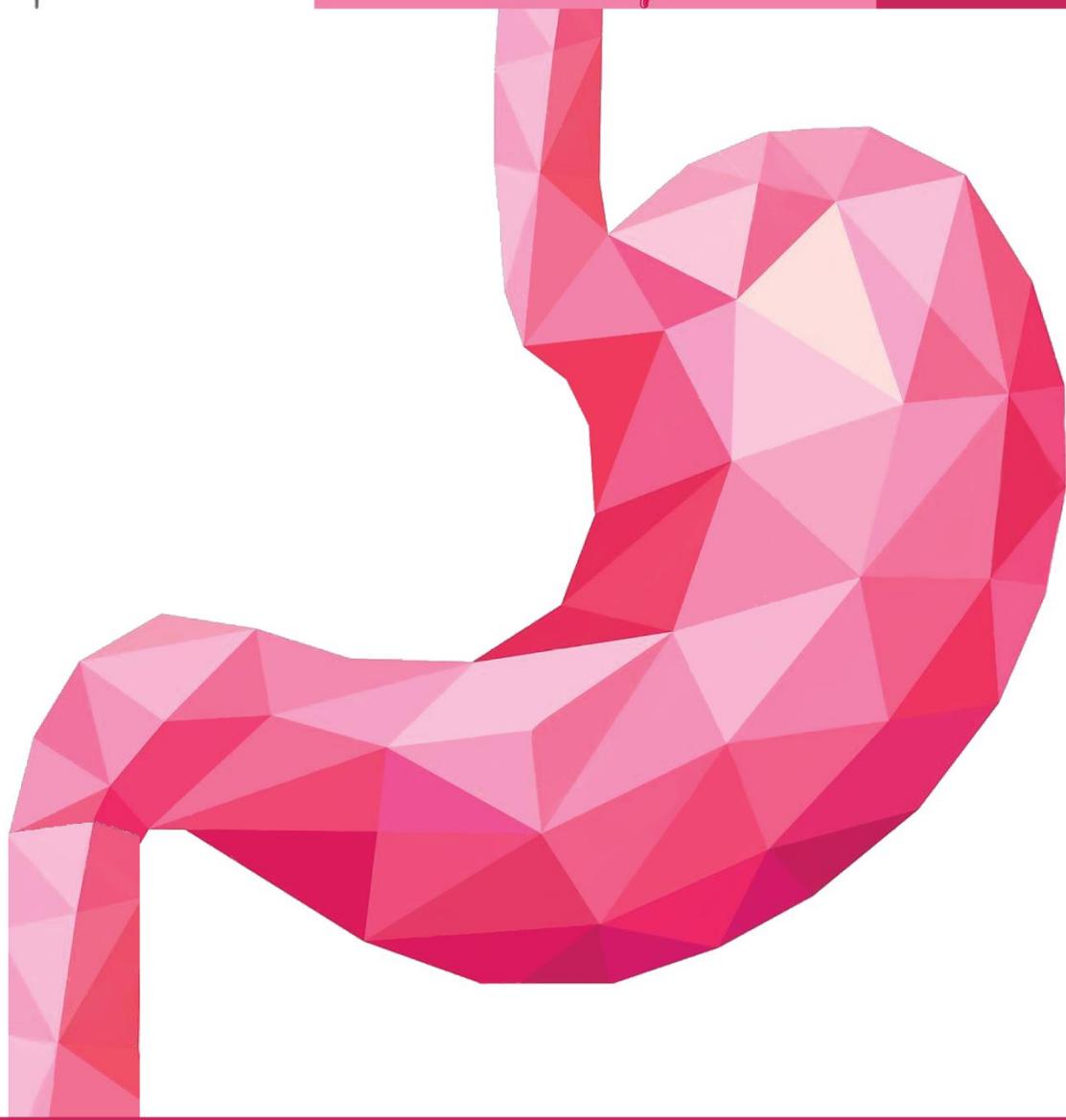




GIS 7

ANATOMY



Done by: Rama Abbady

Scientific Correction: Hala Dradkah

Gramatical Correction: Hala Dradkah

Doctor: Mohammad Al-Muhtaseb

→ Note! Additional pictures were added for clarification. Anything underlined is from the slides but was not mentioned by the doctor during the lecture.

➤ The Peritoneum (Recap):

- The **peritoneum** is a serous membrane which lines the abdominal cavity and covers the abdominal organs. It is divided anatomically into a parietal and visceral peritoneum.
- The parietal peritoneum lines the anterior and posterior abdominal walls, the lower surface of the diaphragm and the pelvic viscera.
- The visceral peritoneum lines the **visceral organs**.
- The abdominal organs can be divided according to their relationship to the peritoneum into **Intraperitoneal** (stomach, small intestine ,spleen ,transverse colon) and **retroperitoneal** "behind posterior parietal peritoneum " (ex : duodenum except first & last inches ,pancreas , ascending colon descending colon , kidneys and suprarenal ,abdominal aorta & IVC .)



➤ The Peritoneal Recesses and Fossae

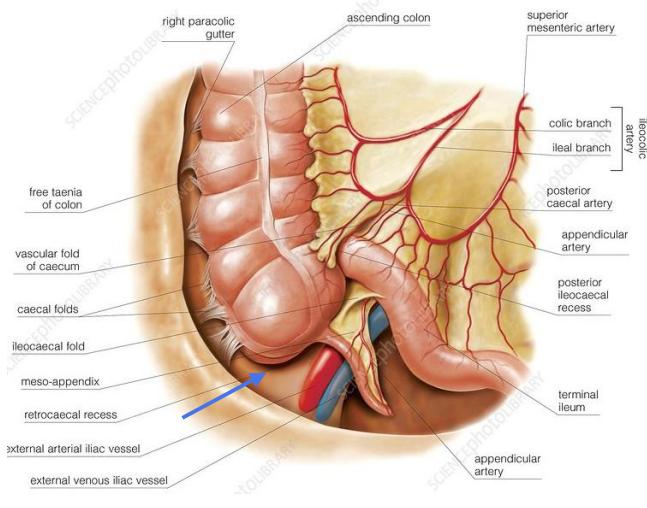
- In certain parts of the abdomen (at the junction between intraperitoneal and retro peritoneal organs) the transition from a **retroperitoneal** organ to an **intraperitoneal** one creates a fold of peritoneum; this fold may have a **recess or fossa** beneath it.
- An example on this is the fossa found around the epiploic foramen (the foramen between the greater and lesser sacs).
- From a surgical point of view, the omental bursa can be considered to belong to this category, with its opening at the epiploic foramen, bounded in front by the free border of the lesser omentum.
- These recesses are of surgical importance since they may become the site of internal hernia, that is, a piece of intestine or the greater omentum may enter a recess or fossa and if there is pressure on the walls of the intestine, **internal hernia** will become strangulated hernia (the intestine is constricted or strangulated by the peritoneal fold granding the entrance to the recess → cut of blood supply to that part of the intestine).
- The cut of the blood supply in **strangulated** hernia will cause gangrene (degeneration of cells) in the part of the small intestine that is herniated, and this requires urgent surgical intervention where we remove the gangrenous part of the small intestine and connect the two healthy parts together.
- A person with internal hernia (especially kids) will have a feeling of discomfort and slight pain but if it progresses to strangulated hernia there will be severe pain.
- These recesses are sometimes found in relation to **the duodenum** (retroperitoneal except the first and last inches and the jejunum is intraperitoneal so there are recesses around it), **cecum** (in the right iliac fossa, the cecum is retroperitoneal while the ileum is intraperitoneal *please note that the cecum as a whole is considered intraperitoneal*) and **sigmoid colon** (intraperitoneal but the descending colon is retroperitoneal so recesses may form).

1. Duodenal Recesses:

- A. The superior duodenal recess or fossa (posterior abdominal wall)
- B. The inferior duodenal recess or fossa (posterior abdominal wall)
- C. The paraduodenal recess or fossa
- D. The duodenojejunal recess or fossa

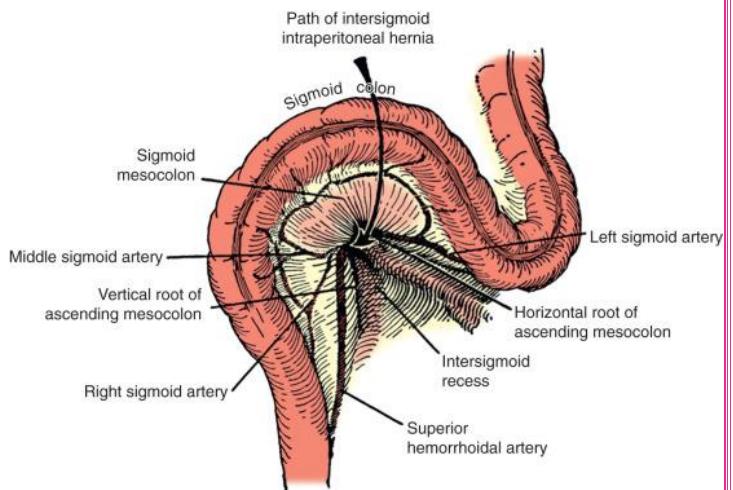
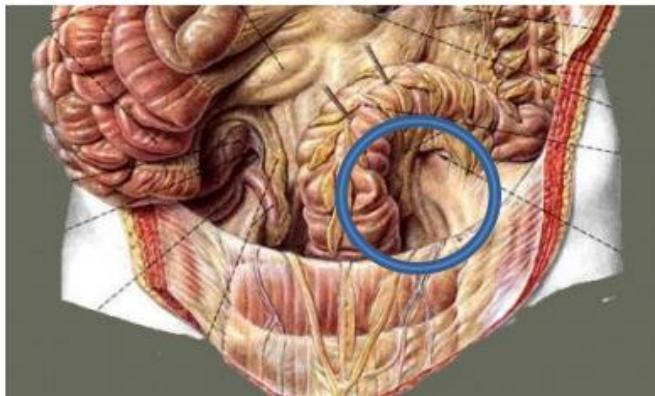
2. Cecal Recesses:

- A. The superior ileocecal or fossa
- B. The inferior ileocecal or fossa
- C. The rectocolic recess or fossa
- D. The retrocecal recesses or fossa (the most important one):
 - ✓ It is a large fossa behind the cecum
 - ✓ The appendix is frequently found there (common site of appendix)



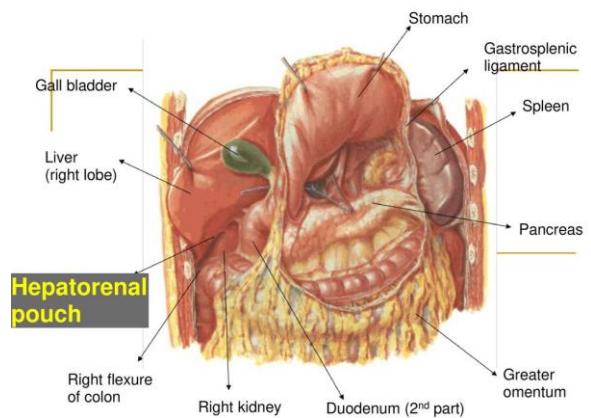
3. The Intersigmoid Recess

- ✓ It is formed by the inverted V attachment of sigmoid mesocolon
- ✓ In the posterior abdominal wall



4. Hepatorenal Recess (Morison's pouch)

- ✓ Found on the right side.
- ✓ It lies between the right lobe of liver, right kidney, and right colic flexure, and is the lowest parts of the peritoneal cavity when the subject is supine.
- ✓ Sometimes in the case of appendicitis, if rupture occurs the pus may gather there, and abscess will form between the liver and the right kidney. In this case, drainage of abscess is required.



▪ Folds and recess of the posterior abdominal wall:

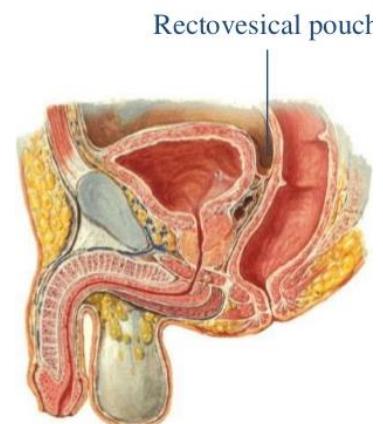
- The superior duodenal fold and recess
- The inferior duodenal fold and recess
- The intersigmoid recess

➤ **Pouches**

- In the lesser pelvis, the peritoneum dips downwards forming a larger fossa, named pouch.
- The clinical importance of pouches: potential sites for internal abdominal hernia.

A. In Males: The Rectovesical Pouch

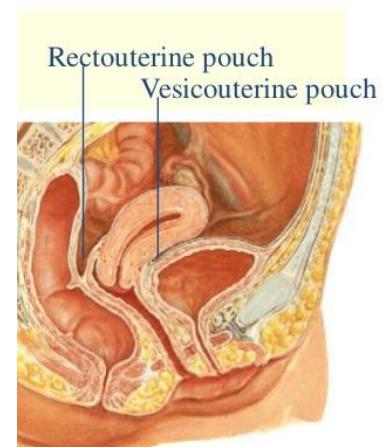
- ✓ It lies between the rectum and the urinary bladder or the seminal vesicles and the ampulla ductus deferentes.
- ✓ Remember that the peritoneum covers the upper 3rd of the rectum completely (except the posterior wall) and covers the rest of the rectum anteriorly. Then it covers the upper surface of the urinary bladder creating a pouch between the rectum and the urinary bladder.
- ✓ Internal hernia may happen here but not as common because it is wide.
- ✓ The retrovesical pouch is the lowest part of the peritoneal cavity in anatomical position in male.



B. In Females: Two Pouches (Anterior and posterior to the uterus)

1. Rectouterine pouch or Douglas pouch:

- ✓ Posterior to the uterus
- ✓ Between the rectum and the uterus
- ✓ Parts of the small and large intestines are usually found here
- ✓ The rectouterine pouch is formed between the anterior surface of the rectum and the posterior surface of the uterus and the upper part of vagina.



2. Vesicouterine pouch

- ✓ Anterior to the uterus
- ✓ Between the bladder and the uterus
- ✓ The Vesicouterine pouch is formed between the anteroinferior surface of the uterus and the superior surface of the urinary bladder.

⇒ **In conclusion:** recesses, fossae, and pouches are spaces formed by **the folding of the peritoneum** and internal hernia is a disadvantage of these spaces.

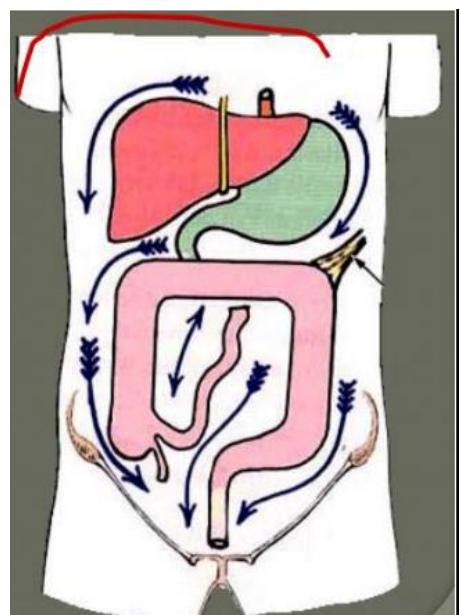
➤ Peritoneal Subdivisions

- The transverse colon and the transverse mesocolon divide the greater sac into:
 - Supracolic compartment (above the transverse colon & mesocolon)
 - Infracolic compartment (below the transverse colon & mesocolon)
 - Rt. extraperitoneal space (bar area of liver & diaphragm)

Remember that the transverse colon is bound to the anterior border of the pancreas

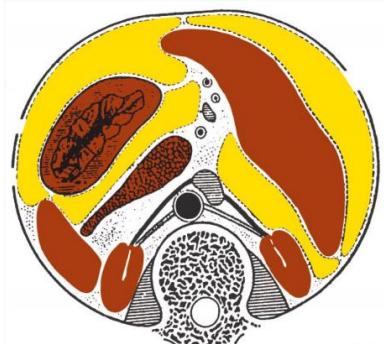
A. Supracolic Compartment

- The supracolic compartment is divided into a:
 1. Subphrenic (subdiaphragmatic) space
 2. Subhepatic space
- Remember what we said above about appendicitis and Morison's pouch (which is found between the liver, the right kidney and the right colic flexure)
- If acute appendicitis progresses to **chronic**, abscess formation will occur and in case of rupture the pus could reach Morison's pouch or the right subdiaphragmatic (subphrenic) space further spreading the infection and formation of other abscesses in these spaces will occur which have to be treated by drainage (notice in the following picture the arrows and how there is a connection between the location of the appendix and the aforementioned spaces).
- The patient in this case would have unstable temperature that goes up and down and would sleep on his right side and on his back and wouldn't eat. If he had untreated acute appendicitis, you can diagnose the issue based on his history.



1. Subphrenic Space (Subdiaphragmatic):

- **from sheet 2017:** The subphrenic space is a peritoneal space between the anterior part of the liver and the diaphragm, separated into right and left by the falciform ligament, and postero-superiorly bounded by the coronary ligament.
- It is divided by the attachment of the falciform ligament into:
 - ✓ Right subphrenic space (abscess formation is more common here than in the left space because it is more open, check the picture with the arrows above)
 - ✓ Left subphrenic space



2. Subhepatic Space

- It is divided into:
 - ✓ Right subhepatic space (morison's pouch)
 - ✓ Left subhepatic space (lesser sac)

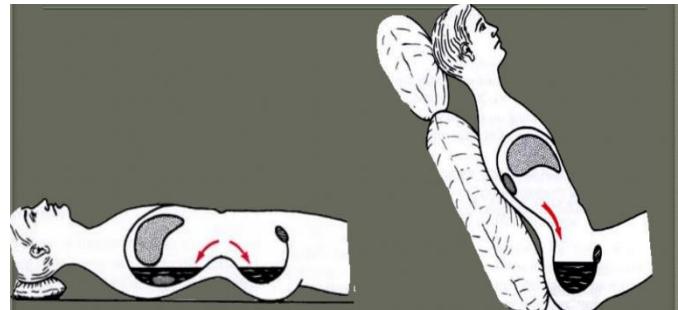
B. Infracolic Compartment

- The infracolic compartment lies below the transverse colon and transverse mesocolon.
- It is divided by root of the mesentery of small intestine into:
 - ✓ Right Infracolic compartment (closed from the pelvis by the mesentery)
 - ✓ Left infracolic compartment (open to the pelvis)



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- When a person is sleeping on his back fluid in the abdomen will gather in 2 cavities, one in the abdomen and one in the pelvis.
- If the person is sitting up fluid will gather in the pelvis. The fluid descends to the pelvis because of the presence of paracolic gutters.



- We know that the ascending and descending colons are retroperitoneal, but the peritoneum not only covers their anterior surfaces but also covers their sides and fixes them to the posterior abdominal wall, and the attachment of the peritoneum to the post. The abdominal wall creates the gutters or sulcus on the sides of the colons, and these gutters or grooves are what allow movement of fluid in the abdominal cavity either above or below (think of them like rivers).

• Right Paracolic Gutter (Sulcus):

- Subdivided into:

A. Right medial paracolic gutter:

- ∞ It is **closed** from above and below therefore infection in the right medial paracolic gutter is **localized** and does not spread anywhere.



B. Right lateral paracolic gutter:

- ∞ It is **open**, it communicates with the hepatorenal recess and the pelvic cavity and provides a route for the spread of infection between the pelvic and the upper abdominal region (to morison's pouch or to the subdiaphragmatic space on the right side).

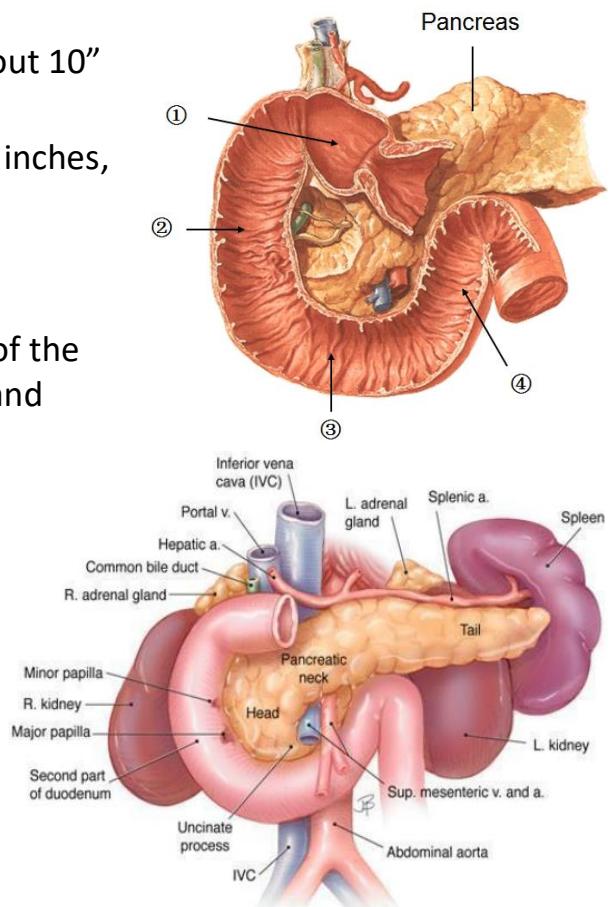
- **Left Paracolic Gutter (Sulcus):**
 - Subdivided into:
 - A. Left medial paracolic gutter:**
 - ∞ It is separated from the area around the spleen by the transverse colon and mesocolon which prevent the spread of infection upwards (Notice the arrows in the picture above).
 - B. Left Lateral paracolic gutter:**
 - ∞ It is separated from the area around the spleen by the phrenicocolic ligament (a fold of peritoneum that passes from the colic flexure to the diaphragm), and this ligament prevents the spread of infection upwards.
 - ∞ i.e. infection in this gutter doesn't reach the left subdiaphragmatic space due to the ligament between the left colic flexure and the diaphragm.
 - Both of those gutters communicate with the pelvis and are open to the outside through it. Therefore, infection in both gutters can spread only downwards to the pelvis.

The Small Intestine

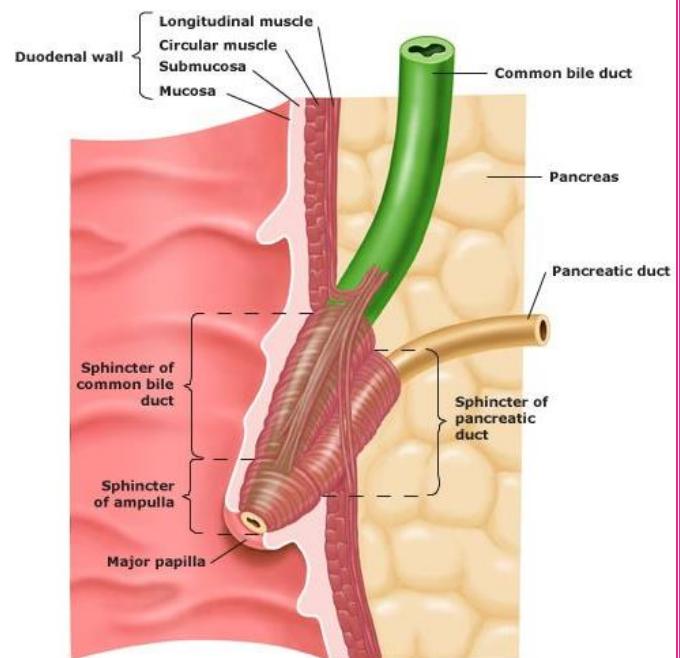
- The small intestine is made up of 3 parts:
 - The duodenum which is 25cm (10 inches) and is **retroperitoneal** except the first and last inches.
 - The jejunum and ileum which are 6 meters long and are **intraperitoneal** (they have a mesentery).

➤ The Duodenum

- The duodenum is a c-shaped concave tube about 10" in length.
- It has four parts, the 1st is 2 inches, the 2nd is 3 inches, the 3rd is 4 inches and the 4th in 1 inch).
- It joins the stomach to the jejunum.
- The concavity of the duodenum has the head of the pancreas. The pancreas has a tail, body, neck and head and the duodenum curves around the head of the pancreas to **the left and backwards**.
- The portal vein forms behind the neck of pancreas from the splenic and superior mesenteric veins and continues to the liver.
- Notice the location of the uncinate process of the head, left of the duodenum. The superior mesenteric artery and veins pass in front of this process.



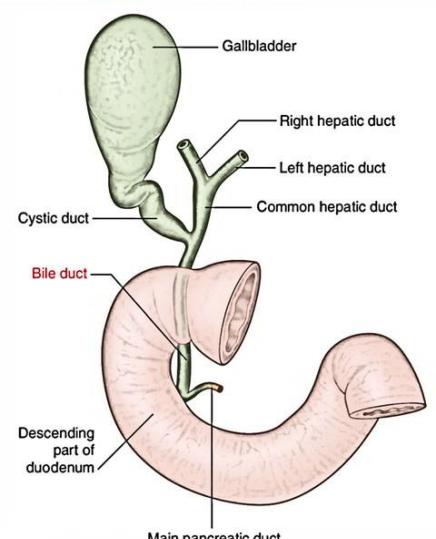
- Most of the duodenum is retroperitoneal except the 1st inch & last inch, this short segment (1st inch) has the lesser omentum on its upper border, the greater omentum on its lower border, and the lesser sac posterior to it.
- The duodenum begins at the pyloric sphincter (stomach) and ends at the ligament of Treitz which continue as the jejunum.
- Importance of duodenum: the 2nd part receives the opening of the common bile and pancreatic ducts; they secrete substances to complete the digestion of fat which occurs in the duodenum.
- The common bile duct and the pancreatic duct have the same opening in the duodenum. When they meet, they form a **bulge** in the duodenal wall called **ampulla of vater**.
- Around it is a sphincter called **sphincter of Oddi** (a smooth muscle).
- We call the opening from inside **the major duodenal papilla**, sometimes there is another opening 1 inch above the major papilla for accessory pancreatic ducts called **minor duodenal papilla**.
- The duodenum is situated in the epigastric and umbilical regions.



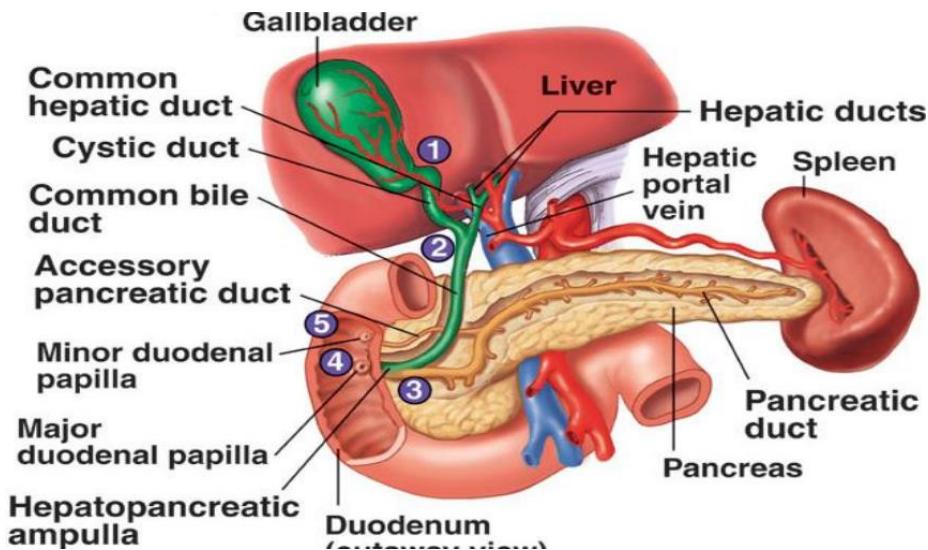
⇒ **Origin of the common bile duct:** the liver has left and right lobes, and the left and right hepatic ducts form the common hepatic duct which meets with the cystic duct of the gallbladder to form **the common bile duct**.

Histology Section:

- The GI track has 4 layers (mucosa, submucosa, muscular layer and adventitia or serosa).
- The folds on the inside of the duodenum are called plicae circulares.
- The lining epithelium of the duodenum (mucosa) is simple columnar epithelium with goblet cells.
- In the submucosa of duodenum there are glands called Brunner's glands that produce the alkaline secretion that neutralizes the acidity of the chyme when it comes from the stomach.
- Note: in the entirety of the GI track only 2 organs have glands in their submucosa, and they are the esophagus and duodenum.



- In the mucosa of the duodenum there is lamina propria which also contains glands called crypts of Lieberkühn.
- The lamina propria is a thin layer of loose (areolar) connective tissue, which lies beneath the epithelium, and together with the epithelium and basement membrane constitutes the mucosa, from the web.
- **The doctor discussed ERCP (Endoscopic retrograde cholangiopancreatography)**
 - This is a new technique where an endoscope is placed through the mouth and proceeds retrogradely through the pharynx, esophagus, stomach and duodenum and then you find the major duodenal papilla and you cut the sphincter of oddi and you enter either the pancreatic or common bile ducts based on what you want to do.
 - This technique is used in treatment of stones that form in the common bile duct and block it and this causes **jaundice** (yellow sclera, yellow and itchy skin) which was treated with surgery in the past, when you find the stone with the endoscope you use a basket and remove the stone and leave it in the duodenum and it gets out with the stool.
 - Sometimes stasis of the secretion of pancreas happens and it becomes like mud or forms stones and closes the pancreatic duct and may cause pancreatitis which is very dangerous, and it is treated with ESRP, by entering the duct with the endoscope and adding saline which will dissolve the stones.
- **The Parts of the Duodenum and their Relations**



1. 1st Part of The Duodenum

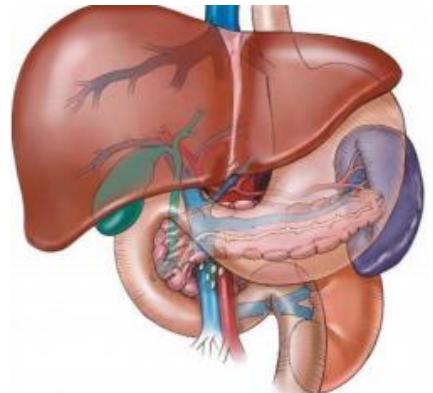
- The first part is 2 inches long, and is divided into two parts:
 - ✓ The first inch (**intraperitoneal**)
 - ∞ Common site of peptic\duodenal ulcers
 - ∞ Duodenal ulcers are more common than gastric ulcers and happen because the chyme that comes from the stomach is acidic (the duodenal secretions are alkaline and work to neutralize that acidity, but ulcers could still happen if the acidity was too high), the posterior wall of duodenum is affected the most.
 - ✓ The second inch (**retroperitoneal**)

- The first part begins from the pyloduodenal junction.
- At the level of the transpyloric line.
- Runs **upward** and **backward** at the level of the 1st lumbar vertebra 1 inch **to the right**.

- Relations of the first part:**

- **Anteriorly:**

- ✓ The liver (quadratus lobe)
- ✓ The gall bladder



- **Superiorly:**

- ✓ The epiploic foramen (anterior to it there is a free edge of lesser omentum containing three structures: the common pyloric duct, the hepatic artery and portal vein)

- **Posteriorly:**

- ✓ The lesser sac
- ✓ The bile duct
- ✓ The portal vein
- ✓ Inferior vena cava
- ✓ gastroduodenal Artery (if there is a peptic ulcer on the posterior wall of the 1st inch perforation and infiltration may occur along with bleeding from this artery)



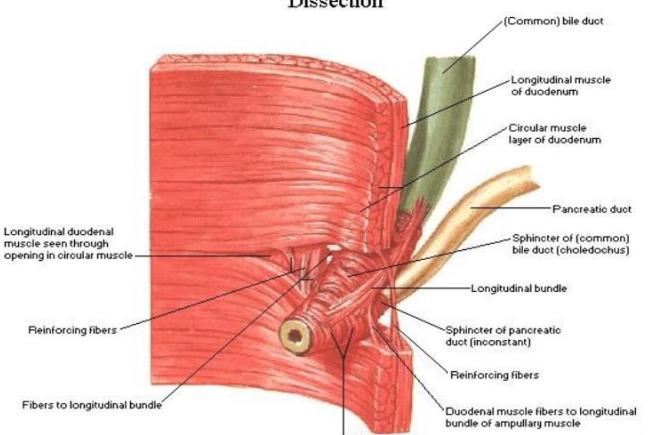
- **Inferiorly:**

- ✓ The head of the pancreas

2. 2nd Part of the Duodenum

- It is 3 inches long, runs downward vertically on the right side in front of the right kidney and right ureter and ends next to 3rd and 4th lumbar vertebrae.
- Halfway of it, the bile duct and the main pancreatic duct pierce the medial wall, and then form the ampulla that opens in the major duodenal papilla.
- The accessory pancreatic duct (if present) opens in the minor duodenal papilla more superiorly.
- Importance of the 2nd part: it receives the common bile and pancreatic ducts.

Junction of Bile Duct and Duodenum
Dissection



- **Relations of the second part:**

- **Anteriorly:**

- ✓ The gallbladder (fundus)
- ✓ The right lobe of the liver
- ✓ The transverse colon
- ✓ The coils of small intestine

- **Posteriorly:**

- ✓ Hilum of the right kidney
- ✓ The right ureter

- **Laterally:**

- ✓ Right colic flexure
- ✓ Ascending colon
- ✓ Right lobe of the liver

- **Medially:**

- ✓ Head of the pancreas
- ✓ Bile and pancreatic ducts

3. 3rd Part of the Duodenum

- 4 inches' long
- Runs horizontally to the left, in front of the vertebral column
- On the subcostal plane.
- Under the lower margin of the head of pancreas
- Above the coils of the jejunum.

- **Relations of the third part:**

- **Anteriorly:**

- ✓ The root of the mesentery of the small intestine
- ✓ The superior mesenteric vessels contained within the mesentery coils of the jejunum

- **Posteriorly:**

- ✓ The right ureter
- ✓ The right psoas muscle
- ✓ The inferior vena cava
- ✓ The aorta

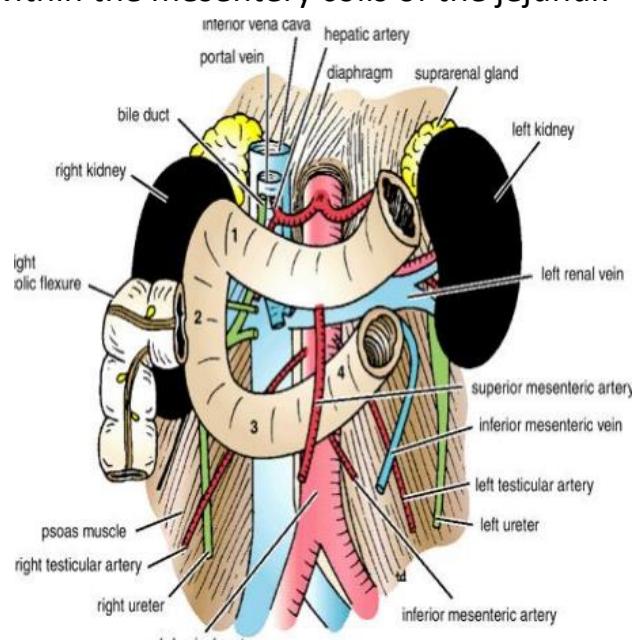
- **Superiorly:**

- ✓ The head of pancreas

- **Inferiorly:**

- ✓ Coils of jejunum

Hepaticopancreatic ampulla
(Ampulla of Vater)



4. 4th Part of the Duodenum

- 1 inch long
 - Runs upward to the left
 - Ends in the duodejejunal junction at the level of the 2nd lumbar vertebrae 1 inch to the left.
 - The junction (flexure) is held in position by the ligament of Treitz, which is attached to the right crus of the diaphragm (duodenal recess).
-
- Relations of the fourth part:
 - Anteriorly:
 - ✓ The beginning of the root of the mesentery
 - ✓ Coils of the jejunum
 - Posteriorly:
 - ✓ Left psoas major muscle
 - ✓ The sympathetic chain on the left margin of the aorta
 - Superiorly:
 - ✓ Uncinate process of the pancreas

⇒ Blood supply of the duodenum:

● Arteries:

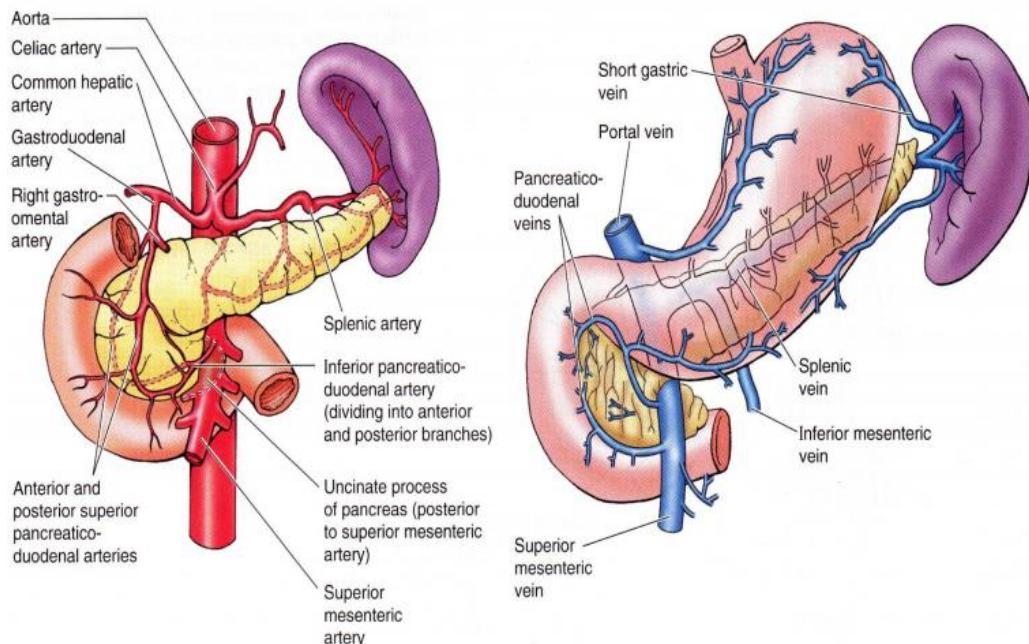
1. The upper half (1st part + upper half of the 2nd part) follows the **foregut** and is supplied by **the superior pancreaticoduodenal artery**, a branch of the gastroduodenal artery (**from celiac trunk**).
 2. The lower half (lower half of the 2nd part + 3rd + 4th part) follows the **midgut** and is supplied by the **inferior pancreaticoduodenal artery**, a branch of the **superior mesenteric artery**
- The upper and lower halves are separated by the major duodenal papilla and sphincter of Oddi.

⊕ Embryology Section:

- The GI track is divided to three parts:
 1. Foregut (esophagus (lower part), stomach and upper half of duodenum)
 - ✓ Blood supply of foregut → Celiac trunk of abdominal aorta
 2. Midgut (from lower half of duodenum to lateral\distal third of transverse colon)
 - ✓ Blood supply of midgut → Superior mesenteric artery
 3. Hindgut (from distal third of transverse colon to rectum)
 - ✓ Blood supply of hindgut → Inferior mesenteric artery

- Veins:
 - The superior pancreaticoduodenal vein drains into the portal vein.
 - The inferior vein joins the superior mesenteric vein.

Arterial supply and venous drainage of the duodenum



⌚ Lymphatic drainage

- The lymph vessels follow the arteries:
- ✓ Drainage upward → via pancreaticoduodenal nodes → the gastroduodenal nodes → the celiac nodes.
- ✓ Drainage downward → via pancreaticoduodenal nodes → the superior mesenteric nodes around the origin of the superior mesenteric artery.

⌚ Nerve supply

- Sympathetic nerves
- Parasympathetic nerves from:
 1. The celiac plexus.
 2. Superior mesenteric plexus.
- ∞ The nerve supply will be discussed in detail with the rest of the small intestine

"الأشياء الجميلة تأخذ بعض الوقت"

Hala Dradkah