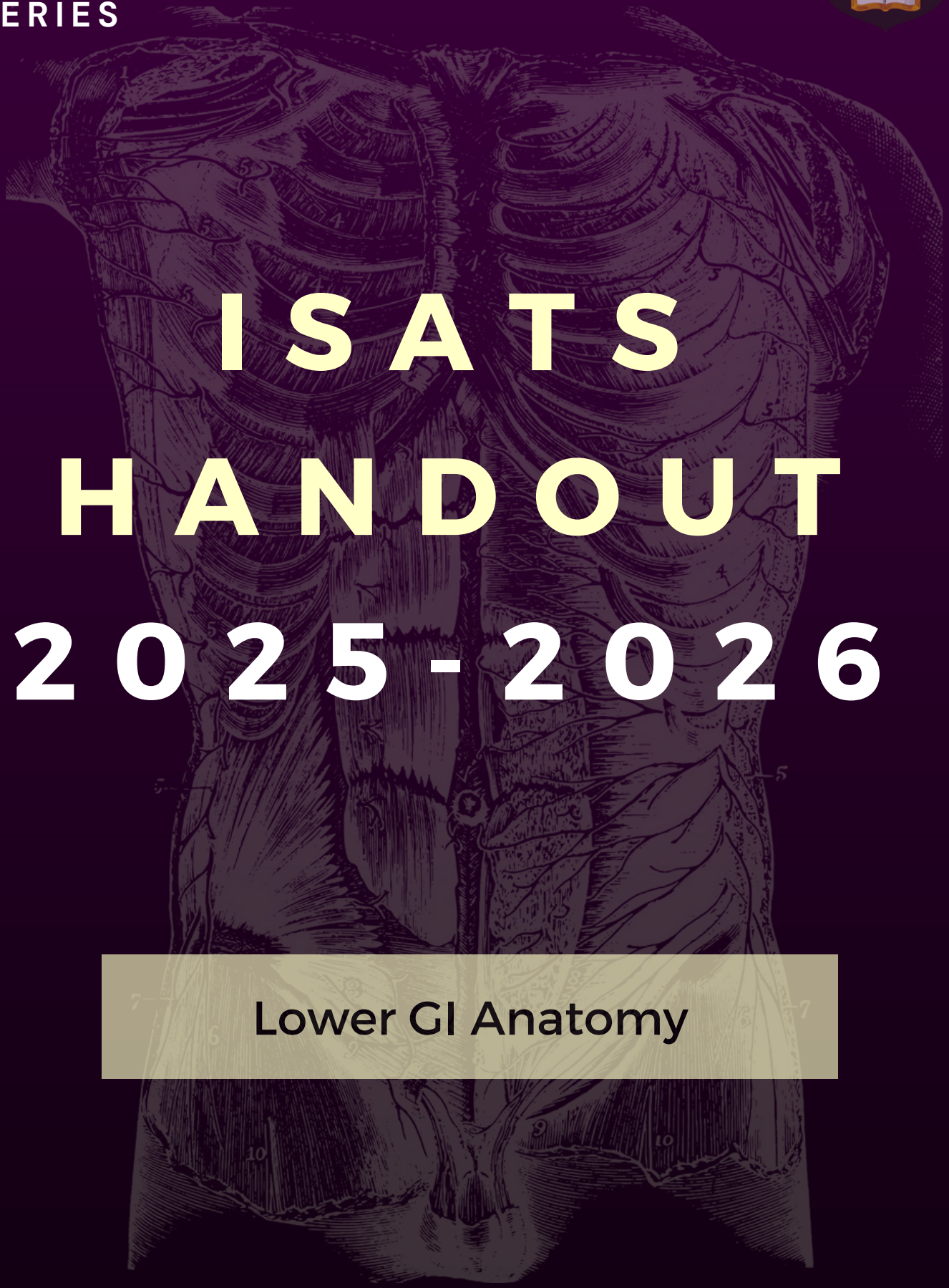
INTERNATIONAL SURGICAL ANATOMY TEACHING SERIES



ISATS HANDOUT 2025-2026

Lower GI Anatomy

High Yield | Surgical Relevance | Approved for CPD Points

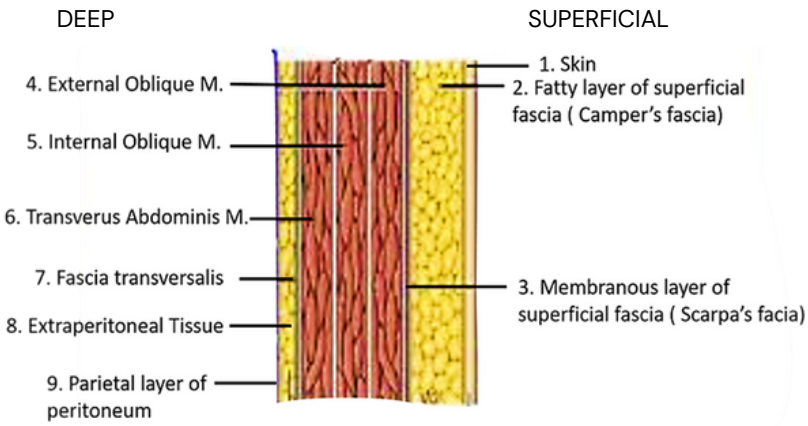
LOWER GI ANATOMY

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

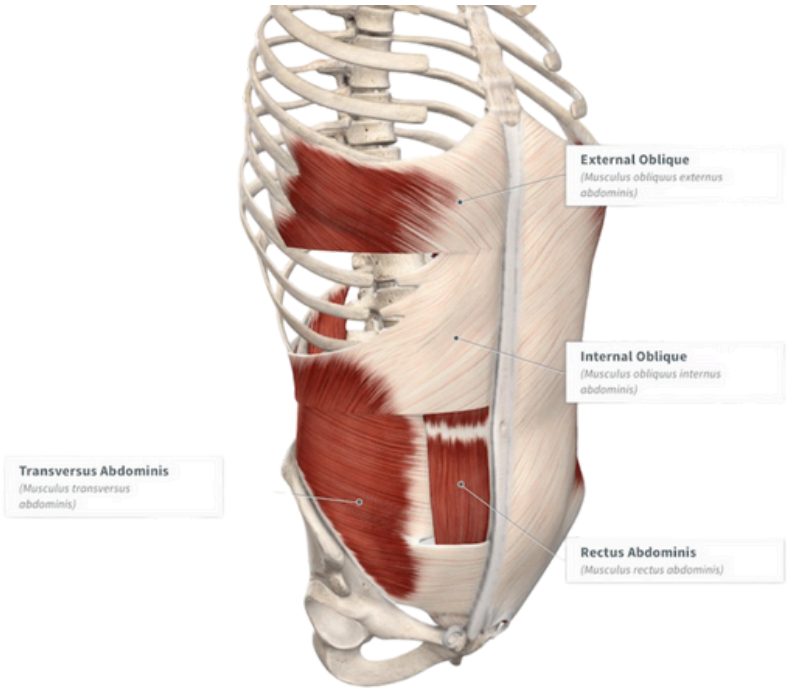
Anterolateral Abdominal Wall

Layers

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



Fatty Camper's wear SCARVES



Muscles

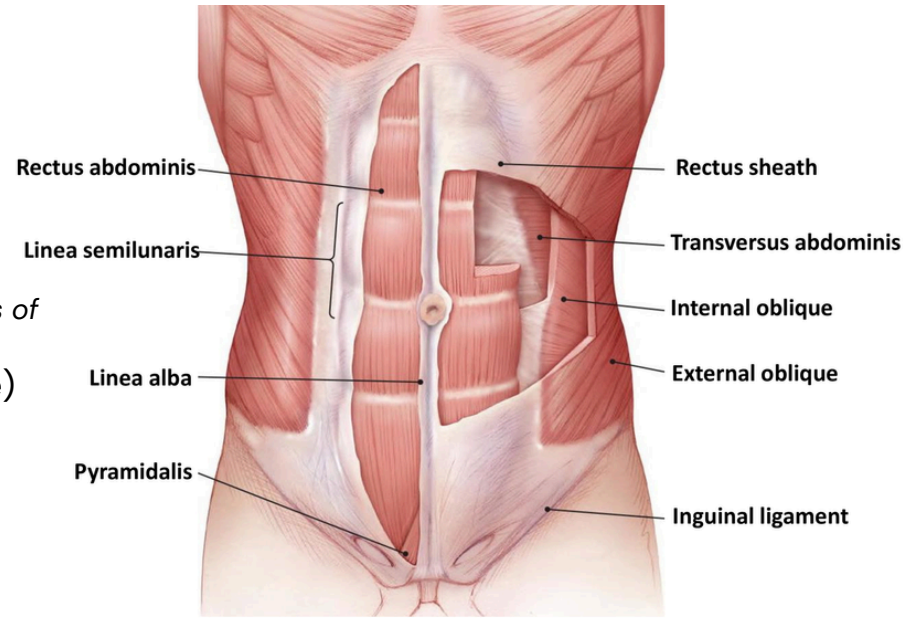
Anterolateral Muscles

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

Actions: *compresses and supports abdominal viscera, flexes and rotates trun*

Linea Alba = Interlacing fibres of EO, IO and TA

- Collagenous
- Avascular - point of longitudinal incision in midline laparotomies



Vertical Muscles

4. Rectus Abdominis

- Origin - *pubic crest, pubic symphysis*
- *Insertion - Xiphoid process, costal cartilages of ribs 5-7*

5. Pyramidalis (absent in 20% of people)

- Origin - pubic crest, pubic symphysis
- Insertion - Linea Alba

LOWER GI ANATOMY

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

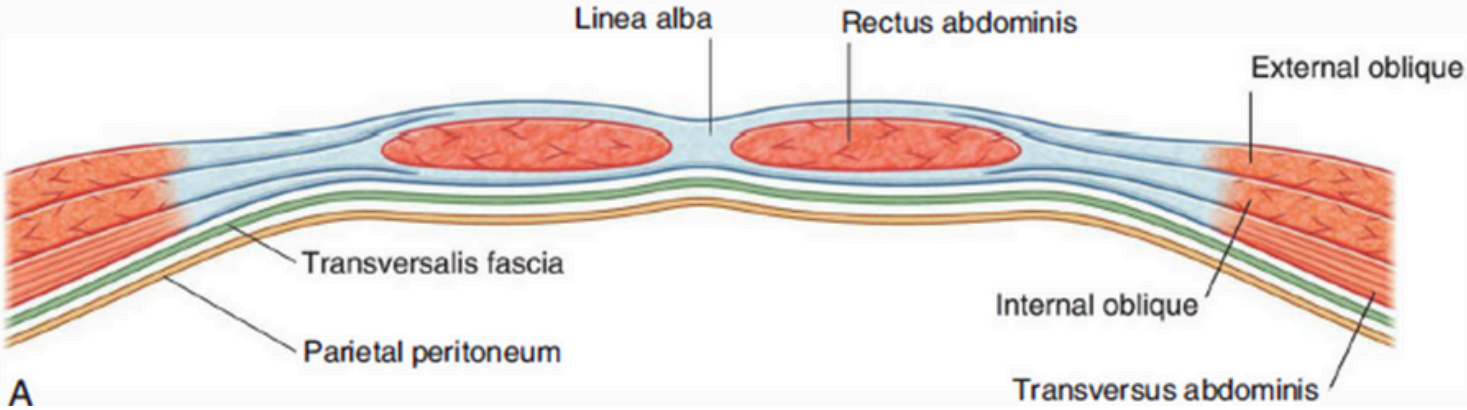
Rectus Sheath

- **Rectus sheath –** aponeurotic tendinous sheath enclosing abdominis and pyramidalis
- **Transversalis fascia** - Continuous layer of deep fascia, lines abdominal cavity
- **Extraperitoneal fascia** - Separates transversalis fascia from peritoneum

Arcuate Line – midway between umbilicus and pubic crest

Above Arcuate Line

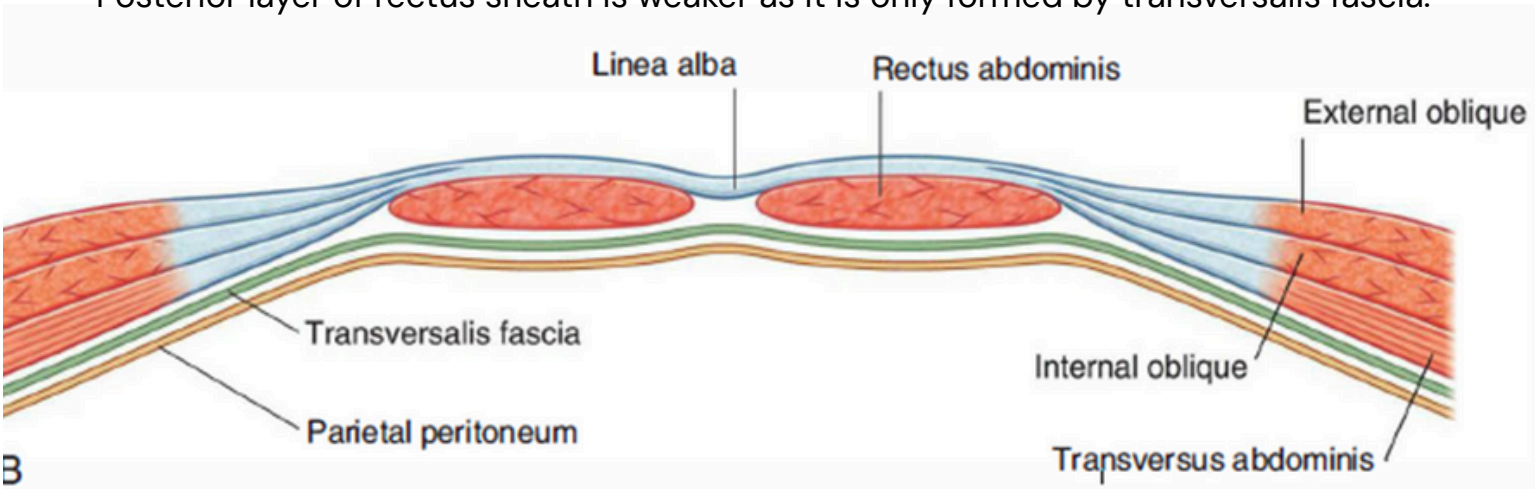
Internal oblique aponeurosis splits into two layers:
Anterior laminae - anterior to rectus abdominis.
Posterior laminae - posterior to rectus abdominis.



Anterior abdominal wall comprised of aponeurosis of EO & 1/2 IO (anterior laminae)
Posterior abdominal wall comprised of - aponeurosis of 1/2 IO (posterior laminae) & TA

Below Arcuate Line

All muscle aponeuroses pass anterior to rectus abdominis.
Posterior layer of rectus sheath is weaker as it is only formed by transversalis fascia.



Anterior abdominal wall comprised of aponeurosis of EO, IO + TA
Posterior abdominal wall comprised of transversalis fascia only

LOWER GI ANATOMY

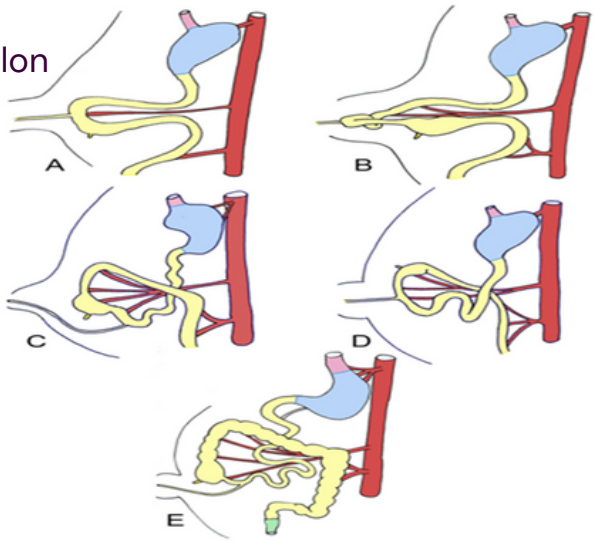
***Objectives**: Understand the gross anatomy and structure of the distal small bowel (jejunum and ileum), large bowel, rectum and anal canal. Appreciate and understand the neurovascular supply of the lower gastrointestinal tract.*

MIDGUT

Distal Duodenum to the proximal ⅔ of Transverse Colon

Week 5 development – midgut loops ventrally herniating into umbilical cord - primary gut loop

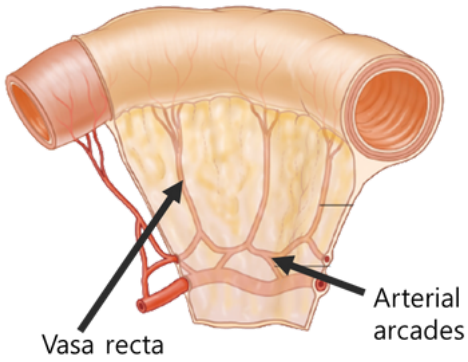
- Cranial limb - Distal duodenum, jejunum and ileum
- Caudal limb – distal ileum, caecum, appendix, ascending colon and 2/3 transverse colon

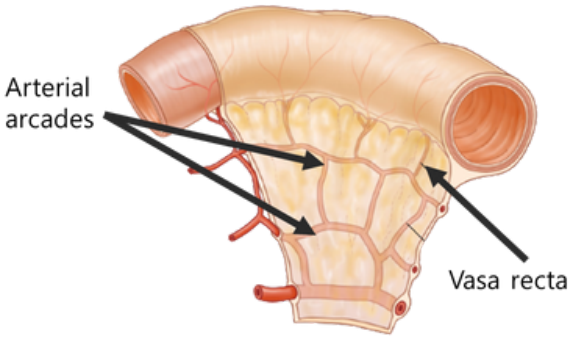


As midgut lengthens, rotates 90 degrees anticlockwise around combined Superior Mesenteric Artery and Umbilical Cord

Week 10 – midgut retracts back into abdominal cavity and rotates a further 180 degrees anticlockwise

SMALL BOWEL





Characteristics of the Jejunum and Ileum	
JEJUNUM	**ILEUM**
Mesentery contains less fat	Mesentery contains more fat
Thicker Walls	Thinner Walls
Wider Lumen	Narrow Lumen
Long Vasa Recta + Fewer Arterial Arcades → **Greater Blood Supply**	Short Vasa Recta + More Arterial Arcades →**Lesser Blood Supply**
Dense Plicae Circulares	Sparse or Absent Plicae Circulares
Few Peyer's Patches	Many Peyer's Patches

Swallowed foreign objects are most likely to become lodged in:

- The pylorus, the duodenojejunal flexure (duodenum – jejunum), the ileocaecal junction

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

OMPHALOCOELE

Abdominal contents protruding from central umbilical ring through the anterior wall, due to malrotation of midgut.

- Failure of rectus abdominis to develop correctly
- Covered in an amniotic sac formed by amniotic membrane and peritoneum.

GASTROSCHISIS

Defect in the anterior abdominal wall just lateral to the umbilical cord, often to the right.

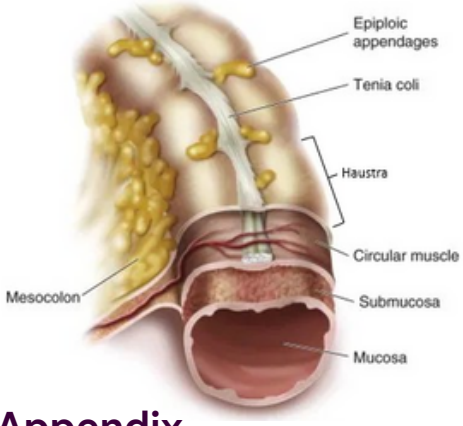
- Not covered by the amniotic sac bowel directly exposed to amniotic fluid
- Defect in the abdominal wall formation, often linked to weaker tissue

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.*

HINDGUT

Distal ⅓ of Transverse Colon to the Anal Canal



Cardinal Features of the Colon:

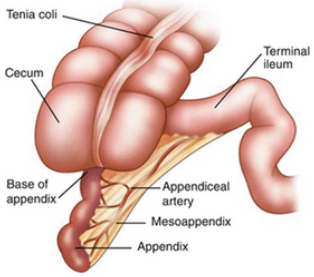
- Haustra - sacculations
- Appendices Epiploicae (Omental Appendices) - fat pouches
- Taeniae Coli - three longitudinal bands of muscle

Caecum

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

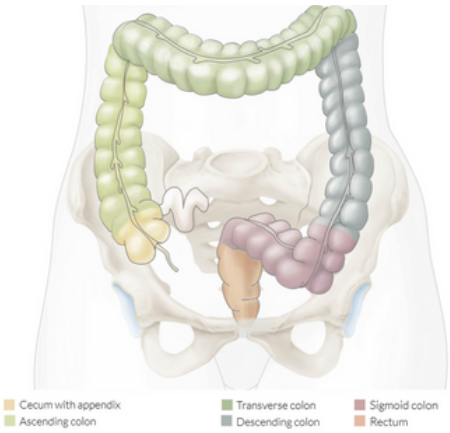
Appendix

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



Colon

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



Diverticular Disease

Diverticulosis

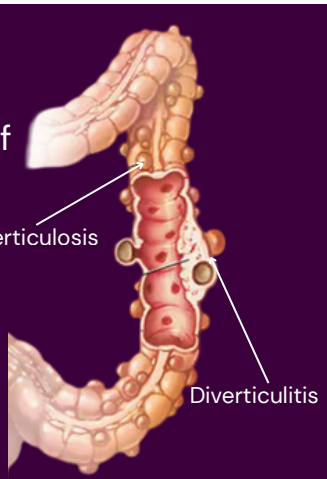
Outpouching of the colonic mucosa and submucosa through weaknesses of muscle layers in the colon

Diverticulitis

Infections and Inflammation of diverticulum

- Symptoms - lower abdominal pain, fever and altered bowel habits.
- Ivgx - CT Abdo/ Colonoscopy
- Management - antibiotics; in severe cases, surgery

Sigmoid most commonly affected



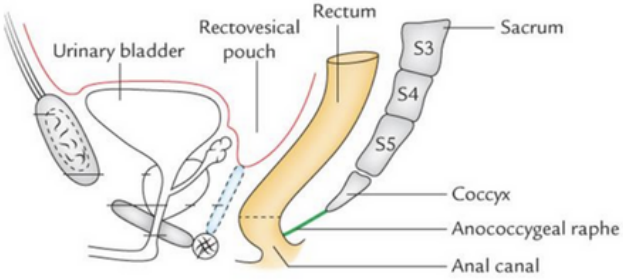
LOWER GI ANATOMY

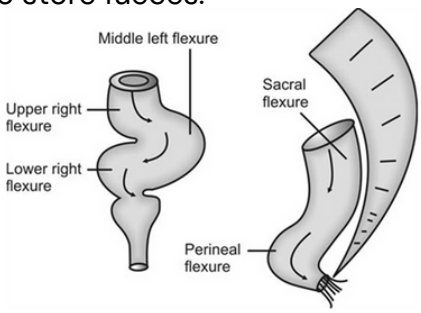
***Objectives**: Understand the gross anatomy and structure of the distal small bowel (jejunum and ileum), large bowel, rectum and anal canal. Appreciate and understand the neurovascular supply of the lower gastrointestinal tract.*

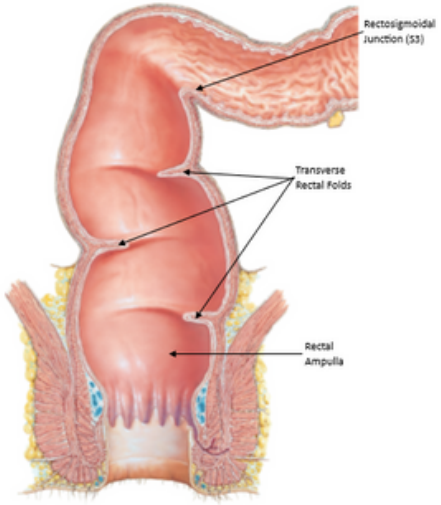
Rectum

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.



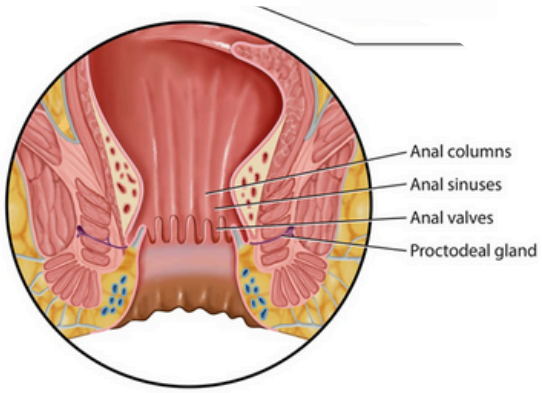


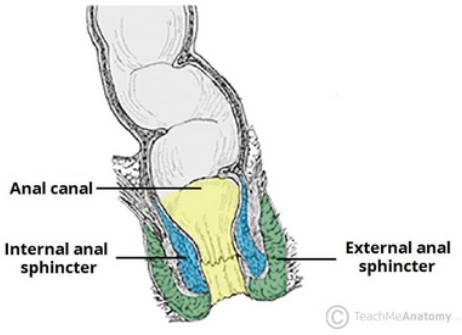


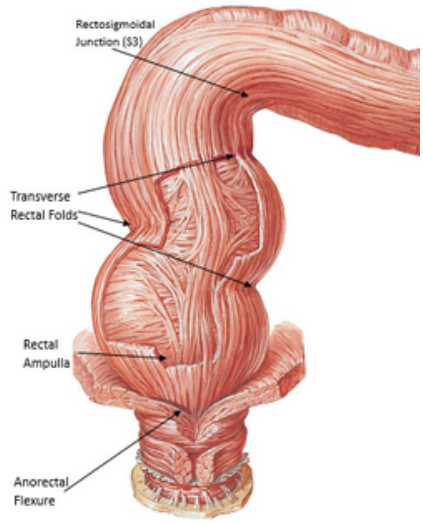
Anal Canal

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





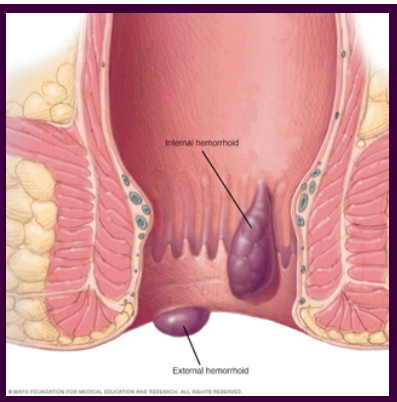


Haemorrhoids

Vascular structures in the anal canal that are composed of arterio-venous channels and connective tissue, acting as cushions. Pathological when become inflamed/swollen.

- Above dentate line, from superior rectal plexus
- External - below dentate line

- Aetiology - prolonged increased intra-abdo pressure, chronic constipation, prolonged straining, low-fibre diet, pregnancy
- Igx - mainly clinical diagnosis DRE (+ Proctoscopy)
- Management
  - Conservative - analgesia, fibre supplementation + topical e.g., corticosteroids/LA creams
  - Non-conservative - band ligation, sclerotherapy or haemorrhoidectomy



LOWER GI ANATOMY

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

Neurovascular Supply of Lower GI Tract

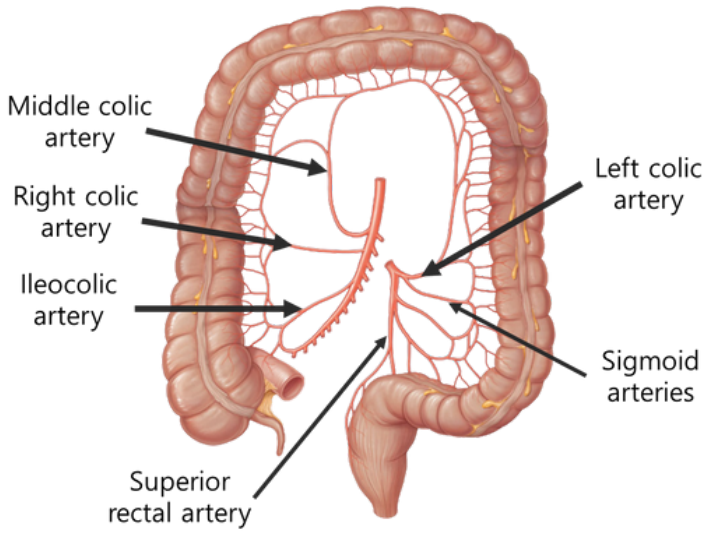
Arterial Supply

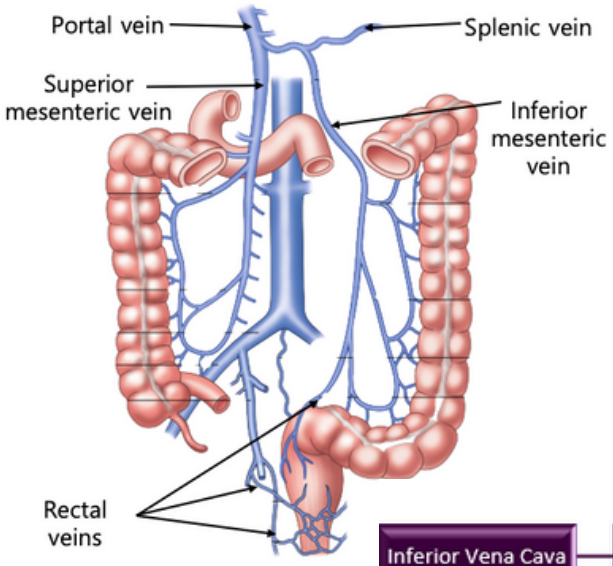
Superior Mesenteric Artery Branches
- Jejunal & Ileal arteries, Ileocolic artery, Right colic artery, Middle colic artery

Inferior Mesenteric Artery 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.



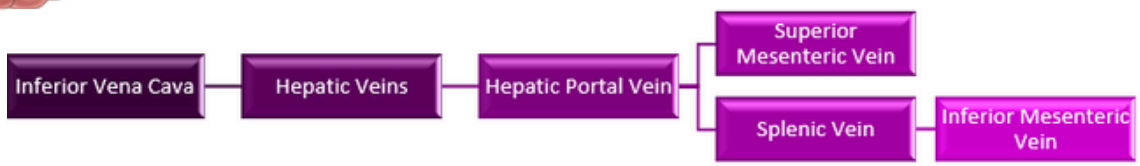


Venous Drainage

Superior Mesenteric Vein drains
- small bowel, cecum, ascending colon, transverse colon.

Inferior Mesenteric Vein drains
- rectum, sigmoid colon, descending colon and splenic flexure

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

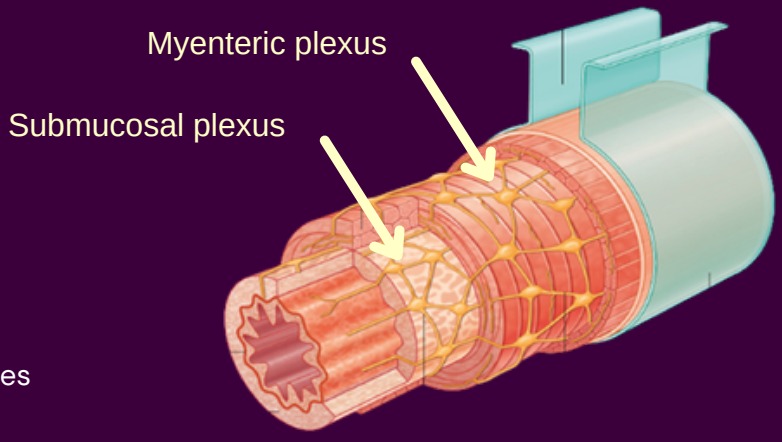


Innervation

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 Your Knowledge

1) Label the layers of the Abdominal Wall

1 .....

2 .....

3 .....

A .....

B .....

C .....

D .....

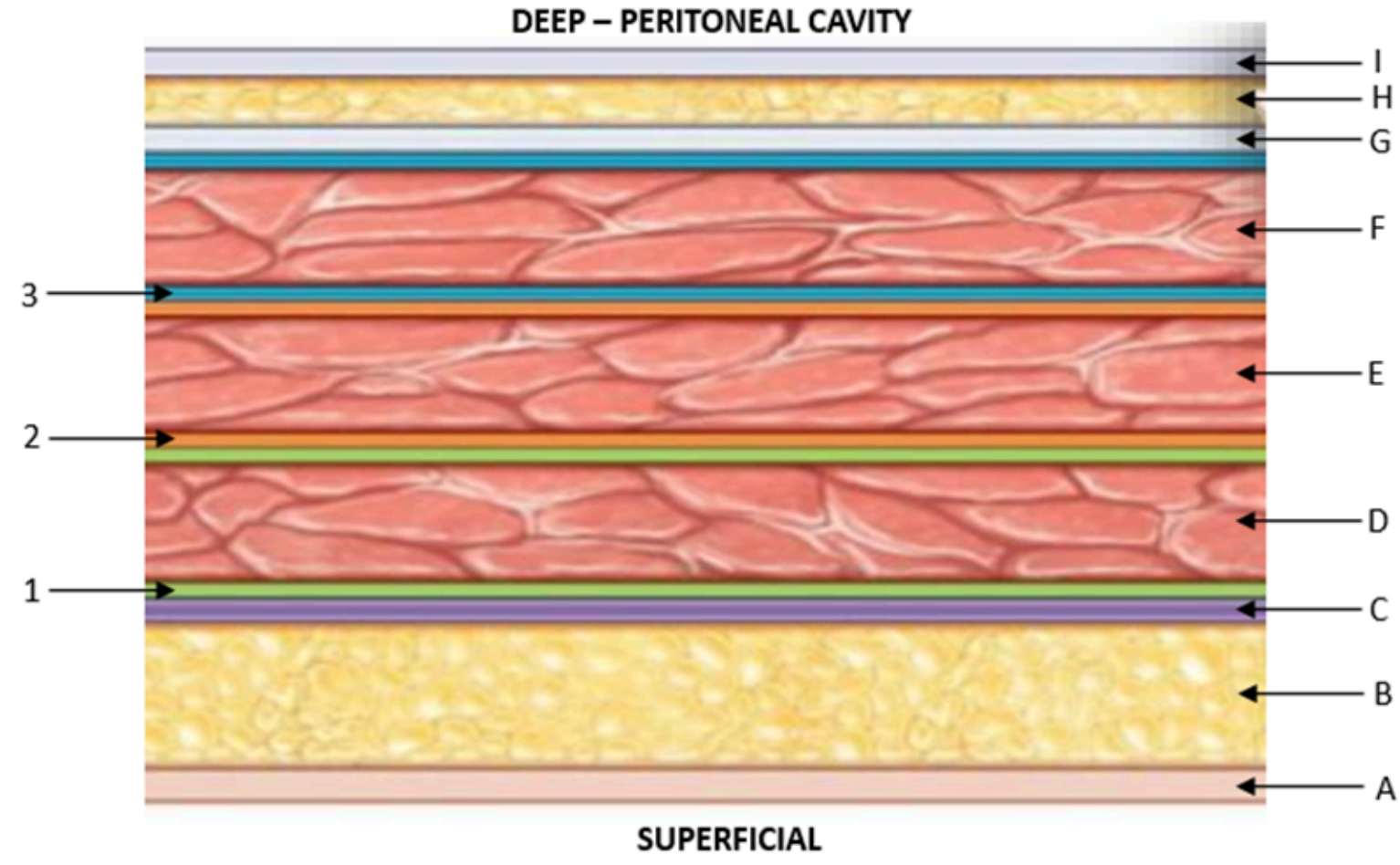
E .....

F .....

G.....

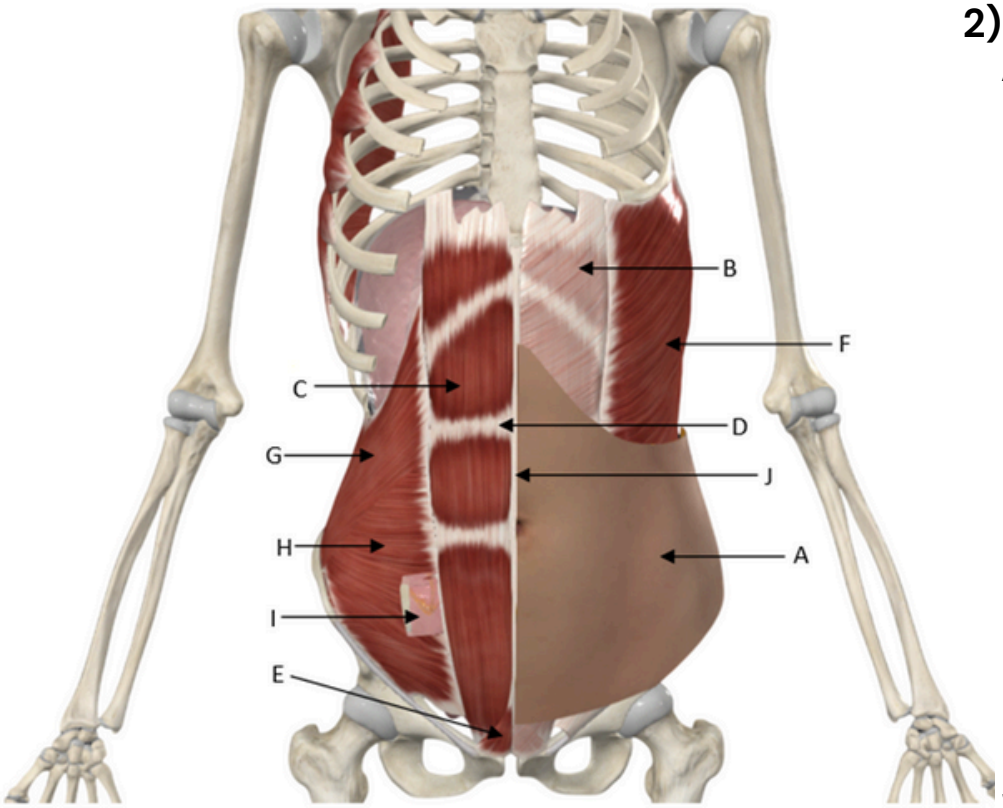
H.....

I.....



LOWER GI ANATOMY

Test Your Knowledge



2) Label the structures of the Abdominal Wall

A .....

B .....

C .....

D .....

E .....

F .....

G.....

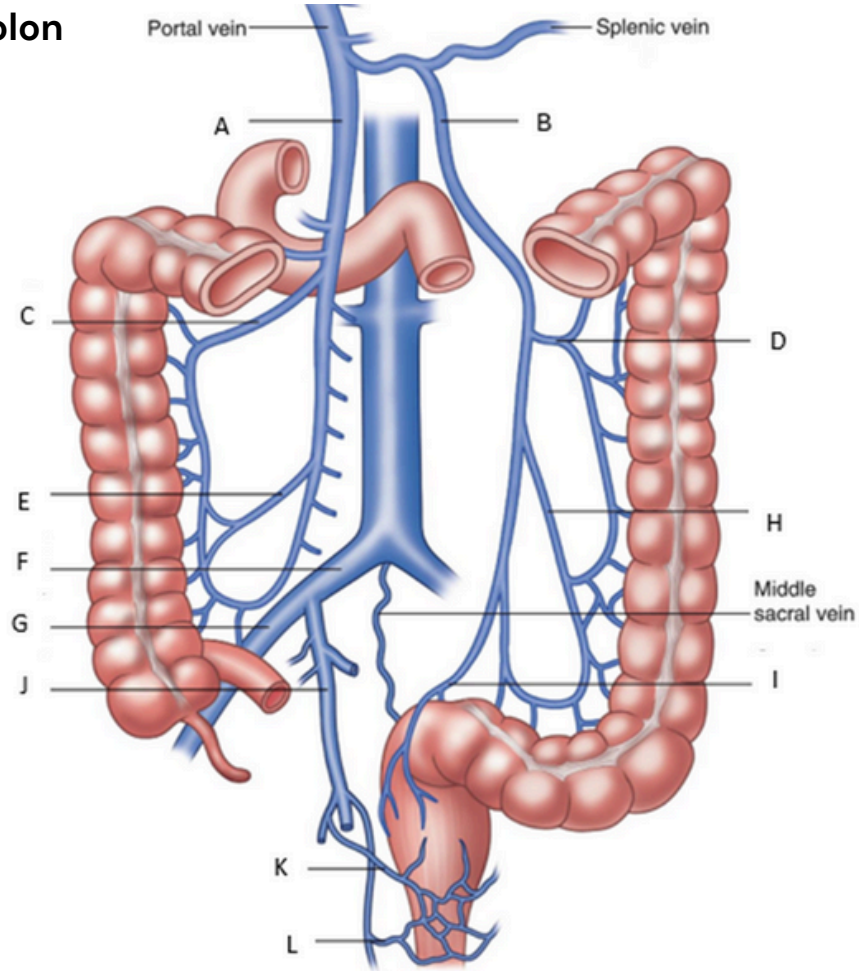
H.....

I.....

J.....

3) Label the venous supply to the colon

- A .....
- B .....
- C .....
- D .....
- E .....
- F .....
- G.....
- H.....
- I.....
- J.....
- K.....
- L.....



LOWER GI ANATOMY

Test Your Knowledge

MCQ 1

Which of the following statements about the jejunum and ileum is true?

A. The jejunum has a narrower lumen, the ileum has a wider lumen
B. The ileum contains few Peyer's patches, and the jejunum has many Peyer's patches
C. Mesentery of the jejunum contains more fat compared to the mesentery surrounding the ileum
D. The jejunum has sparse/absent plicae circulares whereas the jejunum has dense plicae circulares
E. The ileum has more arterial arcades and short vasa recta so less blood supply with the converse true for the jejunum leading to greater blood supply

MCQ 2

A patient requires an emergency laparotomy. Which muscles form an aponeurosis to form this structure the Linea Alba?

A. Pyramidalis, Transversalis Abdominus, External Oblique
B. Internal Oblique, External Oblique, Pyramidalis
C. Internal Oblique, Rectus Abdominus, Transversus Abdominus
D. External Oblique, Transversus Abdominus, Internal Oblique
E. External Oblique, Rectus Abdominus, Pyramidalis

MCQ 3

What is the sympathetic innervation to the hindgut?

A. Vagus Nerve (CNX)
B. Greater thoracic splanchnic (T5 –T9)
C. Lumbar splanchnic nerves (L1 – L2)
D. Lesser thoracic splanchnic (T10 – T11)
E.Pelvic splanchnic nerves (S2 – S4)

MCQ 4

1.At the GP surgery, a 62-year-old patient presents with rectal pain/ bleeding, pruritis and occasional anal discharge, ongoing for 6 months. On examination there is a palpable mass at the anal entrance suspicious for malignancy. Which lymph nodes would also need to be examined in this patient?

A. Mesorectal lymph nodes
B. Superficial inguinal lymph nodes
C. Para-vertebral lymph nodes
D. Para-aortic lymph nodes
E. Lumbar lymph nodes

MCQ 5

When making a surgical incision, there are many layers to cut through. Firstly the skin, followed by the superficial connective tissue of the abdomen which differentiates into Camper's and Scarpa's fascia below the Umbilicus. Which of the following statements regarding Camper's and Scarper's fascia is true?

A. Camper's fascia is continuous with the superficial fascia of the thigh, whereas Scarpa's fascia is continuous with the fascia lata of the thigh
B. Scarpa's fascia is fattier than Camper's fascia
C. Camper's fascia is deeper than Scarpa's fascia
D. Camper's fascia is continuous with the deep fascia lata of the thigh, whereas Scarpa's fascia is continuous with the superficial fascia of the thigh
E. Camper's fascia is strongly adhered to the Linea alba and pubic symphysis, Scarpa's fascia is not.

LOWER GI ANATOMY

Test Your Knowledge

OSCE Station - Case Based Discussion

A 65-year old female has presented to the Emergency Department complaining of severe abdominal pain, characterised as a lower abdominal cramping pain, scoring 9/10 and presenting with nausea and vomiting. On examination, the patient has a distended, bloated abdomen, with tinkling sounds on auscultation. The patient has not passed stool and on further questioning reveals that there has been a change in bowel habits and has been experiencing fatigue and dyspnoea over the past few months. The patient has a background of TII DM, is slightly overweight with a 20-year pack history of smoking.

Q1. Which conditions increases the risk of developing this condition?

Q2. Explain the primary diagnosis, underlying cause and pathophysiology of the root condition.

Q3. How would you confirm diagnosis and assess severity in this patient?

Q4. Is this patient's presentation considered an emergency and if so why?

Q5. What does management entail for this conditions?

Q6. Discuss any national programmes relating to this condition and referral criteria.

Answers

Labelling Exercises 1: 1. Deep investing fascia, 2. intermediate investing, 3. superficial investing; A. skin B. Camper's, C. Scarpa's, D. External Oblique; E. Internal Oblique, F. Transversus Abdominis, G. Transversalis Fascia, H. Extraperitoneal Fascia, I. Parietal Peritoneum. **Exercise 2:** A. Skin, B. Rectus Sheath, C. Rectus Abdominis, D. Tendinous Intersection. E. Pyramidalis, F. External Oblique, G. Internal Oblique, H. Transversus Abdominis, I. Transversalis Fascia. **Exercise 3:** A. SMV, B. IMV, C. Right Colic Vein, D. Left Colic Vein, E. Ileocolic Vein, F. Common Iliac Vein, G. Right External Iliac Vein, H. Sigmoid Vein, I. Superior Rectal Vein, J., Right Internal Iliac Vein, K. Middle Rectal Vein, L. Inferior Rectal Vein

MCQs. 1. E, **2.** D, **3.** C, **4.** B, **5.** A

OSCE Case: 1. Genetic syndromes e.g., FAP, Lynch Syndrome . **2.** Bowel obstruction secondary to colorectal cancer due to a large tumour, resulting in luminal narrowing; colorectal cancer results through microsatellite instability pathway and chromosomal instability, along with epigenetic changes. **3.** Gold standard investigation: CT Contrast Abdomen Pelvis (Contrast CTAP) , findings include: bowel collapse distal to obstruction, dilated bowel loops proximal to obstruction, transition in features at tumour site e.g., annular 'apple-core' lesion, and in advances cases, ascites, perforation and pericolic fat stranding. **4.** Yes! This is an acute surgical emergency as it can result in bowel ischaemia, perforation, sepsis and if left untreated, death. **5.** Emergency resection (e.g., Hartmann's) and resuscitation management (IV fluids, NG tube for decompression", bloods + cultures, electrolytes, analgesia. **6.** Bowel screening programme for 50 - 74 years, every two years; FIT, if positive FIT result, ≥10mcg of haemoglobin per gram of faeces, refer for a colonoscopy. Red flags for two-week referral following positive FIT - unexplained IDA, abdominal mass, changes in bowel habits; age 40 + - unexplained weight loss + abdominal pain, or age <50 with rectal bleeding + abdominal pain +/or weight loss; age 50+ with any of the following unexplained symptoms - abdominal mass, rectal bleeding, weight loss. Patients with rectal mass, an unexplained anal mass or unexplained anal ulceration do not need to be offered FIT before referral is considered.