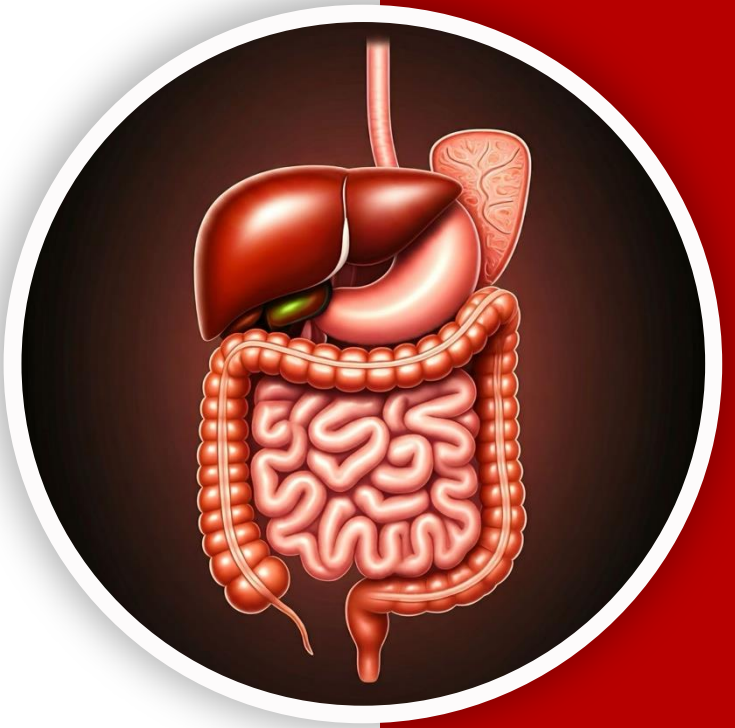
بسم الله الرحمـٰن الرحيم

(وَفَوْقَ كُلِّ ذِي عِلْمٍ عَلِيمٌ)

GIS Anatomy | MID 4

The Small Intestine



Written by : DST

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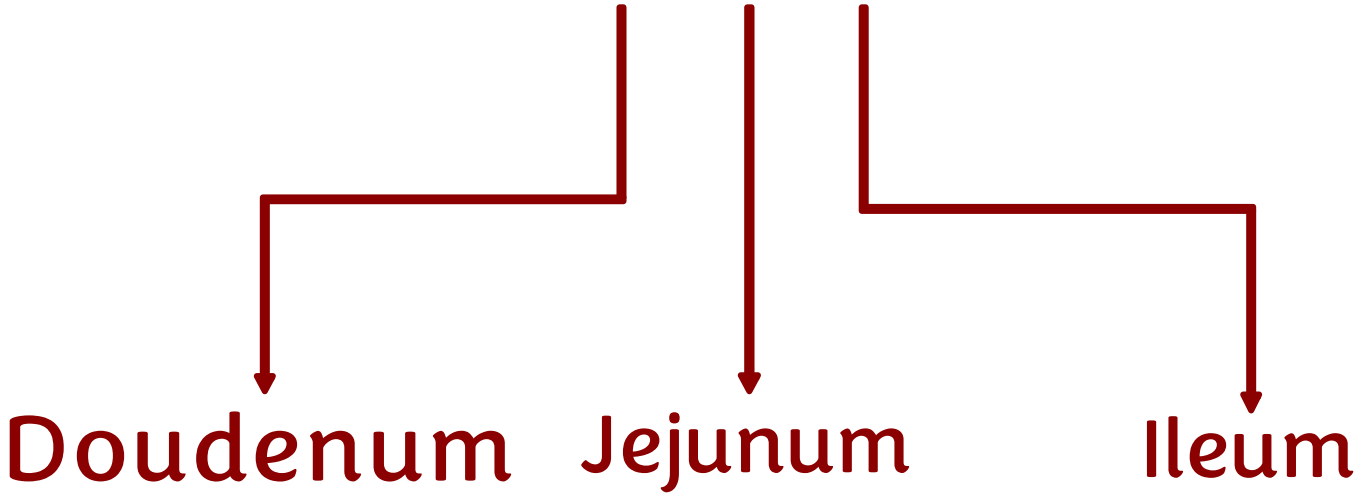
Color code of the Modified :

- Doctor’s word that is not in the slides.
- Doctor’s Slide that wasn’t mentioned in the lecture.
- Extra information.
- Doctor’s slide that was mentioned in the Lecture.

The small intestine

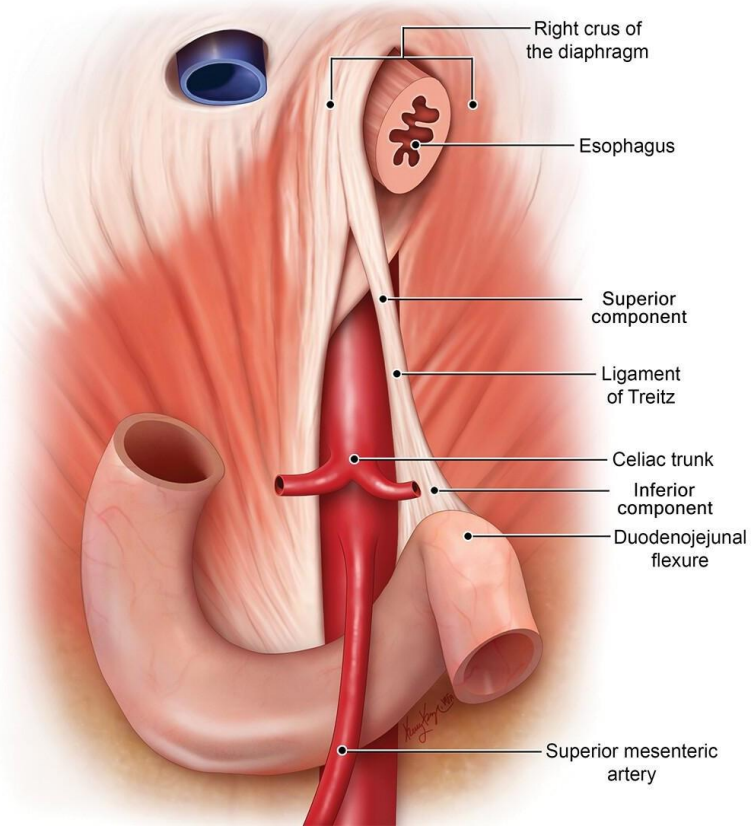


DOUDENUM

Not Mentioned in the slides

Duodenum: Start and End Points

Start:
Begins at the **pyloric sphincter**, marking the end of the stomach.



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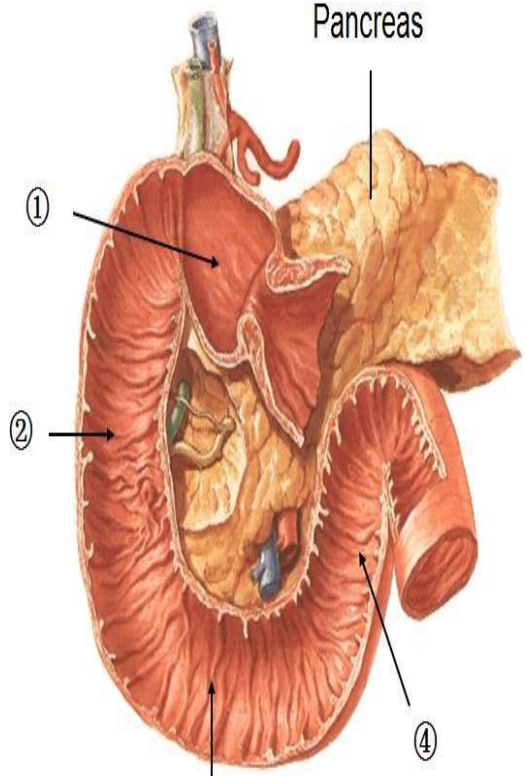
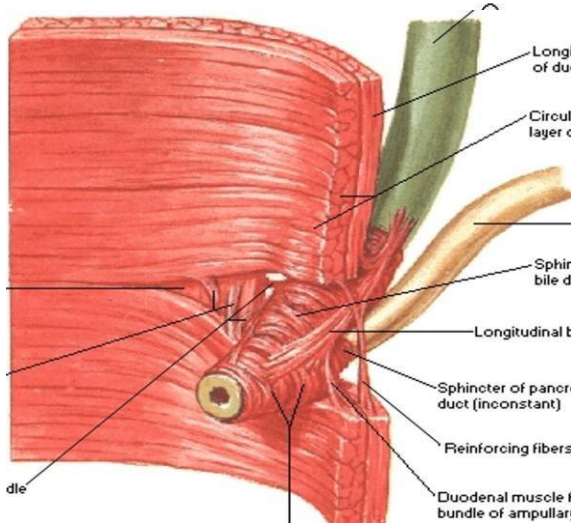
- The duodenum is a c-shaped
- Concave tube , it curves around the head of pancreas to left and backwards. The tail of pancreas goes toward the spleen
- The Duodenum is about 10 inches (*25cm*) in length, divided into 4 parts .
- It joins the stomach to the jejunum.
- The importance of duodenum ; its second part receives **Common Bile duct +Main Pancreatic Duct** (Sometimes an accessory pancreatic duct is also present) , these ducts release the the bile , bile salts ,and pancreatic enzymes respectively ,into the duodenum to digest fat .





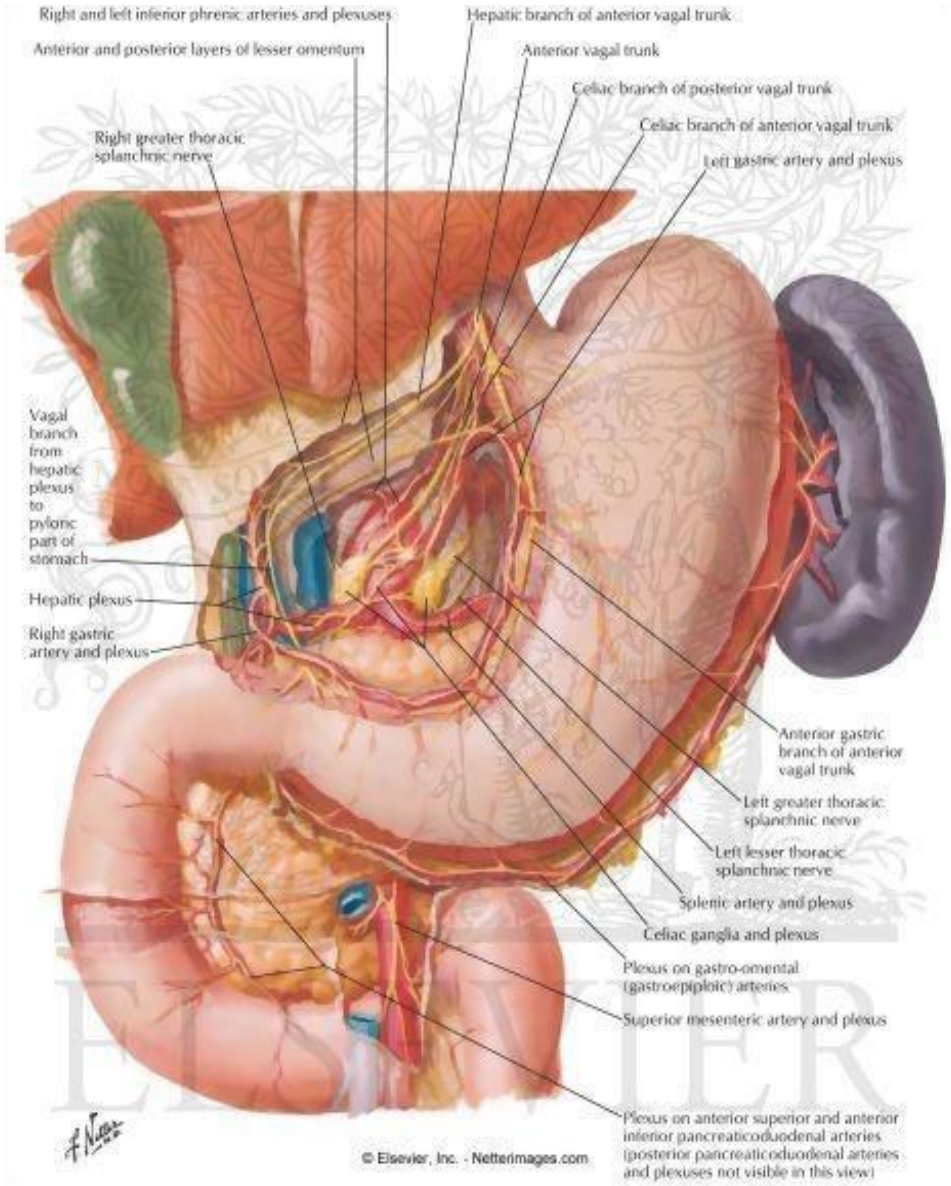
duodenum….cont

- Most of the duodenum is **retroperitoneal** except the 1st inch & last inch which are **intraperitoneal.**

- 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 extends from the pylorus to the jejunum.

- Last inch of duodenum intraperitoneal because it's connected to jejunum which is surrounded by peritoneum
- It is divided into 4 parts.



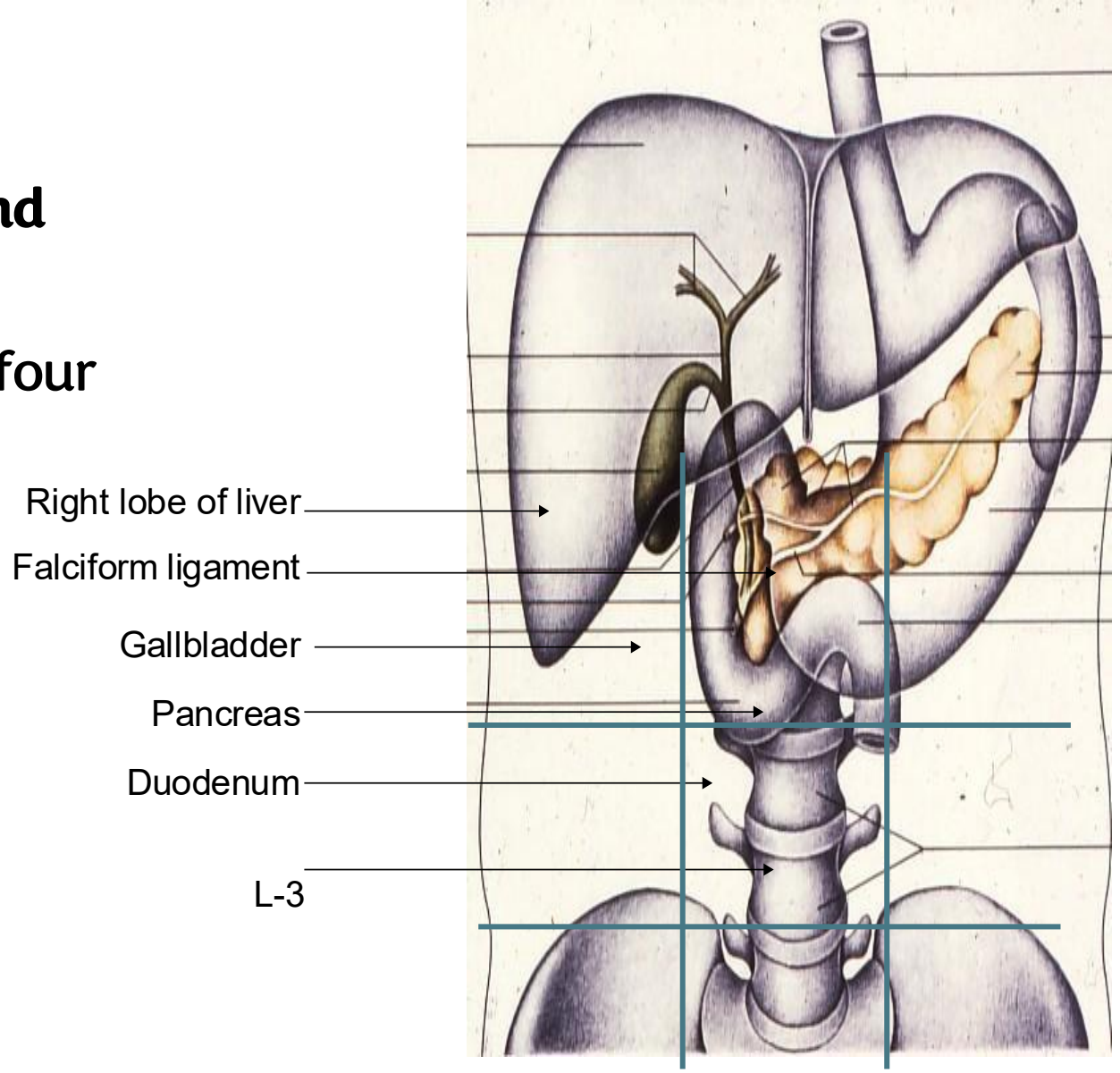
Clinical Note: Peritoneal Folds at the Duodenojejunal Junction

- **Anatomical Transition:** The transition of the duodenum from a retroperitoneal to an intraperitoneal structure at the duodenojejunal junction creates peritoneal folds.
- **Clinical Disadvantage:** The highly mobile small intestines (jejunum and ileum) can sometimes slip behind these folds.
- **Pathology:** This displacement can cause a strangulated internal hernia.
- **Consequence:** The herniation cuts off the blood supply, leading to severe complications (further discussed in peritoneal anatomy)

Site of duodenum

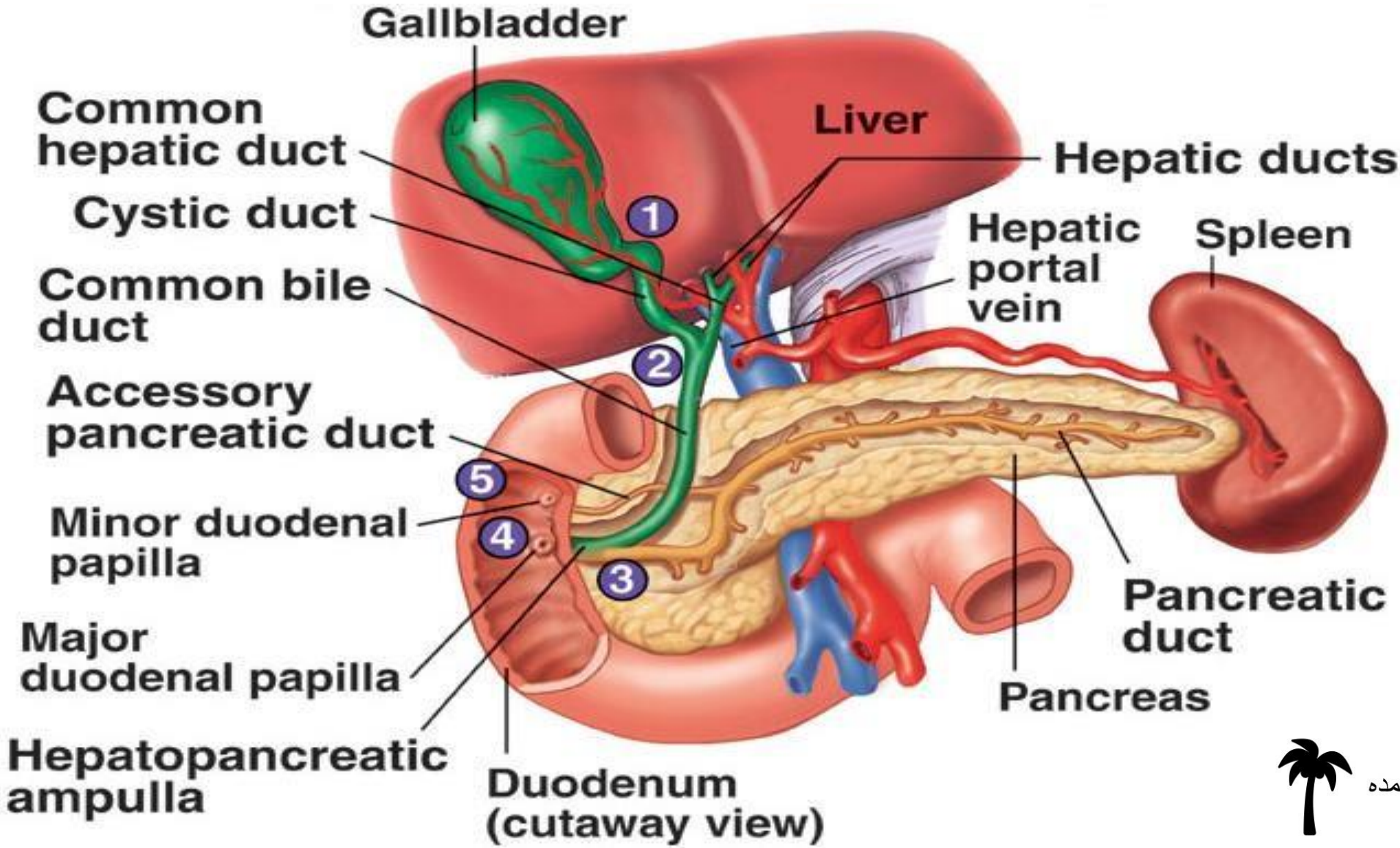
-The duodenum is situated in the **epigastric and umbilical regions**

- for purposes of description, is divided into four parts



· **Bile Duct Formation:** Cystic duct + Common hepatic duct = **Common bile duct**.
· **Duct Merger:** The Common bile duct merges with the **Main pancreatic duct**.
· **Ampulla of Vater:** The dilated junction (chamber) where these two ducts unite.
· **Sphincter of Oddi:** The smooth muscle surrounding the Ampulla of Vater to control flow of bile & pancreatic secretions.
· **Major Duodenal Papilla:** The actual physical opening (the "door") on the inner wall of the duodenum where the Ampulla of Vater empties its contents.
· **Minor Duodenal Papilla:** A separate, smaller opening located above the major papilla, solely for the drainage of the **Accessory pancreatic duct** (if present).

Parts of the duodenum &Their relations



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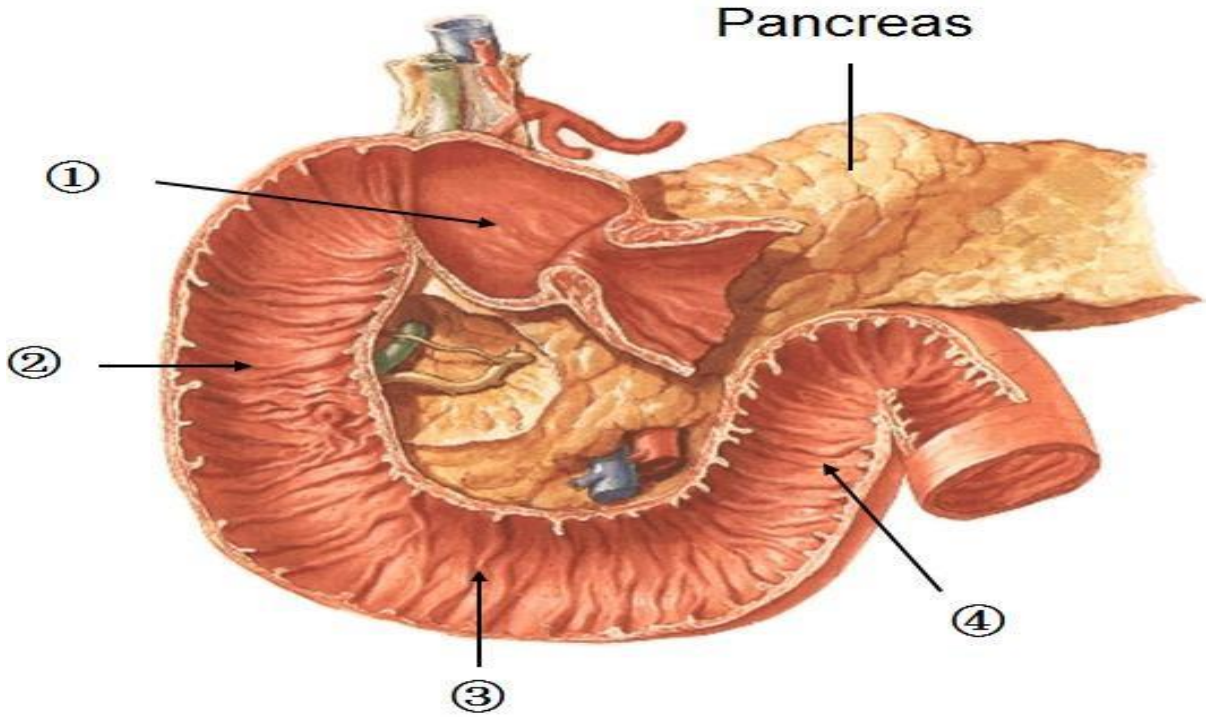
Parts of the duodenum & Their relations

Lengths of the Duodenum (in inches):

1. First part: **2** inches
2. Second part: **3** inches
3. Third part: **4** inches
4. Fourth part: **1** inch



Duodenal Relations to the Lumber Vertebrae :

First part: at the level of **L1** (horizontal)
Second part: from **L1 to L3** (vertical)
Third part: at the level of **L3**
(horizontal) Fourth part: from **L3 to L2**
(vertical)

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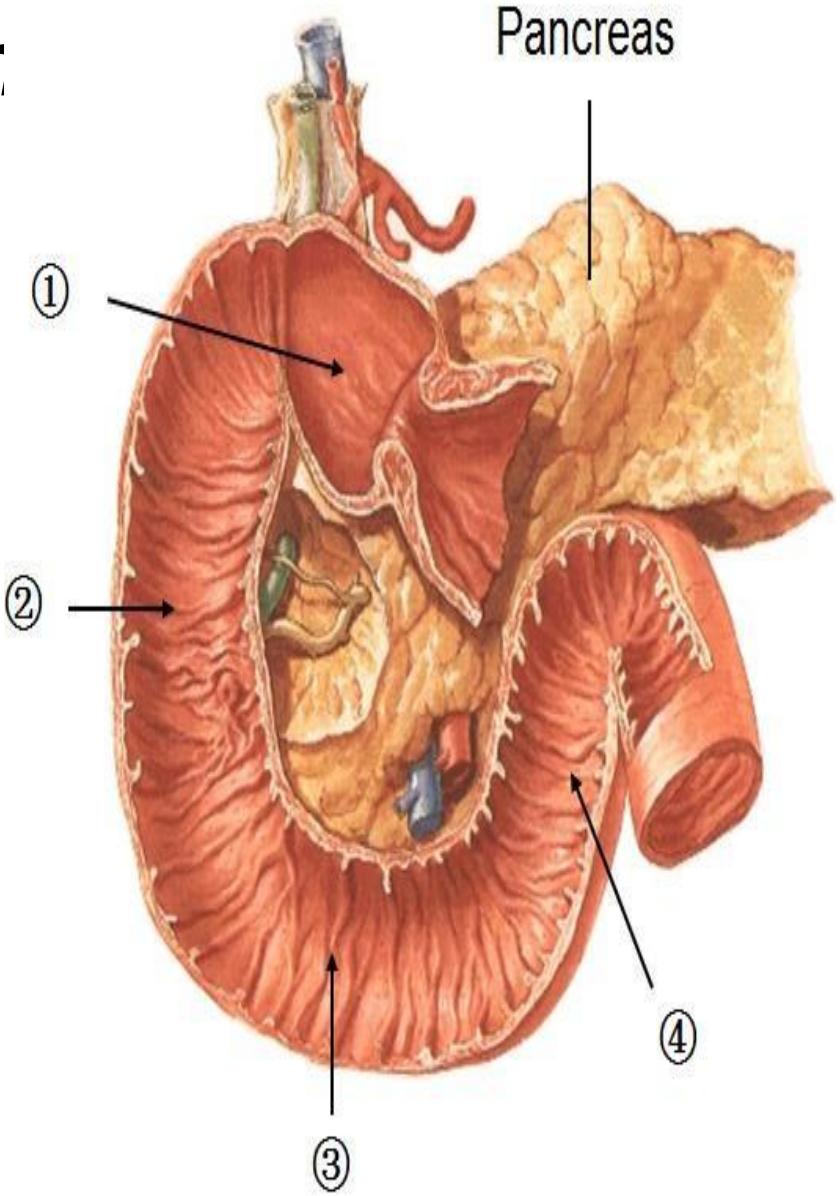
1st part of Duodenum

It travels upwards and to the right, reaching the level of the neck of the gallbladder.

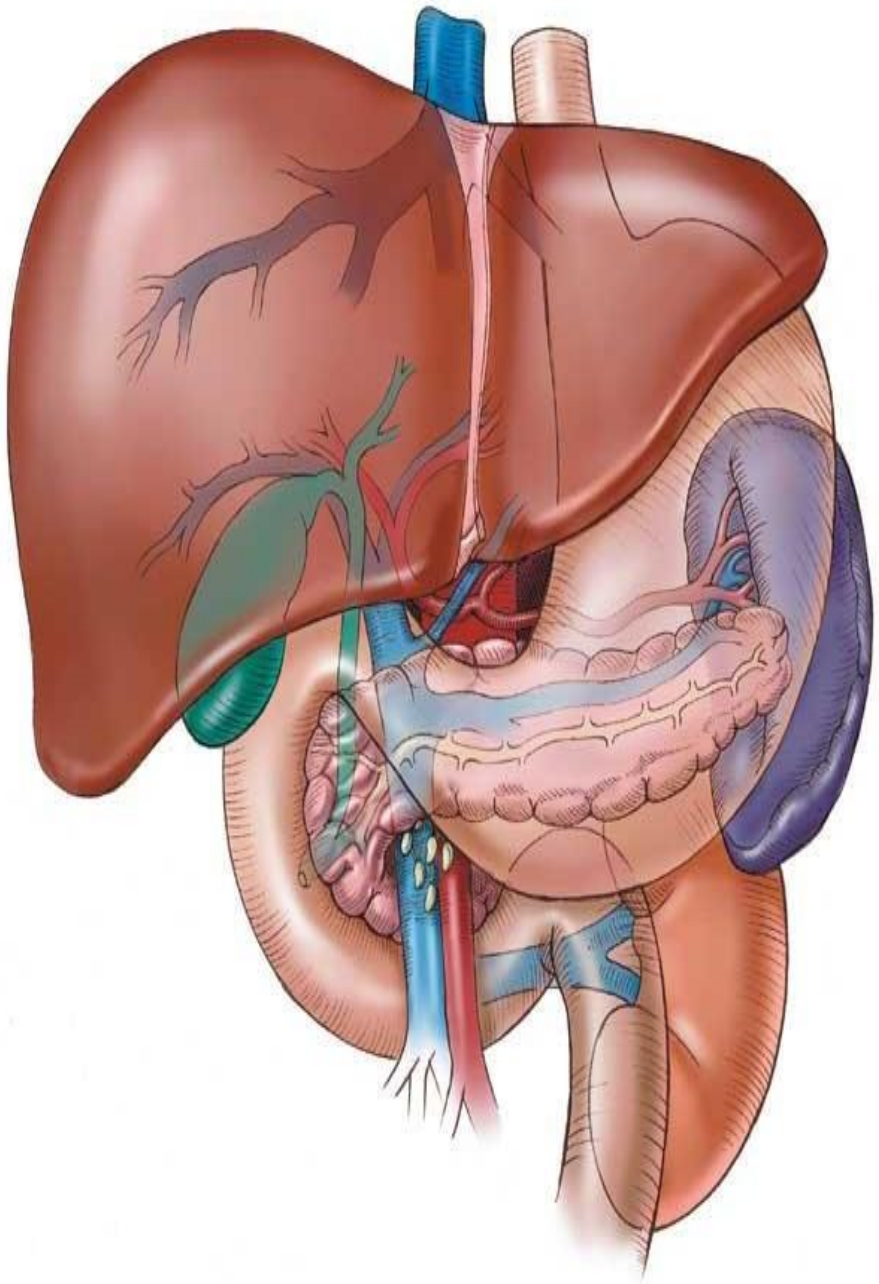
- The first part is 2 inches long.
- Peptic ulcers are most common in the first inch of the duodenum, where direct exposure to highly acidic chyme emptying immediately from the stomach causes severe mucosal irritation. This ulceration occurs despite the duodenum's compensatory mechanism of neutralizing the acid via alkaline secretions.
- It 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 1st part of doudenum

Ant.

- The liver (quadratus lobe)
- gall bladder



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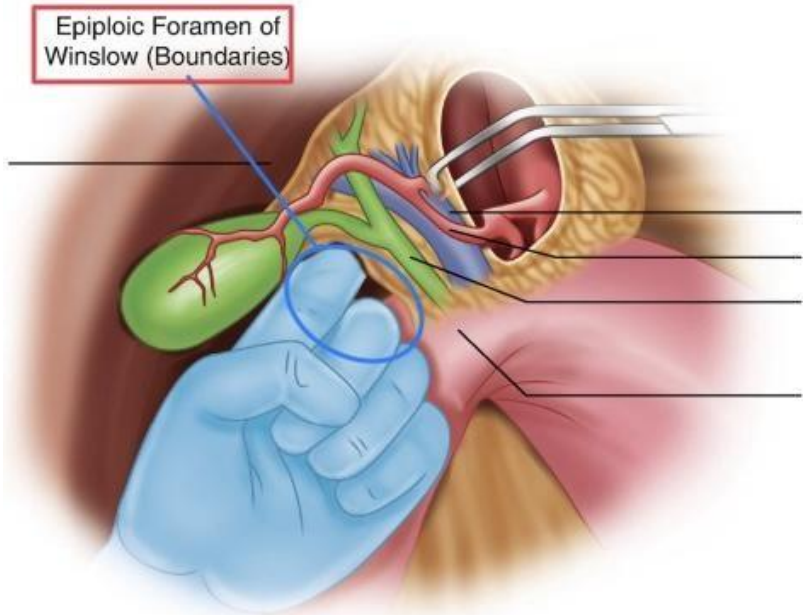
Relations of 1st part of duodenum……cont

Sup.

- the epiploic foramen



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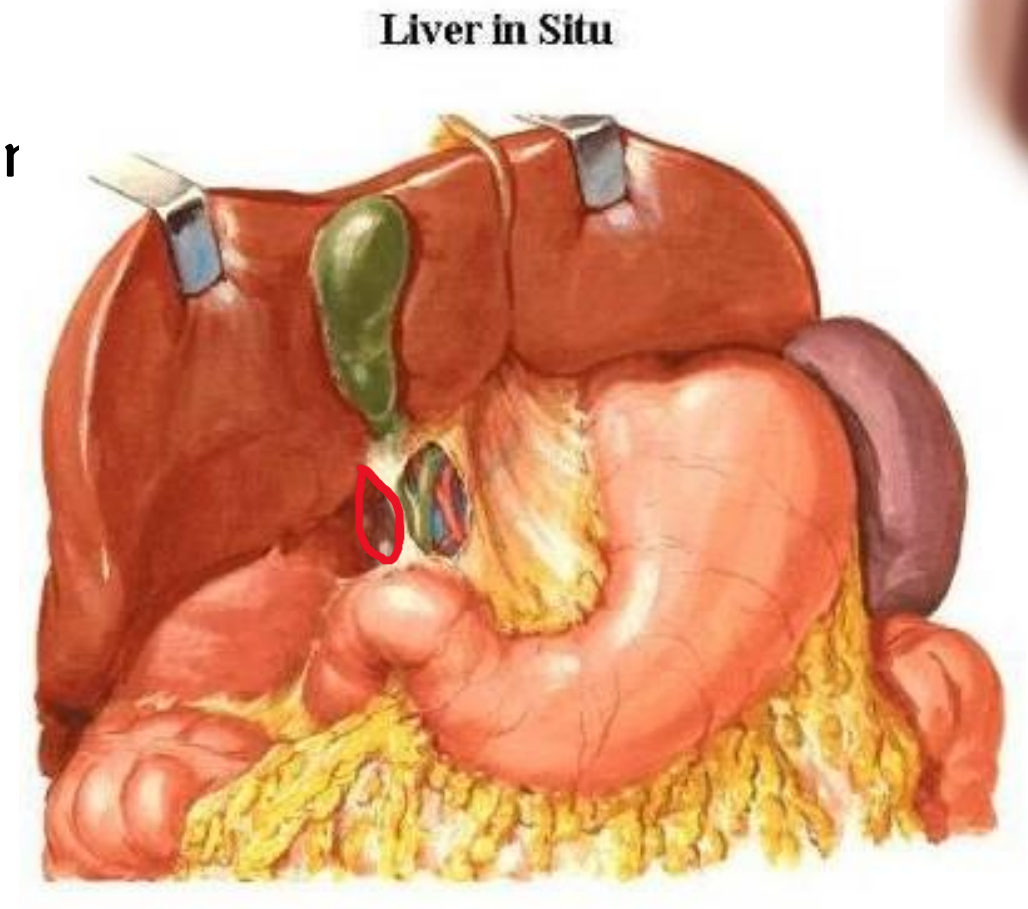

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Posterior Relations :

Lesser sac

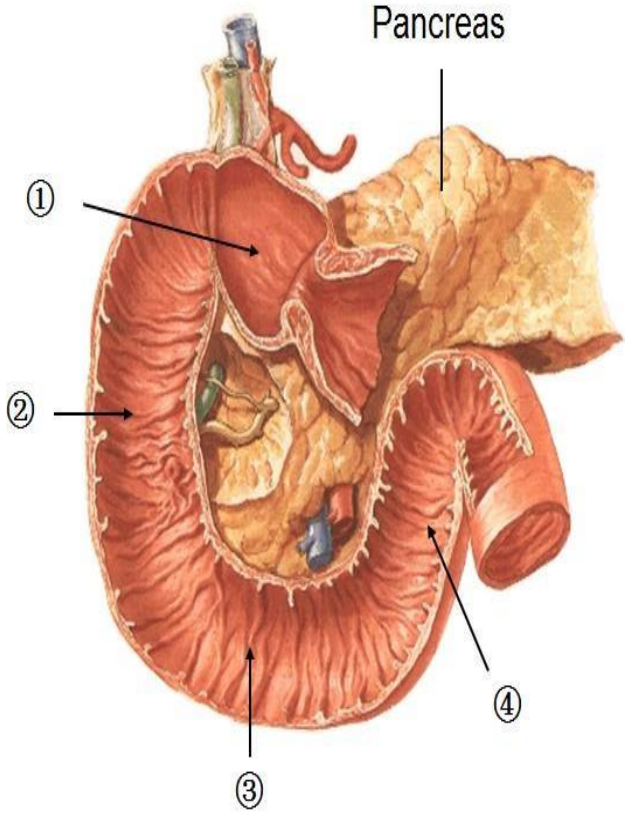
Gastroduodenal artery → (branch of hepatic artery) that supplies the duodenum and right gastroepiploic

If a posterior Peptic ulcer perforates, it can injure this artery, causing bleeding.

Common bile duct

Portal vein

Inferior vena cava (IVC)



Inferior Relation:

Head of the pancreas

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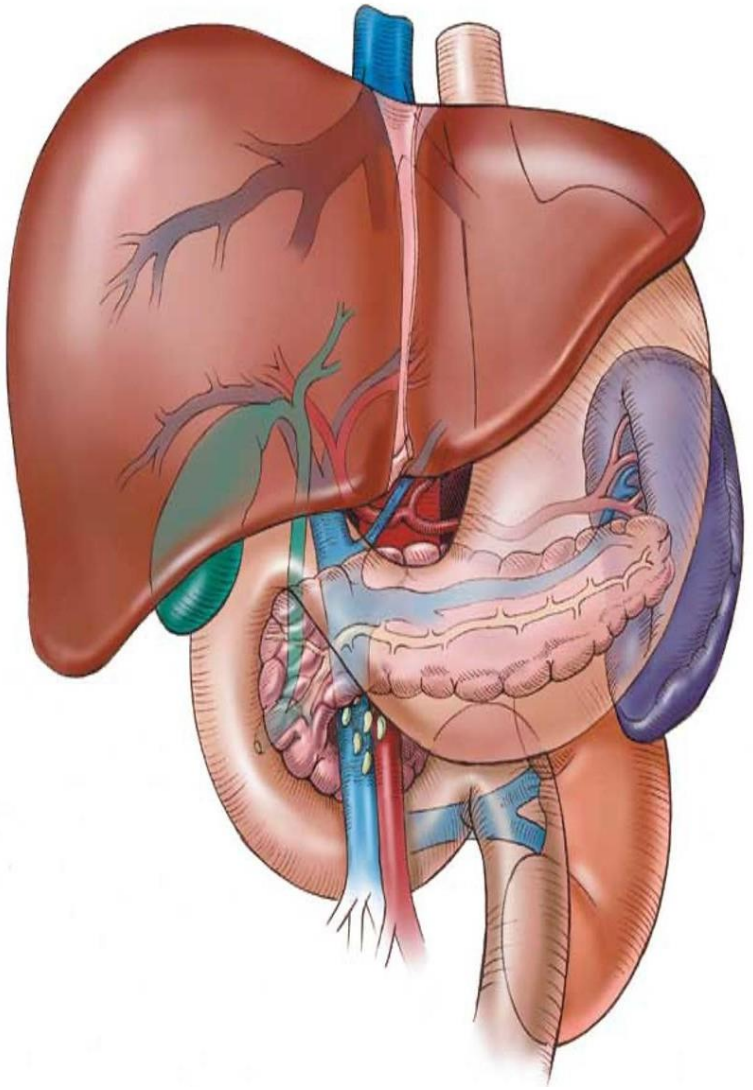
Quick Recap :

Relations of the 1st Part of the Duodenum

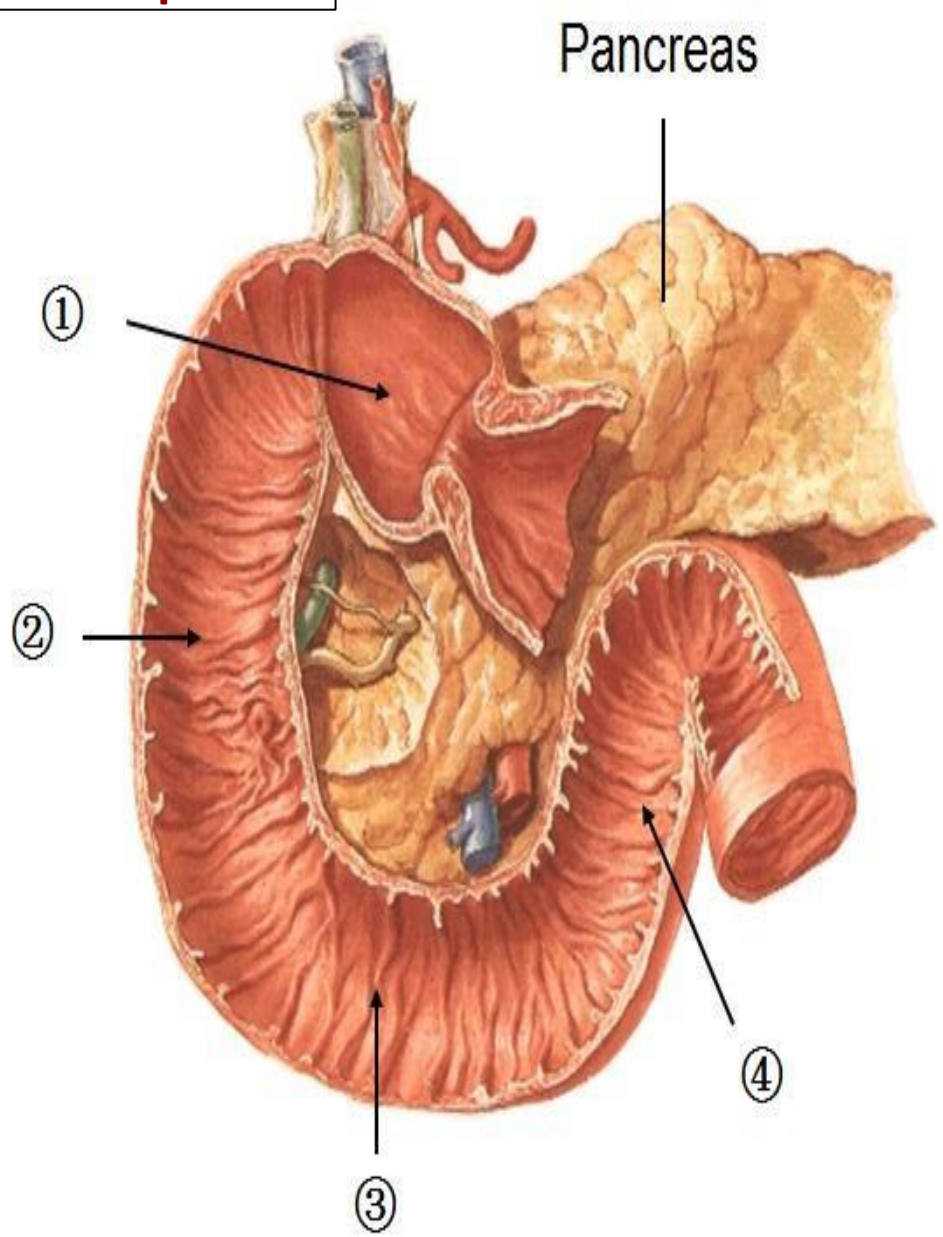
Relation	Structures
Anterior	Quadrate lobe of the liver, gallbladder
Posterior	Portal vein, gastroduodenal artery, common bile duct, inferior vena cava (IVC), lesser sac
Superior	Epiploic foramen (foramen of Winslow)
Inferior	Head of the pancreas



2nd part of duodenum

Vertical part

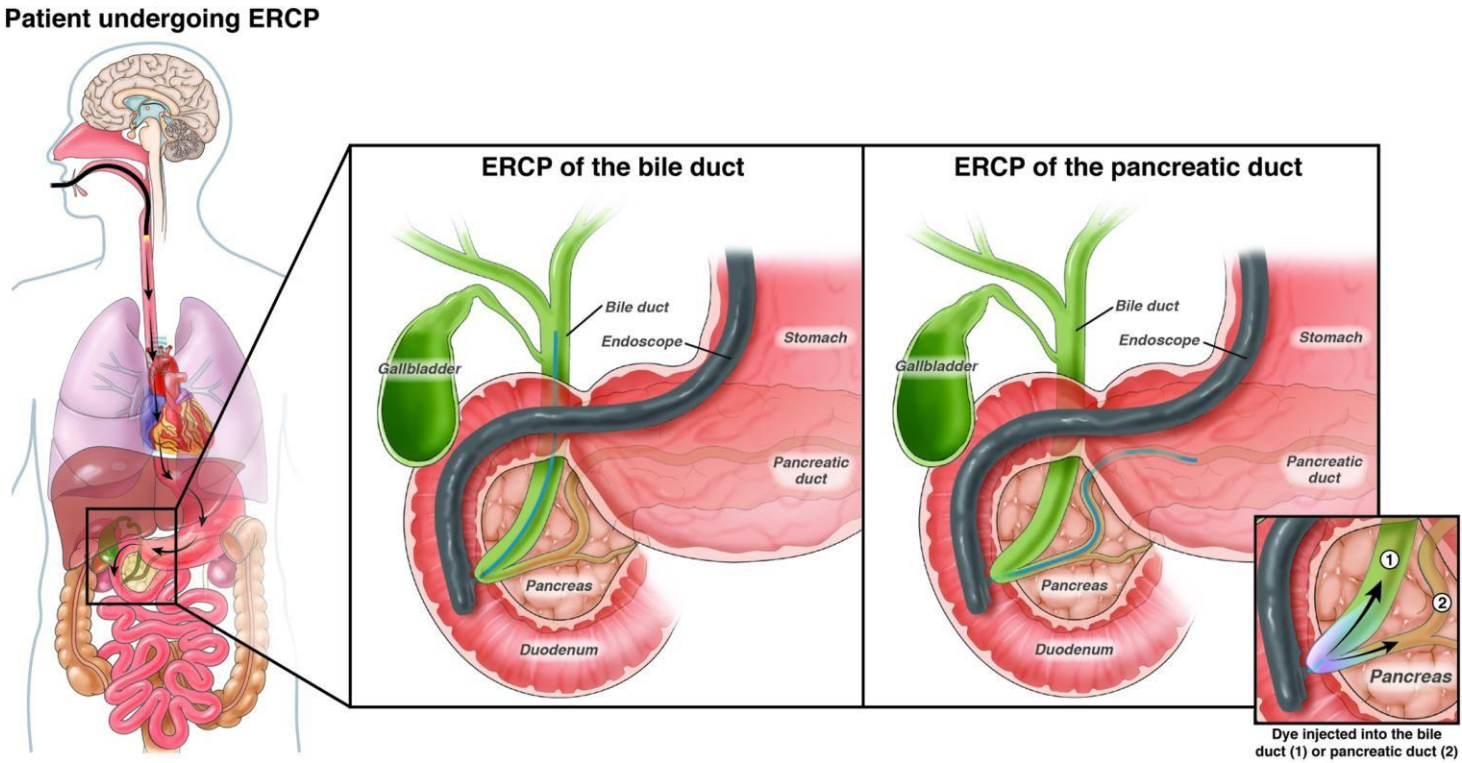
- It is 3”(3 inch) long
- runs downward vertically on the right side
- In front of the Rt.kidney
- next to the 3rd and 4th lumbar vertebrae (Ends at the level of the disc between L3 and L4)
- halfway of it, The bile duct and the main pancreatic duct pierce the medial wall, and then form the **ampulla** that opens in the major **duodenal papilla.**
- The accessory pancreatic duct (if present) opens in the **minor duodenal papilla** more superiorly.



ERCP (Endoscopic Retrograde Cholangiopancreatography) :

Picture not mentioned in the slides

Itis a diagnostic and therapeutic procedure used to visualize and treat problems in the **bile ducts**, **gallbladder**, and **pancreatic ducts.**



- Used in cases of :

- **Cholecystitis** (especially if due to gallstones blocking the bile duct)
- **Obstruction of the common bile duct** (e.g., by stones or tumors)
- **Pancreatic duct blockage**

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Hepaticopancreatic ampulla (Ampulla of Vater)

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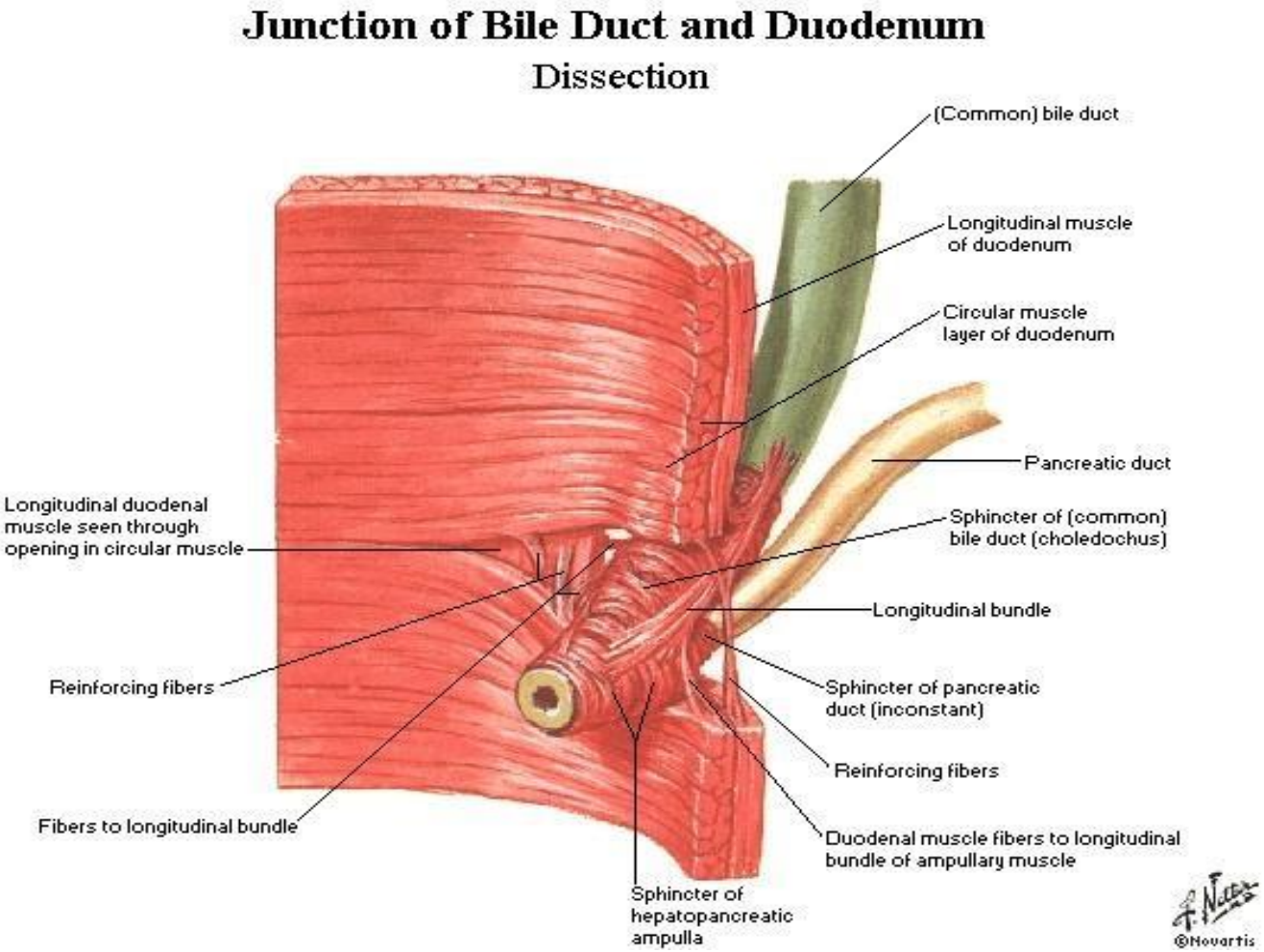
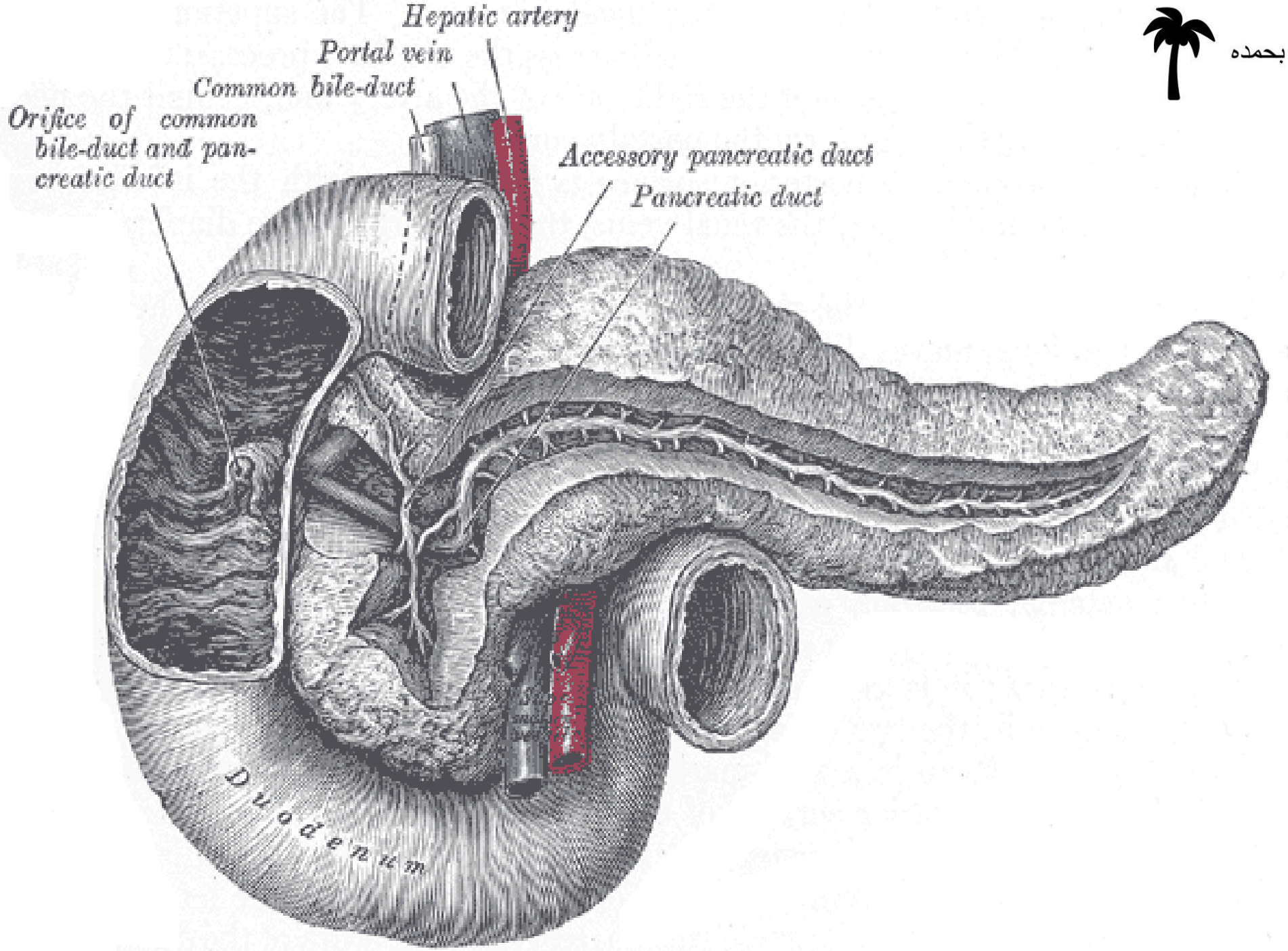




Relations of 2nd part of duodenum

Ant.

- The gallbladder (fundus)
- Right lobe of the liver
- Transverse colon
- coiled of small intestine.

Post.

- Hilum of Rt. Kidney
- Rt. Ureter.

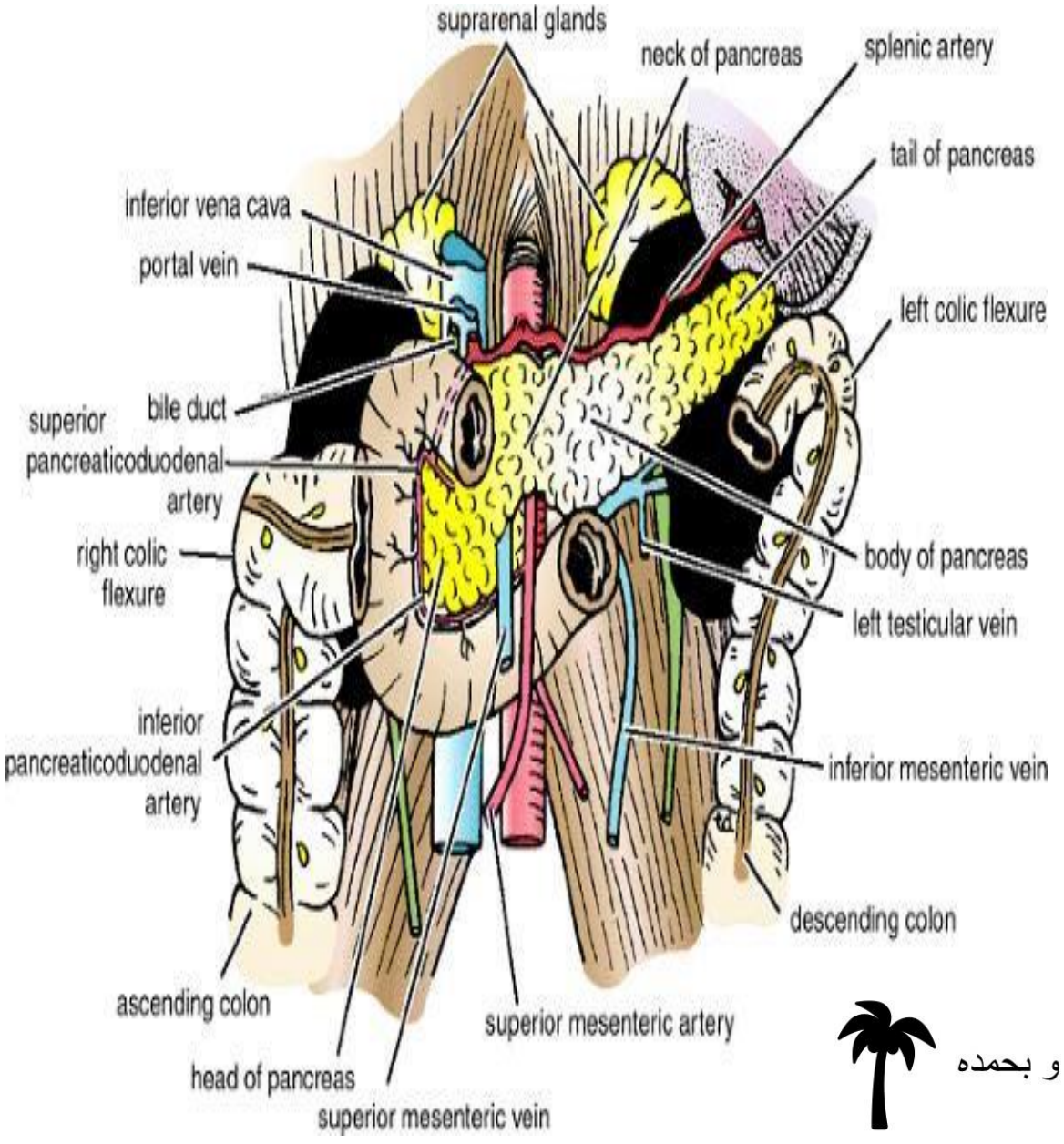
Lateral.

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

Medial.

-Head of pancreas

-Bile and pancreatic ducts.



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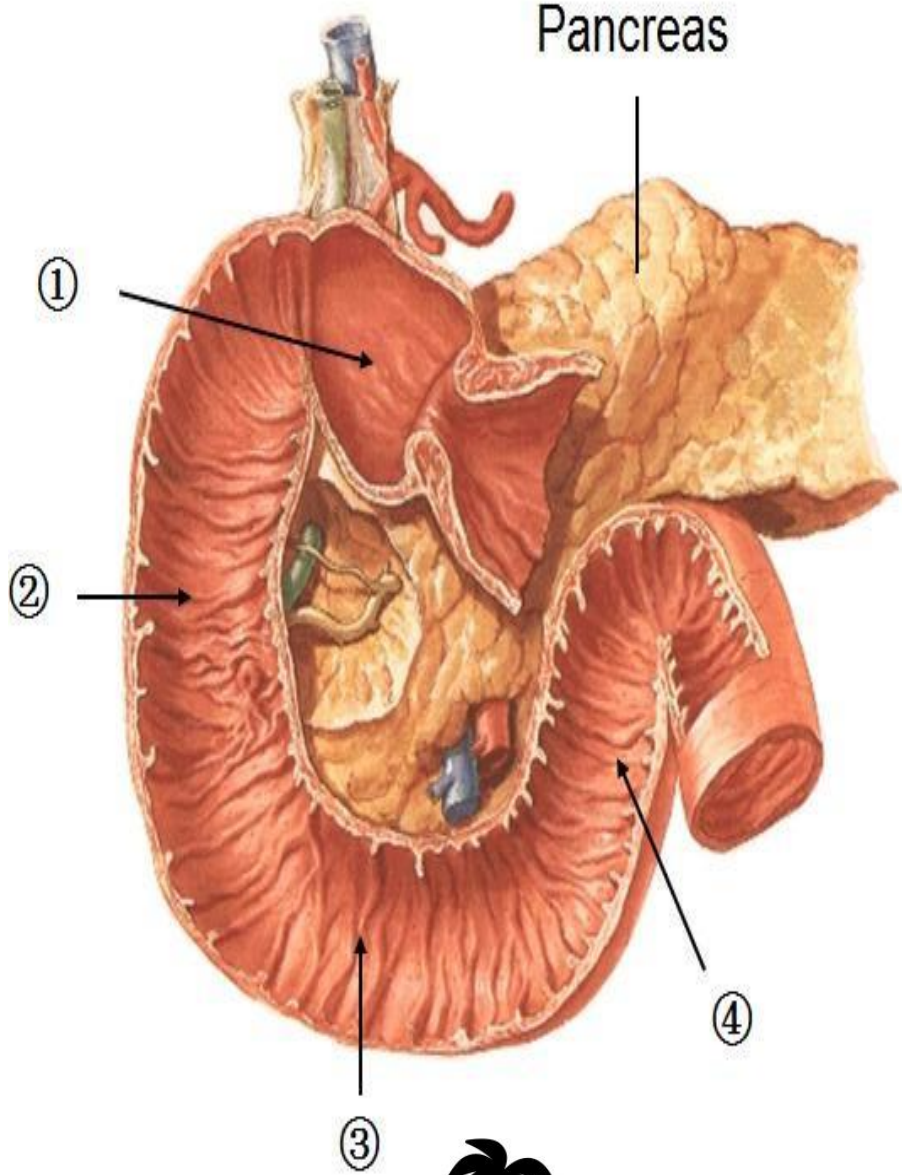
3rd part of duodenum

(Horizontal part)

- 4" long
- Runs horizontally to the left
- On the subcostal plane.
- Runs in front of the vertebral column (At the level of L3)
- Under the lower margin of the head of pancreas
- Above the coils of the jejunum.

Found in the posterior abdominal wall (Remember: It is Retroperitoneal) and it crosses the structures that are laying on the inferior abdominal wall like the aorta / inferior vena cava /Right psoas muscle



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Relations of 3rd part of duodenum

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Anteriorly:

- The root of the mesentery (2 folds of peritoneum surrounding jejunum & Ileum) of the small intestine
- the superior mesenteric vessels contained within the mesentery *Remember, the small intestine is part of the Midgut which is supplied by the superior mesenteric vessels*
- coils of jejunum

Posteriorly:

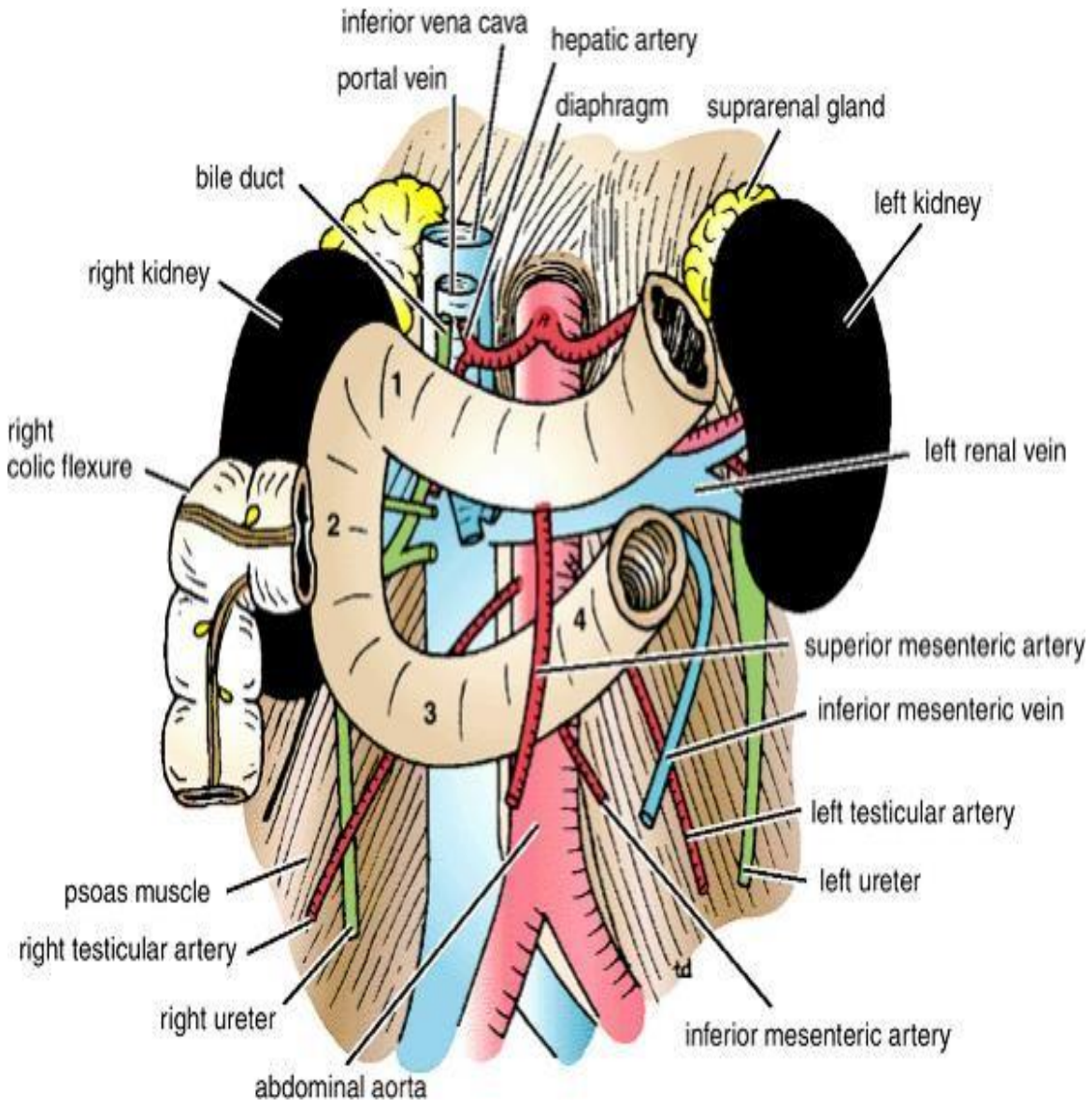
-The right ureter
- the right psoas muscle
- the inferior vena cava
-the aorta

Superiorly:

The head of the pancreas

Inferiorly:

Coils of jejunum



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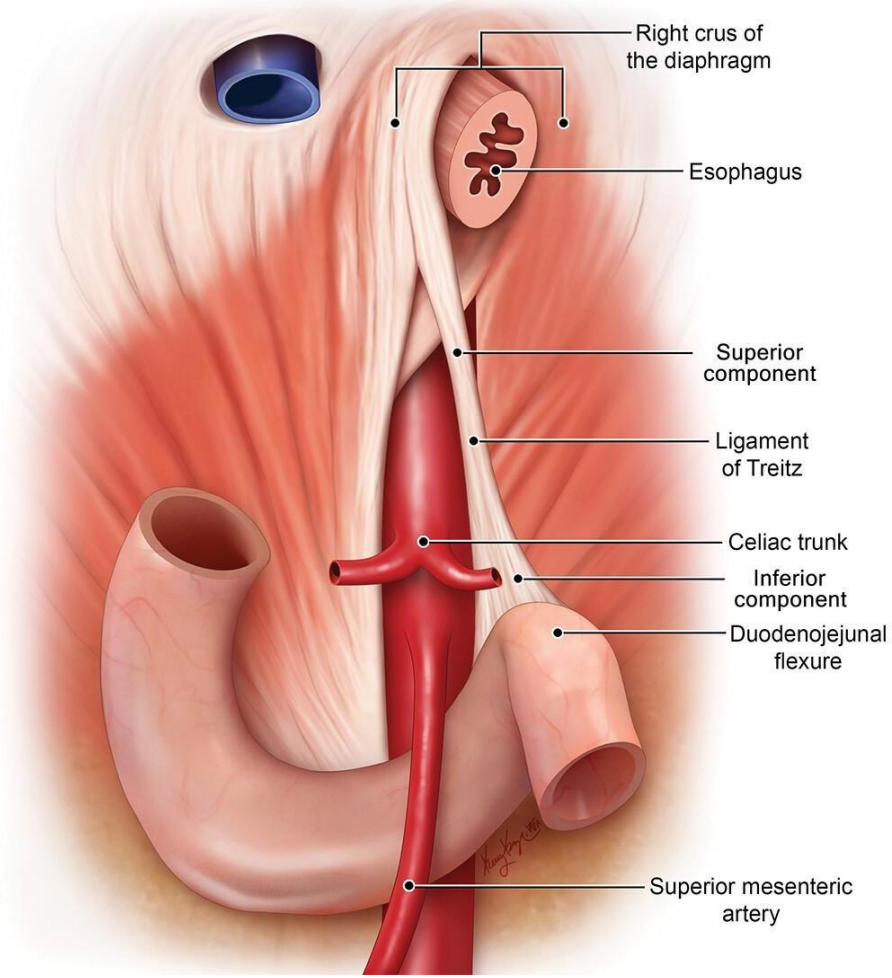
4th part of duodenum…..cont

- 1” long
- Runs upward to the left

- End in the duodejejunal junction at the level of the 2nd lumbar vertebrae 1” to the left.

- The junction (flexure) is held in position by the **ligament of Treitz**,(A peritoneal fold attached to the junction between the duodenum and jejunum.) which is attached to the right crus of the diaphragm (duodenal recess).

- The **ligament of Treitz** serves as an important **surgical landmark** to identify the end of the duodenum and the beginning of the jejunum



Relation of 4th part of duodenum

Ant.

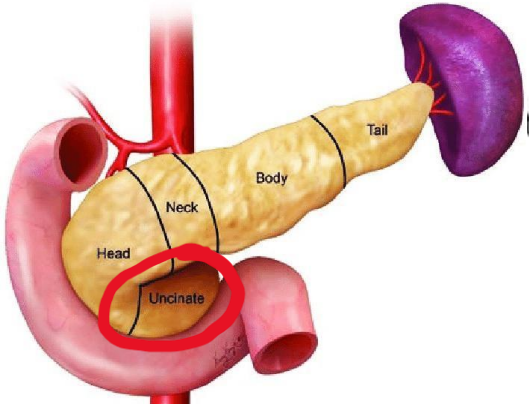
- The beginning of the root of the mesentery
- coils of the jejunum.

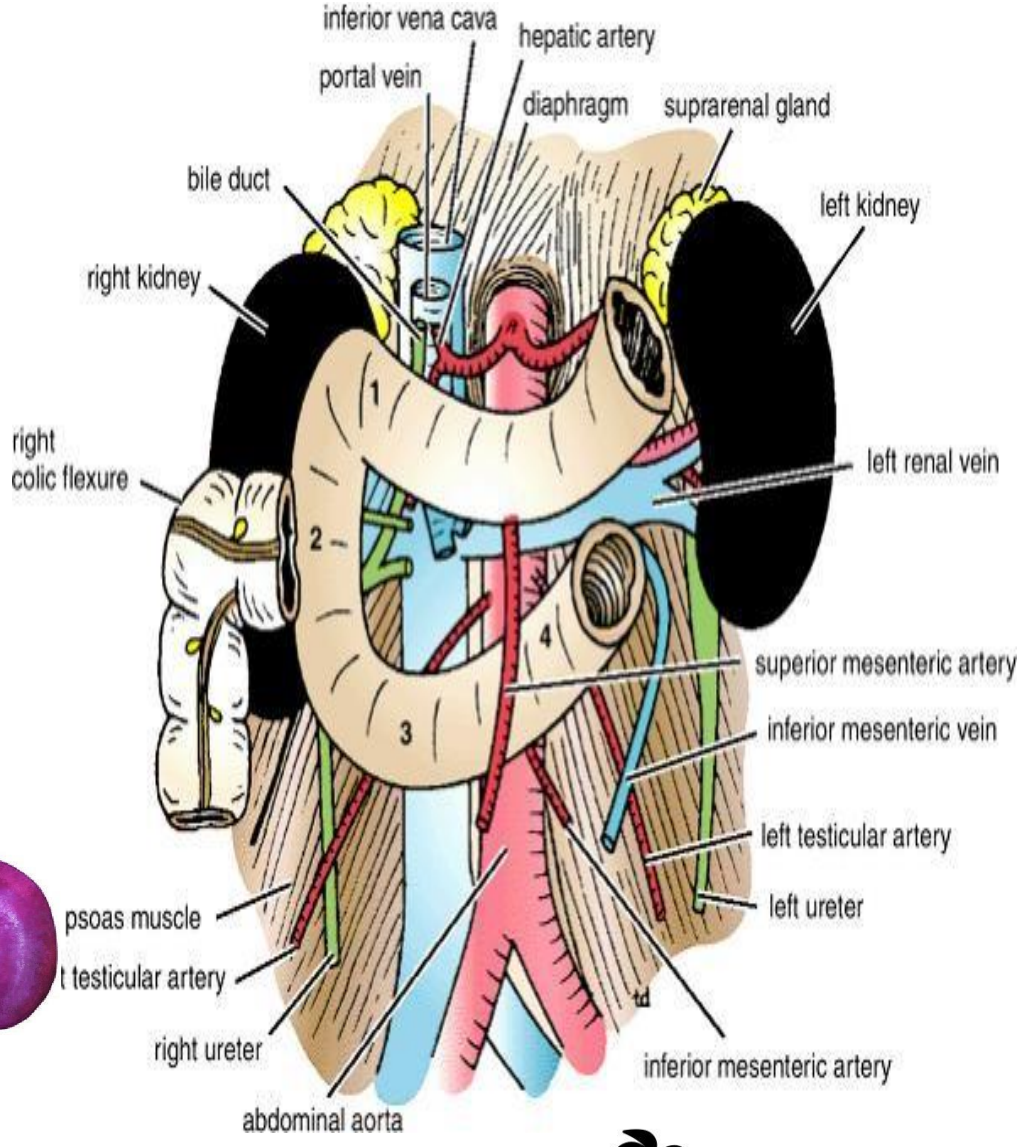
Post.

- Lt. psoas major
- The sympathetic chain
- Left margin of the aorta.

Sup.

- Uncinate process of the pancreas. (end of the head of pancreas).





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Blood supply of duodenum

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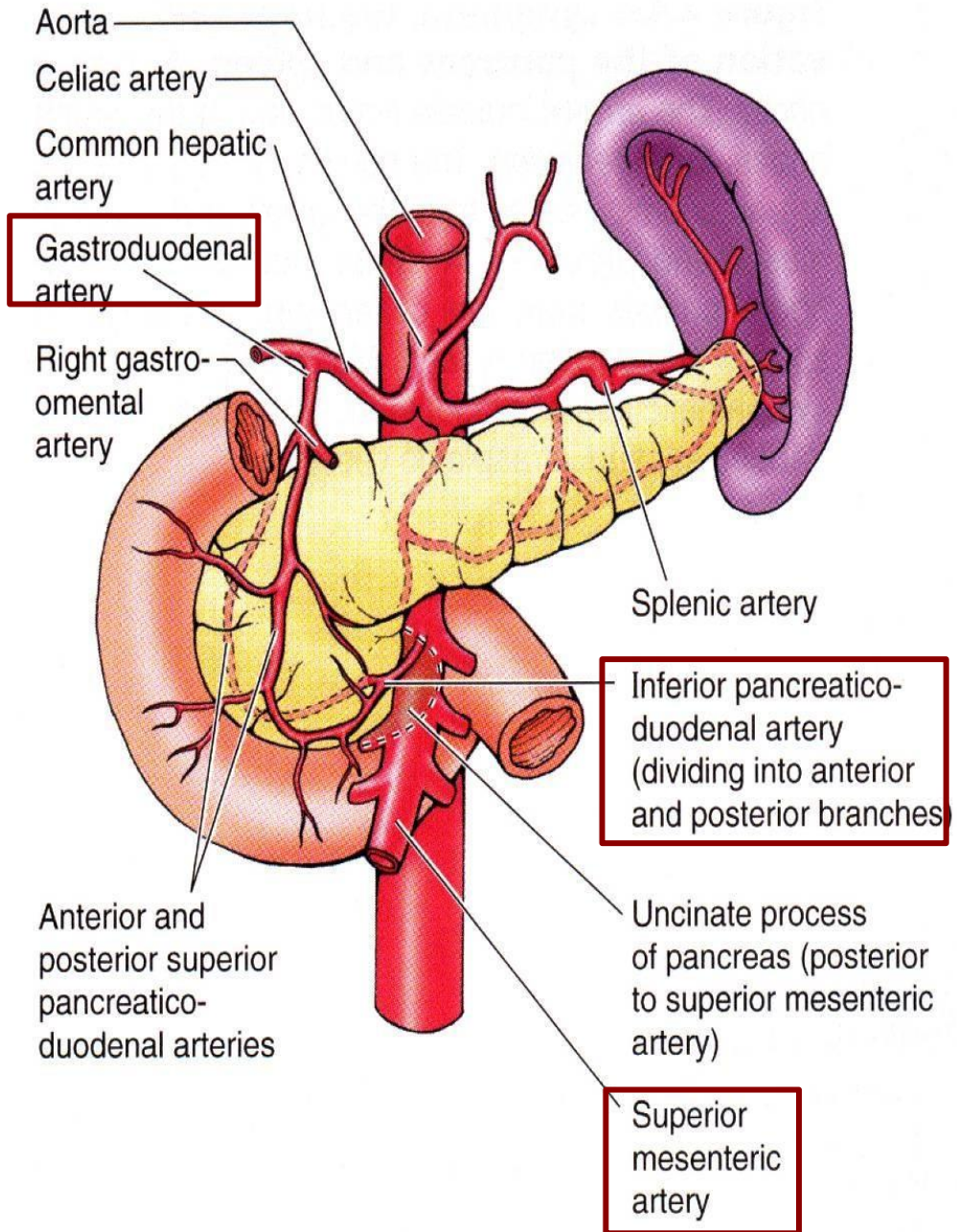
Remember : The Duodenum is divided into two halves:
- Upper Half (**above the Ampulla of Vater**): Made by the **Foregut** —> Supplied by vessels of the **Celiac Plexus**
- Lower Half (**Below the Ampulla of Vater**): Made by the **Midgut** —> Supplied by the superior **mesenteric vessels**

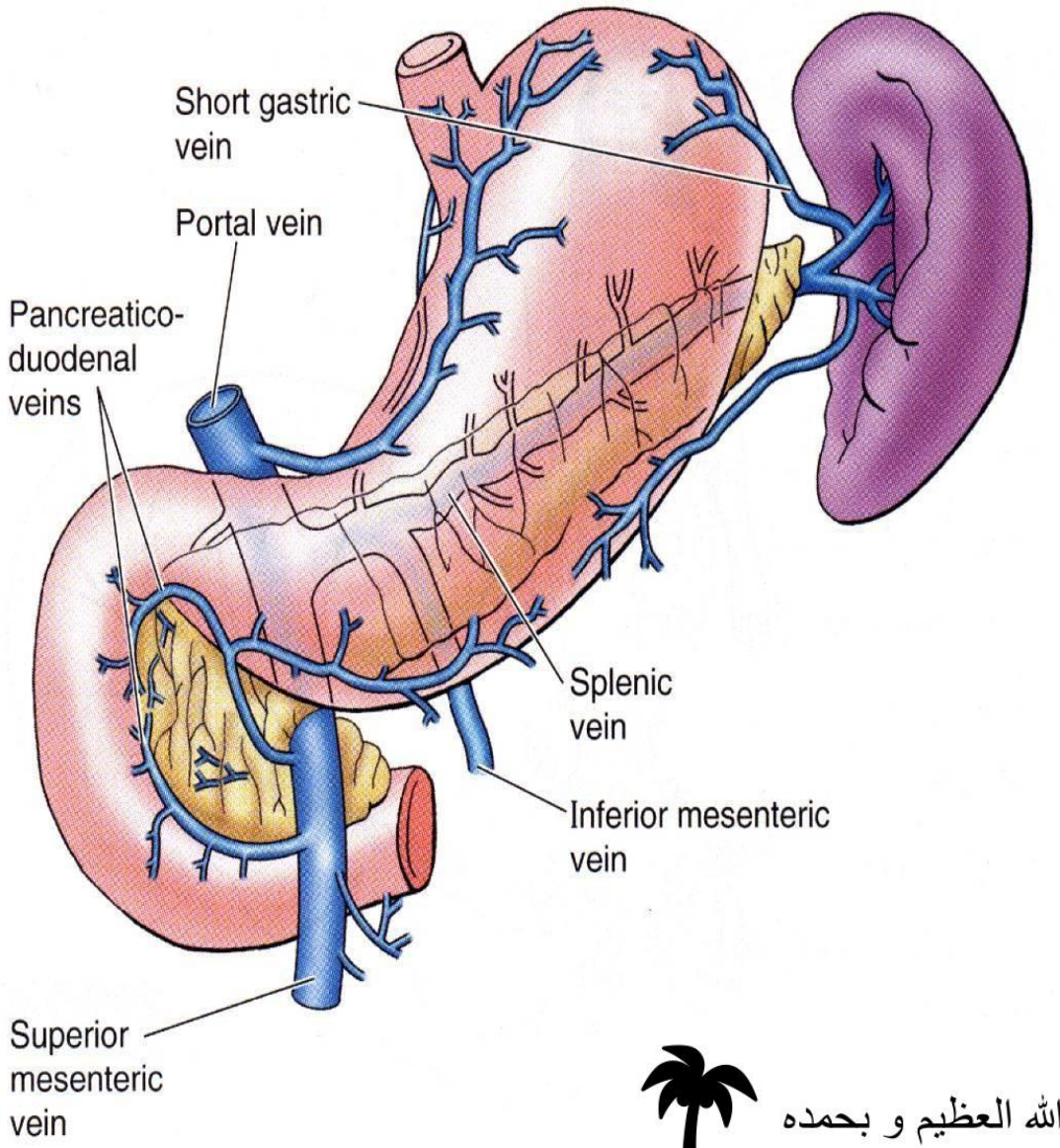
- **Arteries**

1 **upper half** (1st part + upper 1/2 of 2nd part) is supplied by the **superior pancreaticoduodenal artery**, a branch of the gastroduodenal artery, which is a branch of the Hepatic artery, which rises from the Celiac Plexus.

2 **The lower half** (lower ½ of 2nd part + 3rd + 4th part) is supplied by the **inferior pancreaticoduodenal artery**, a branch of the superior mesenteric artery

Arterial supply and venous drainage of the duodenum





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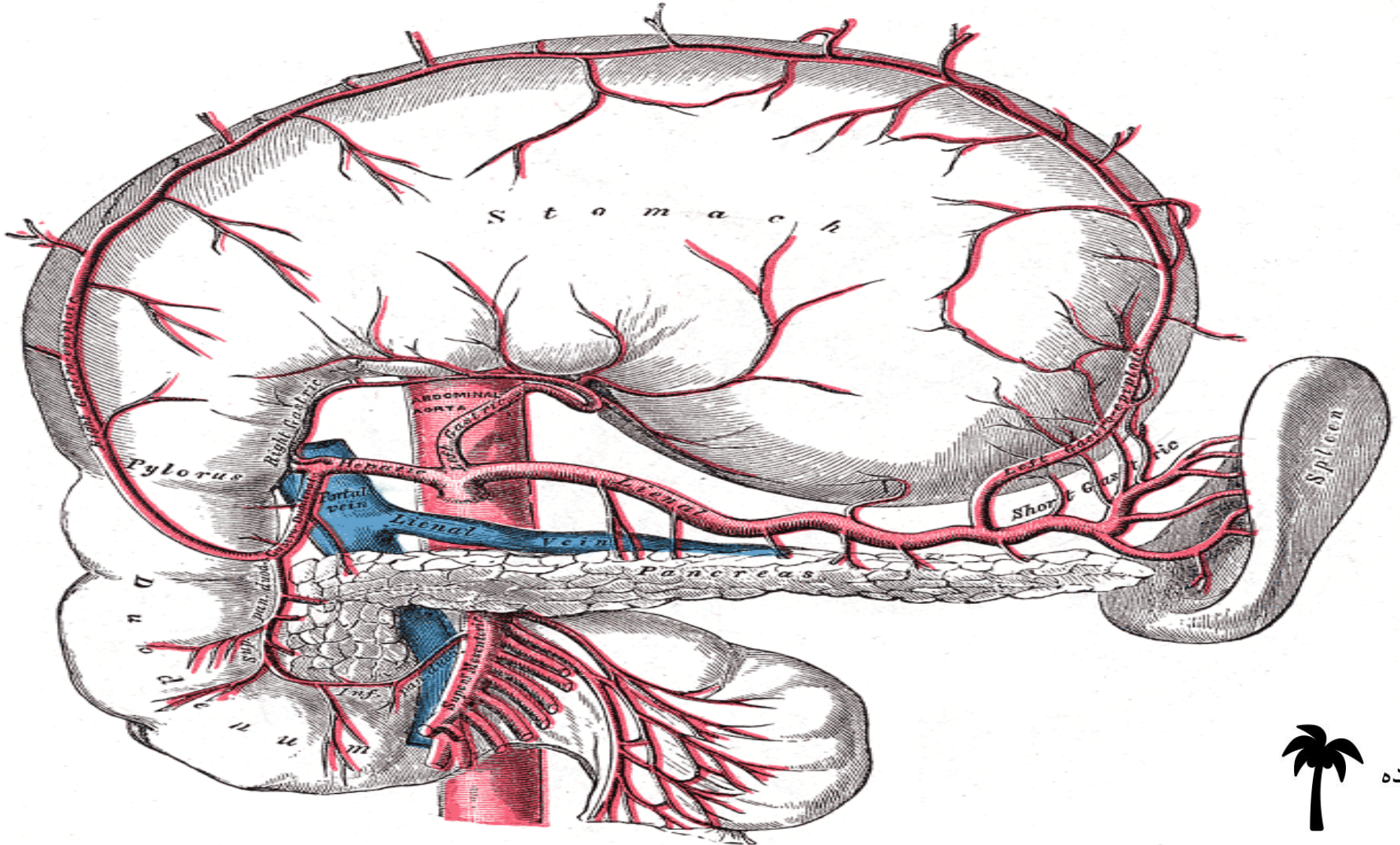
Blood supply for duodenum



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Veins of duodenum

Upper Half :

- The superior pancreaticoduodenal vein drains into the portal vein

Lower Half:

- The inferior vein joins the superior mesenteric vein .

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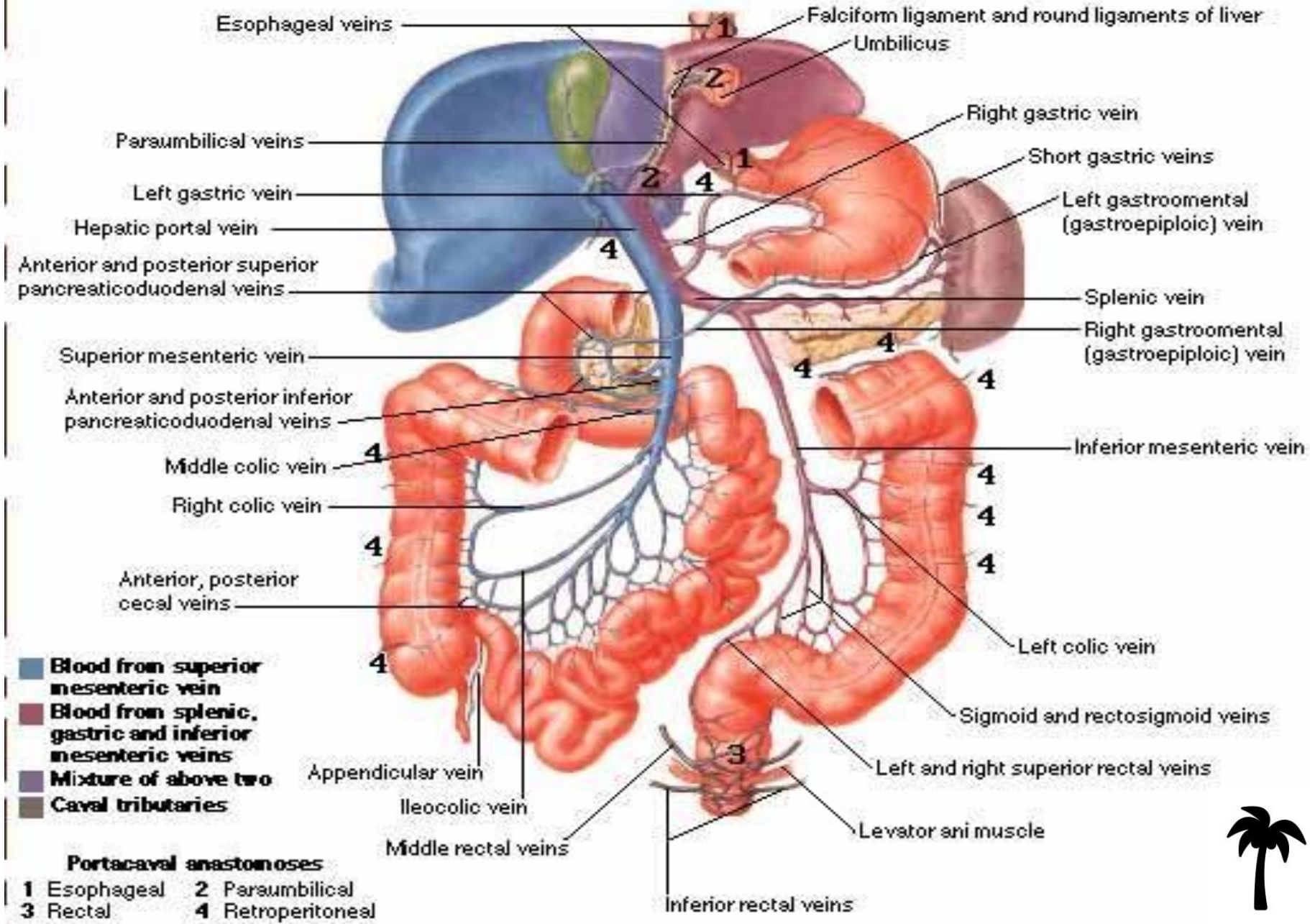
Hepatic Portal Vein Tributaries

Portocaval Anastomoses



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Lymphatic drainage

The lymph vessels follow the arteries :

- **drain upward** (upper half) via pancreaticoduodenal nodes the gastroduodenal nodes the celiac nodes

- **drain downward** (lower half) via pancreaticoduodenal nodes the superior mesenteric nodes around the origin of the superior mesenteric artery.

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Nerve supply

- **Sympathetic innervation :**
- **Origin**: The spinal cord at the level of the **Thoracic Vertebrae**
- Sympathetic fibers then descend and **penetrate the Diaphragm**
- **Synapse :**

Sympathetic Fibers to the **Upper duodenum → celiac ganglion**

Sympathetic Fibers to the **Lower duodenum → superior mesenteric ganglion**

- **Postganglionic Fibers :**

Travel via nerve fibers of the celiac plexus (Greater and Lesser Splanchnic Nerves) which eventually form plexuses around the blood vessels supplying the duodenum

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Nerve supply… cont

- **Parasympathetic Innervation:**

- **Origin**: Vagus nerve (cranial nerve X)

- **Synapse** : At the **Enteric (myenteric and submucosal) plexuses** in the **duodenal wall,** from which short postganglionic fibers arise and innervate the structures in the duodenal wall.
- Function: Secretomotor – Glands , Peristaltic movement – Smooth muscles.

Jejunum and Ileum
Location and Description

They are intraperitoneal organs = Movable

- The jejunum and ileum measure about 20 ft (6 m) long
- the upper two fifths is the jejunum C the lower 3/5 is the ileum
- Each has distinctive features
- there is a gradual change from one to the other
- The jejunum begins at the duodenojejunal flexure which attaches to the ligament of trietz + The level of the beginning of mesenteric root
- the ileum ends at the ileocecal junction (found at the right iliac fossa).
- The coils of jejunum and ileum are freely mobile andare attached to the posterior abdominal wall by a fan-shaped fold of peritoneum known as the mesentery of the small intestine.

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SMALL INTESTINES ANATOMY

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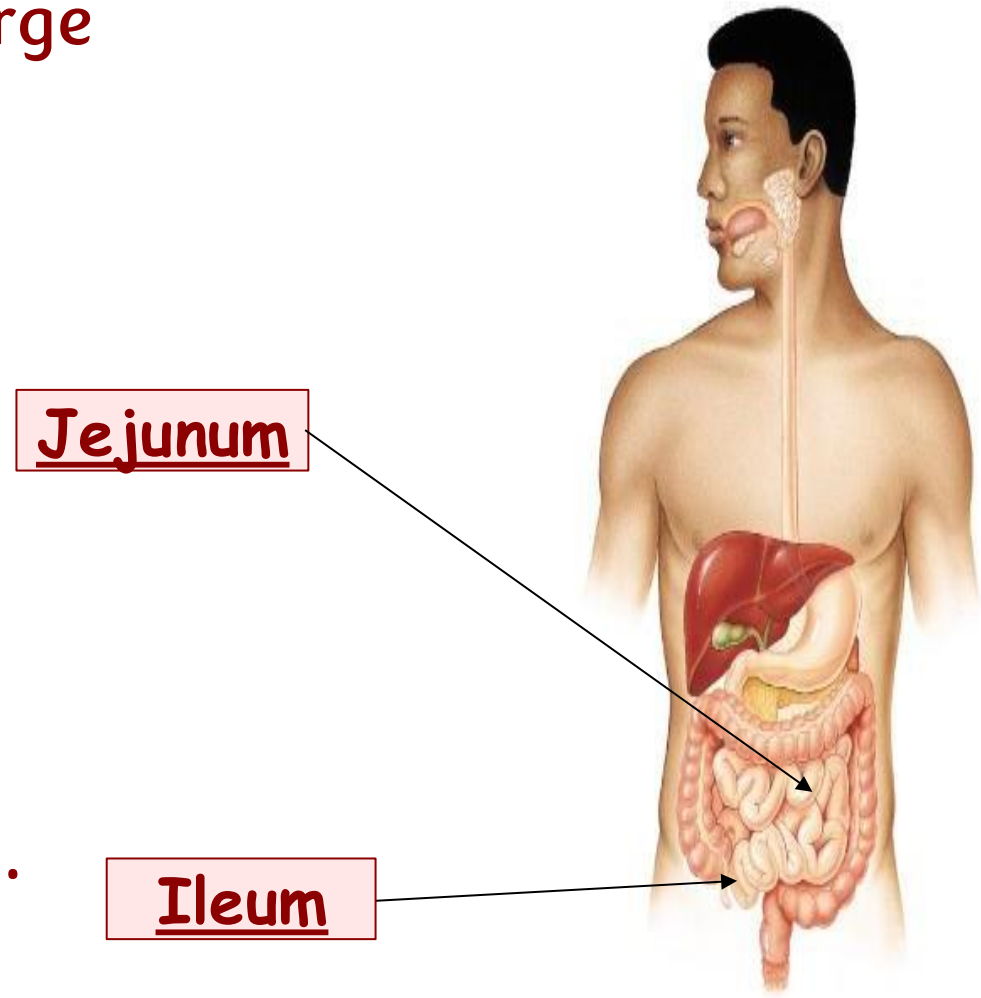
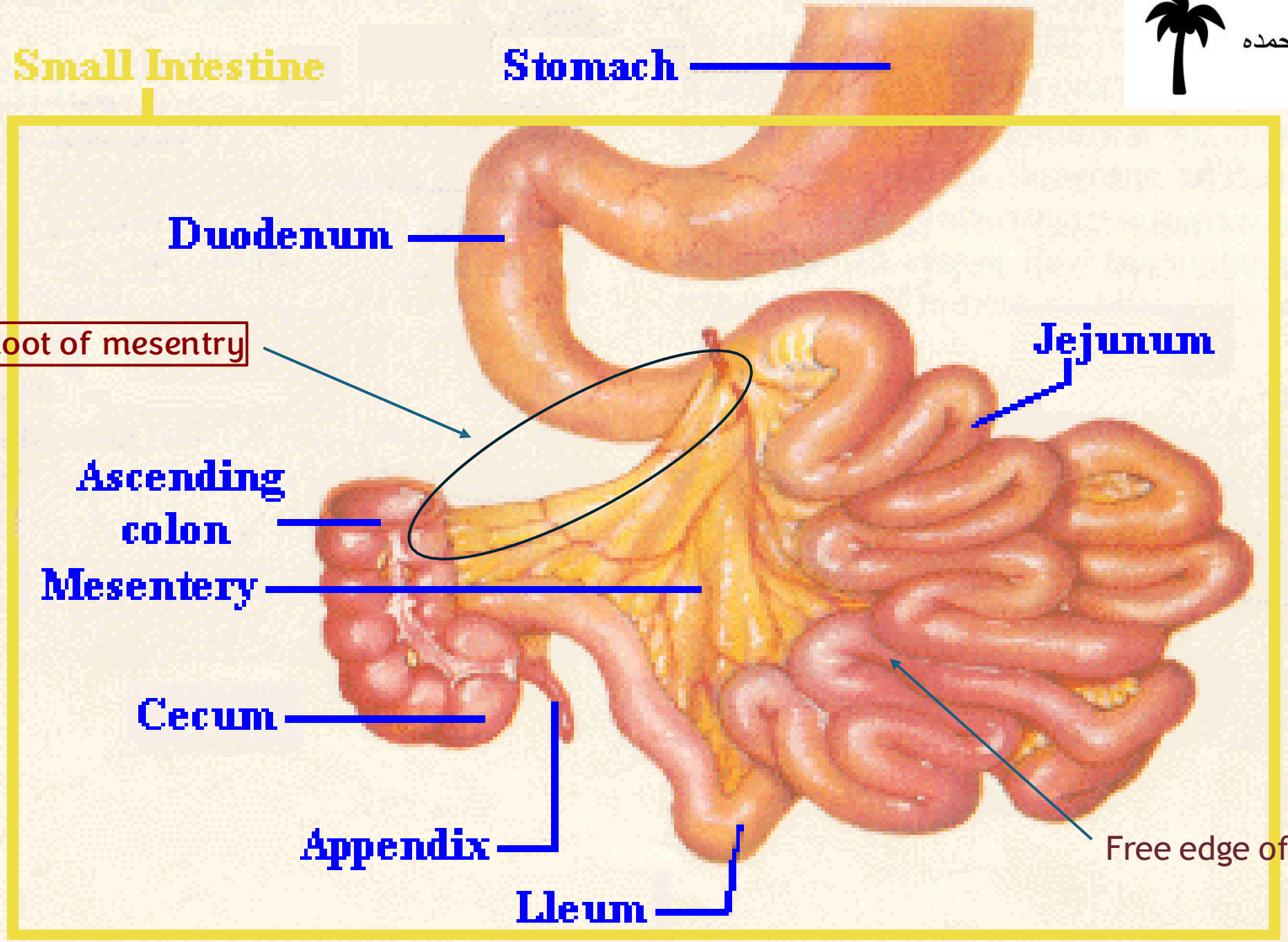
Look at the arrangement of of the large intestine (cecum &appendix / ascending colon / transverse colon / descending colon / sigmoid rectum / anal canal) they are all found at **edges** of the abdominal cavity

On the other hand, the jejunum & ileum are found at the umbilical region (in the middle surrounded by. the large intestine, A Central Structure)



Small Intestine



Anatomical position of small intestine

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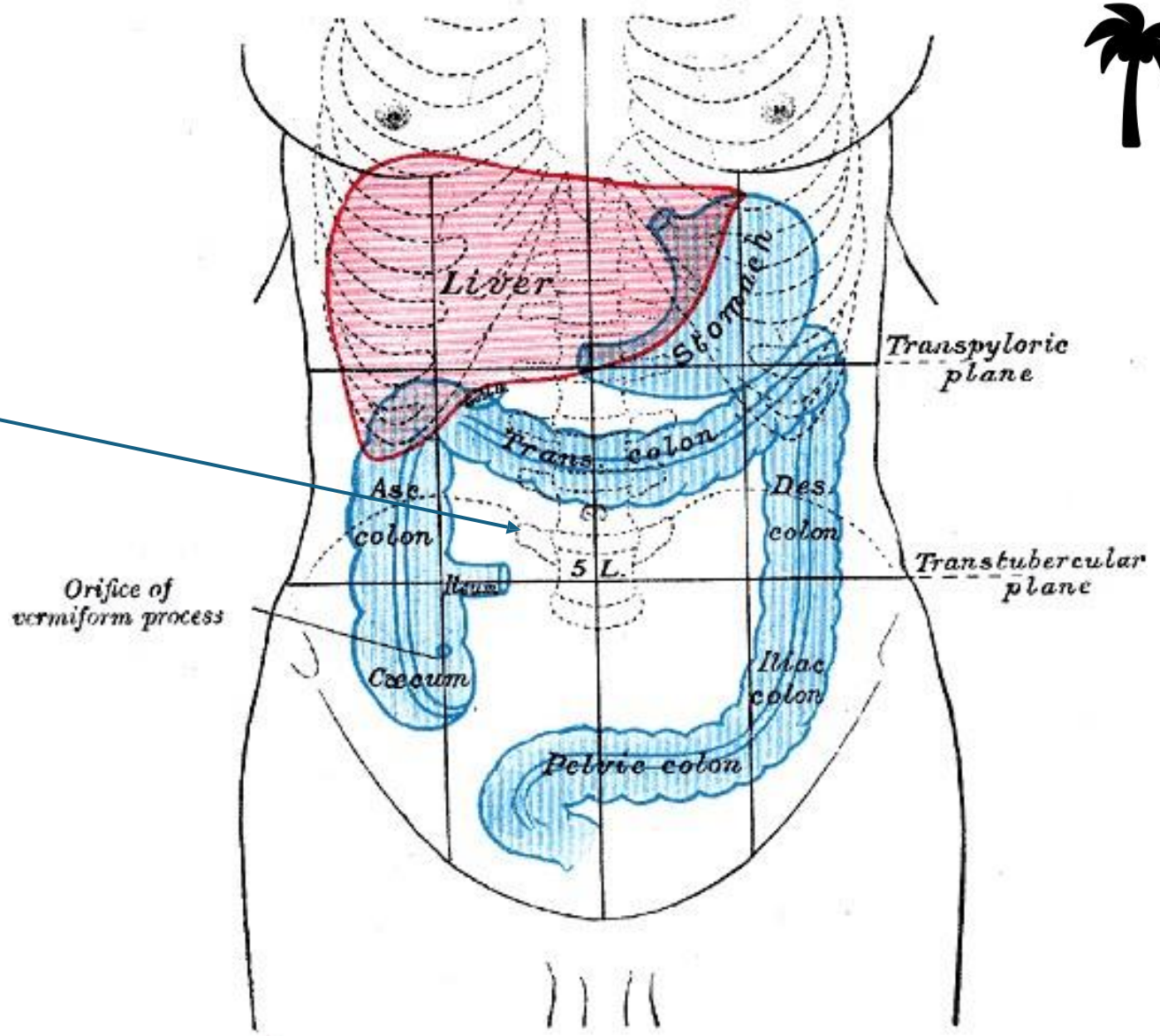
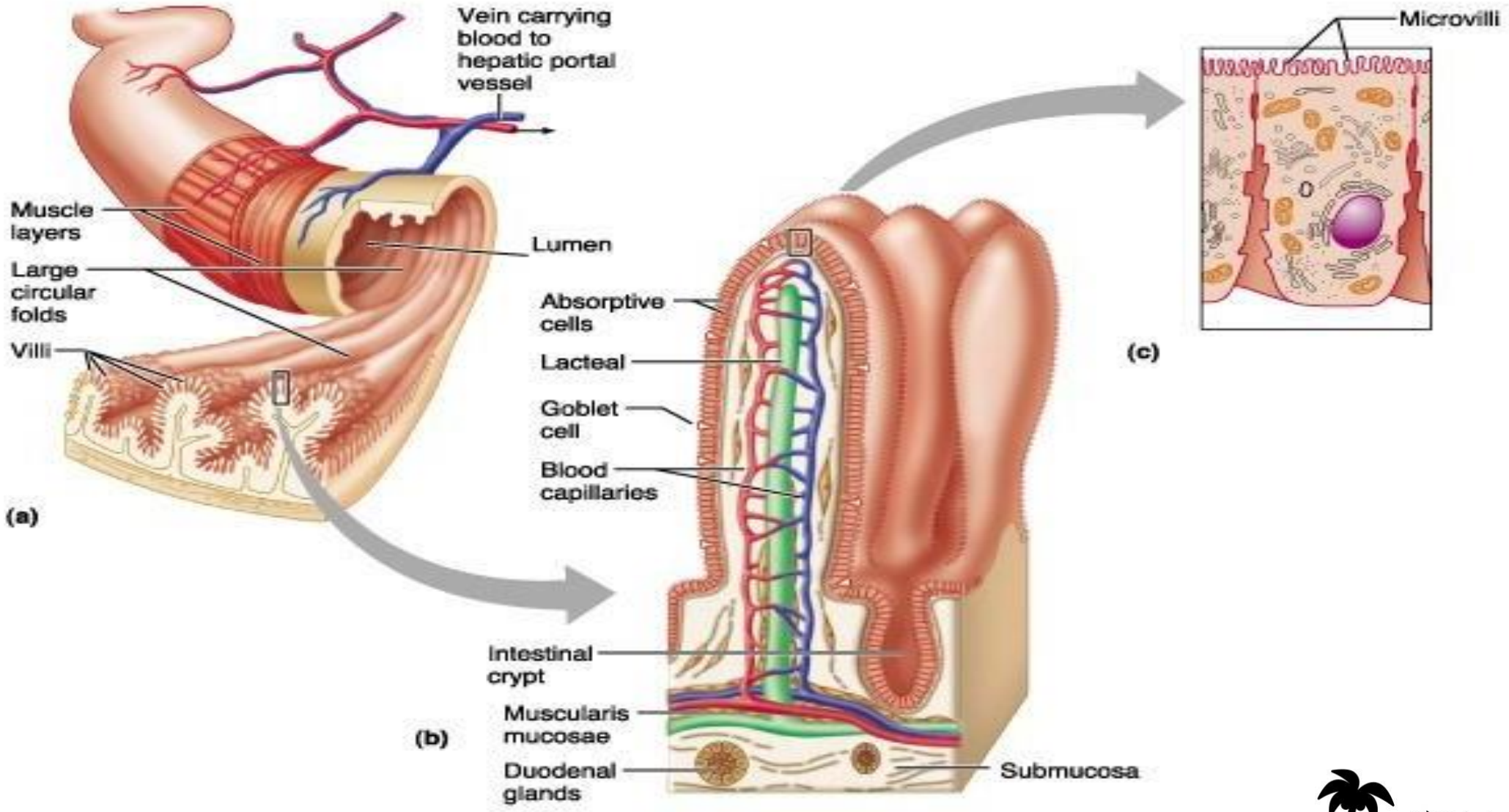
Jejunum & ileum



Structure of the Villi in the Small Intestine



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mesentery of the small intestine

- fan-shaped fold of 2 layers of peritoneum

- The long free edge (6 meters) of the fold encloses the mobile intestine (jejunum &ileum).

- The short root of the fold is continuous with the parietal peritoneum on the posterior abdominal wall

- Along a line that extends downward and to the right from the left side of the second lumbar vertebra 1inch to the left to the region in front of the right sacroiliac joint

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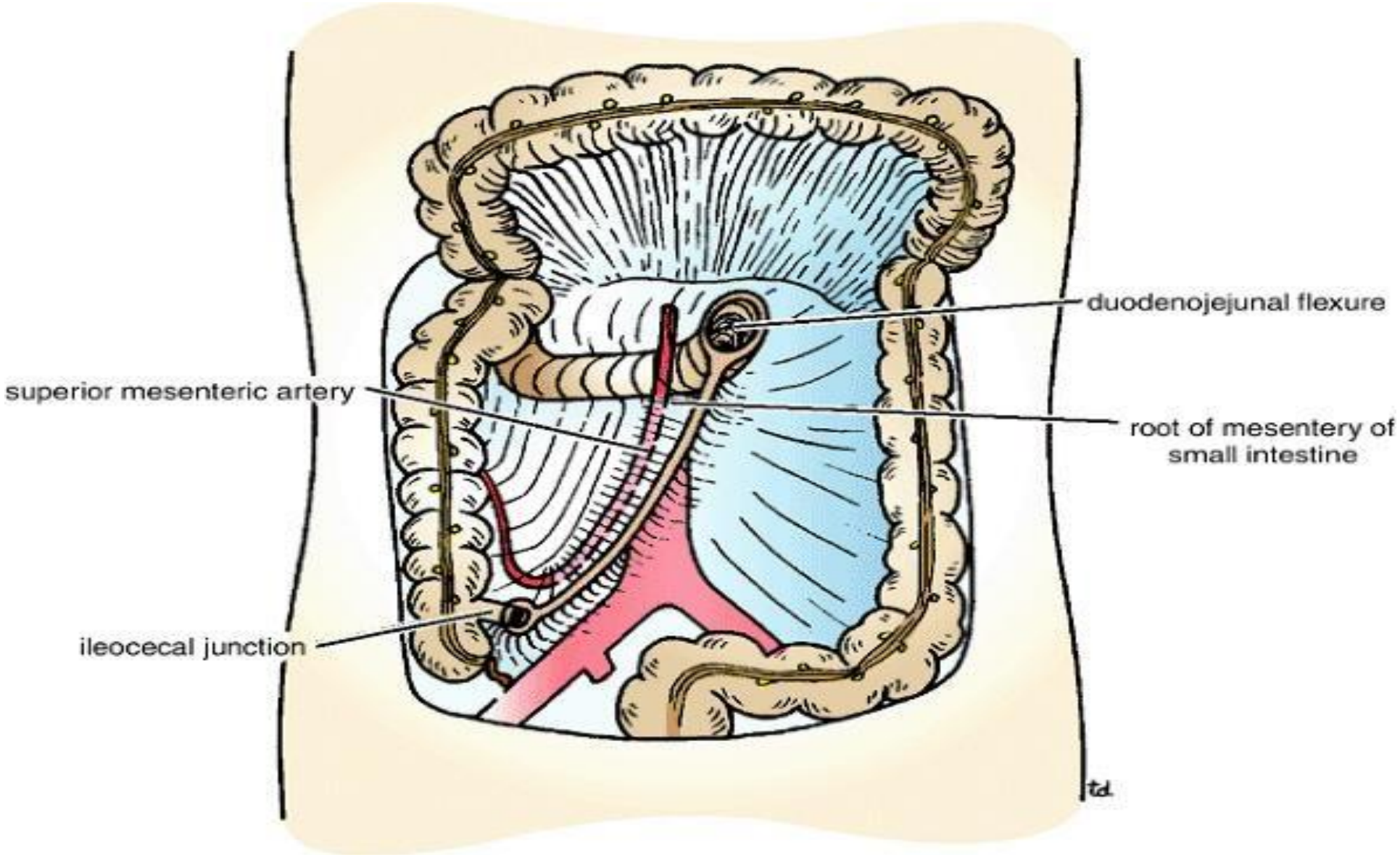
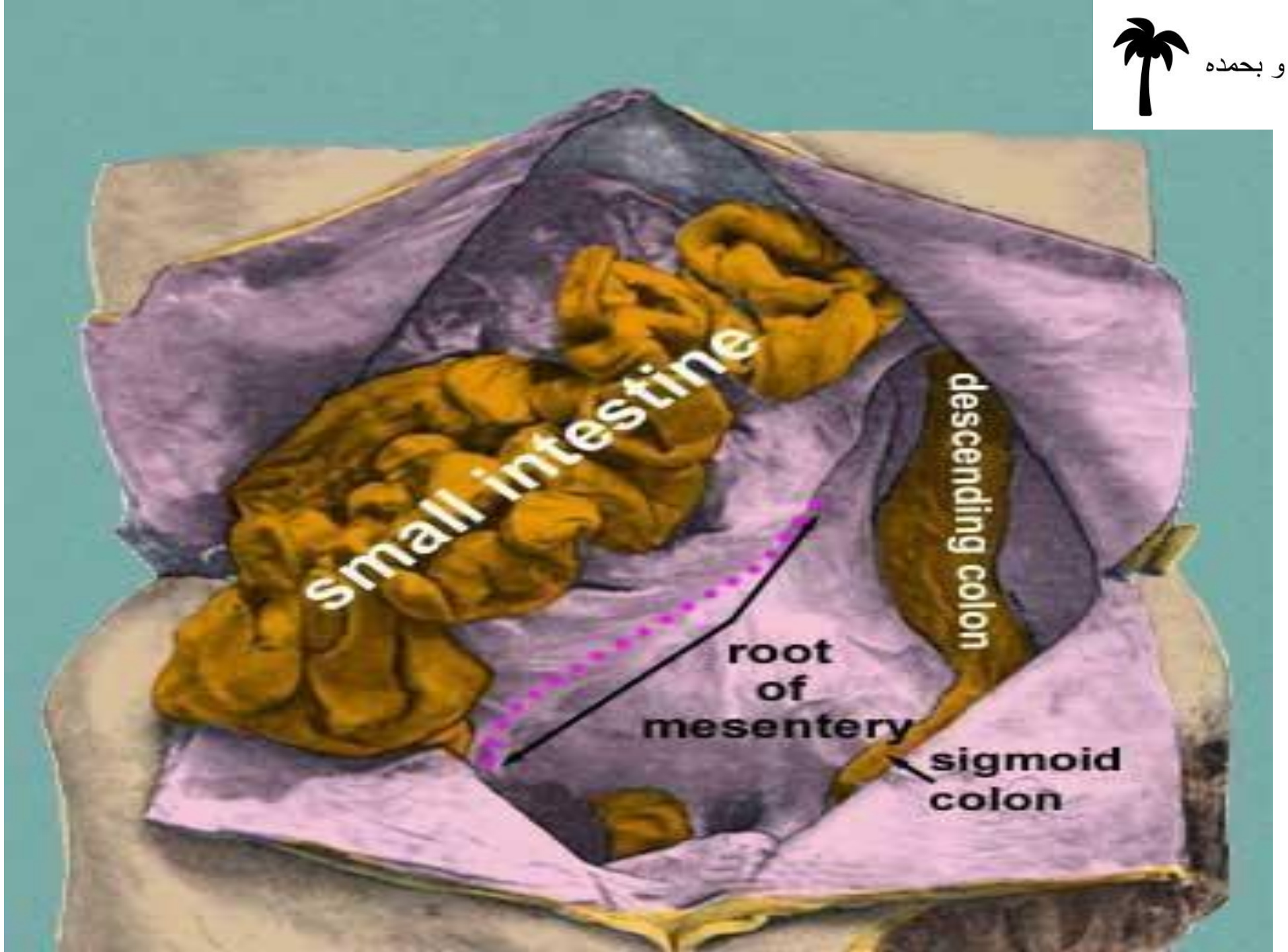
Root of the mesentery



سُبحان الله العظيم و بحمده



Contents of the mesentery

- The branches of the superior mesenteric artery and vein
- Lymphatic vessels C lymphatic nodes
- nerves (sympathetic & parasympathetic)

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Difference between Jejunum s Ileum

	jejunum	Ileum
length	Proximal 2/5	Distal 3/5
site	in the upper part of the peritoneal cavity below the left side of the transverse mesocolon	in the lower part of the cavity and in the pelvis
wall	thicker wall &redder	Thinner & less redder
Arcades in mesentery **Arcades are branches from superior mesenteric artery that connect forming window like structures, these arcades give raise to the Vasa Recta**	-simple ,only one or two arcades -with long infrequent branches -Long vase recta	numerous short terminal vessels arise from a series of three or four or even more Complex Arcades - Short vase recta
Fat in mesentery	- the fat is deposited near the root - it is scanty near the intestinal wall - Less in amount →appear window	- the fat is deposited throughout mesentery - Big amount - No window appear

Difference between Jejunum s Ileum

	jejunum	Ileum
Diameter	wider	smaller
villi	numerous	Less numerous
Plicae circularis(the permanent enfolding of the mucous membranes submucosa	**More Prominent** They are: 1 larger 2 more numerous 3 closely set	**Less Prominent** they are: 1 smaller 2 more widely separated 3 in the lower part they are absent .
Lymphatic follicles	No or few	Aggregations of lymphoid tissue (Peyer's patches) are present in the mucous membrane

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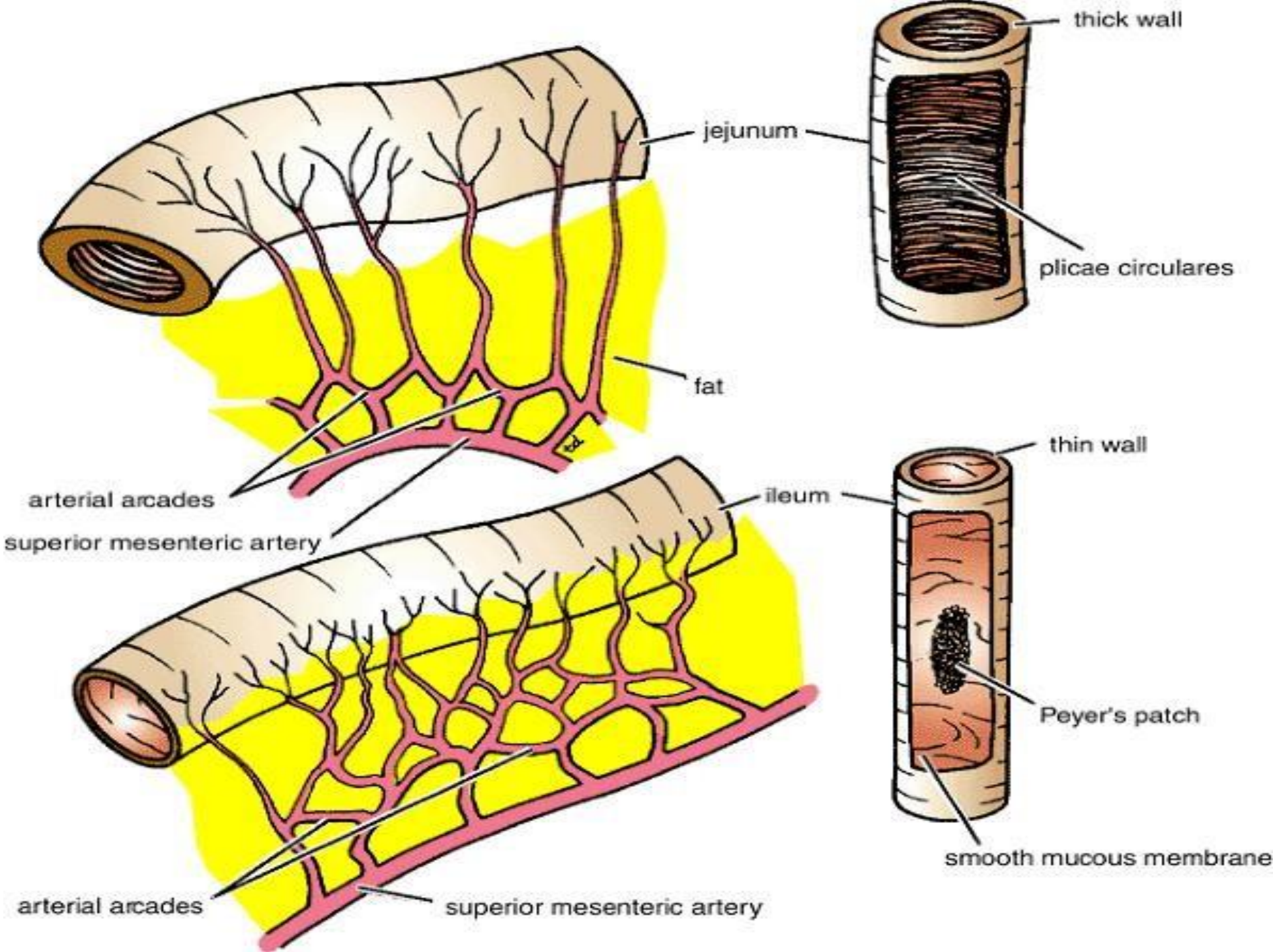
In the jejunum:
simple arcades
Longvase recta

Histologically Differentiating sign: Plicae circularis

In the ileum:
Complicated arcades
Short vase recta

Histologically Differentiating sign: Peyer's patch



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Blood supply of Jejunums Ileum

Arteries:

- The arterial supply is from branches of the **superior mesenteric artery ,** which form the **arcades** and in turn give raise to the **Vasa Recta**
- The intestinal branches arise from **the left side** of the artery and run in the mesentery to reach the gut.
- They anastomosis with one another to form a series of **arcades.**
- The lowest part of the ileum is also supplied by **the ileocolic artery.**

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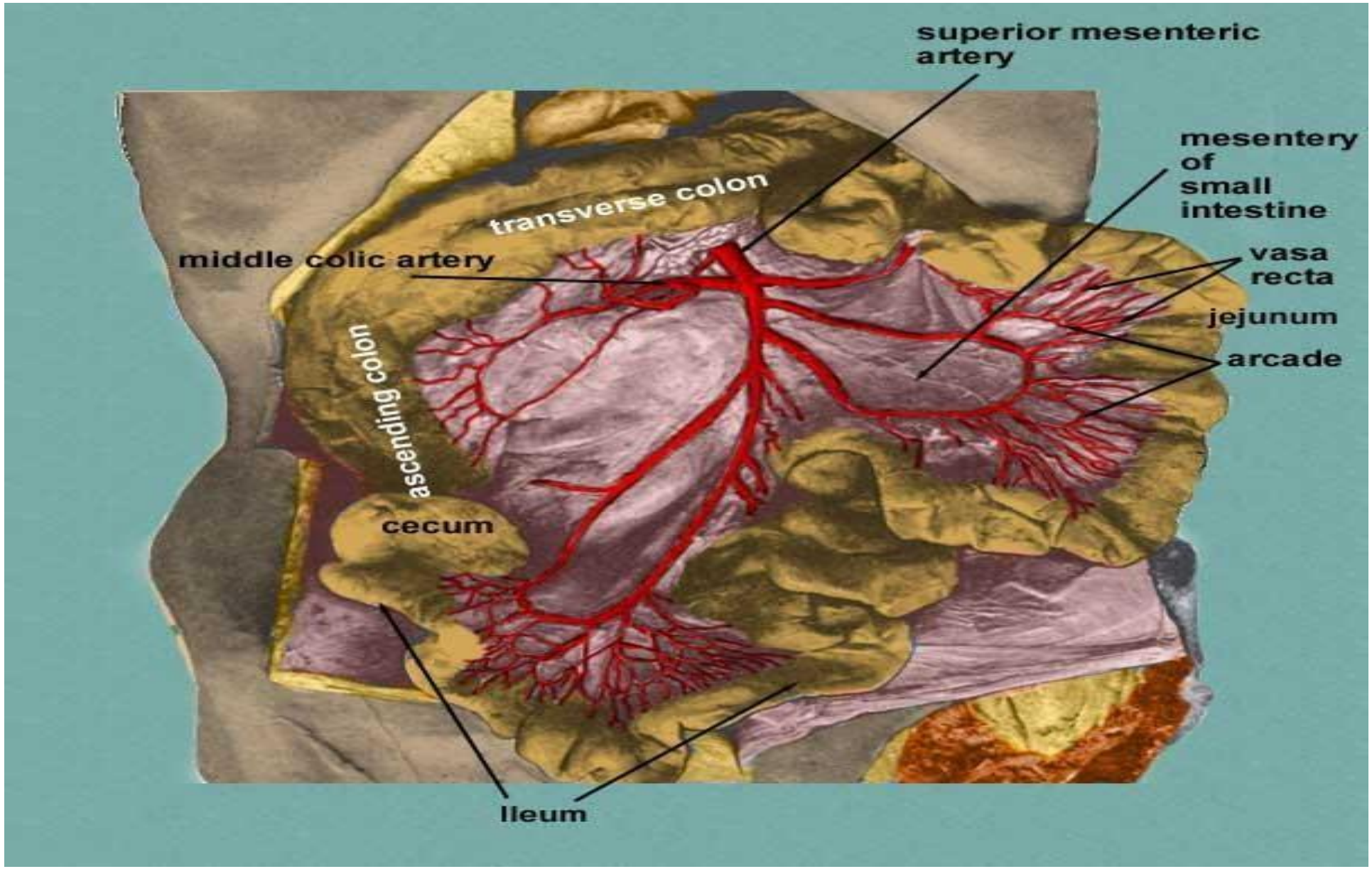
Blood supply for jejunum s Ileum



Veins:

- The veins correspond to the branches of the superior mesenteric artery.
- Drain into the superior mesenteric vein.
- **(SMV) unites with the splenic vein posterior to the neck of the pancreas to form the portal vein.**

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Lymphatic Drainage of jejunum s ileum

- The lymph vessels pass through many intermediate mesenteric nodes

- Finally reach the superior mesenteric nodes→ around the origin of the superior mesenteric artery.

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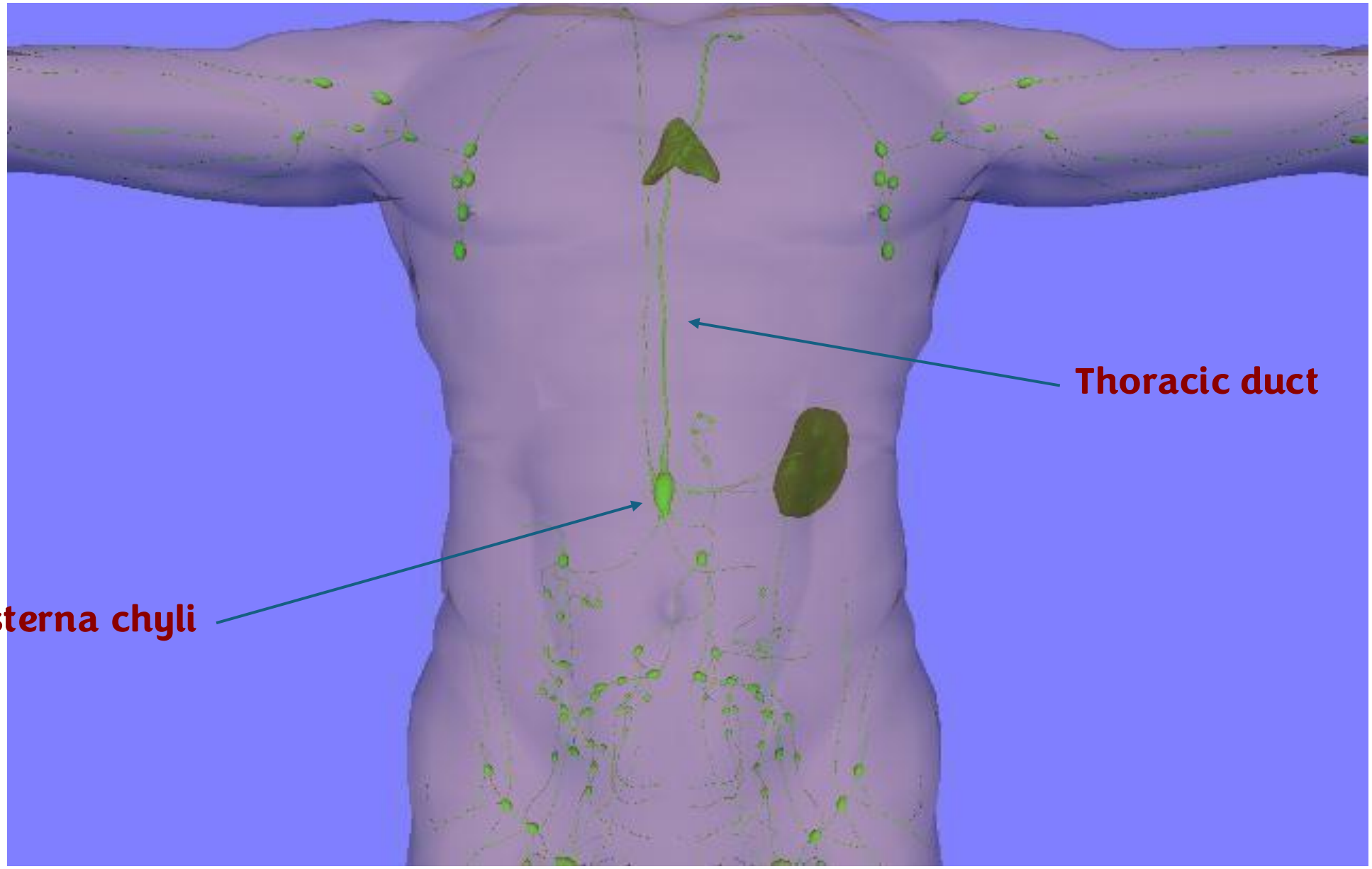
Lymph Drainage of jejunum s ileum



Additional notes

- All the lymphatics of the lower limp, the pelvis and the abdomen drain in the cisterna chyli.
- Cisterna chyli is a lymphatic sac that is present at the aortic orifice of the diaphragm.
- The thoracic duct then arises from the Cisterna Chyli and eventually empties into the venous angle at the level of the left brachiocephalic vein.

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Nerve Supply of jejunum s Ileum

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- *It has a completely similar autonomic pathway to the duodenal autonomic innervation :*

Sympathetic Innervation:

- Origin: **Thoracic spinal cord**
- Pathway:
- Preganglionic fibers descend through the diaphragm
- Synapse in the **superior mesenteric ganglion**
- Postganglionic fibers then follow the branches of the superior mesenteric artery to reach the jejunum and ileum

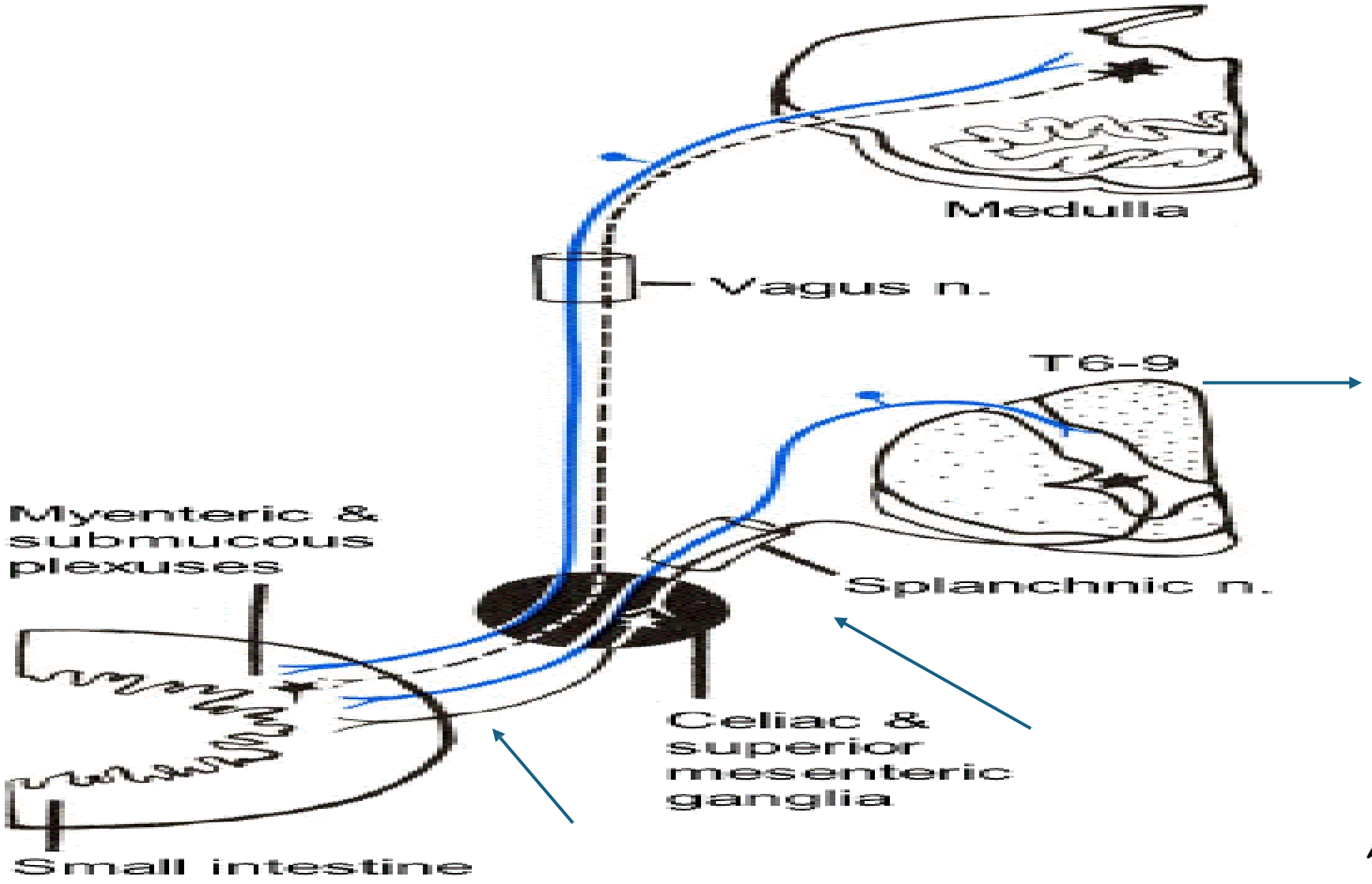
Function: Innervate Blood Vessels, and causes vasoconstriction

Parasympathetic Innervation:

- Origin: **Vagus nerve** (cranial nerve X)
- Pathway:
- Vagal fibers descend through the diaphragm
- **Synapse in the wall of the intestine (In the Enteric Plexuses)**, the Myenteric (Auerbach's) plexus and the Submucosal (Meissner's) plexus
- Short postganglionic fibers innervate the smooth muscle and glands Function:

secretomotor of the gland Peristaltic movement

Nerve supply for small intestine



سُبحان الله العظيم و بحمده

Congenital anomaly of small intestine

Meckel's Diverticulum:

- a congenital anomaly of the ileum.
- Present in 2% of people.
- 2 feet from iliocecal junction.
- 2 inch long.
- contains gastric or pancreatic tissue.
- Remains of vitelline duct of embryo.

❑ Clinical significance:

- It is a **highly common site for infection, inflammation, ulceration** and in case of rupture, it can cause **Peritonitis**
- May **mimic appendicitis** if inflamed or infected (It has similar shape, size and region to the appendix)

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Meckel's Diverticulum

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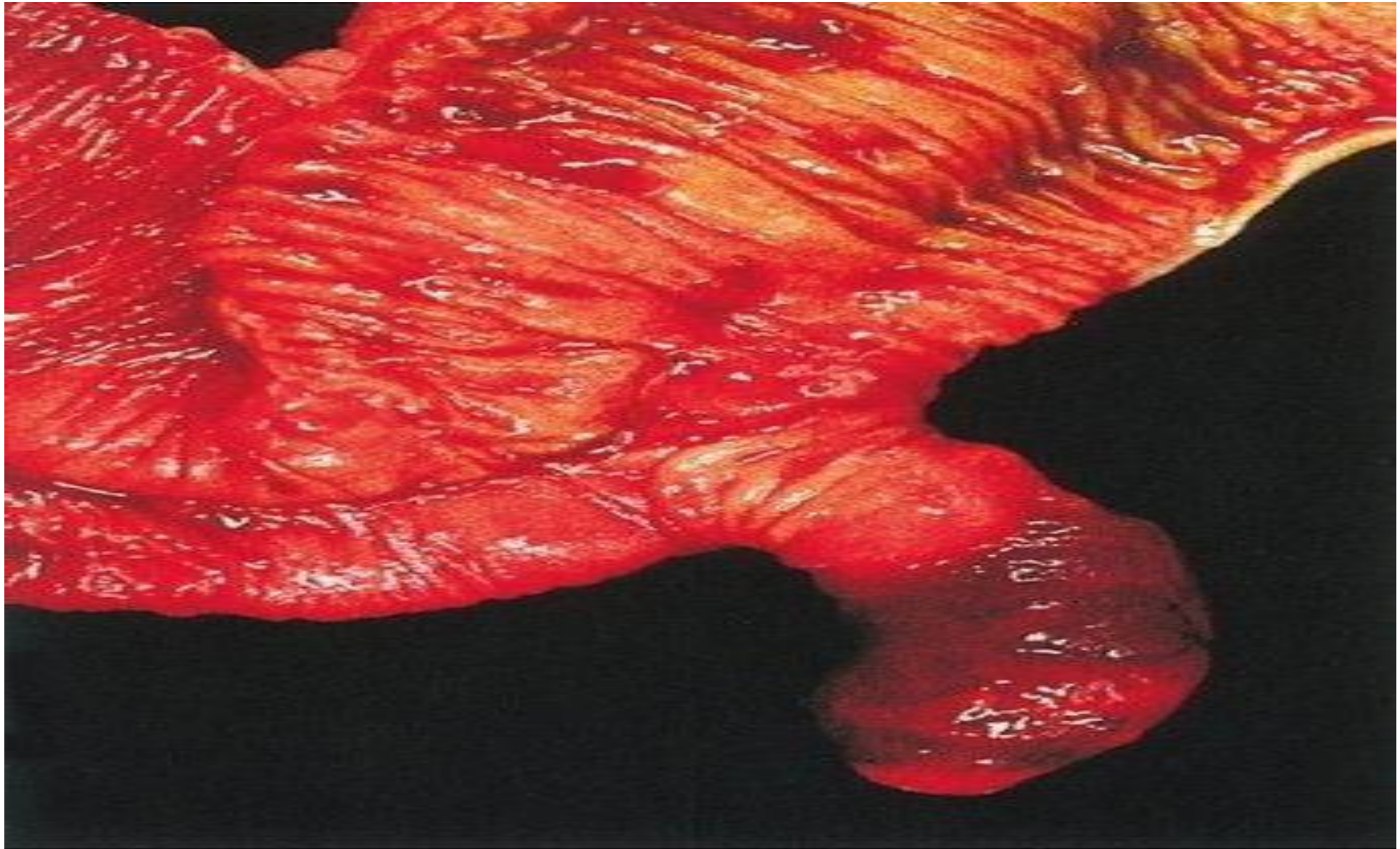

رسالة من الفريق العلمي:

ما رواه الترمذي وغيره عن أبي أمامة الباهلي، أن رسول الله ﷺ قال: **(عليكُم بقيامِ اللَّيلِ فإنَّهُ دأبُ الصَّالِحينَ قبلَكُم، وقُربةٌ إلى ربِّكُم، ومكفَرةٌ للسيِّئاتِ، ومنهاةٌ عنِ الإثمِ)** وحسنه الألباني في صحيح الجامع.

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			