

INTERNATIONAL SURGICAL  
ANATOMY TEACHING  
SERIES



# ISATS HANDOUT 2023/24

Upper GI

# UPPER GI ANATOMY

**Objectives:** Understand the neurovascular supply and relations of the oesophagus, stomach and duodenum. Describe the structure of the peritoneum, mesentery and omentum. Apply anatomical knowledge to the setting of Upper GI Surgery (oesophagectomy + gastrectomy)

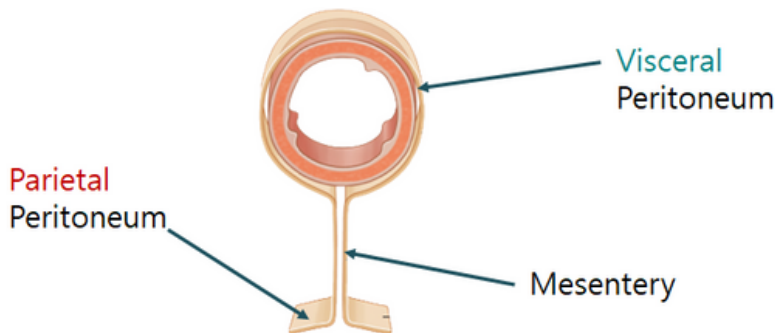
## Peritoneum

### Parietal

- Lines the abdominal wall – the innermost lining of the abdominal wall
- **Somatic innervation** – pain is well localised

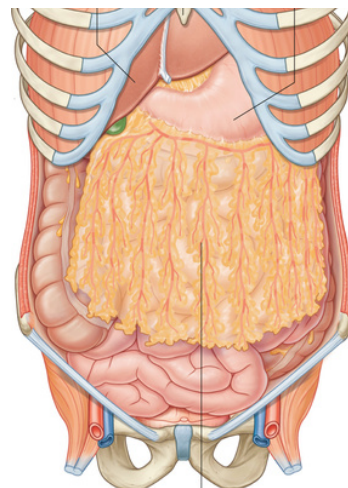
### Visceral

- Covers and encloses abdominal viscera
- **Autonomic innervation** – poorly localised pain



## Mesentery

- Double layer of visceral peritoneum
- Attaches from small intestines to posterior abdominal wall
- Allows important neurovascular structures to travel from abdominal wall to abdominal viscera.



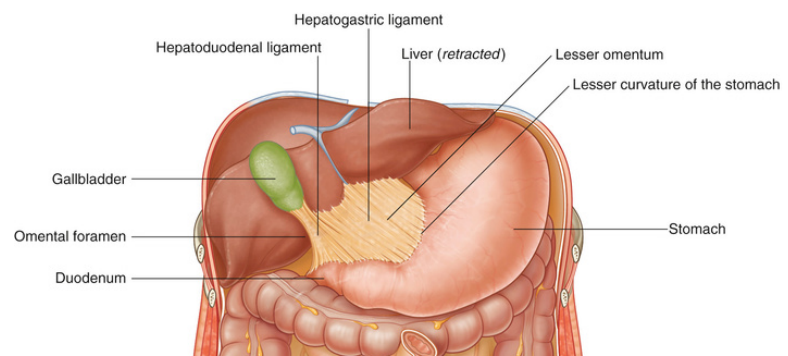
The mesentery can also be associated with other organs. In this case, it is named with the prefix '-meso'. E.g. mesocolon

## Greater Omentum

- 4 layers of visceral peritoneum.
- Extends from **greater curvature** of the stomach to transverse colon.
- Mobile and provides immune response "policeman of the abdomen".

## Lesser Omentum

- 2 layers of visceral peritoneum.
- Contains the **hepatogastric** and **hepatoduodenal** ligaments.
- **Lesser curvature** and **1st part of duodenum** to inferior surface of the liver.



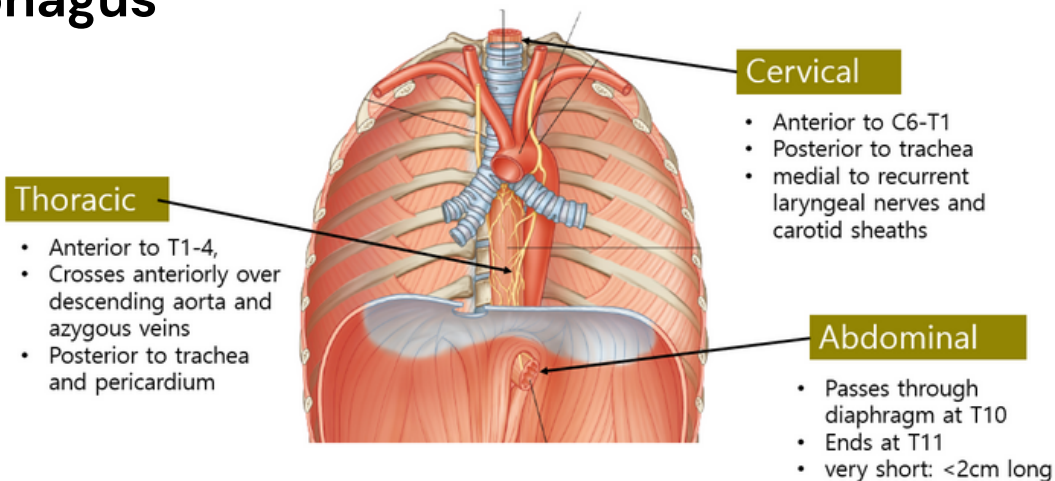
## Greater and Lesser Sacs

- **Greater Sac** = most of the peritoneal cavity, deep to the parietal peritoneum
- **Lesser Sac** = posterior to the stomach and liver
  - Continuous with the stomach via the **epiploic foramen (Foramen of Winslow)**

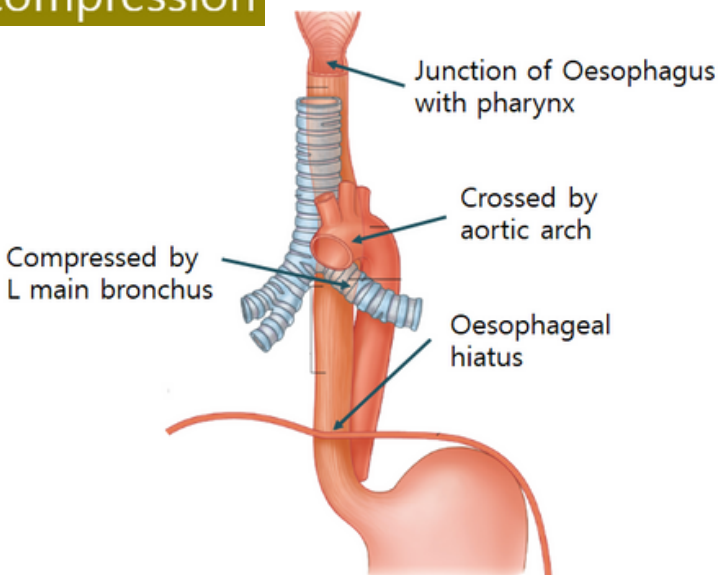
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## Oesophagus



### Sites of compression



### Arterial Supply:

- Thoracic aorta
- Left gastric artery
- Other:
  - Bronchial arteries
  - Inferior thyroid artery
  - Left inferior phrenic artery

### Venous Drainage:

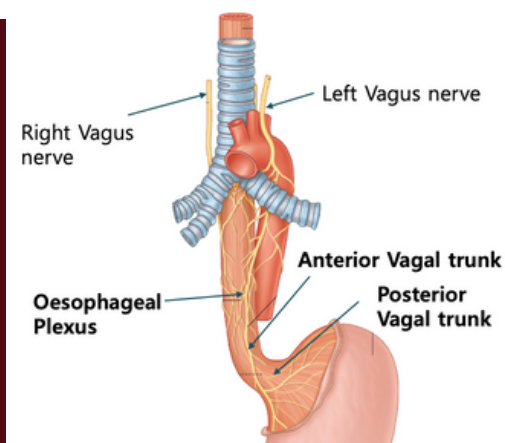
- Azygos and hemiazygos veins
- L gastric vein -> portal system

### Lymphatic Drainage:

- Posterior mediastinal nodes & left gastric nodes

## Innervation of Oesophagus

- **Striated muscle** = efferents from Vagus: Auerbachs and Meissners Plexuses
- **Smooth muscle** = parasympathetic – visceral efferents from Vagus
- **Sensory** = visceral afferents from Vagus, sympathetic trunks and splanchnic nerves
  - Vagus – information on physiology and reflexes
  - Sympathetic trunks and splanchnic nerves – pain
- The two Vagus nerves form the **Oesophageal plexus**, which then forms two trunks just above the diaphragm
  - The **Anterior Vagal Trunk** is formed mainly from the L Vagus
  - The **Posterior Vagal Trunk** is formed mainly from the R Vagus

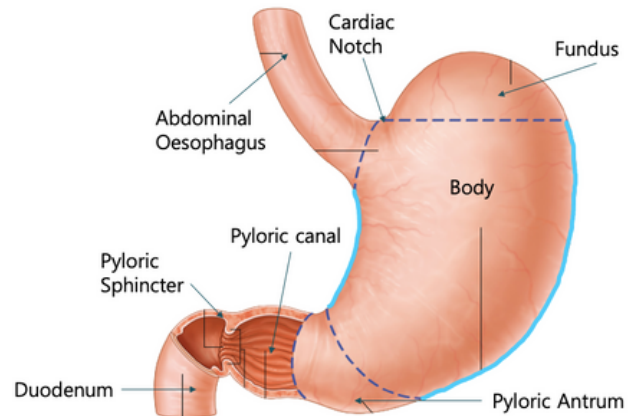


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## Stomach

- The stomach has a **lesser** and **greater** curvature.
- Transpyloric Plane (of Addison) = L1 corresponds to:
  - Pylorus of stomach
  - Neck of pancreas
  - Fundus of gallbladder
  - Hilum of L & R kidneys
- Lymphatic drainage - **gastric** and **gastro-omental** lymph nodes at curvatures.



## Relations of the Stomach

Superior	Anterior	Posterior
<ul style="list-style-type: none"> <li>• Oesophagus</li> <li>• L dome of diaphragm</li> </ul>	<ul style="list-style-type: none"> <li>• Diaphragm</li> <li>• Greater Omentum</li> <li>• Liver (L lobe)</li> </ul>	<ul style="list-style-type: none"> <li>• Lesser sac</li> <li>• Pancreas</li> <li>• L kidney</li> <li>• L adrenal gland</li> <li>• Spleen</li> <li>• Splenic artery</li> </ul>

## Venous Drainage

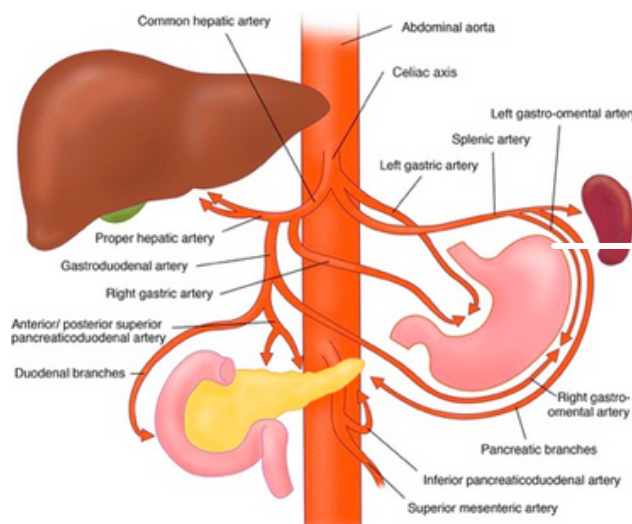
- R and L gastric veins --> hepatic portal vein
- Short gastric veins + L gastro-omental --> splenic vein + SMV --> hepatic portal vein
- R Gastro-omental veins --> superior mesenteric vein

## Innervation

- **Sympathetic**
  - Greater splanchnic nerve (T5-9)
  - Synapses in coeliac ganglion to innervate foregut
- **Parasympathetic**
  - Coeliac plexus from Vagus nerve

## Arterial Supply

- **Greater Curvature**
  - R gastro-omental (gastrooduodenal)
  - L gastro-omental (splenic)
  - Short gastric arteries (splenic)
- **Lesser Curvature**
  - R gastric (common hepatic)
  - L gastric (coeliac trunk)



## Thoracic Splanchnic Nerves

- **Greater** - T5-T9 & travels to coeliac ganglion
- **Lesser** - T9+T10 & travels to superior mesenteric ganglion
- **Least** - T12 & travels to inferior mesenteric ganglion & renal plexus

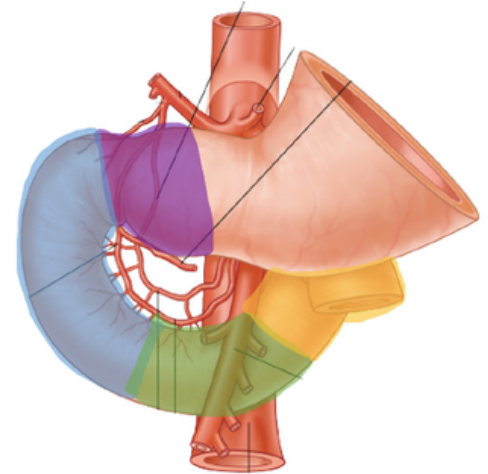
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## Duodenum

- **Superior part** – pyloric orifice to gallbladder neck (L1)
- **Descending part** – gallbladder neck to lower border of L3
- **Inferior part** – inferior duodenal flexure (L3)
- **Ascending part** – L3 to L2, duodenojejunal flexure

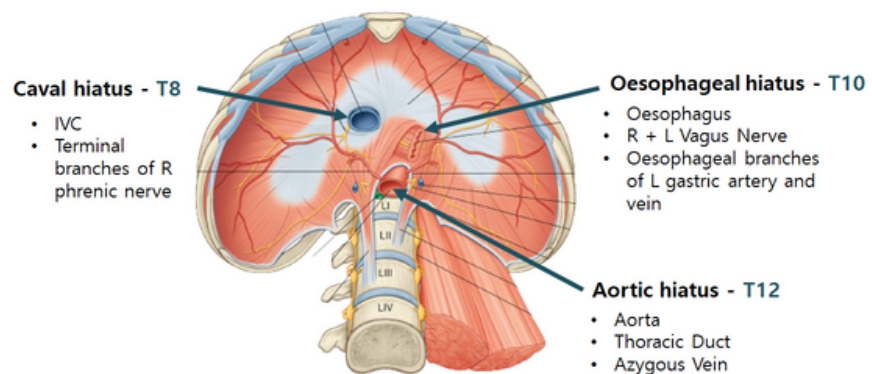
The duodenum is mostly retroperitoneal, however the first part is intraperitoneal.



## Duodenum – Vasculature

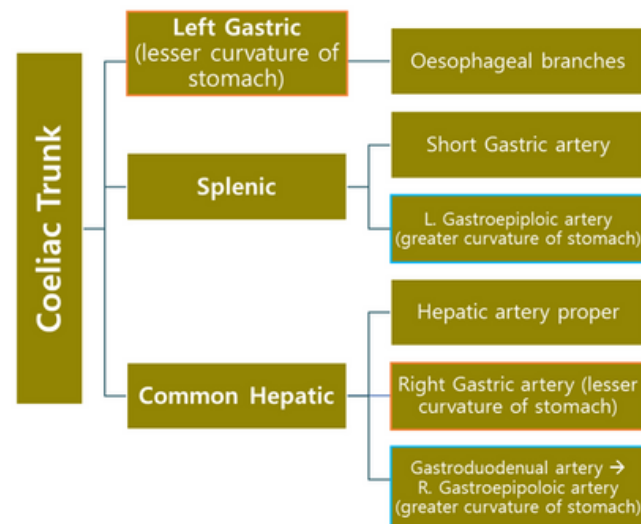
- **Arterial Supply:**
  - Supraduodenal arteries (gastroduodenal of coeliac)
  - Superior pancreaticoduodenal arteries (from coeliac trunk)
  - Inferior pancreaticoduodenal arteries (from SMA)
  - Jejunal branches
- **Venous Drainage:**
  - Pre-pyloric vein
  - Superior pancreaticoduodenal veins
  - Inferior pancreaticoduodenal veins

## Diaphragmatic Openings



## Overview of Foregut

- From the inferior oesophagus to the 2nd part of the duodenum.
- **Arterial supply** = coeliac trunk.
- **Venous drainage** = portal vein, splenic veins and SMV.
- **Sympathetic innervation** = greater splanchnic nerve (synapses in coeliac ganglion).
- **Parasympathetic innervation** = Vagus nerve.

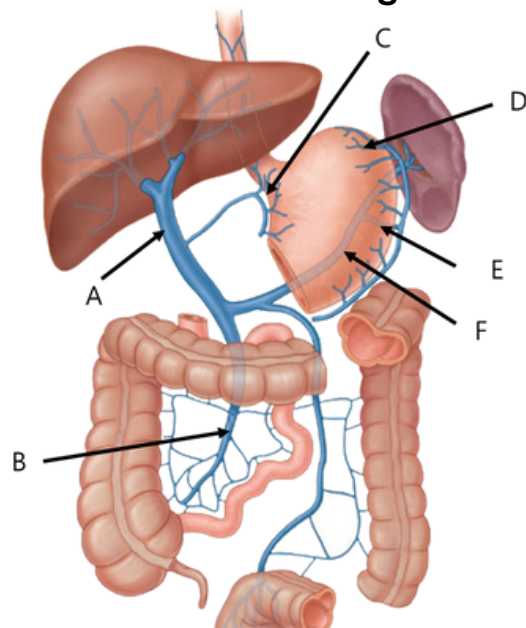


# UPPER GI ANATOMY

## Test yourself

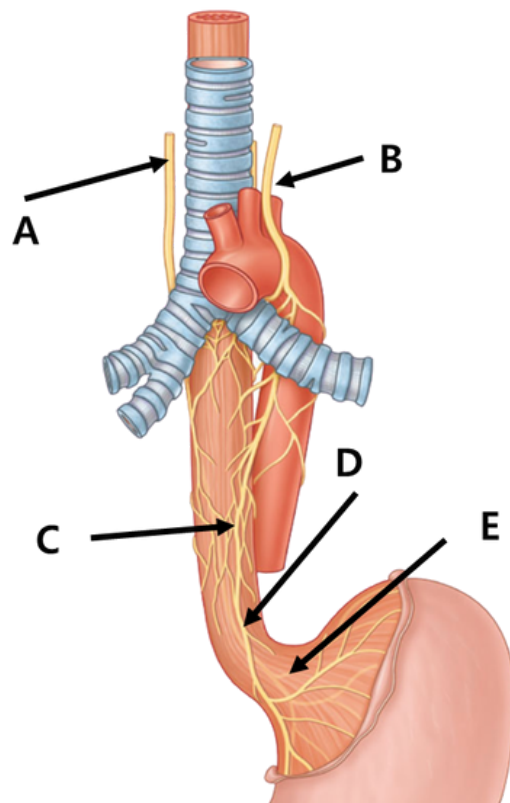
1) Label the following components of the venous drainage of the stomach:

- A .....
- B .....
- C .....
- D .....
- E .....
- F .....



2) Label the nerves supplying the oesophagus:

- A .....
- B .....
- C .....
- D .....
- E .....



# UPPER GI ANATOMY

## Test yourself

### MCQ 1

A 50-year-old male presents to A&E with severe abdominal pain and rebound tenderness on examination. Abdominal XR shows air under diaphragm and endoscopy shows a perforated ulcer in the stomach fundus. Which artery is causing the intraabdominal bleeding?

- A. Splenic artery
- B. Common hepatic artery
- C. Short gastric artery
- D. Inferior phrenic artery
- E. Left gastro-omental artery

### MCQ 3

A 45-year-old male presents to A&E with upper abdominal pain occurring with food. Endoscopy displays several ulcers of the stomach fundus. Which nerve transmits the sensation of pain from the fundus?

- A. Lumbar splanchnic nerve
- B. Spinal nerves T5–T12
- C. Vagus nerve
- D. Greater thoracic splanchnic nerve
- E. Spinal nerves T12–L2

### MCQ 5

Which of the following structures are correctly paired with their anatomical relationship to the duodenum?

- A. Portal vein – posterior
- B. Gallbladder – posterior
- C. Inferior vena cava – anterior
- D. Transverse colon – posterior
- E. vertebral column – anterior

### MCQ 2

Which specific artery does the right gastric artery arise from?

- A. Aorta
- B. Gastroduodenal artery
- C. Splenic artery
- D. Common hepatic artery
- E. Coeliac trunk

### MCQ 4

Which of the following structures does not have a posterior relationship with the stomach?

- A. Lesser sac
- B. Pancreas
- C. Liver
- D. Left adrenal gland
- E. Spleen

### MCQ 6

A 36-year-old female presents with dysphagia. A barium swallow test shows the bird's beak sign. Which of the following nerves is most likely to contribute to the oesophageal achalasia?

- A. Splanchnic nerves
- B. Thyroid nerve
- C. Laryngeal nerve
- D. Phrenic nerve
- E. Vagus nerve

# UPPER GI ANATOMY

## Test yourself

### OSCE Station – Case Based Discussion

An 82 year-old man comes to his GP practice with a 4 month history of difficulty swallowing. He says that initially his food would get stuck but now food and water is sticking and coming back up. He mentions that he has lost around 10kg of weight in the same time period and has a history of gastro-oesophageal reflux disease (GORD). He smokes around 10 cigarettes a day for the last 40 years and drinks 2-3 lagers per night.



**Q1. How many pack years does this patient have?**

**Q2. What is the clinical name for his presenting symptom?**

**Q3. What is the most likely cause of his symptoms / what must be ruled out?**

**Q4. Given the past-medical and social history, what is the likely location of the problem site in the GI tract?**

**Q5. How will this patient be diagnosed?**

**Q6. If this patient was deemed suitable for an operation. What procedure would they most likely undergo?**

**Answers**  
 1) A – Hepatic portal vein; B – Superior mesenteric vein; C – Left gastric vein; D – Short gastric vein; E – Left gastro-omental vein; F – Splenic vein  
 2) A – Right vagus nerve; B – Left vagus nerve; C – Oesophageal plexus; D – Anterior vagal trunk; E – Posterior vagal trunk.  
 MCQs: 1) C; 2) D; 3) D; 4) C; 5) A; 6) E.  
 OSCEs:  
 1) 20 pack years  
 2) Dysphagia  
 3) Oesophageal cancer  
 4) Lower 1/3rd of the oesophagus  
 5) Endoscopy + biopsy  
 6) Ivor-Lewis type oesophagectomy