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INTERNATIONAL SURGICAL  
ANATOMY TEACHING  
SERIES



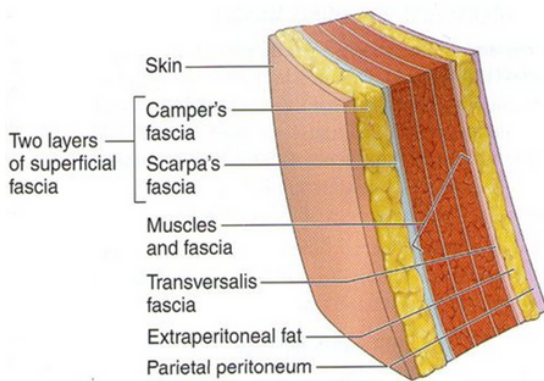
**ISATS**  
**HANDOUT**  
**2024/25**

Lower GI Anatomy

# LOWER GI ANATOMY

**Objectives:** Recall the muscular layers of the anterolateral abdominal wall.

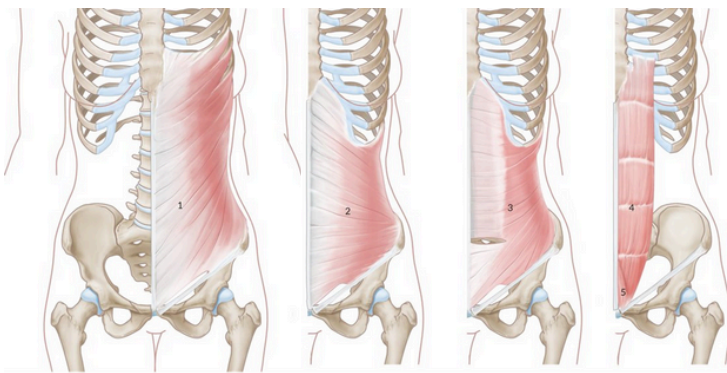
## Anterolateral Abdominal Wall



### Layers:

- Skin
- Superficial fascia
  - **Camper's fascia** - fatty layer
  - **Scarpa's fascia** - thin and membranous
- 3 flat muscles + 3 vertical muscles
- Transversalis fascia
- Extraperitoneal fascia
- Peritoneum (parietal & visceral)

### Muscles:



#### 3 flat muscles

1. **External oblique** (*inferomedial fibers*)
2. **Internal oblique** (*superomedial fibers*)
3. **Transversus abdominis** (*transverse fibers*)

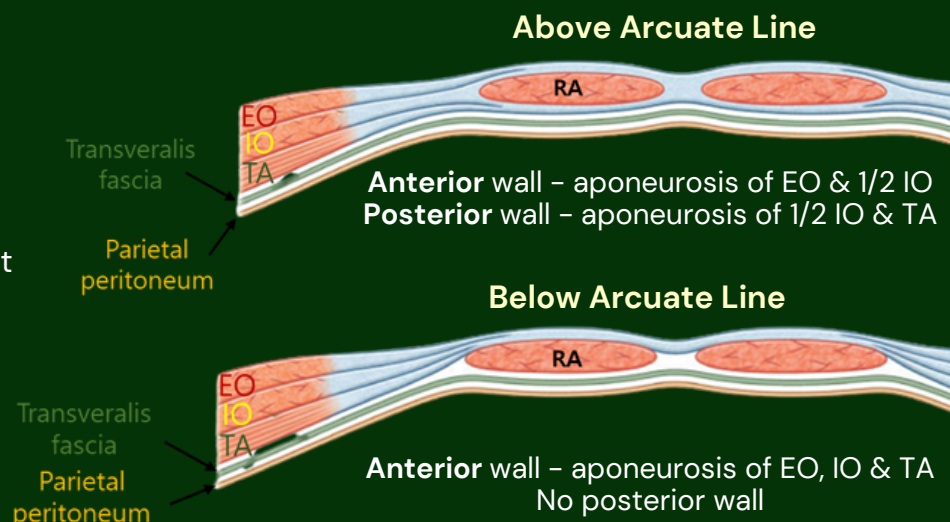
Each flat muscle forms an aponeurosis in the midline = **linea alba**

#### 2 vertical muscles

4. **Rectus Abdominis** (*from pubic crest to costal margin*)
5. **Pyramidalis** (*from pubic crest to pubic symphysis*)

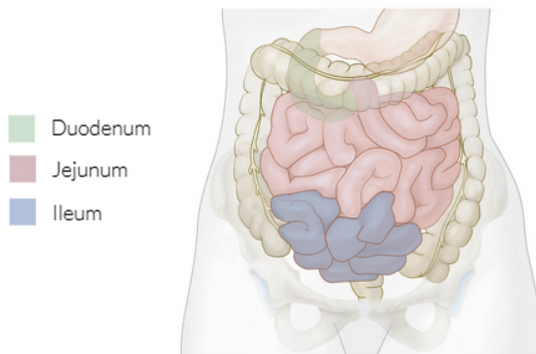
## Rectus Sheath

- **Rectus sheath** - aponeurotic tendinous sheath enclosing abdominis and pyramidalis
- **Arcuate line** - approx. half way between umbilicus and pubic crest
- **Transversalis fascia**
  - Continuous layer of deep fascia, lines abdominal cavity
- **Extraperitoneal fascia**
  - Separates transversalis fascia from peritoneum



# LOWER GI ANATOMY

**Objectives:** Understand the gross anatomy and structure of the distal small bowel (jejunum and ileum), large bowel, rectum and anal canal. Appreciate and understand the neurovascular supply of the lower gastrointestinal tract.

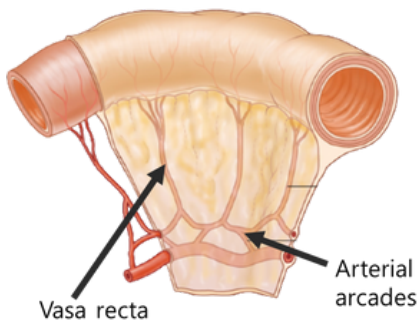
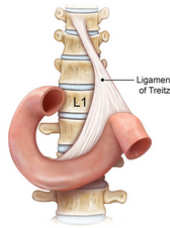


Upper GI Tract

Lower GI Tract

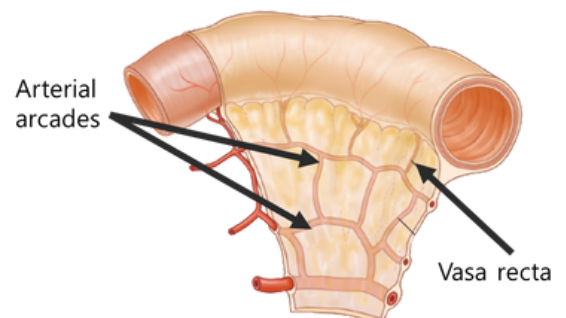
## Jejunum

- Starts at the duodenojejunal flexure, suspended by the ligament of Treitz
- Proximal 2/5 small bowel (LUQ)
- Key features**
  - Thicker intestinal walls
  - Numerous plicae circulares
  - Longer vasa recta
  - Fewer arterial arcades
- Arterial:** superior mesenteric artery (5 jejunal arteries)
- Venous:** SMV + splenic vein → portal vein



## Ileum

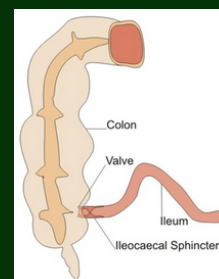
- Distal 3/5 of small bowel (RLQ)
- Key features**
  - Thinner intestinal wall
  - Fewer plicae circulares
  - Shorter vasa recta
  - Numerous arterial arcades
- Ends in ileocaecal junction – joins to caecum and ascending colon
- Arterial:** superior mesenteric artery (ileal and ileocolic artery)
- Venous:** SMV + splenic vein → portal vein



## Narrowest Points in the Small Bowel

Swallowed foreign objects are most likely to become lodged in:

- The pylorus (stomach – duodenum)
- The duodenojejunal flexure (duodenum – jejunum)
- The ileocaecal junction (ileum – caecum)

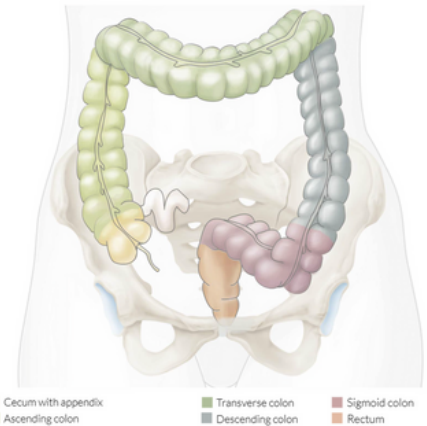
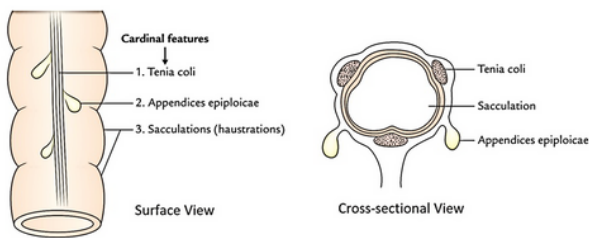


The ileocaecal junction is used as landmark during colonoscopy separating small and large intestine

# LOWER GI ANATOMY

**Objectives:** Understand the gross anatomy and structure of the distal small bowel (jejunum and ileum), large bowel, rectum and anal canal. Appreciate and understand the neurovascular supply of the lower gastrointestinal tract.

## Large Bowel

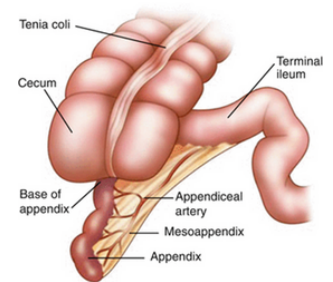


## Caecum

- First part of large intestine & inferior to ileocaecal junction
- Situated in the right iliac fossa

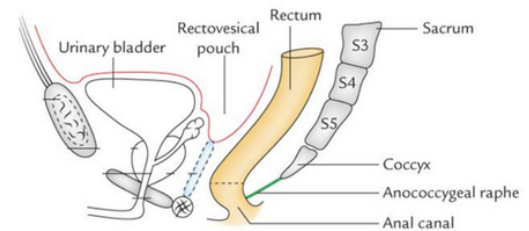
## Appendix

- Narrow, hollow, blind-ended tube
- Contains aggregations of lymphoid tissue
- Suspended by mesoappendix



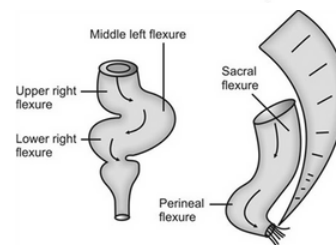
## Colon

- **Components**
  - Ascending and descending – **secondarily retroperitoneal**
  - Transverse and sigmoid – **intra-peritoneal**
  - Sigmoid colon (S-shaped) – from pelvis inlet to S3 vertebra



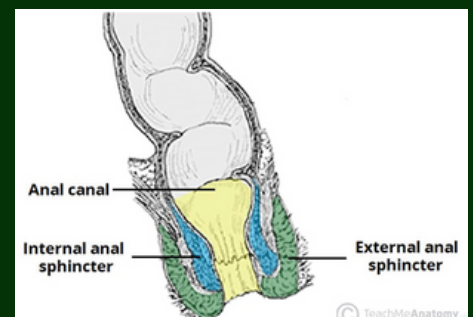
## Rectum

- From rectosigmoid junction → to anorectal junction
- Begins at the level of S3 vertebra
- Retroperitoneal structure
- 3 anterior flexures, 2 lateral flexures
- Ampulla (final segment) – relaxes to store faeces.



## Anal Canal

- Terminal part of the GI tract
- 4cm in length
- Maintains faecal continence with 2 sphincters
  - **Internal anal sphincter** – upper 2/3 (**involuntary** control)
  - **External anal sphincter** – lower 2/3 (**voluntary** control)
- Dentate/pectinate line – divides anal canal into
  - Upper 2/3 = derived from hindgut
  - Lower 1/3 = derived from ectoderm



# LOWER GI ANATOMY

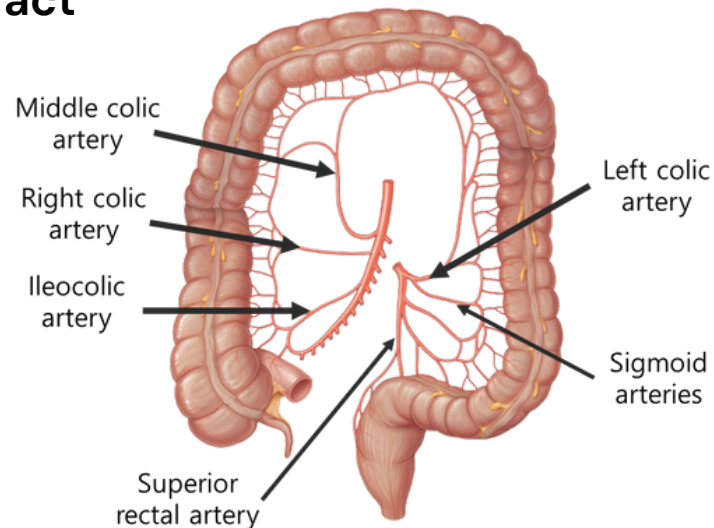
*Objectives: Understand the neurovascular supply of the lower gastrointestinal tract.*

## Neurovascular Supply of Lower GI Tract

### Arterial Supply

- **SMA Branches:** Jejunal & Ileal arteries, Ileocolic artery, Right colic artery, Middle colic artery
- **IMA branches:** Left colic artery, Sigmoid arteries & Superior rectal artery
- **Rectum/Anal Canal**
  - Above dentate line - superior + middle rectal arteries
  - Below dentate line - inferior + middle rectal arteries

**Marginal Artery of Drummond** - anastomotic collateral artery between colic arteries.

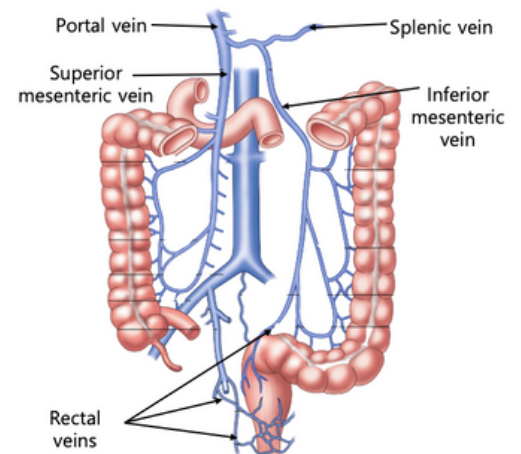


### Venous Drainage

- Superior mesenteric vein - drains small bowel, cecum, ascending colon, transverse colon.
- Inferior mesenteric vein - drains rectum, sigmoid colon, descending colon and splenic flexure
- Splenic vein - drains pancreas

IMV + SMV + Splenic Vein --> Portal Vein --> Liver --> IVC

- **Rectum/Anal Canal**
  - Above dentate line - superior rectal vein --> IMV
  - Below dentate line - inferior rectal vein --> internal pudendal vein --> IVC



## Innervation

### Superior Mesenteric Plexus

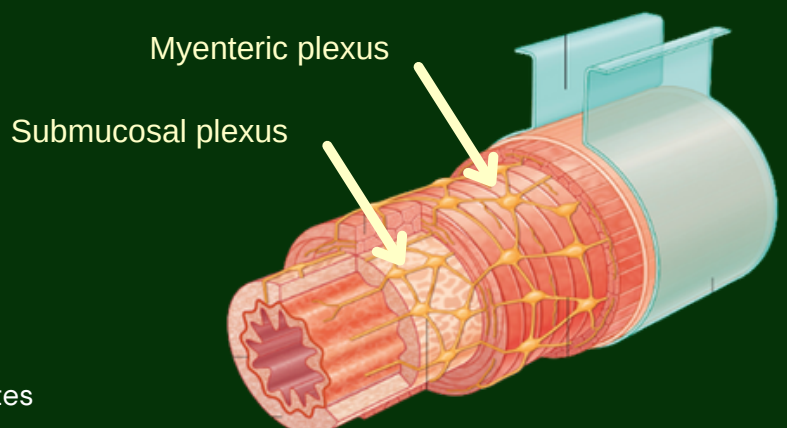
- Sympathetic: lesser splanchnic nerve
- Parasympathetic: vagus

### Inferior Mesenteric Plexus

- Sympathetic: lumbar splanchnic nerves
- Parasympathetic: pelvic splanchnic nerves

### Enteric Nervous System

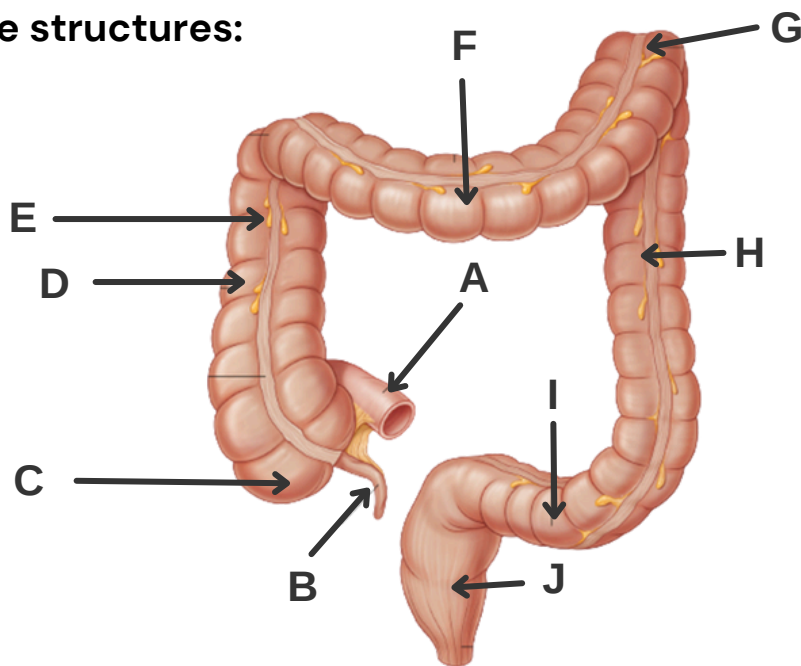
- **Myenteric and submucosal plexus:** Co-ordinates gastric secretions, GI blood flow, and peristalsis



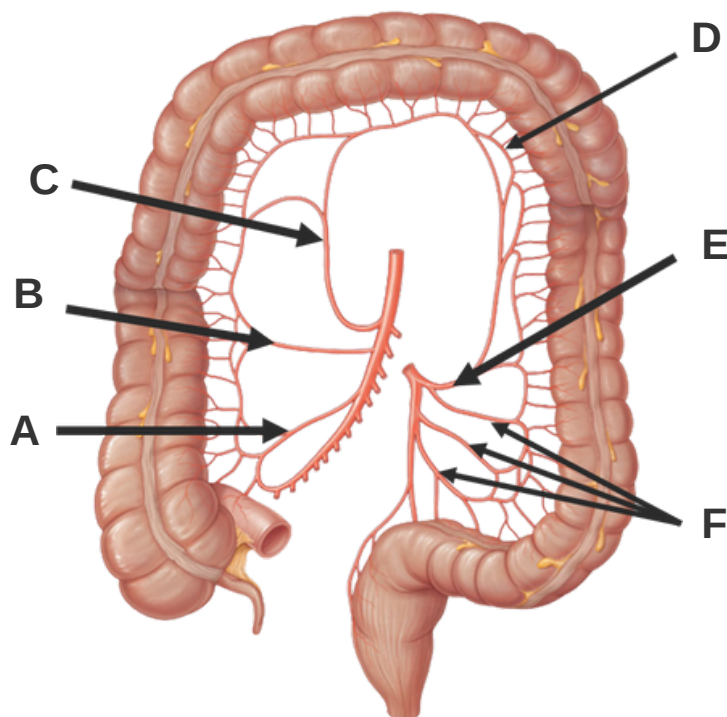
# LOWER GI ANATOMY

*Test yourself...*

1) Label the structures:



2) Label the structures providing arterial supply to the colon:



# LOWER GI ANATOMY

## Test yourself

### MCQ 1

At which vertebral level does the rectum begin?

- A. S1
- B. S3
- C. S2
- D. S4
- E. L5

### MCQ 2

A 68-year-old woman with a history of atrial fibrillation presents with abdominal pain and bloody stools. Imaging suggests ischemia at the splenic flexure. Which vessel is primarily responsible for supplying this region?

- A. Right colic artery
- B. Middle colic artery
- C. Left colic artery
- D. Ileocolic artery
- E. Superior rectal artery

### MCQ 3

Which of the following statements on the jejunum and ileum are NOT true:

- A. The ileum has thinner walls
- B. The ileum has longer vasa recta
- C. The jejunum has more arterial arcades
- D. The ileum is found mainly in the RLQ
- E. The jejunum starts from the duodenojejunal flexure

### MCQ 4

A 38-year-old woman presents with a midline abdominal bulge that becomes more prominent when she performs a sit-up. There is no associated pain or tenderness. Physical examination reveals a defect along the midline of the anterior abdominal wall.

- A. Linea alba
- B. Rectus abdominis muscle
- C. Arcuate line
- D. Transversalis fascia
- E. Internal oblique muscle

### MCQ 5

A 56-year-old man presents with painless rectal bleeding during defecation. Digital rectal examination reveals a non-tender mass located just above the dentate line. Which of the following best describes the condition affecting this patient?

- A. External hemorrhoid
- B. Internal hemorrhoid
- C. Anorectal abscess
- D. Rectal prolapse
- E. Anal fissure

### MCQ 6

A 65-year-old man with a history of atherosclerosis presents with acute abdominal pain and bloody diarrhea. Imaging reveals ischemia of the large intestines. Which vascular structure is primarily responsible for maintaining collateral blood flow to this region?

- A. Superior rectal artery
- B. Left colic artery
- C. Middle colic artery
- D. Marginal artery of Drummond
- E. Inferior mesenteric artery

# LOWER GI ANATOMY

## Test yourself

### OSCE Station – Case Based Discussion

A 10-week year old male neonate presents to the paediatric emergency department with bilious vomiting and abdominal wall discolouration. The parents were also very concerned as it has been 2 days since their child last passed stool. The on-call general surgical registrar performs an examination of the patient who reports a highly distended abdomen and signs of peritonitis. The registrar believes the patients is beginning to show signs of haemodynamic instability.



**Q1. What is this patients likely diagnosis?**

**Q2. What specific signs indicates potential ischaemia to the bowel?**

**Q3. What investigations would you do to confirm this diagnosis? What are the characteristic features found on imaging?**

**Q4. Is this patient's presentation considered a surgical emergency and why?**

**Q5. How would you surgically manage this patient?**

**Q6. What are the potential complications of surgical management?**

Labels: 1. A = terminal ileum, B = appendix, C = caecum, D = ascending colon, E = omental appendices, F = transverse colon, G = left colic flexure, H = descending colon, I = sigmoid colon, J = rectum.  
 2. A = ileocolic, B = right colic artery, C = middle colic artery, D = marginal artery, E = left colic artery, F = sigmoid arteries  
 MCQs. (1) B, (2) C, (3) C, (4) A, (5) B, (6) D  
 OSCEs: 1. Midgut volvulus due to intestinal malrotation. 2. Peritonitis and haemodynamic instability  
 3. Gold standard investigation: upper GI radiograph with contrast. This shows a dilated stomach, beak-like duodenum & corkscrew duodenum. 4. Yes! This is a surgical emergency due to the acute obstruction of superior mesenteric vessels resulting in bowel ischaemia. 5. Ladd's procedure – prompt surgical intervention. A Ladd's procedure involves de-rotating the bowel, dividing Ladd's bands (adhesions) which extend from the caecum to duodenum and performing an appendectomy. 6. Small bowel obstruction, bowel resection, recurrent volvulus, chronic constipation.