
INTERNATIONAL SURGICAL
ANATOMY TEACHING
SERIES



ISATS
HANDOUT
2024/25

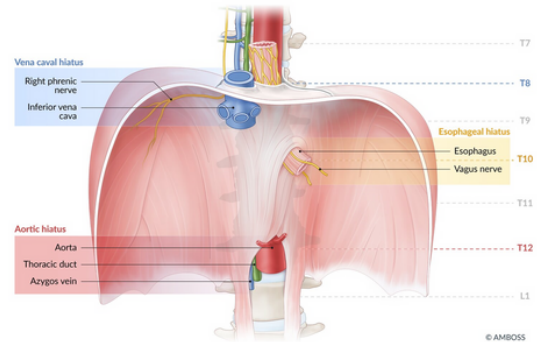
Upper GI Anatomy

UPPER GI ANATOMY

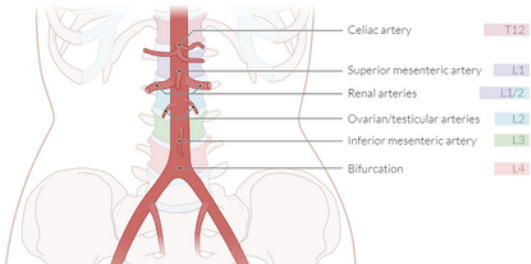
Objectives: Describe the diaphragmatic openings and their contents; Label the main branches of the abdominal aorta; Understand the structure and attachments of the Peritoneum, Mesentery and Omentum; and Identify the vascular territories of the GI tract

Diaphragmatic Openings

Mnemonic	Structure	Level
I Ate	Inferior Vena Cava	T8
Ten Oranges	Oesophagus	T10
At Twelve	Aorta	T12



Abdominal Aorta Branches



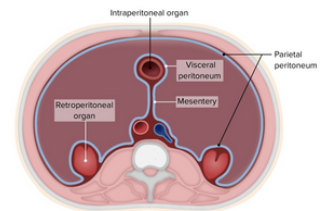
Most important branches for the GI tract are:

1. Celiac trunk
2. Superior mesenteric artery
3. Inferior mesenteric artery

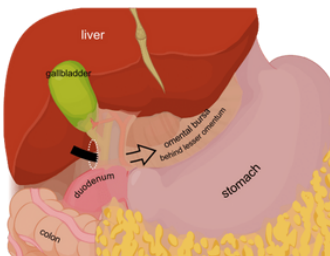
Peritoneum and Mesentery

Mesentery

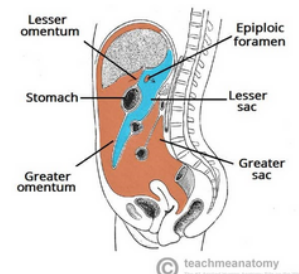
- A double layer of peritoneum
- Attaches intraperitoneal organs to posterior abdominal wall
- Neurovascular communication between organs and body wall
- Allows free movement of intraperitoneal organs



Omentum and Sacs

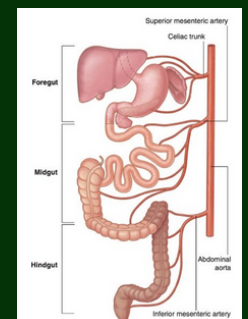


- The greater omentum is a fold between the lesser curvature of the stomach and the liver.
- The lesser omentum is a double-fold between the greater curvature of the stomach and the transverse colon.
- They form the two main sacs of the peritoneum: The lesser and the greater sacs, connected by the Foramen of Winslow.



Vascular Territories of the GI Tract

Foregut	Oesophagus to proximal duodenum	Celiac trunk
Midgut	Distal duodenum to proximal 2/3s of transverse colon	Superior mesenteric artery
Hindgut	Distal 1/3 of transverse colon to rectum	Inferior mesenteric artery



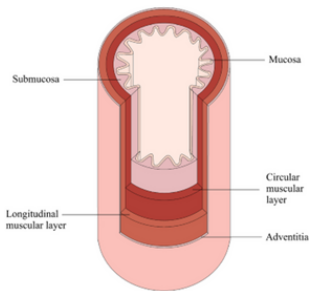
UPPER GI ANATOMY

Objectives:

The oesophagus anatomy: Its course, relations, and neurovascular supply

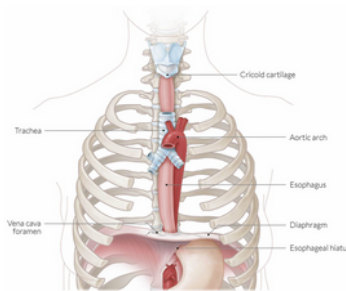
The Oesophagus

Four concentric layers



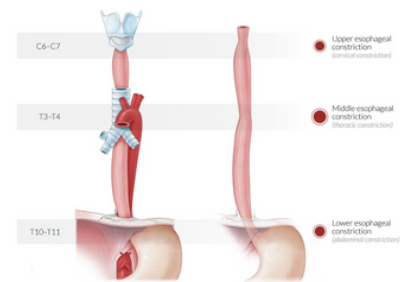
- Outer to inner: Adventitia → muscular layer → submucosa → mucosa
- Muscular layer further divided to
 - Inner circular layer
 - Outer longitudinal layer

Course



- **3 sections:** Cervical, thoracic, and abdominal oesophagus
- Starts at the **cricoid cartilage** at C6
- Cervical oesophagus runs posterior to the **trachea**, and thoracic oesophagus runs to the right of the **thoracic aorta**
- Pierces the diaphragm at T10

Oesophageal Constrictions



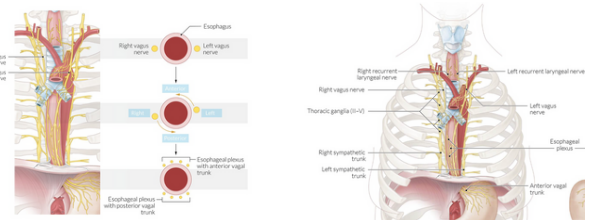
Constriction	Level
Cricopharyngeal constriction	C6
Aortic constriction	T4
Bronchial constriction	T5
Diaphragmatic constriction	T10

Oesophageal Sphincters



- **Upper Esophageal Sphincter (UES):** Voluntary; made of striated skeletal muscle (cricopharyngeus)
- **Lower Esophageal Sphincter (LES):** Involuntary; made of smooth muscle to prevent acid reflux

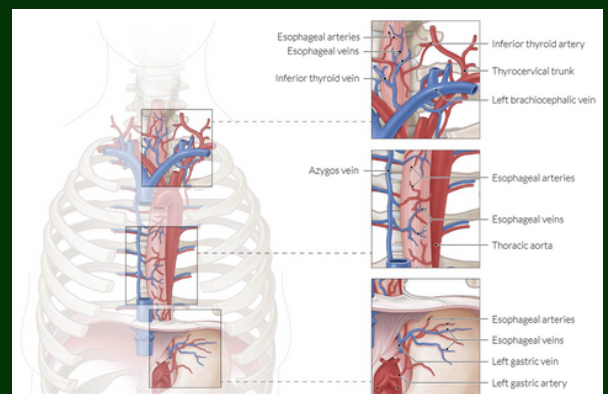
Nerve Supply



- **Sympathetic innervation** via thoracic ganglia II-V
- **Parasympathetic innervation** via branches of the vagus nerve
 - Right vagus nr. → posterior vagal trunk
 - Left vagus nr. → anterior vagal trunk

Blood Supply per region

Section	Arteries	Veins	Lymphatics
Cervical	Inferior Thyroid Artery	Inferior Thyroid Vein	
Thoracic	Thoracic Aorta	Azygos and Hemiazygos Veins	Mediastinal Lymph Nodes
Abdominal	Left gastric artery	Left gastric vein	

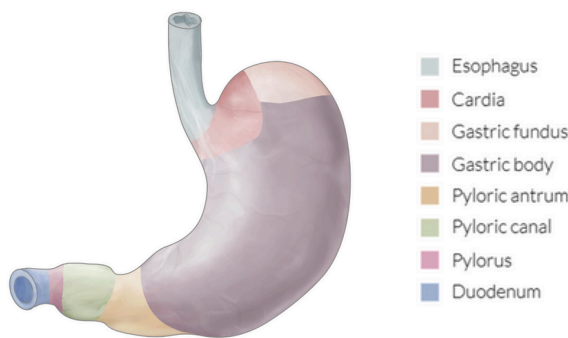


UPPER GI ANATOMY

Objectives:

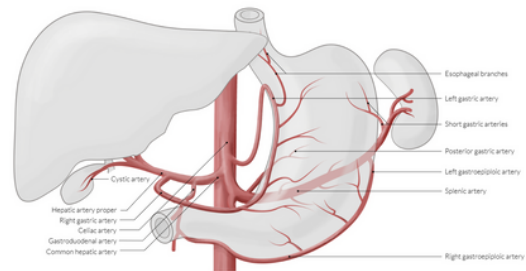
Anatomy of the stomach: course, relations, and neurovascular supply

Anatomy of the Stomach



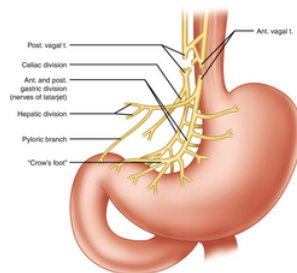
Blood Supply

- **Lesser curvature** – R & L gastric arteries and veins
- **Greater curvature** – R & L gastroepiploic arteries and veins



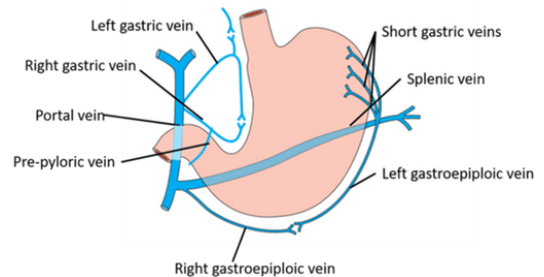
Stomach Nerve Supply

- **Sympathetic innervation** via coeliac ganglia (perception of pain)
- **Parasympathetic innervation** via branches of the vagal nerve (perceptions of nausea and fullness)



Arterial:

All branches of the **coeliac trunk**

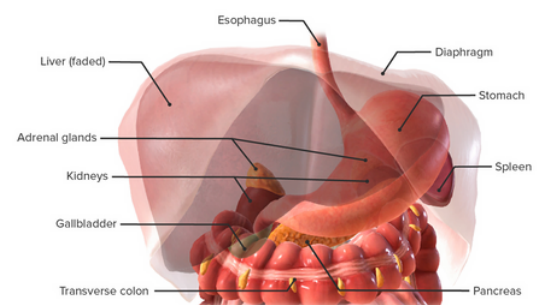
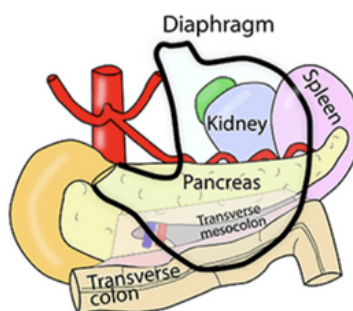


Venous:

All drain to the **portal vein**

Relations

Superiorly	The oesophagus The lesser omentum The left dome of the diaphragm
Anteriorly	The liver The diaphragm Anterior abdominal wall
Inferiorly	Transverse colon Greater omentum
Posteriorly	Lesser sac Pancreas Spleen and Splenic artery Left kidney and renal gland



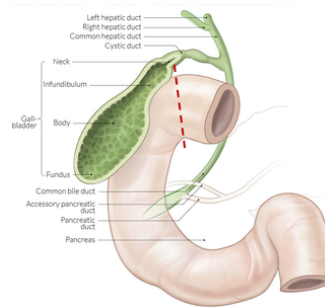
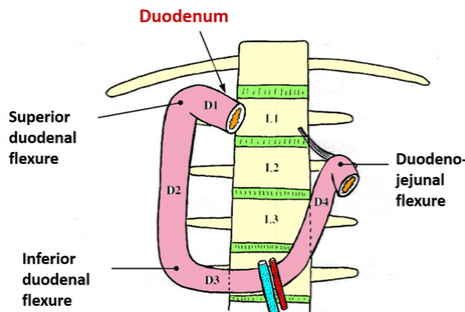
UPPER GI ANATOMY

Objectives:

Anatomy of the duodenum: course, relations, and neurovascular supply

Anatomy of the Duodenum

- The duodenum is divided to 4 parts
- The foregut ends proximal to the **ampulla of Vater**. The midgut starts mid-D2.



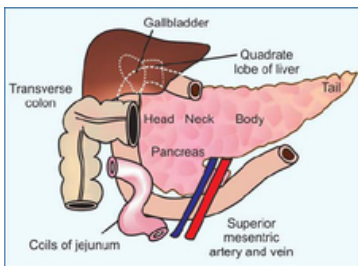
Superior duodenal flexure (at the neck of the gallbladder)

Superior Duodenum (D1)
Descending Duodenum (D2)
Inferior Duodenum (D3)
Ascending Duodenum (D4)

Inferior duodenal flexure

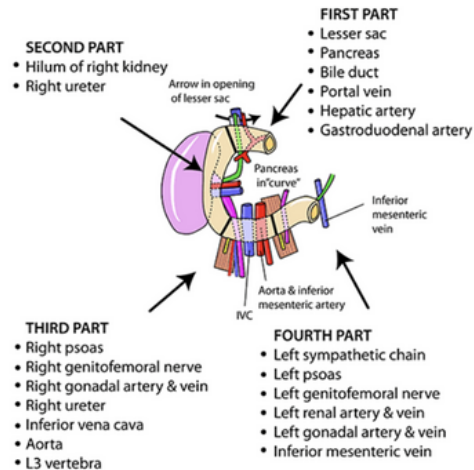
Relations

Anteriorly

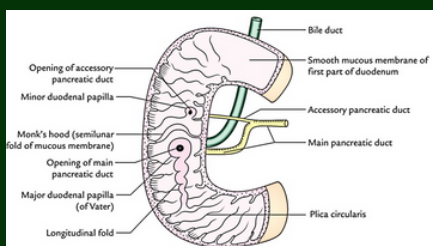


- D1 - the liver & GB
- D2 - the liver & GB, and transverse colon
- D3 - SMA & SMV
- D4 - transverse colon

Posteriorly



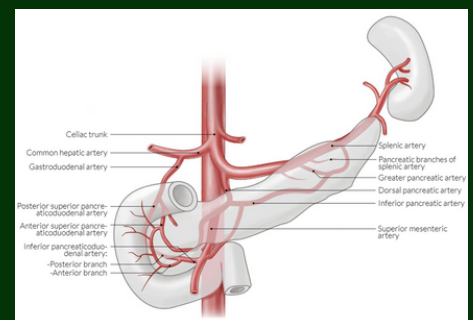
Openings in D2



- Accessory pancreatic duct → **Minor duodenal papilla**
- Bile duct + main pancreatic duct → **Major duodenal papilla (of Vater)**

Blood Supply

Celiac Trunk	<ul style="list-style-type: none"> Gastroduodenal artery 2 Superior pancreaticoduodenal arteries (anterior & posterior)
SMA	<ul style="list-style-type: none"> 2 Inferior pancreaticoduodenal arteries (anterior & posterior)

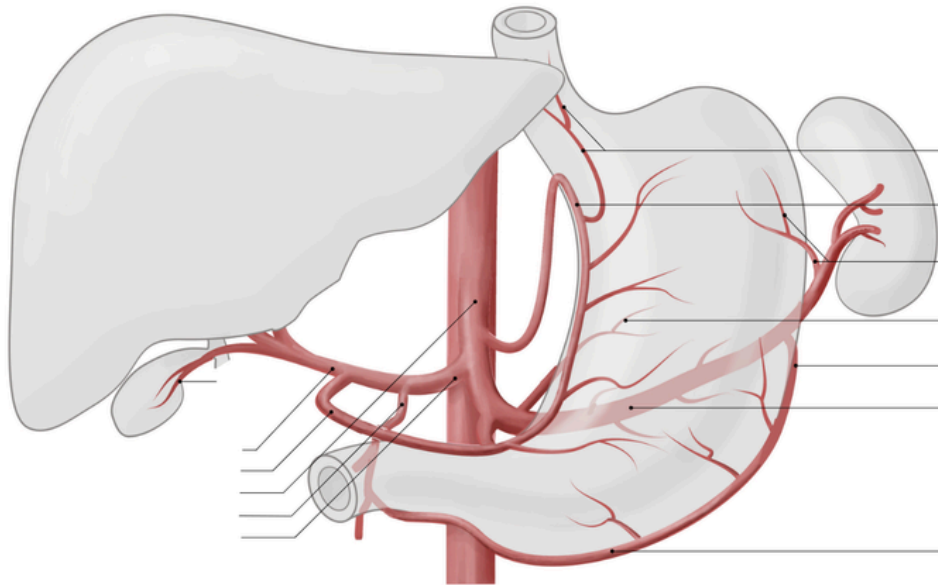


- The foregut part is supplied by the coeliac trunk
- The midgut part is supplied by the superior mesenteric artery
- The venous drainage highly varies across people, but follows the same naming as that of the arterial supply.

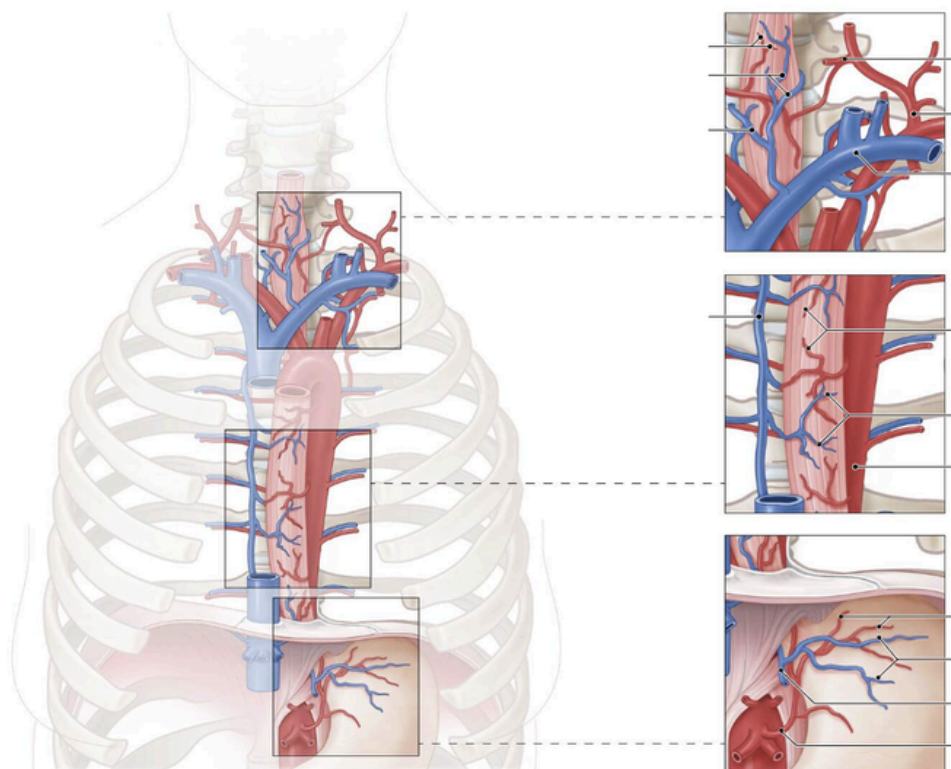
UPPER GI ANATOMY

Test yourself

1) Label the branches of the coeliac trunk that supply the stomach:



2) Label the structures supplying the oesophagus:



UPPER GI ANATOMY

Test yourself

MCQ 1

A patient undergoing exploratory laparotomy is found to have ascitic fluid between the layers of the peritoneum. Which of the following best describes the space where this fluid is located?

- A. Lesser sac
- B. Peritoneal cavity
- C. Mesenteric space
- D. Retroperitoneal space
- E. Omental bursa

MCQ 3

During surgery, a surgeon identifies a structure containing blood vessels, lymphatics, and nerves supplying the jejunum and ileum. What is this structure?

- A. Greater omentum
- B. Lesser omentum
- C. Mesentery
- D. Transverse mesocolon
- E. Gastrocolic ligament

MCQ 5

A 45-year-old male presents with severe abdominal pain. Imaging reveals a perforated gastric ulcer with omental thickening in the region. What is the role of the omentum in this case?

- A. Absorbs nutrients from the gastric contents
- B. Acts as a conduit for nerves to the stomach
- C. Protects the pancreas from inflammation
- D. Facilitates gastric motility
- E. Localizes the spread of peritoneal infections

MCQ 2

A 50-year-old man presents with progressive dysphagia to solids and liquids. Imaging reveals dilation of the esophagus and a narrowed lower esophageal sphincter (LES). What type of muscle primarily constitutes the esophagus at its lower third?

- A. Skeletal muscle
- B. Cardiac muscle
- C. Smooth muscle
- D. Mixed skeletal and smooth muscle
- E. No muscle layer

MCQ 4

A patient with a suspected pancreatic tumor undergoes imaging. The tumor is located in the head of the pancreas and is causing obstruction of an adjacent organ. Which foregut-derived structure is most likely obstructed?

- A. Ileum
- B. Ascending colon
- C. Duodenum (2nd part)
- D. Transverse colon
- E. Descending colon

MCQ 6

A 40-year-old man presents with severe upper abdominal pain radiating to the back. Imaging reveals an ulcer at the posterior wall of the first part of the duodenum. Which artery is most at risk of erosion?

- A. Gastroduodenal artery
- B. Superior mesenteric artery
- C. Right gastroepiploic artery
- D. Inferior pancreaticoduodenal artery
- E. Left gastric artery

UPPER GI ANATOMY

Test yourself

OSCE Station – Case Based Discussion

A 35-year-old male presents to the emergency department with severe abdominal pain and shortness of breath after a high-speed motor vehicle accident. On examination:

- **Vital signs:** HR 115 bpm, BP 90/60 mmHg, RR 26/min, O₂ saturation 89% on room air.
- **Inspection:** Abdomen appears scaphoid, and there is bruising over the left lower thorax.
- **Auscultation:** Diminished breath sounds on the left hemithorax with audible bowel sounds.
- **Other findings:** Evidence of mediastinal shift with apex beat displaced to the right.



Q1. What would be the initial management of this patient?

Q2. What is your top differential diagnosis, and what are the other potential differentials from this presentation?

Q3. Which investigations will be useful in confirming a diagnosis?

Q4. How will you manage this patient?

Q5. What clinical features can help differentiate a diaphragmatic hernia from other causes of respiratory distress in this patient?

Q6. What are the potential complications of a diaphragmatic hernia?

OSCEs:
 Q1) Stabilize the patient with: supplemental oxygen, securing the airway (intubation if necessary), and fluid resuscitation.
 Q2) Top differential: traumatic diaphragmatic hernia. Others: Tension pneumothorax (traumatic), rib fractures with contusion, hemothorax.
 Q3) Chest X-ray, FAST scan, CT scan of the chest and abdomen.
 Q4) After stabilizing, treatment is surgical repair (open/laparoscopic). If unable to stabilize the patient → diagnostic laparoscopy and repair.
 Q5) Diminished breath sounds on the affected side with audible bowel sounds; A scaphoid abdomen combined with respiratory distress supports the diagnosis; Mediastinal shift observed on physical exam or imaging; absence of hyperresonance on percussion and the presence of bowel loops on imaging.
 Q6) Respiratory distress due to lung compression; strangulation or ischemia of the trapped bowel loops.

MCS: 1) B, 2) C, 3) C, 4) C, 5) E, 6) A.