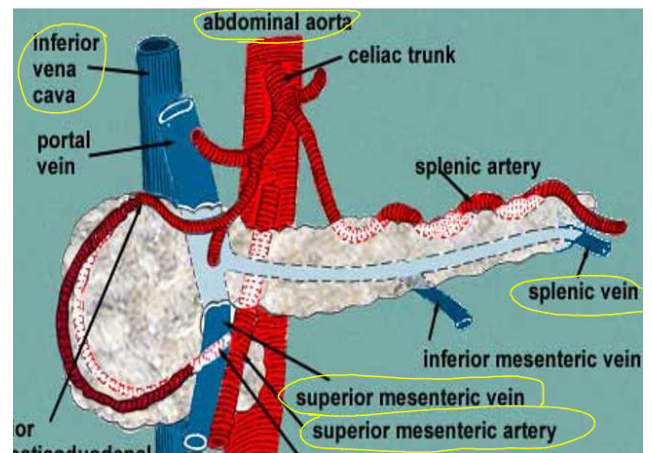
-Inferior surface:

- Narrow on the right but broader on the left
- Covered by peritoneum from the greater omentum. When we say greater omentum here we mean the mesocolon that passes over the anterior border of the pancreas. The other layer descends downwards so it covers the inferior surface.
- (In the slide: lies upon the duodenojejunal flexure, Some coils of the jejunum, its left extremity rests on the left colic flexure.)

-Posterior surface:

- Lies in the posterior abdominal wall, so it's devoid of peritoneum (unlike the anterior and inferior surfaces where the anterior surface is covered with lesser sac and the inferior surface with the greater sac).
- Posterior to the posterior surface (posterior relations):

Aorta, inferior vena cava (not written in the slide), splenic vein, left kidney, left suprarenal gland, the origin of the superior mesenteric artery, and the left crest (crura) of the diaphragm.



PANCREATIC TAIL

- ♣ It has an impression in the hilum of the spleen.
- ♣ Extends to the hilum of the spleen.
- ♣ It lies in the splenicorenal (lieno-renal) ligament.

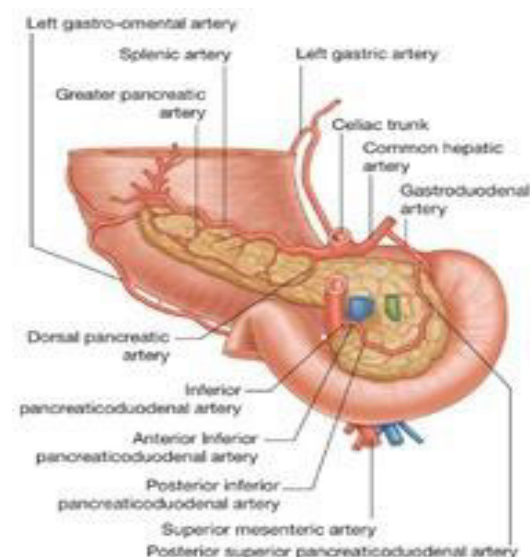
Lienorenal (Splenicorenal) ligament contains: tail of pancreas, splenic vessels and lymph nodes.

Surgically in spleen-ectomy the splenic vessels are ligated and we should be careful not to injure the tail of pancreas, because if we do, the enzymes may cause infections and peritonitis.

BLOOD SUPPLY OF PANCREAS

Arteries:

- The splenic artery
- The superior pancreatico-duodenal artery

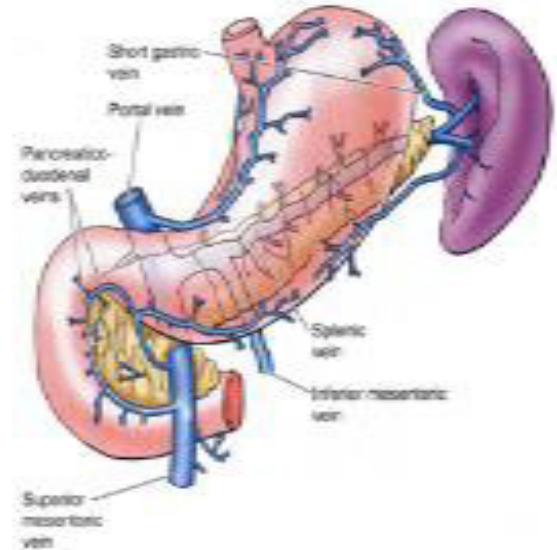


(from celiac trunk).

-The inferior pancreaticoduodenal artery
(from the **superior** mesenteric).

We will take in embryology: origin of pancreas belongs to the foregut and midgut (two parts met together and made the pancreas).

Veins: The portal vein is formed by the union of the superior mesenteric vein and splenic vein. The superior pancreaticoduodenal vein drains into the portal vein while the inferior pancreaticoduodenal drains into the superior mesenteric.



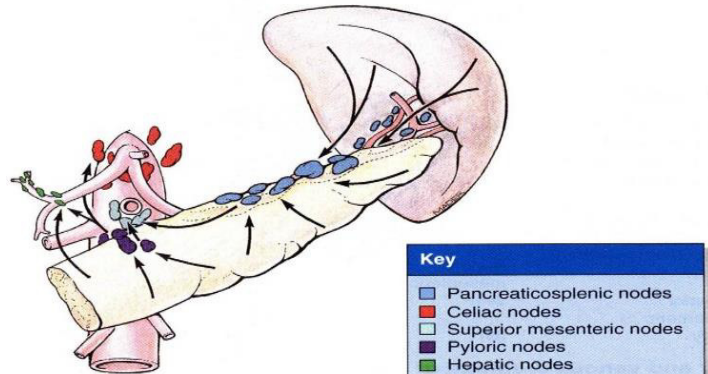
LYMPH NODES

Are situated in the lienorenal ligament.

Vessels drain into celiac lymph nodes if they're from the upper part of the pancreas corresponding to the superior

pancreaticoduodenal vessels. Or

drain into the superior mesenteric lymph nodes if related to inferior pancreaticoduodenal vessels.



(in the slide: Lymph nodes are situated along the arteries that supply the gland. The efferent vessels ultimately drain into the celiac and superior mesenteric lymph nodes.)

خدوا نفس عميق وكملاوا ما ضل كثير.

NERVE SUPPLY

Has sympathetic and parasympathetic chains:

- Parasympathetic (from the vagus nerve): it is secreto-motor so it is mainly for the exocrine glands; for the secretion of enzymes.
- Sympathetic is mainly for endocrine part (depends on the blood supply) so it is vasomotor.

Recently, they found that the pancreas has its own enteric plexus (contains both; parasympathetic and sympathetic). It has a reflex like the spinal reflex (receives the stimulation and gives a direct response from the enteric plexus).

The congenital defect in formation of pancreas will be discussed in embryology; annular pancreas and ectopic pancreas.

Clinical notes

- Cancer of the head of pancreas : (one of the common diseases clinically) enlargement of the head; first of all it presses on the common bile duct which leads to obstructive jaundice, the patient will come to you complaining about jaundice .
 - ❖ *Causes of obstructive jaundice:* stones, infection, or tumors in the head of pancreas.

The relations are important; enlargement pressures the portal vein, leading to congestion of Veins' blood and portal hypertension. (In the slide: Cancer body of pancreas → pressure → I.V.C & portal vein)

- Acute pancreatitis: inflammation of the pancreas.

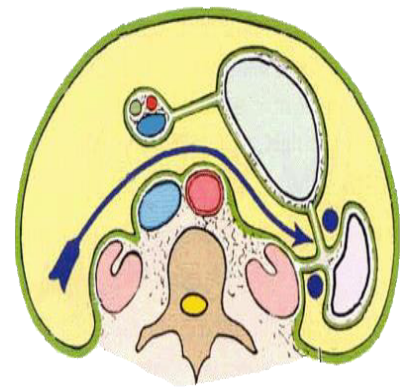
Spleen

- ❖ It is a lymphatic organ (mass of lymphoid tissue).

- ✧ Not related to the GI tract, it's considered as a reservoir of blood (filled with blood); so the splenic artery divides into 4-5 branches in the helium, also the splenic vein has 4-5 tributaries in the helium.
- ✧ It is reddish & oval shaped.
- ✧ The upper border has a notch (related to embryology).
- ✧ It has two surfaces two border and two ends.
- ✧ It's completely covered by peritoneum (intraperitoneal)

Site of spleen:

- ▲ In the left hypochondriac rejoin, in the lateral edge/ left boundary of the lesser sac.
- ▲ Related to the left 9th, 10th, 11th ribs.
- ▲ Its longitudinal axis is parallel to the 10th rib from the upper angle till the inferior one.
- ▲ In the slide: It lies just beneath the left half of the diaphragm



Clinical note:

Any trauma on the 9th, 10th, 11th left ribs, left hypochondriac region, or fracture, might result in a ruptured spleen. The patient will present with severe pain in the left shoulder; he'd always put his hand on his left shoulder and complain from it- this is called referred pain.

Why does this happen? Because the bleeding accumulated under the left copula of the diaphragm; and the innervation of peritoneum in that part is from (C3,4,5), and the phrenic nerve -which has the same root value- innervates the left shoulder joint. So there is a referred pain.

How to diagnose it? By Aspiration; insert a needle in the anterior abdominal wall at the left hypochondriac region and you'll find blood. Therefore, they conclude that there is a hemorrhage and rapture in spleen.

Treatment: splenectomy.

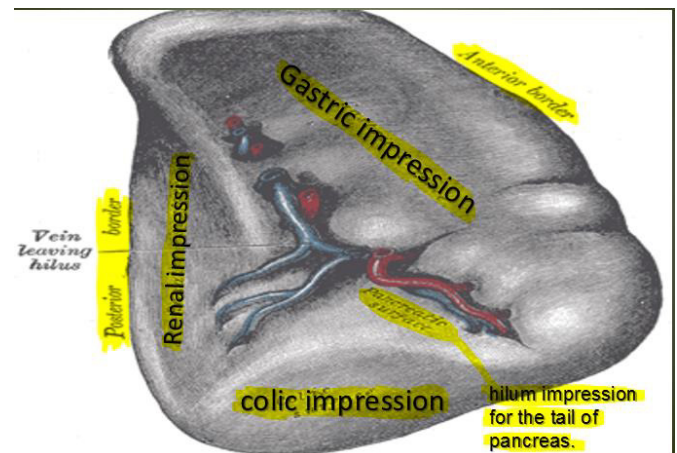
Spleen has 2 ends, 2 surfaces, 2 borders

Borders of spleen:

1. Upper border (anterior, superior): It is sharp, thin, lobulated and has notches (caused by lobules in the embryo). (in the slide: it is free, separates the diaphragmatic surface from the gastric surface)

2. Inferior border (posterior):

- ✍ Rounded without notches.
- ✍ Renal impression above it.
- ✍ Lower to it there's the colic impression.
- ✍ (In the slide: separates the renal from diaphragmatic surface, corresponds to the lower border of 11th rib, lies between the diaphragm and left kidney.)



(In the slide not mentioned in the lec.: Intermediate margin: is the ridge which separates the renal and gastric surfaces. Internal border separates the diaphragmatic from the colic surface.)

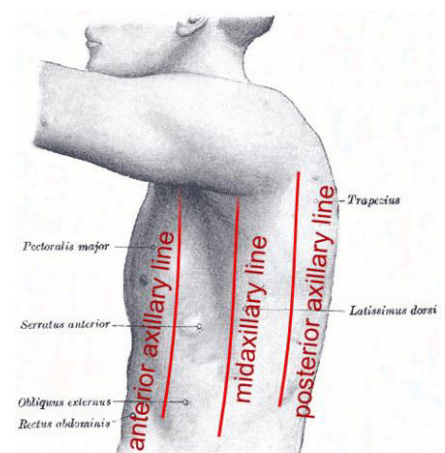
Ends of spleen(angles)

1. Upper end (superior angle):

- ✚ Medial.
- ✚ Lies 4cm away from dorsal spine of the vertebra i.e 4 cm away from the posterior mid line (which is the line between the dorsal spines of the vertebra)

2. Lower end(inferior angle):

- ✚ Lateral
- ✚ It lies in the **left** mid axillary line (from the apex of axilla downward, and there is also an anterior and posterior axillary line).



*Remember that the axilla in the upper limb has an apex and from it descends the mid axillary line.

*Also in the anterior fold there is an anterior axillary line, and in the posterior fold there is a posterior axillary line.

Ligaments:

- A- Gastro-splenic: between the spleen & greater curvature of stomach, contains short gastric artery and left gastroepiploic vessels before they reach the greater omentum.
- B- Lienorenal (splenico-colic) ligament: between spleen & left kidney, contains the splenic vessels and the tail of the pancreas.

SIZE (all of them are odd numbers
1, 3, 5, 7)

- One inches thickness.
- Three inches broad.
- Five inches in length.
- Weight 7 ounce. (means 0.25 kilogram) = أوقية
-

Shape: Two ends, two borders, 2 surfaces.

Surfaces:

- A- Costal surface (Diaphragmatic): related to **left** costal cartilage 9, 10, 11, diaphragm separates it from left pleura and lung.
- B- Visceral surface related to:
 - Gastric impression (for the stomach, above the hilum between it and the anterior/upper border).

In the slide not mentioned:

1-diaphragmatic: Has Post- lat. Relation, Convex, Smooth.

2- visceral:

A-Has Ant- med. Relation.

B-It is divided by a ridge into:

1-Anterior (gastric): Extends forward, upward, and medial ward, broad and concave, related to stomach.

2-Posterior (renal): Directed medial ward and downward, It is somewhat flattened, related to Lt.kidney.

C-Lower extremity has: Colic and pancreatic surface.

Colic surface: It is flat, triangular in shape, rests upon the left flexure of the colon and the phrenico-colic ligament, and is generally in contact with the tail of the pancreas(pancreatic surface)

- Renal impression (for the left kidney, between the hilum and inferior border).
- Colic impression (for left colic flexure of transverse colon, inferiorly; below the hilum).
- In the hilum impression for the tail of pancreas.

*The hilum contains the splenic artery (ant) and vein (post), and the tail of pancreas.

NOTE: correct slide# 87; in the diaphragmatic surface it should be: “left’ Ribs 9, 10, 11”. Instead of “Ribs 9, 10, 11”

BLOOD SUPPLY

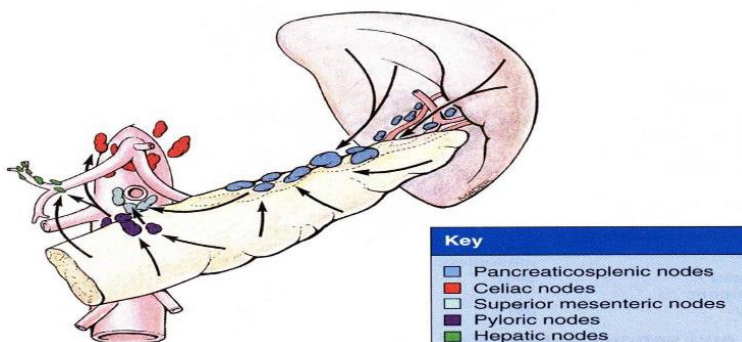
Arterial supply: The splenic artery is the largest branch of the celiac trunk. It runs tortuously along the upper border of pancreas and at the hilum, it gives 5-6 branches.

The vein is the opposite exactly; the splenic vein leaves the hilum, behind the tail and body of pancreas, and it is a tributary for 4-5 branches.

*Behind the neck: splenic and superior mesenteric form the portal vein.

LYMPH NODES

Begin at the hilum, runs in the ligaments (especially the lienorenal ligament), and ends in the celiac lymph nodes, around the celiac artery.



(in the slide: The lymph vessels emerge from the hilum and pass through a few lymph nodes along the course of the splenic artery and then drain into the celiac nodes.)

Nerve Supply

- The nerves accompany the splenic artery and are derived from the celiac plexus. (Sympathetic and parasympathetic).