

Intestine عمر إبراهيم Written by: عمرو النجادا عُمر إبراهيم **Reviewed by:** Slides + Dr. doesn't mention **Color Code:** Slides + Dr. mentions

MID | Lecture 4

The Small

بسم الله الرحمن الرحيم



﴿ وَإِن تَتَوَلَّوْا يَسْتَبَدِلْ قَوْمًا غَيْرَكُمْ ثُمَّ لَا يَكُونُوَا أَمْتَ لَكُم ٢

اللهم استعملنا ولا تستبدلنا

APPROVED

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Extra from Dr.



بسم الله الرحمن الرحيم

Press on the palm Tree you've gained إن شاء الله to open the quiz for previous lecture :





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بسم الله الرحمن الرحيم

رب اشرح لي صدري ويسر لي أمري واحلل عقدة من لساني يفقهوا قولي

صلوا على رسولنا وقائدنا محمد



A quick but important comparison between the Small and Large intestines :

Feature	Small Intestine	Large Intestine
Length	6 meters	1.5 to 2.5 meters
Diameter	Smaller	Larger
Function	Digestion and absorption	Absorption of water and formation of feces
Location in the abdominal cavity	Central in the abdominal cavity	Peripheral in the abdominal cavity (forms a frame or border around the small intestine)

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DOUDENUM

Duodenum: Start and End Points

Start:

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

End:

Ends at the duodenojejunal junction, which is located:

- At the level of the second lumbar vertebra (L2)
- Approximately 1 inch to the left of the midline

- Attatched to the **ligament of Treitz** (suspensory ligament of the duodenum), which connects the **duodenojejunal flexure** to the **Right crus of the diaphragm**



Not Mentioned in the slides



Superior mesenteri artery

- The duodenum is a c-shaped
- Concave tube, with the concavity directed towards the Left and Backwards
- The concavity of the duodenum contains :
- **1- Head of Pancreas**

2- Common Bile duct + Main Pancreatic Duct, which come together and open into the 2nd part of the duodenum as the Major Duodenal Papilla that forms a projection (bulge) inside the duodenum called Ampulla of Vater

3- Accessory Pancreatic Duct which opens into the **2nd part** of the duodenum as the **Minor Duodenal Papilla**

These ducts release the the pancreatic and Bile secretions into the duodenum to start acting on the food.

- The Duodenum is about 10 inches (*25cm*) in length.
- It joins the stomach to the jejunum.



Clinical Implication :

In case of Pancreatic Head Cancer, common clinical consequences would be :

- Compression and **obstruction of the common bile duct** leading to **Obstructive Gaundice** :

Conjugated bilirubin is drained with the bile through the common bile duct, in case of obstruction:

- \rightarrow Prevents proper drainage of conjugated bilirubin into the duodenum
- \rightarrow Leads to accumulation of bile in the common bile duct and liver
- \rightarrow Conjugated bilirubin leaks into the bloodstream
- \rightarrow Results in obstructive jaundice

Features: yellowing of skin and eyes, dark urine (bilirubin deposits in urine), pale stools (no bilirubin in stool), pruritus

- Compression of the main pancreatic duct :

- \rightarrow Blocks the flow of pancreatic enzymes
- \rightarrow Causes backup of digestive enzymes into the pancreas
- \rightarrow Can lead to pancreatitis

Features: epigastric pain, elevated pancreatic enzymes, inflammation

duodenum....cont

- Most of the duodenum is retroperitoneal except the 1st inch & last inch which are intraperetoneal
- 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
- It is divided into 4 parts.



Site of duodenum

- The duodenum is situated in the epigastric and umbilical regions

- for purposes of description, is divided into four parts

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Picture not mentioned in the slides

The sphincter of oddi:

- The sphincter of Oddi is a **circular smooth muscle structure** that surrounds the terminal portion of the following ducts:

- 1- Common bile duct
- 2- Main pancreatic duct

- Function :

Controls the flow of bile and pancreatic secretions into the duodenum.

Prevents reflux of duodenal contents into the bile and pancreatic ducts.

- It is always contracted and is stimulated to relax by **neural** (Vagus and ENS) and **Hormonal** (CKK mainly) stimuli **once the food reaches the duodenum**



Parts of the duodenum & Their relations

Lengths of the Duodenum (in inches):

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



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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)

Parts of the duodenum & Their relations



1st part of Duodenum

- The first part is 2 inches long.
- It begins from the pyloduodenal junction
- At the level of the transpyloric line

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 Runs upward and backward at the level of the 1st lumbar vertebra 1 inch to the right.



Relations of 1st part of doudenum

<u>Ant.</u>

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- The liver (quadratus lobe)
- gall bladder



Relations of 1st part of duodenum.....cont

<u>Sup.</u>

- the epiploic foramen

Liver in Situ





Picture not mentioned in the slides

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Posterior Relations :

Lesser sac

- Gastroduodenal artery
- Common bile duct
- Portal vein
- Inferior vena cava (IVC)

Inferior Relation:

Head of the pancreas

Clinical Implication : Duodenal Ulcers

The first part of the duodenum is **the most common site for peptic ulcers** (duodenal ulcers).

- In the case of **posterior perforation:**
- The **gastroduodenal artery is most commonly affected** \rightarrow can cause life-threatening hemorrhage.

Other vital posterior structures (portal vein, bile duct, IVC) may also be compromised.





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

- 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) :

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

- Used in cases of :

Picture not mentioned in the slides



- **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



Hepaticopancreatic ampulla (Ampulla of Vater)





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Relations of 2nd part of duodenum

<u>Ant.</u>

- 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 (hepatic flexure)
- Ascending colon
- Right lobe of the liver.

<u>Medial.</u>

- Head of pancreas
- Bile and pancreatic ducts.

سبحان الله



• 4" long

- Runs horizontally to the left
- On the subcostal plane.
- Runs in front of the vertebral column (At the level of L3)
- 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

(Horizontal part)

- Under the lower margin of the head of pancreas
- Above the coils of the jejunum.

الحمد لله



Relations of 3rd part of duodenum

Anteriorly:

- The root of the mesentery of the small intestine
- the superior mesenteric vessels contained within the mesentery (that will supply the jejunum & ilium) 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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(المساريق) Additional Notes: The Mesentery

 The Mesentery: A two layers of peritoneum (A Peritoneal Fold) that's root is attached to the posterior abdominal wall and at its free edge of contains the small intestines (jejunum & ileum)

Its Root :

- Begins → (From the Duodenojejunal Junction = Beginning of the Jejunum) at 2nd lumber vertebrae / 1 inch to the left
- Ends → The level of the Right Iliocecal Junction (= End of the Ileum)
- Makes an oblique shape and it is 6 inches in tall

Its free edge : is about 6 meters in length because it contains the jejunum & ileum, as they are 6 meters in length as well.

It contain arteries & veins from superior mesenteric vessels (That supplies the ileum and Jejunum) (+ lymph nodes + plexus of nerves (sympathetic & parasympathetic) + fat

Press to watch a video that could remind you more regarding the mesentery

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لا حول ولا قوة إلا بالله 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**, which is attached to the right crus of the diaphragm (duodenal recess).



Additional notes



- The **ligament of Treitz** serves as an important **surgical landmark** to identify the end of the duodenum and the beginning of the jejunum
- Surgeons look for it during abdominal procedures to orient themselves and locate the proximal jejunum
- Remember : As the Jejunum and Ileum are **Intraperitoneal**, they are considered **movable** and not fixed to the Posterior abdominal wall

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 in midline incision we get all of the mesentery and the jejunum & ilium out of the abdomen then we bring them back to get better access to posterior body compartments



Picture not mentioned in slides

Relation of 4th part of duodenum

<u>Ant.</u>

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

Post.

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

<u>Sup.</u>

- Uncinate process of the **head of** pancreas.

Uncinate process: an extension that rises from the head of pancreas and lodges within the duodenal concavity



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(إنَّ مَعَ الْعُسْرِ يُسْرًا) Blood supply of duodenum



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

<u>1-upper half</u> (1st part + upper1/2 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.

<u>2- The lower half</u> (lower ¹/₂ of 2nd part +3rd+4th part) is supplied by the inferior pancreaticoduodenal artery, a branch of the superior mesenteric artery سُبحان الله العظيم و بحمده

Arterial supply and venous drainage of the duodenum





Blood supply for duodenum



Veins of duodenum

Upper Half :

• The superior pancreaticoduodenal vein drains into the portal vein

Lower Half:

• The inferior vein joins the superior mesenteric vein .





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 \rightarrow the superior mesenteric nodes around the origin of the superior mesenteric artery.









- 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 \rightarrow celiac ganglion Sympathetic Fibers to the Lower duodenum \rightarrow 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



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.

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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 & 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 <u>duodenojejunal</u> flexure which attaches to the ligament of trietz + The level of the beginning of mesenteric root
- the ileum ends at the <u>ileocecal junction</u> (found at the right iliac fossa).
- At the Iliocecal Junction there is a physiologic value (formed by mucosal thickening) which closes under the pressure of the cecum to prevent cecal contents from returning to the ileum

SMALL INTESTINES ANATOMY

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 **(A Peripheral Structure)**

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





Anatomical position of small intestine



Structure of the Villi in the Small Intestine



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ستبحان الله العظيم و بحمده Histology of small intestine

The of the intestinal epithelium is made of <u>simple</u> <u>columnar with goblet cells</u>, it forms two main structures:

1- Finger like projections called **villi** and lining that villi we have **microvilli**, both serve to increase the surface area for absorption Each villi contains: veins / arteries / lymphatic vessel (Lacteal) / smooth muscles and eventually lined by microvilli

2- Indentations that form Secretory Glands



اللهم صل على محمد

mesentery of the small intestine

- fan-shaped fold of **2 layers of** peritoneum
- The long free edge 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 1 inch to the left to the region in front of the right sacroiliac joint





Root of the mesentery





Contents of the mesentery

- The branches of the superior mesenteric artery and vein

- Lymphatic vessels & lymphatic nodes
- nerves (sympathetic & parasympathetic)



Difference between Jejunum & Ileum

	jejunum	lleum
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 (most of the absorption happens in it = more vascularized)	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 & Ileum

		jejunum	lleum
Di	iameter	wider	smaller
vi	lli	numerous	Less numerous
Pli pe the sul Re the	licae circularis(the ermanent enfolding of ne mucous membrane& ubmucosa esembles the Rugae in ne Stomach	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 .
مان الله ا	Lymphatic follicles	No or few	Aggregations of lymphoid tissue (Peyer's patches) are present in the mucous membrane

In the jejunum: simple arcades Long vase 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 Jejunum & 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.

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• The lowest part of the ileum is also supplied by **the ileocolic** artery.

Blood supply for jejunum & Ileum



Veins:

- The veins correspond to the branches of the superior mesenteric artery (tributaries)
- Drain into the superior mesenteric vein.



Lymphatic Drainage of jejunum & ileum

- The lymph vessels pass through many intermediate mesenteric nodes
- Finally reach the superior mesenteric nodes → around the origin of the superior mesenteric artery.



Lymph Drainage of jejunum & 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



Nerve Supply of jejunum & Ileum

- سُبحان الله العظيم و بحمده
- 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: Inhibits peristalsis, reduces secretions, 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: Stimulates motility, secretion, and sphincter relaxation

Nerve supply for small intestine



Congenital anomaly of small intestine

Meckel's Diverticulum:

- a congenital anomaly of the ileum
- Cause: Persistence of the vitelline duct and its insufficient obliteration after birth
- 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)

<u>Meckel's Diverticulum</u>







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			

رسالة من الفريق العلمى:





أَلَيْسَ ٱللَهُ بِكَافٍ عَبْدَهُمَ وَيُخَوِّفُونَكَ بِٱلَّذِينَ مِن دُونِهِ قَصَ يُضْلِل ٱللَهُ فَمَالَهُ مِنْ هَادِ ٢

لا تستعن إلا بالله ولا تطلب إلا من الله ولا تخف إلا من الله فالله كافيك والله غالب على أمره ولكن أكثر الناس لا يعلمون

لا تنسوا أهل غزة من دعائكم