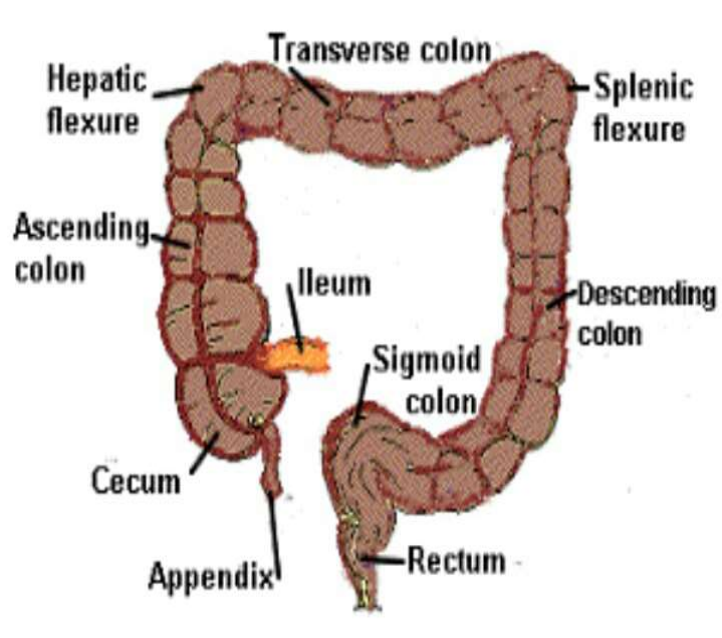
MJF AYURVEDA MAHAVIDYALAYA
Chomu, Jaipur

LARGE INTESTINE



Presented by-
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Department of Rachana Sharir

PO (Programme outcome)	CO (Course outcome)
PO 1-Demonstrate comprehensive knowledge and application of the Trisutraconcept to explore root causes, identify clinical manifestations of disease to treat aments and maintain heathy status	CO6- Explain and demonstrate the gross anatomy of the organs of various systems and their applied anatomy in perspective of Ayurveda and Modern science
PO 2-Demonstrate knowledge and skills in Ayurveda, acquired through integration of multi disciplinary perspectives and keen observation of clinical and practical experiences.	

- Teaching Learnings method-Lecture with power point presentation
- Domain-Cognitive –Psychomotor
- Must to know/desirable to know/Nice to know-Must to know
- Millers pyramid-Knows and shows how
- Bloom texonomy-Remember and Understand

❑ FEATURES

- extends from the ileocaecal junction to the anus
- Diameter 4-6cm
- Length 1.5m
- It has no role in digestion.
- Water absorption

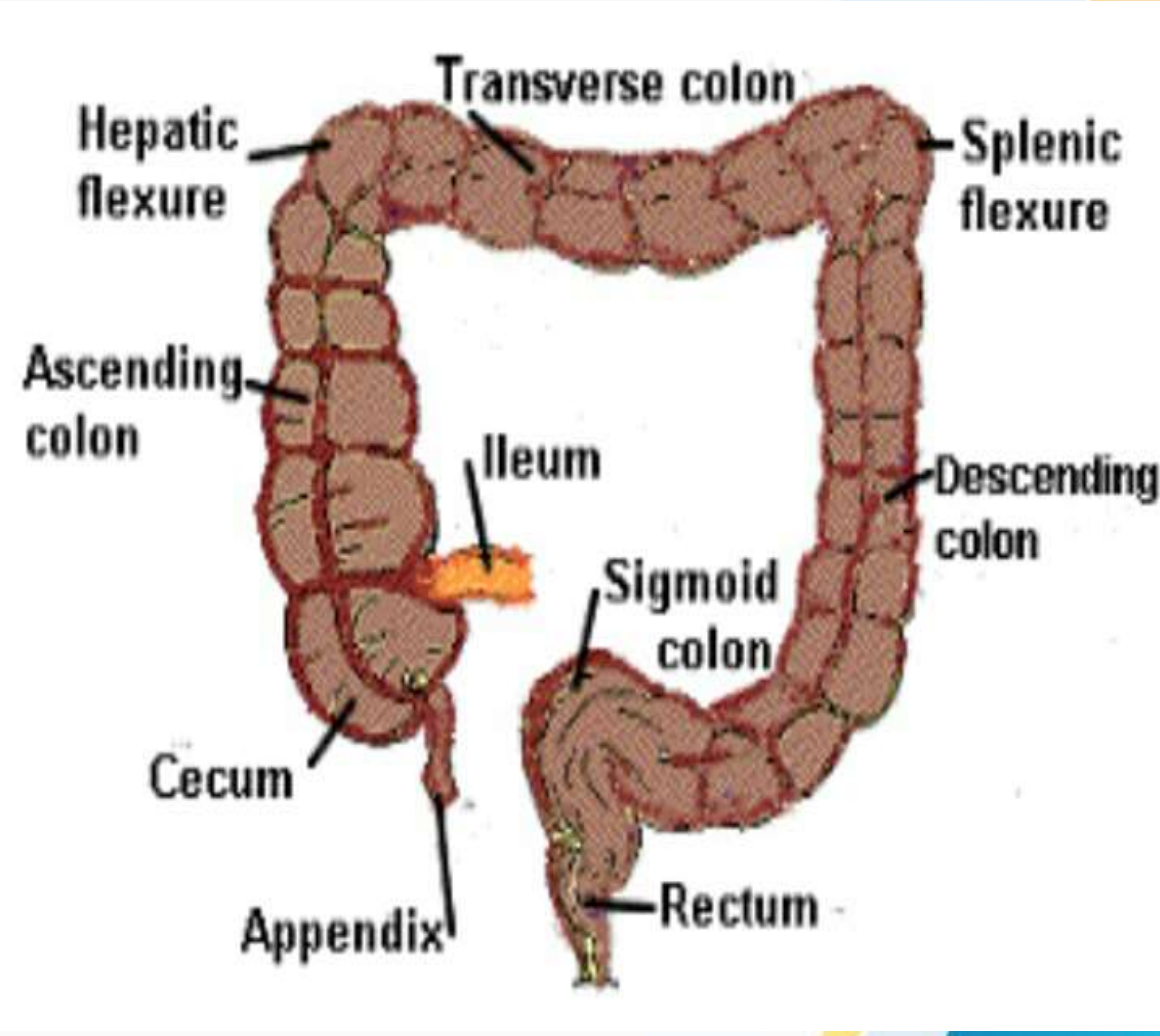
❖ PARTS

-CAECUM

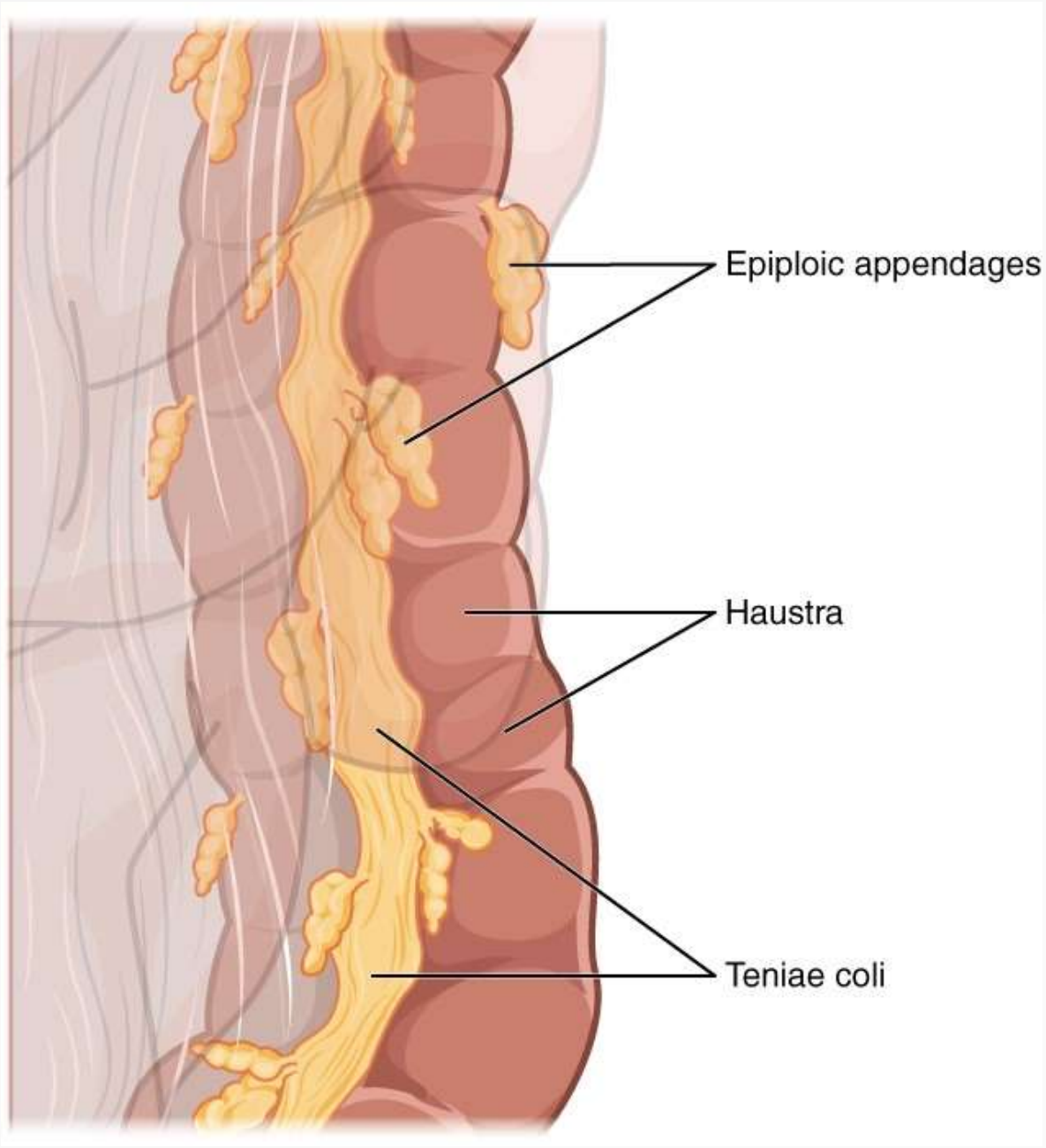
-COLON

-RECTUM

-ANAL CANAL



- The greater part of the large intestine is fixed, except for the appendix, the transverse colon and the sigmoid colon.
- The longitudinal muscle coat forms only a thin layer in this part of the gut. The greater part of it forms three ribbon-like bands, called the taeniae coli. In the caecum, the ascending colon and the descending colon the positions of taeniae are anterior or taenia libera; posteromedial or taenia mesocolica and posterolateral or taenia omentalis but in the transverse colon the corresponding positions of taenia are inferior, posterior and superior.

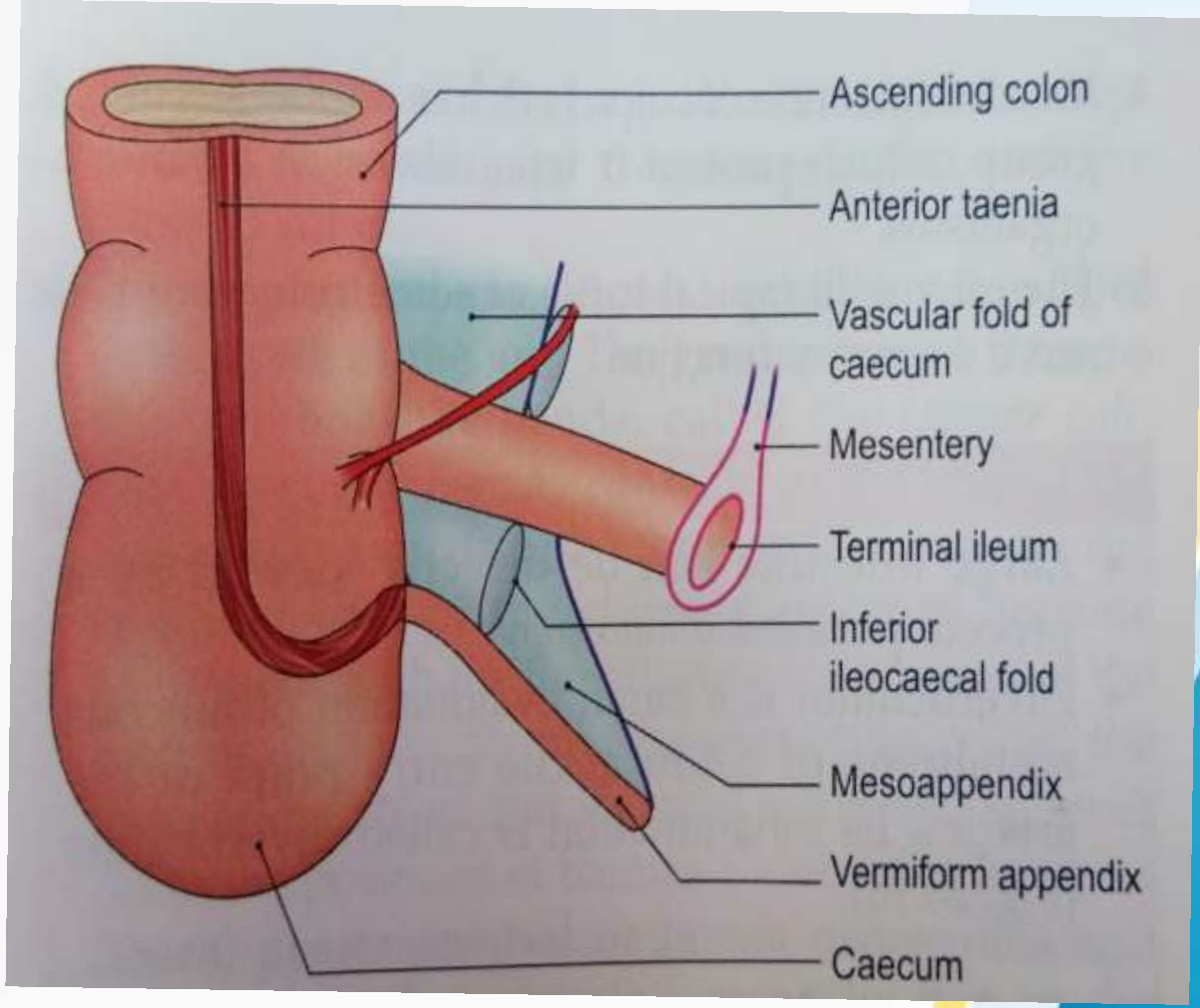

Epiploic appendages
Haustra
Teniae coli

- Small bags of peritoneum filled with fat, and called the appendices epiploicae, are scattered over the surface of the large intestine, except for the appendix, the caecum and the rectum. These are most numerous on the sides of the sigmoid colon and on the posterior surface of the transverse colon.

❑ CAECUM

most proximal part of the large intestine and is located between the ileum and the ascending colon.

- served as a site for **cellulose digestion** in our ancestors, now it acts as a reservoir for chyme which it receives from the ileum.



- location- right iliac fossa.
- Dimensions- 6 cm long and 7.5 cm broad.
- The cecum derives its name from its inferior blind-end.
- Superiorly, the cecum is continuous with the ascending colon.
- Between the cecum and ilium is the **ileocecal valve**.

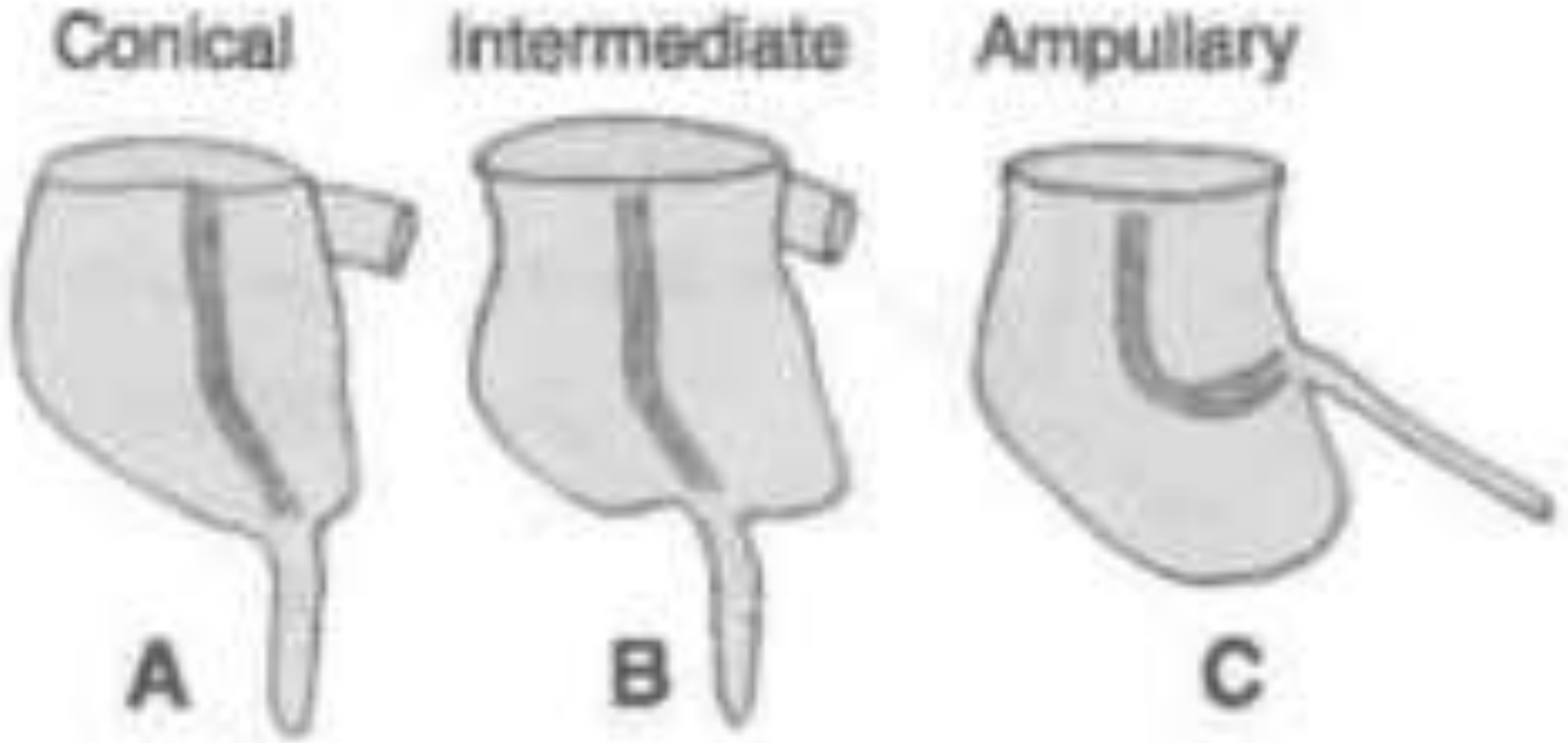
Relations

Anterior: Coils of intestine and anterior abdominal wall.

Posterior : Right psoas and iliacus, Genitofemoral, femoral and lateral cutaneous nerve of thigh (all of the right side).Testicular or ovarian, and often the external iliac (of the right side) vessels, Appendix in the retrocaecal recess .

Types- Developmental arrest in the shift of the appendix forms the basis of the types of caecum.

- 1. Conical type (13%), where the appendix arises from the apex of the caecum.
- 2. Intermediate type (9%), where the right and left caecal pouches are equal in size, and the appendix arises from a depression between them.
- 3. Ampullary type (78%), where the right caecal pouch is much larger than the left, and the appendix arises from the medial side


Conical
Intermediate
Ampullary
A
B
C

Vessels

- caecal branches of the ileocolic artery. The veins drain into the superior mesenteric vein.

Nerves

- Sympathetic-T11 to L1
- Parasympathetic- vagus.

CLINICAL ANATOMY

Caecum is commonly involved in:

(1) Amoebiasis, causing amoebic dysentry;

(2) intestinal tuberculosis (ileocaecal tuberculosis);

(3) carcinoma.

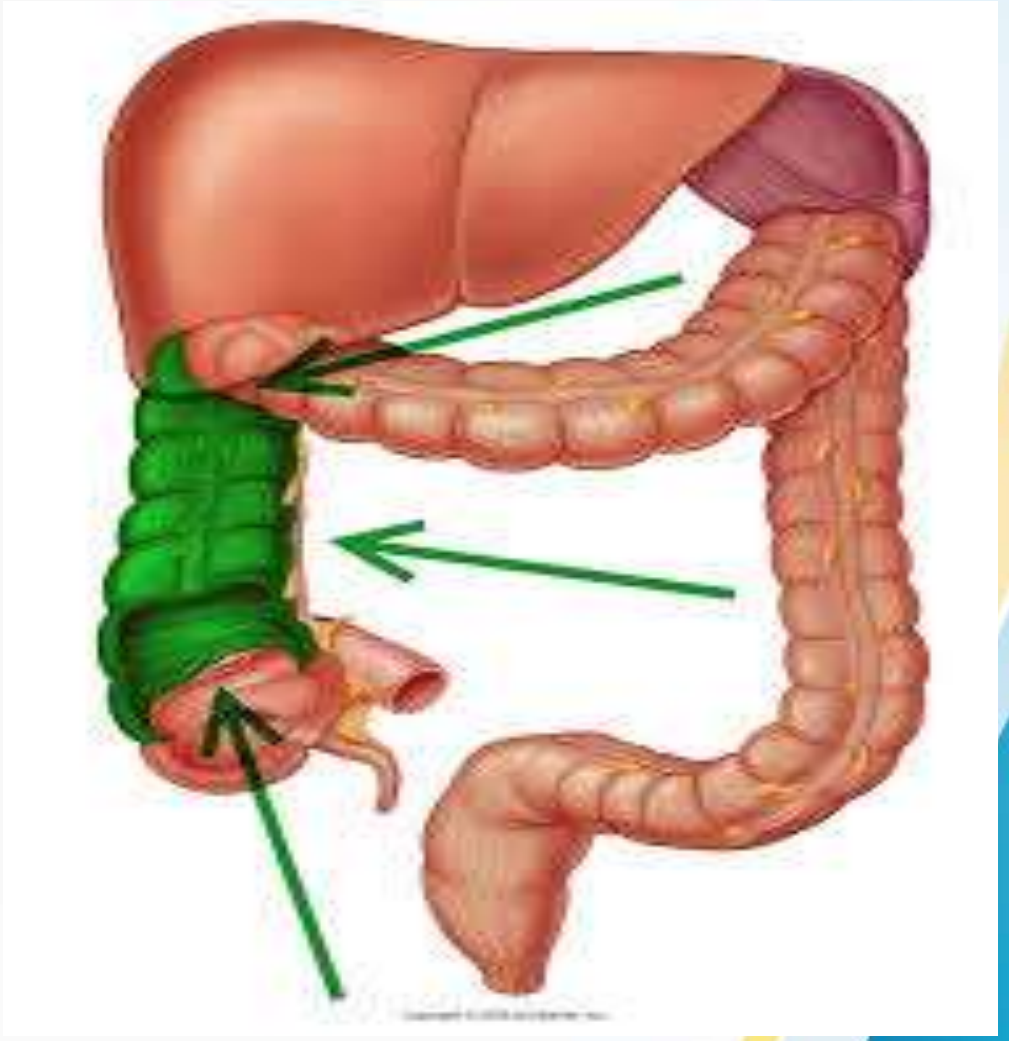
(4) Inflammation of caecum is known as caecitis or typhlitis.

COLON

- The **colon** is the distal part of the GIT, extending from the cecum to the anal canal. It receives digested food from the small intestine, from which it absorbs water and electrolytes to form **faeces**.
- Anatomically, the colon can be divided into **four parts** – ascending (12.5cm), transverse (50cm), descending (25cm) and sigmoid (37.5cm).

❖ ASCENDING COLON -

- A retroperitoneal structure which ascends superiorly from the caecum.
-

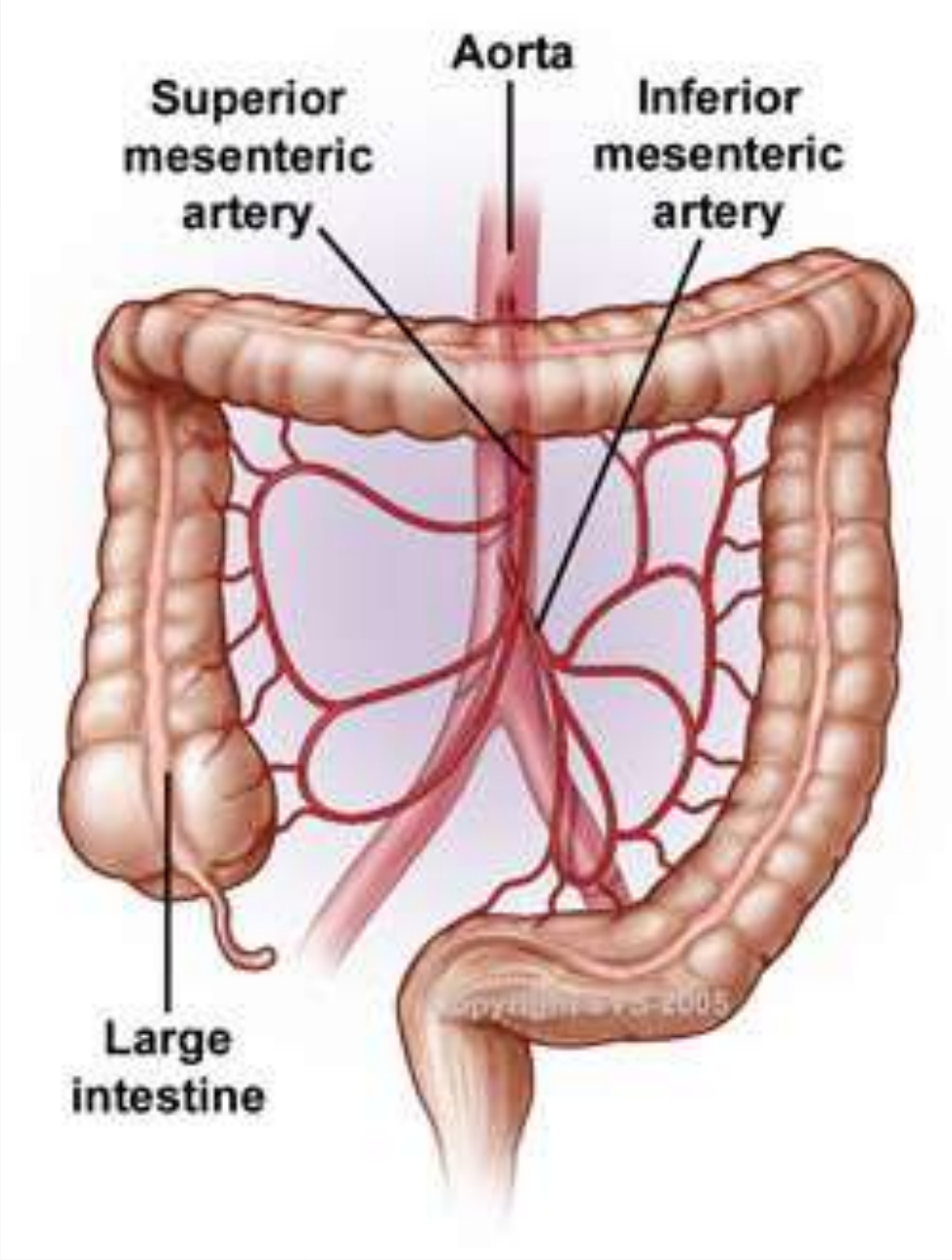


Blood supply of ascending colon and right colic flexure-

- Artery- from branches of the SMA—the ileocolic and right colic arteries.
- Vein- Tributaries of the SMV, the ileocolic and right colic veins.

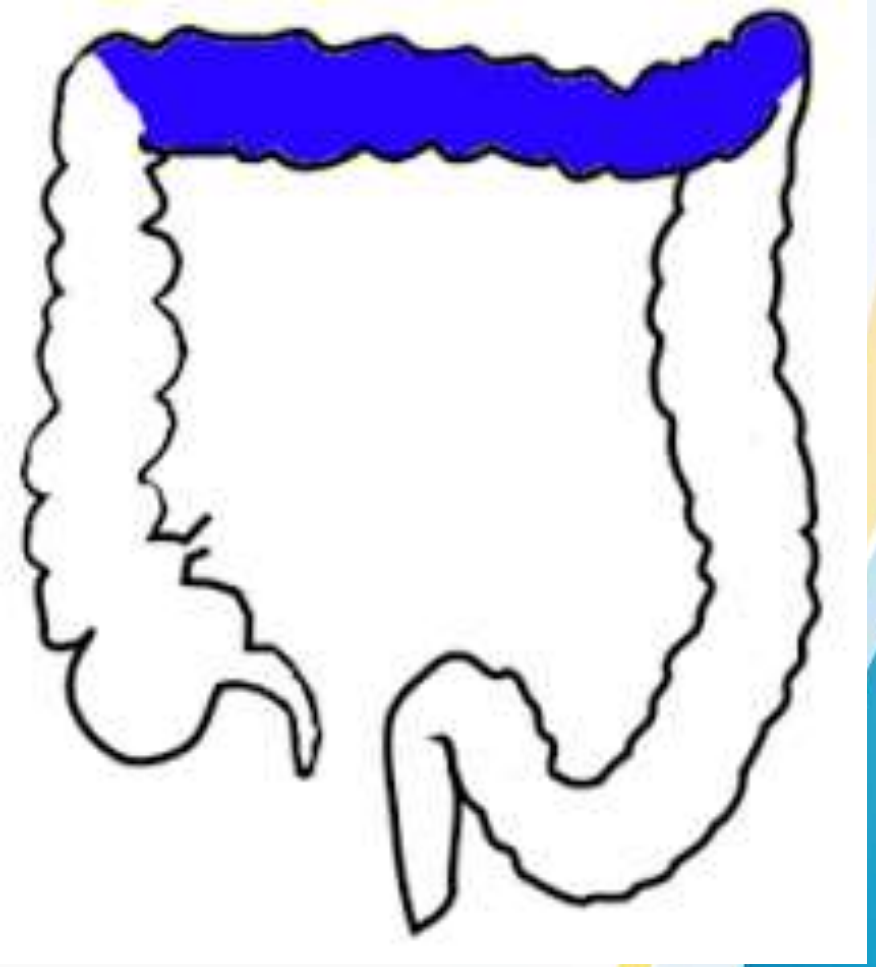
Lymphatic drainage- epicolic and paracolic, ileocolic and intermediate right colic lymph nodes, and from them to the superior mesenteric nodes.

Nerves supply- from the superior mesenteric plexus .


Aorta
Superior mesenteric artery
Inferior mesenteric artery
Large intestine

2. TRANSVERSE COLON-

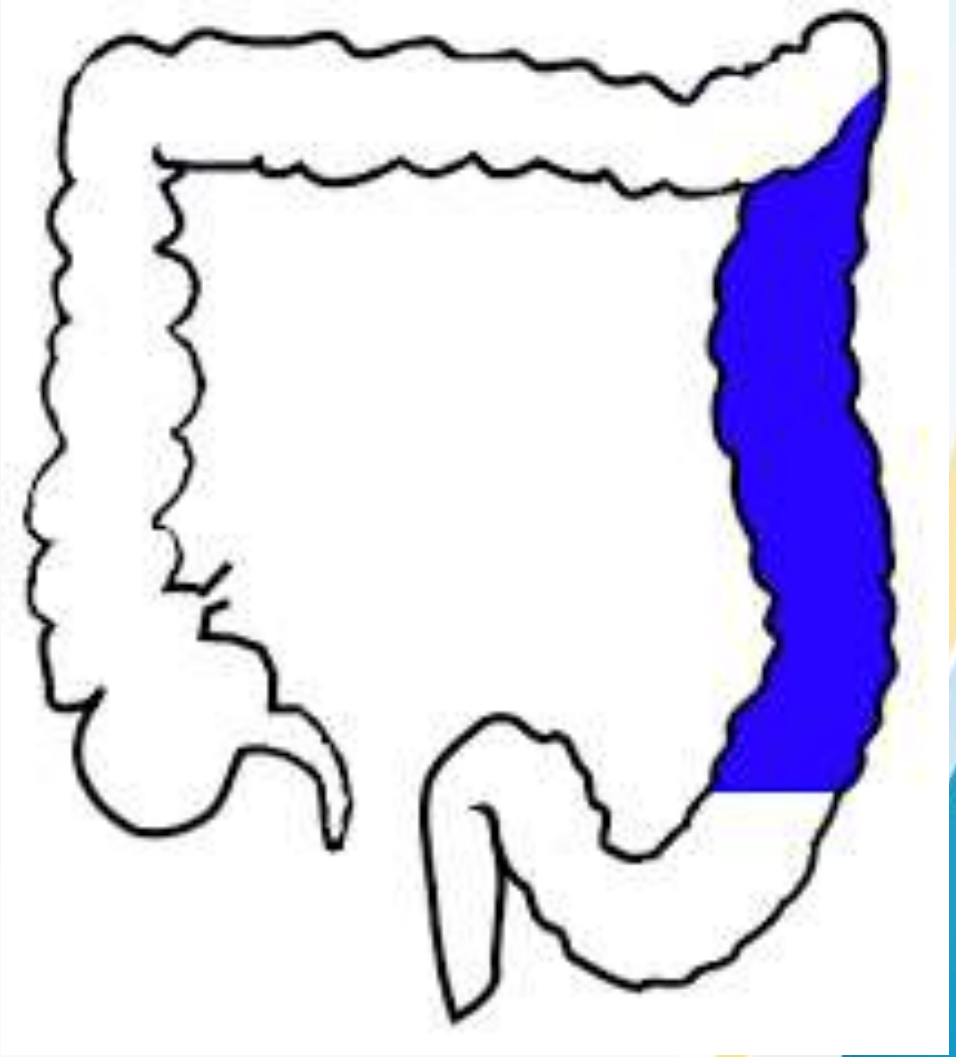
- It extend across the abdomen from the right colic flexure to the left colic flexure (splenic flexure).
  - The transverse colon is the least fixed part of the colon, and is variable in position. It is intraperitoneal and is enclosed by the **transverse mesocolon**..



- Blood supply- from the middle colic artery.
- Venous drainage- through the SMV.
- Lymphatic drainage- middle colic lymph nodes, superior mesenteric lymph nodes.
- Nerves- superior mesenteric plexus .

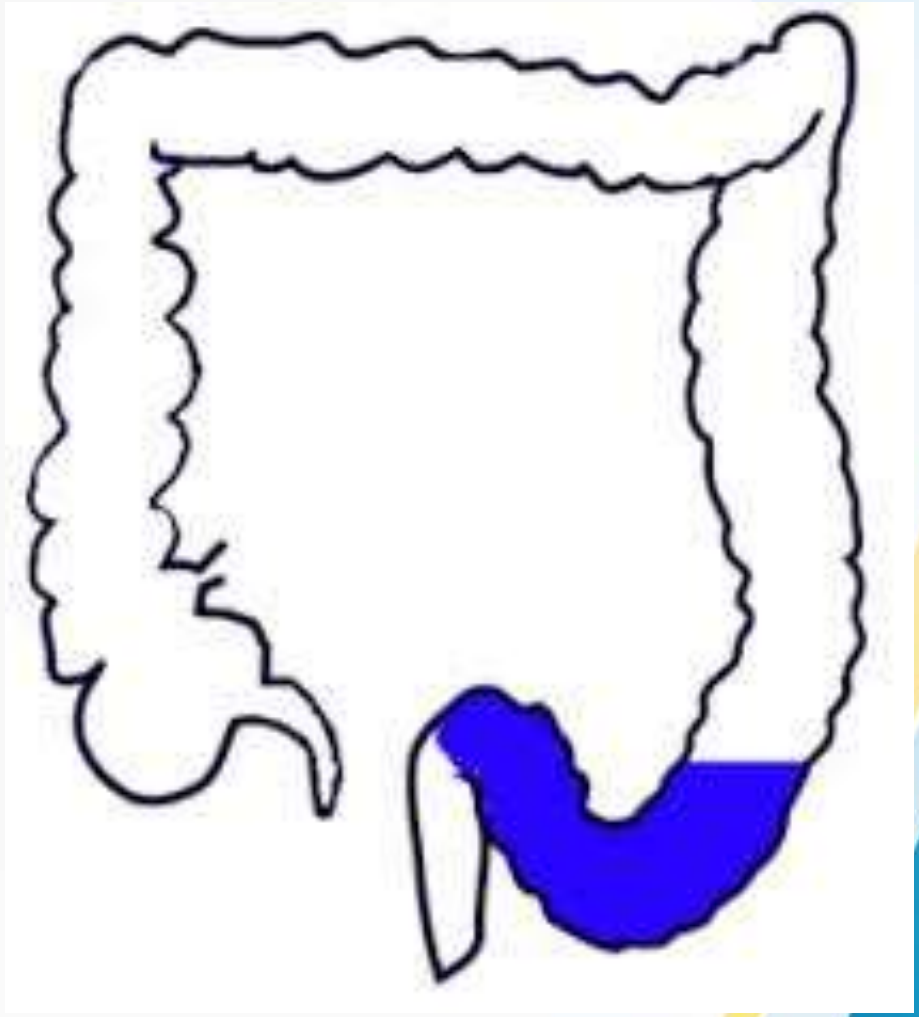
3. DESCENDING COLON

- It extend from the left colic flexure to the sigmoid colon.
- It becomes continue with the sigmoid colon.
- It is retroperitoneal



4. SIGMOID COLON/PELVIC COLON

- located in the **left lower quadrant** of the abdomen, extending from the left iliac fossa to the level of the S3 vertebra.
- “S” shape.
- The sigmoid colon is attached to the posterior pelvic wall by a mesentery – the **sigmoid mesocolon**



- The second important transition in the blood supply to the abdominal portion of the alimentary tract occurs approximately at the left colic flexure. Proximal to this point (back to mid-duodenum), the blood is supplied to the alimentary tract by the SMA (embryonic midgut); distal to this point, blood is supplied by the inferior mesenteric artery (IMA) (embryonic hindgut).
- The arterial supply of the descending and sigmoid colon is from the left colic and sigmoid arteries, branches of the IMA.

IMV returns blood from the descending and sigmoid colon, flowing usually into the splenic vein and then the hepatic portal vein on its way to the liver.

The lymphatic vessels- epicolic and paracolic lymph nodes, intermediate colic lymph nodes. Lymph from these nodes passes to inferior mesenteric lymph nodes.

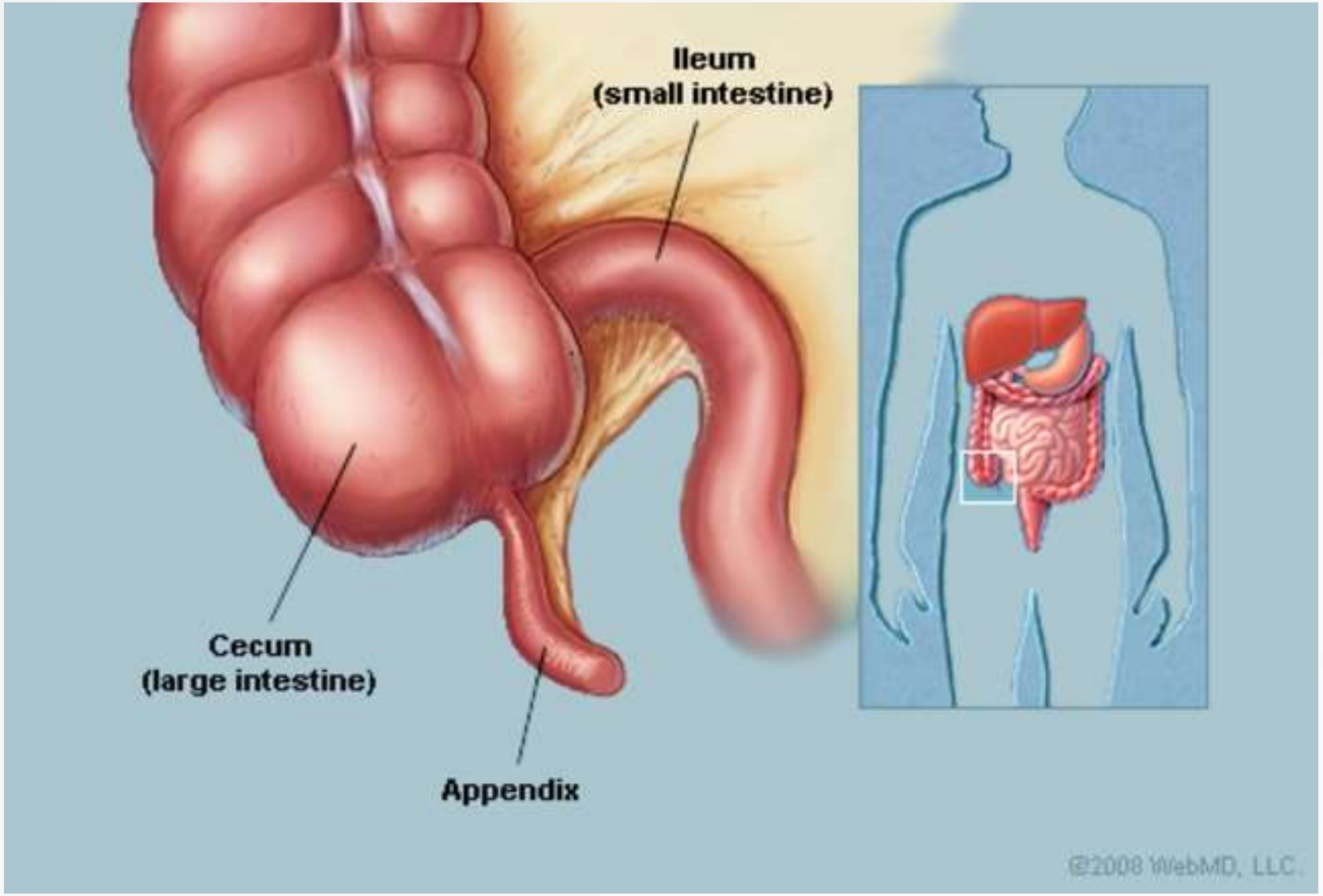
Nerve supply

Sympathetic- lumbar (abdominopelvic) splanchnic nerves, the inferior mesenteric ganglion, and the periarterial plexuses on the IMA and its branches.

Parasympathetic- from the pelvic splanchnic nerves via the inferior hypogastric (pelvic) plexus.

Appendix

- worm-like diverticulum arising from the posteromedial wall, of the caecum, about 2 cm below the ileocaecal orifice.
- length varies from 2 to 20 cm with an average of 9 cm. It is longer in children than in adults.
- The diameter is about 5 mm.
- It contains a large amount of **lymphoid tissue**.
- It is supported by the mesoappendix, a fold of mesentery which suspends the appendix from the terminal ileum.


Ileum
(small intestine)
Cecum
(large intestine)
Appendix
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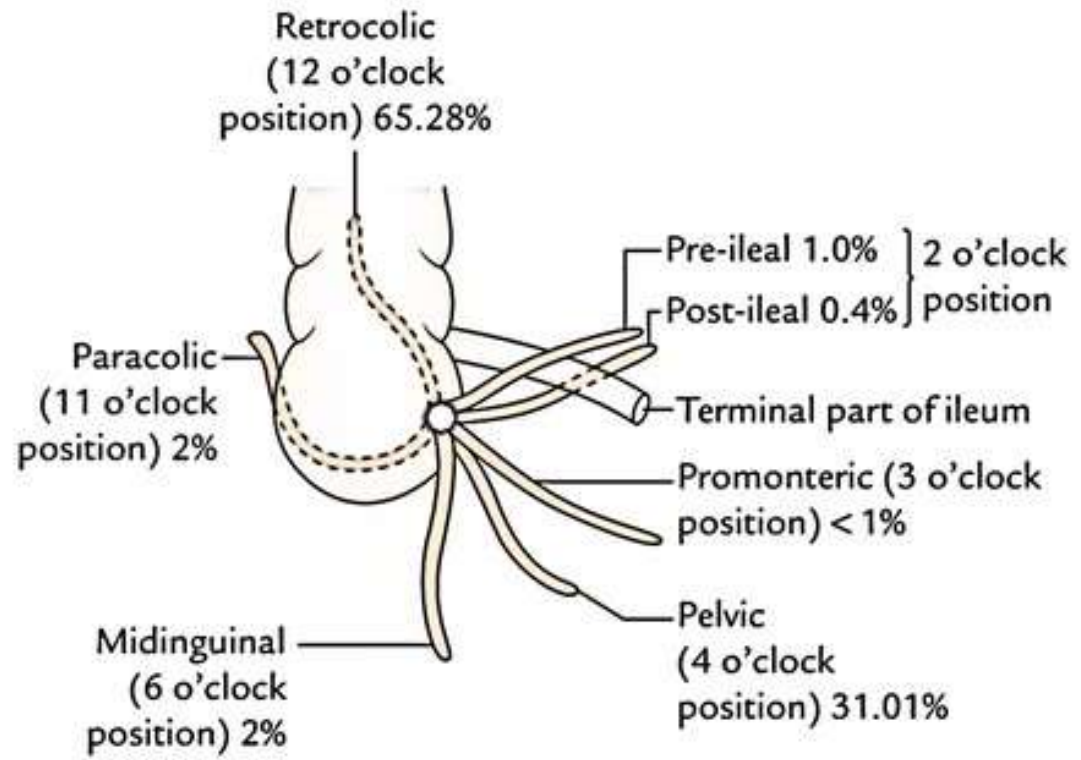
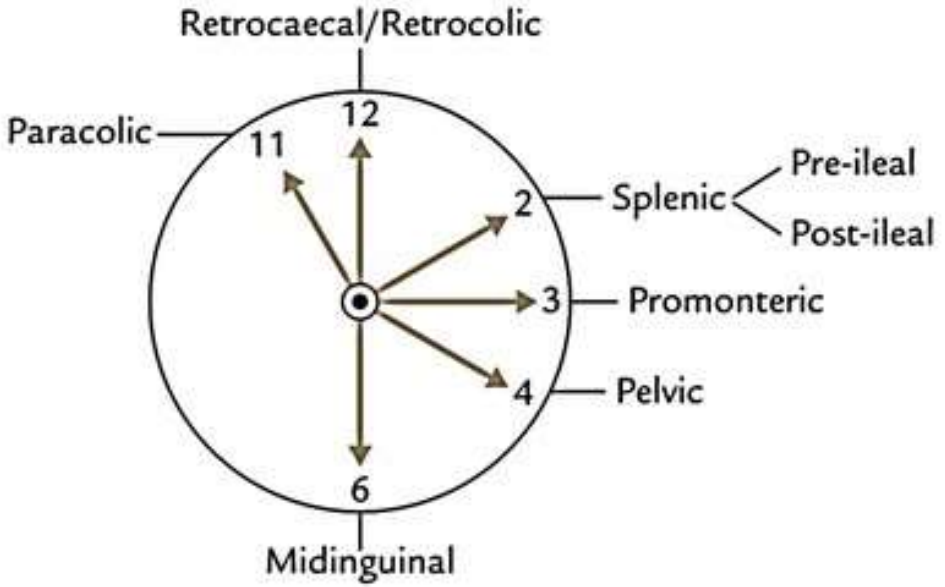
- The position of the free-end of the appendix is highly variable and can be categorized into six main locations depending on its relationship to the ileum, caecum or pelvis.

1. **Paracolic or 11 O'clock position**- appendix may upwards and to the right.
2. **Retrocaecal or 12 O'clock position**- it lies behind the caecum, commonest position of the appendix, about 65%.
3. **Splenic or 2 O'clock position**- appendix may pass upwards and to the left. It points towards the spleen. The appendix may lie in front of the ileum (preileal) or behind the ileum (postileal).

4. **Promontoric or 3 O'clock position** - It may pass horizontally to the left (as if pointing to the sacral promontory).
5. **Pelvic or 4 O'clock position** - It may descend into the pelvis. This is the second most common position about 30%.
6. **Subcaecal or 6 O'clock position**- It may lie below the caecum.

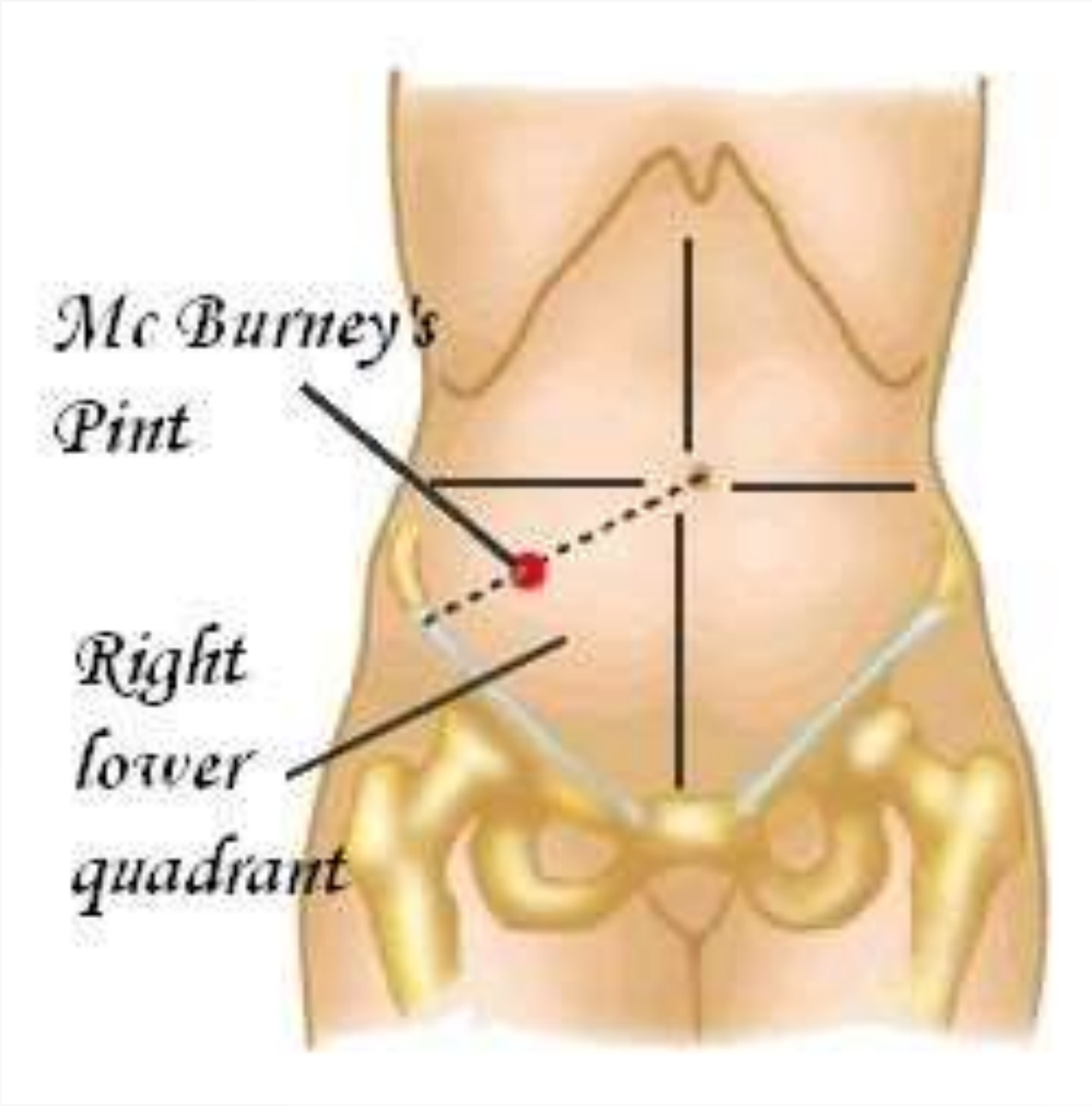

Retrocolic
(12 o'clock
position) 65.28%
Pre-ileal 1.0%
Post-ileal 0.4%
2 o'clock
position
Paracolic
(11 o'clock
position) 2%
Terminal part of ileum
Promonteric (3 o'clock
position) < 1%
Pelvic
(4 o'clock
position) 31.01%
Midinguinal
(6 o'clock
position) 2%

A


Retrocaecal/Retrocolic
Paracolic
12
11
2
Splenic
Pre-ileal
Post-ileal
3
Promonteric
4
Pelvic
6
Midinguinal

B

- The appendicular orifice is occasionally guarded by an semilunar fold of mucous membrane, known as '**valve of Gerlac**.
- **McBurney's point**- is the site of maximum tenderness in appendicitis. The point lies at the junction of lateral one-third and medial two-thirds of the line joining the right anterior superior iliac spine to the umbilicus.


Mc Burney's
Pint
Right
lower
quadrant

Arterial supply- is from the **appendicular artery** (derived from the ileocolic artery) and venous drainage is via the corresponding appendicular vein.

Nerve supply-

- Sympathetic T9-T10
- Parasympathetic- vagus

Lymphatic Drainage

- Lymphatic fluid from the appendix drains into lymph nodes within the mesoappendix and into the **ileocolic lymph nodes**.

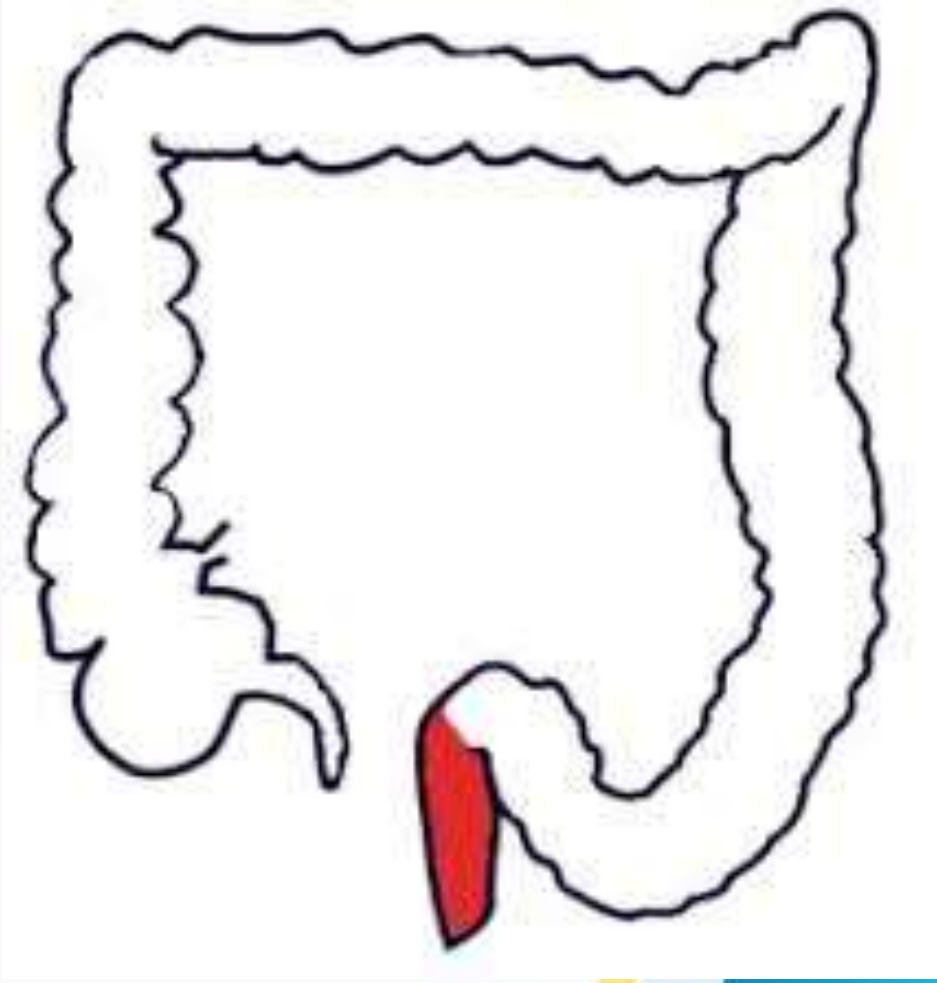
Clinical aspect

Appendicitis-

- **Murphy's Triad** is a collection of three medical signs associated with acute appendicitis, which presents with lower right **abdominal pain,** along with nausea, **vomiting, and fever.**

❖ RECTUM

- 12 cm long
- This is the distal part of the large gut.
- It is placed b/w the sigmoid colon above and the anal canal below.
- Situated in the posterior part of the lesser pelvis.

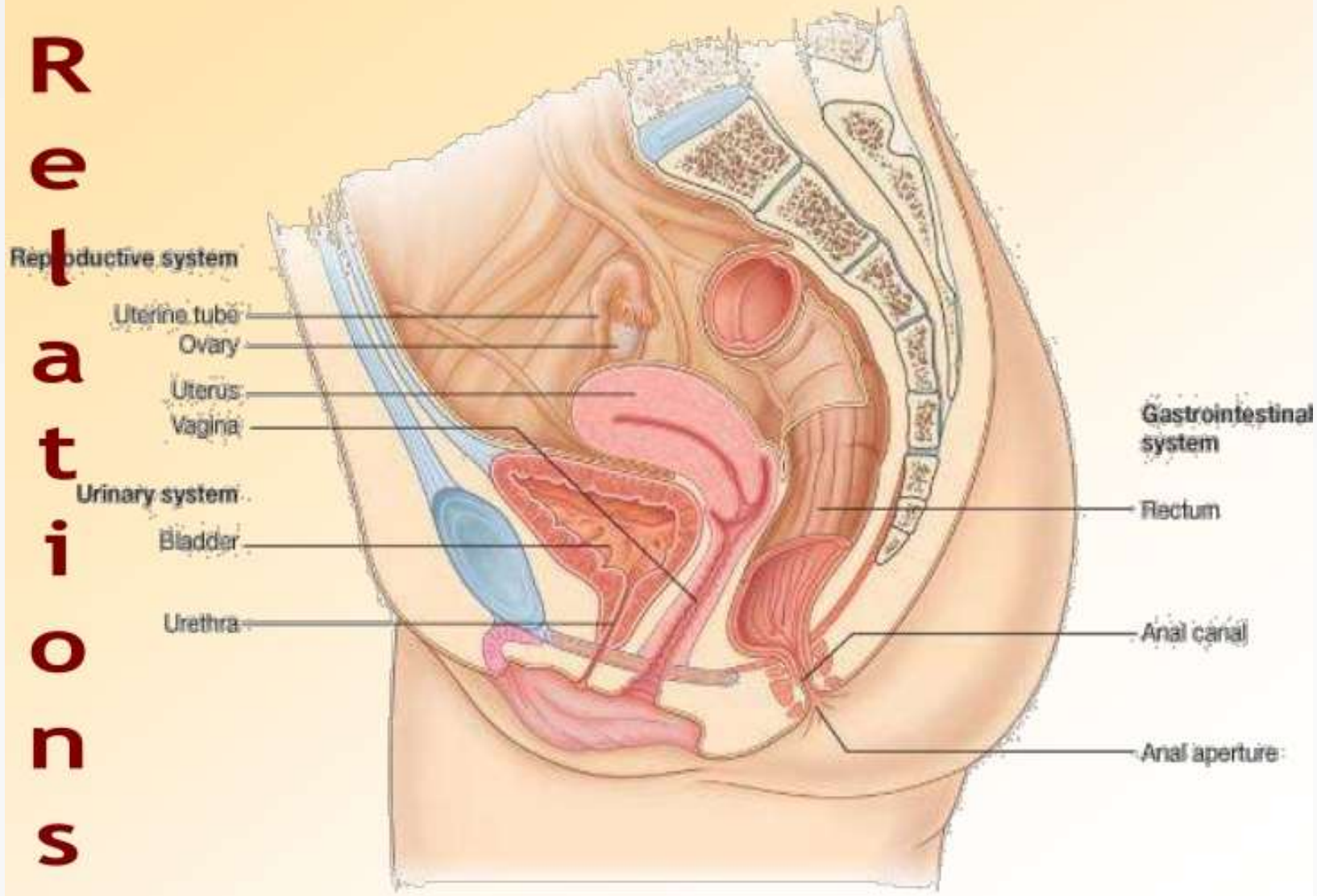


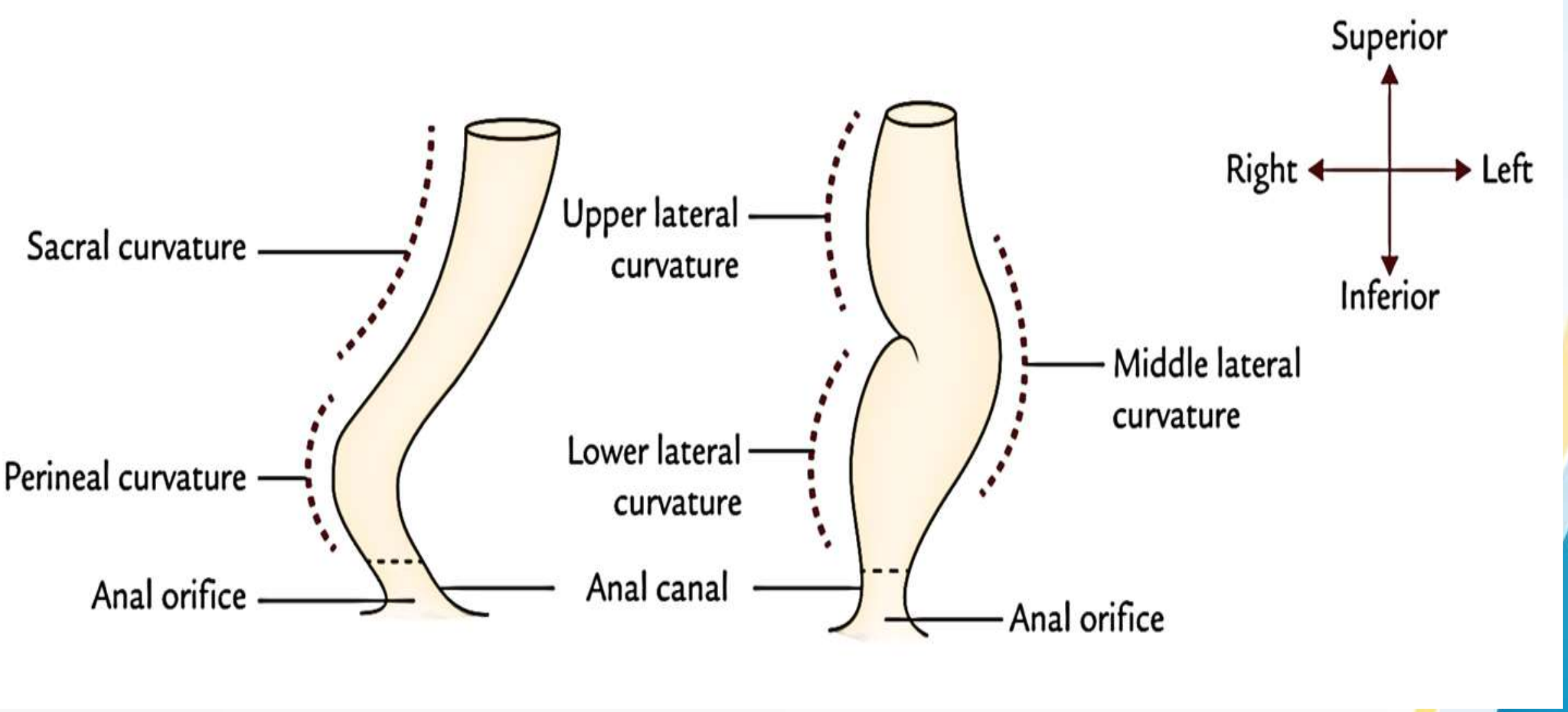
- The rectum begins at the level of the **S3**.
- Absence of taenia coli, omental appendices.

The course of the rectum is marked by two major flexures:

- **Sacral flexure** - anteroposterior curve with concavity anteriorly (follows the curve of the sacrum and coccyx).
- **Anorectal flexure** – anteroposterior curve with convexity anteriorly. This flexure is formed by the tone of the puborectalis muscle.

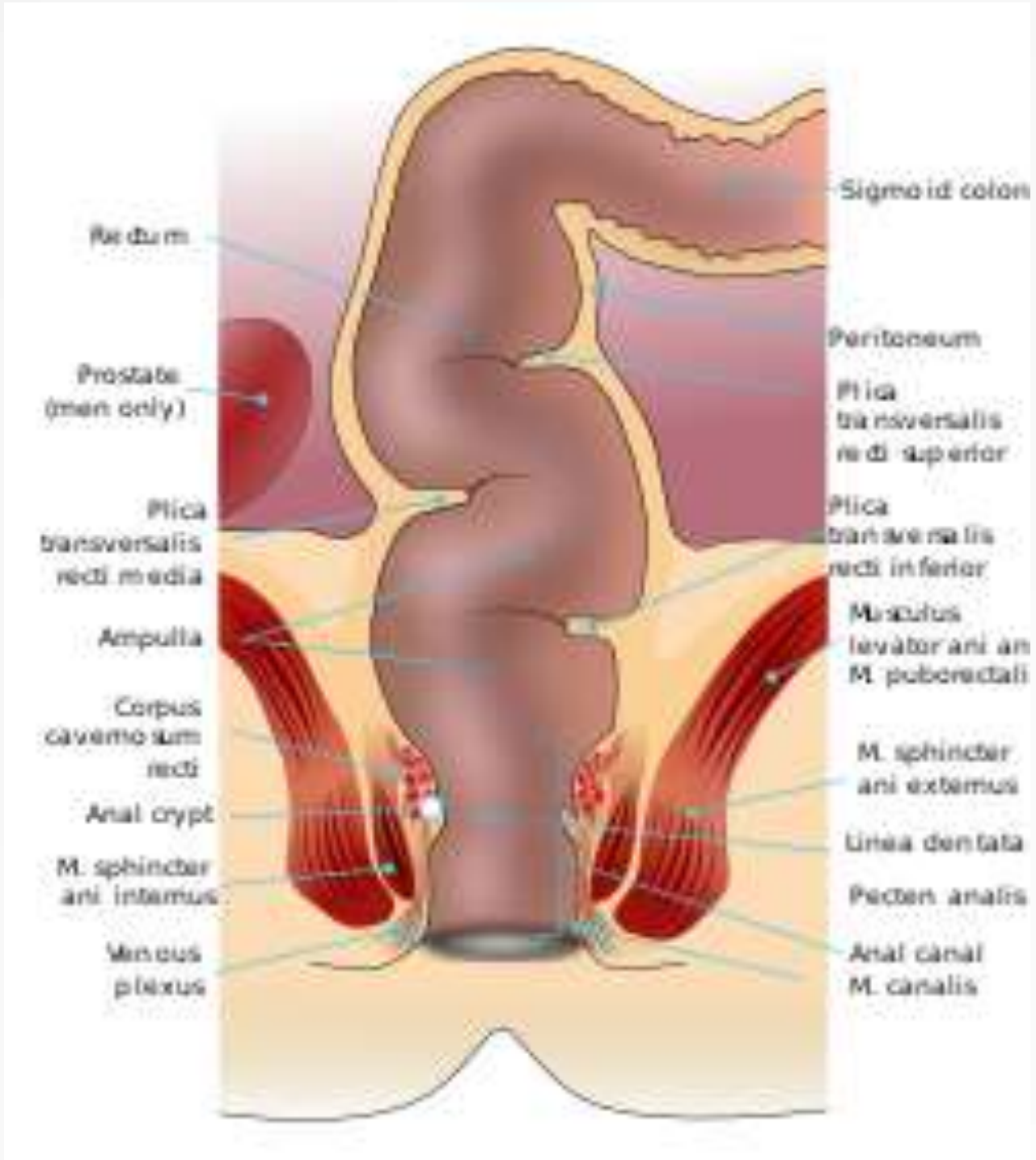
Relations


Reproductive system
Uterine tube
Ovary
Uterus
Vagina
Urinary system
Bladder
Urethra
Gastrointestinal system
Rectum
Anal canal
Anal aperture


Sacral curvature
Perineal curvature
Anal orifice
Upper lateral curvature
Lower lateral curvature
Anal canal
Middle lateral curvature
Anal orifice
Superior
Right
Left
Inferior

There are additionally three **lateral flexures** (superior, intermediate and inferior), which are formed by transverse folds of the internal rectum wall.

- The final segment of the rectum, the **ampulla**, relaxes to accumulate and temporarily store faeces until defecation occurs. It is continuous with the anal canal; which passes through the pelvic floor to end as the anus.


Sigmoid colon
Rectum
Peritoneum
Prostate (men only)
Plica transversalis recti superior
Plica transversalis recti media
Plica transversalis recti inferior
Ampulla
Musculus levator ani an M. puborectali
Corpus cavernosum recti
M. sphincter ani externus
Anal crypt
Linea dentata
M. sphincter ani internus
Pecten analis
Venous plexus
Anal canal
M. canalis

Peritoneal Coverings

- In the superior third of the rectum, the anterior surface and lateral sides are covered by peritoneum. The middle third only has an anterior peritoneal covering, and the lower 1/3 has no peritoneum associated with it.
- In males, the reflection of peritoneum from the rectum to the posterior bladder wall forms the **rectovesical pouch**. In females, the peritoneum reflects to the posterior vagina and cervix, forming the **rectouterine pouch** (pouch of Douglas).

- **Anatomical Relations-** Its anatomical relations are different in men and women:

Anterior

- **Male**

1.Rectovesical pouch

2. Sigmoid colon

3. Ileum

4. Bladder

5. Prostate

6. Seminal vesicles

- Female- anterior relation

1. Rectouterine pouch
2. Sigmoid colon
3. Ileum
4. Vagina
5. Cervix

Posterior relation-

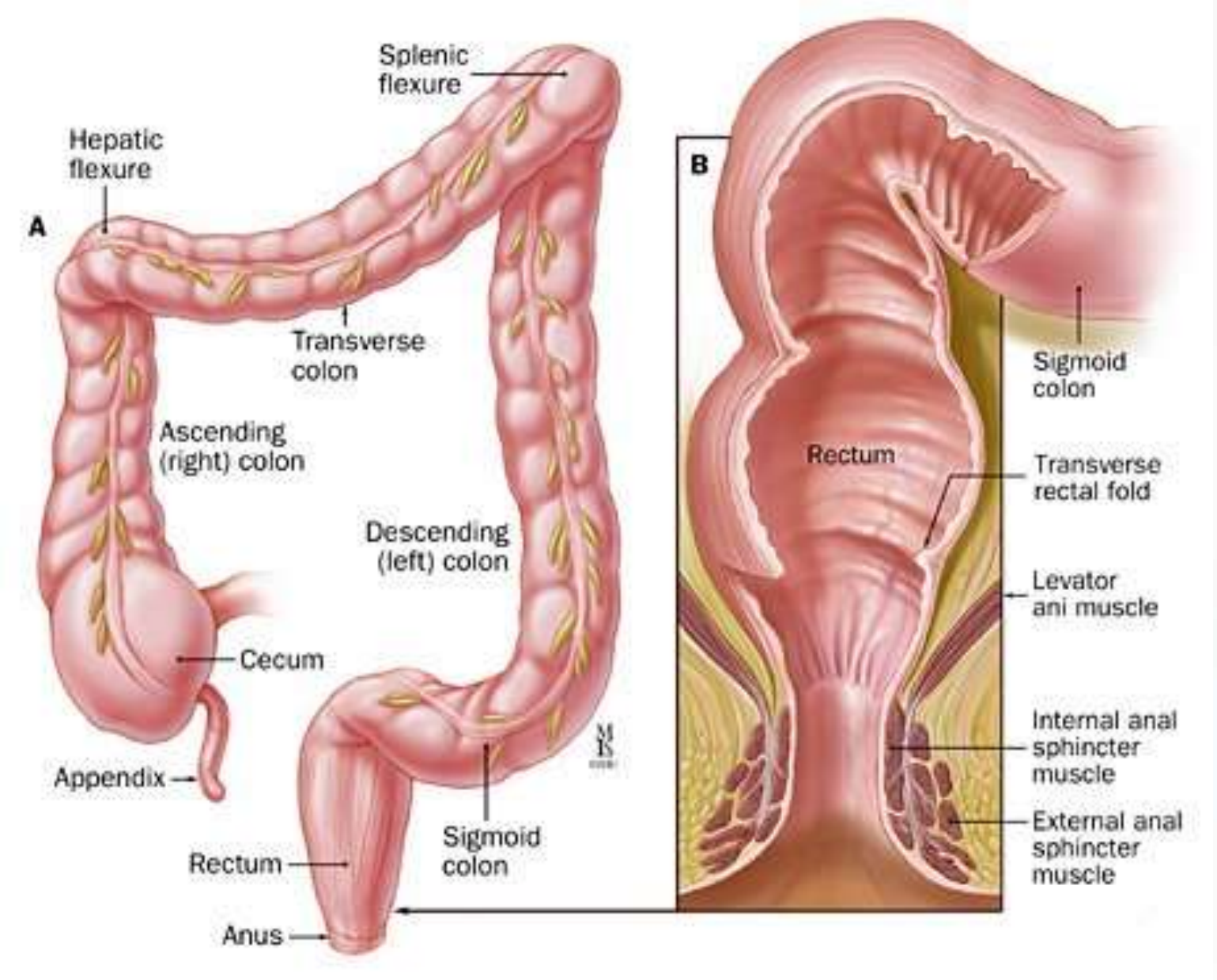
1. Sacrum and coccyx
2. Piriformis
3. Coccygeus
4. Levator ani
5. Sacral plexus

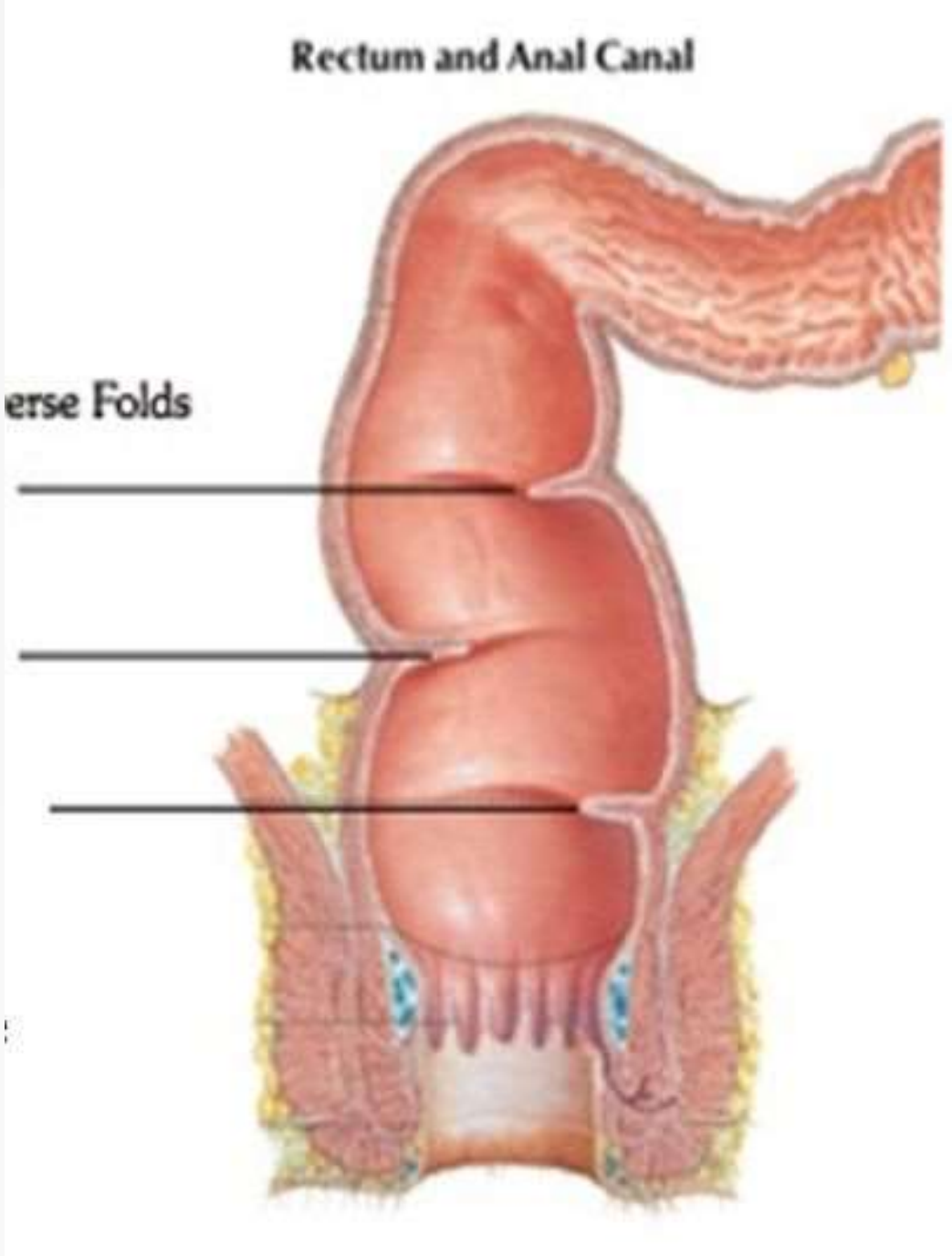
Internal structure

The mucous membrane of an empty rectum shows two types of folds- longitudinal and transverse.

The longitudinal folds are transitory. They are present in the lower part of an empty rectum, and are obliterated by distension.

The transverse or horizontal folds or Houston's valves or plicae transversales are permanent and most marked when the rectum is distended.


A
Splenic flexure
Hepatic flexure
Transverse colon
Ascending (right) colon
Descending (left) colon
Cecum
Appendix
Rectum
Sigmoid colon
Anus
B
Sigmoid colon
Rectum
Transverse rectal fold
Levator ani muscle
Internal anal sphincter muscle
External anal sphincter muscle


Rectum and Anal Canal
erse Folds

Supports of Rectum-

1. Pelvic floor formed by levator ani muscles.
2. Fascia of Waldeyer: It attaches the lower part of the rectal ampulla to the sacrum.
3. Lateral ligaments of the rectum: attach the rectum to the posterolateral walls of the lesser pelvis.
4. Rectovesical fascia of Denonvilliers : It extends from the rectum behind to the seminal vesicles and prostate in front.
5. Perineal body with its muscles.

- Blood supply- The **rectum** receives arterial supply through three main arteries:

1. **Superior rectal artery** – terminal continuation of the IMA.
2. **Middle rectal artery** – branch of the internal iliac artery.
3. **Inferior rectal artery** – branch of the internal pudendal artery.

- Venous drainage is via the corresponding **superior, middle** and **inferior rectal veins**.

❖superior rectal vein empties into- the **portal venous system**,

❖middle and inferior rectal veins empty into- the systemic venous system.

Lymphatic Drainage

- **pararectal lymph nodes**, which drain into the inferior mesenteric nodes.
- lower aspect of the rectum drains directly into the **internal iliac lymph nodes.**

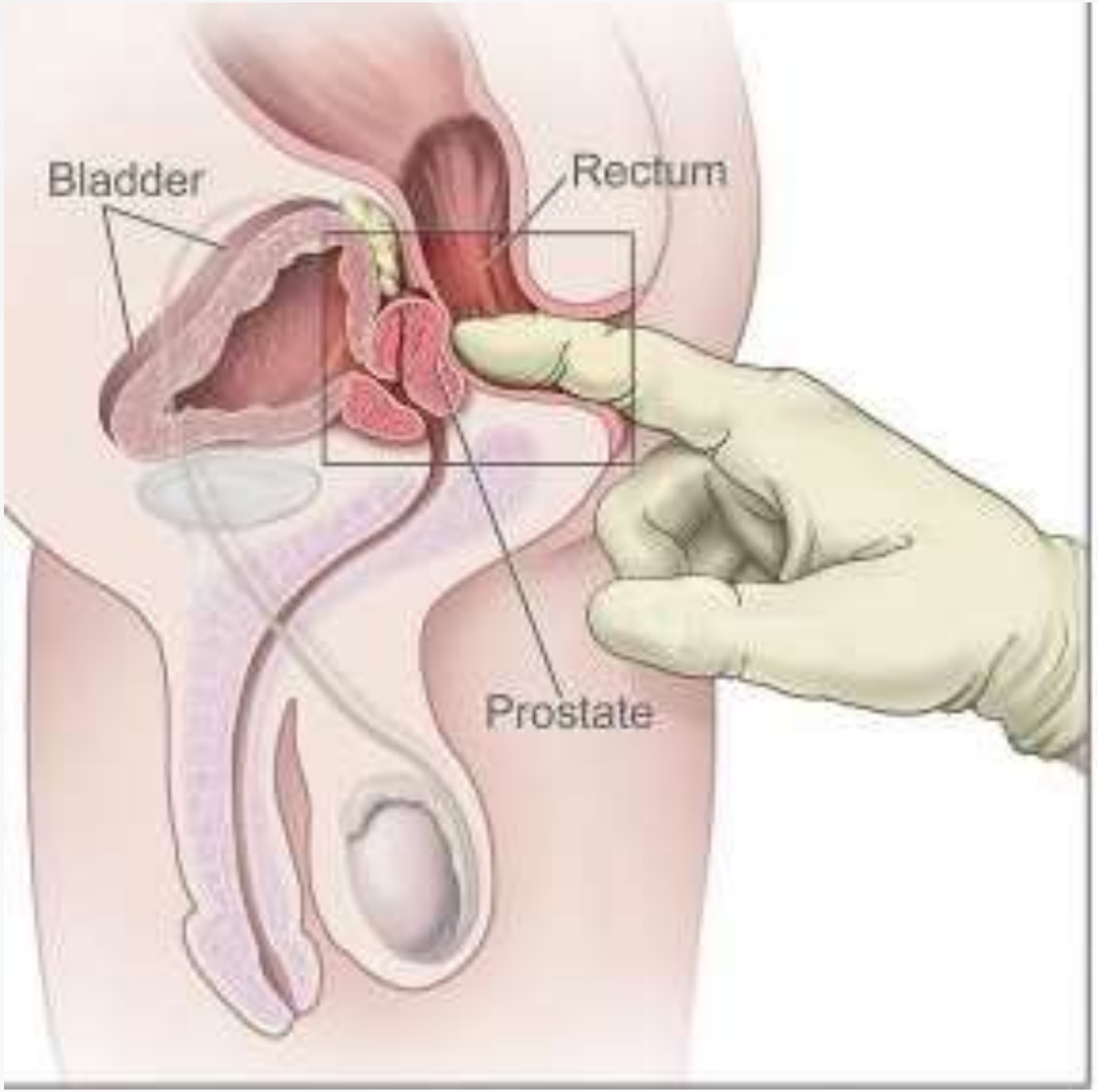
Innervation

- Sympathetic- from the lumbar splanchnic nerves and **superior** and **inferior hypogastric plexuses**.
- Parasympathetic- supply is from S2-4 via the **pelvic splanchnic nerves** and inferior hypogastric plexuses.

Clinical anatomy

Digital Rectal Examination

- The anterior wall of the rectum has a number of close anatomical structures. These can therefore be palpated digitally via the rectum. Most significant are the **prostate** and **seminal vesicles** in males, and **cervix** in females. Bony structures, such as the sacrum and coccyx, may also be palpated in both sexes.


Bladder
Rectum
Prostate

❖ ANAL CANAL

- 4 cm long.
- It is the lowest part of the alimentary canal
- Above it is continuous with the lower end of the rectum.
- Below it open to exterior at the anus.
- directed downwards and backwards.
- the anorectal junction lies at the level of the pelvic diaphragm.

Anatomical Structure

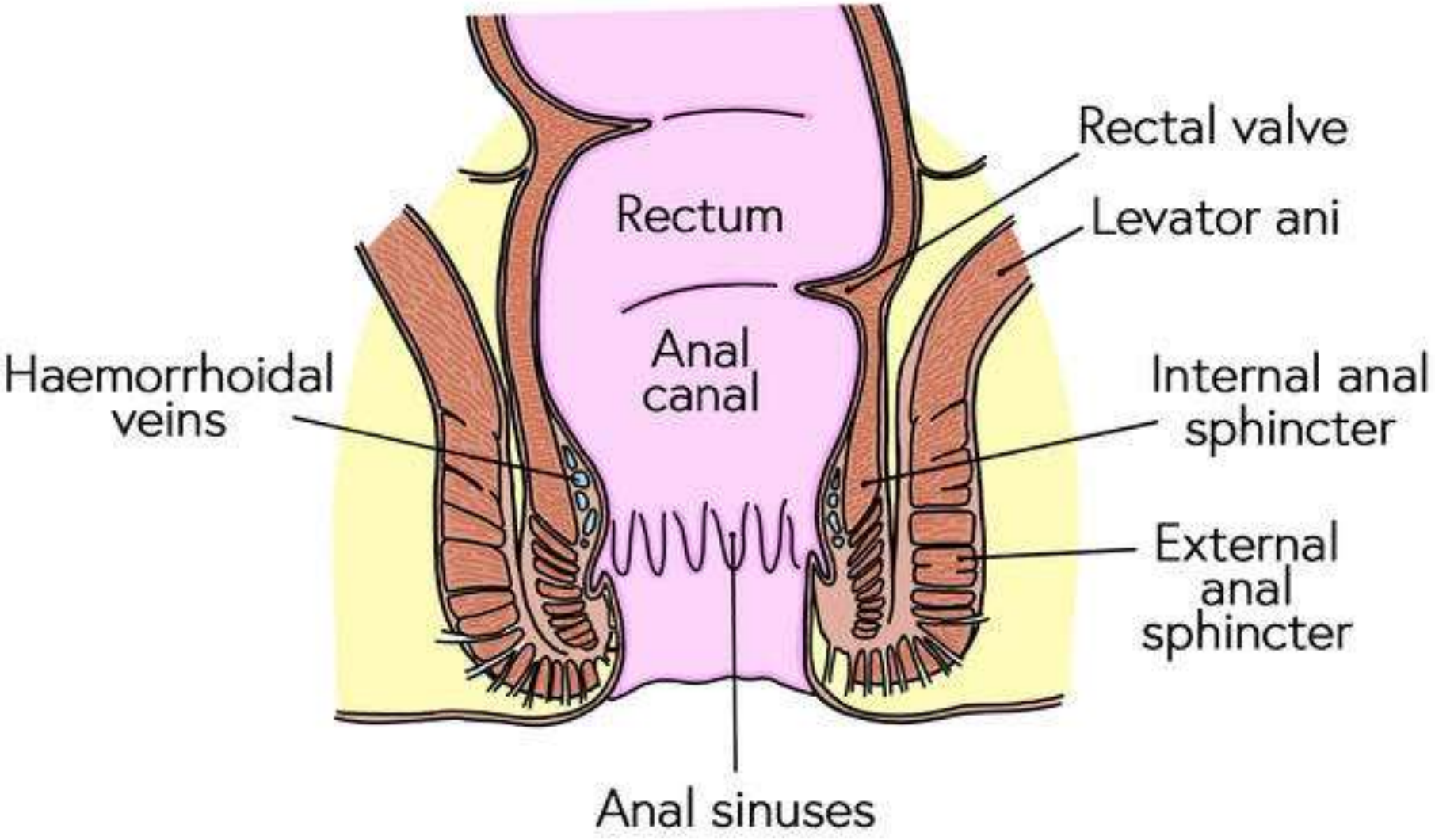
- Except during defecation, the anal canal is collapsed by the internal and external anal sphincters to prevent the passage of faecal material.

Anal Sphincters- The anal canal is surrounded by internal and external anal sphincters, which play a crucial role in the maintenance of faecal continence:

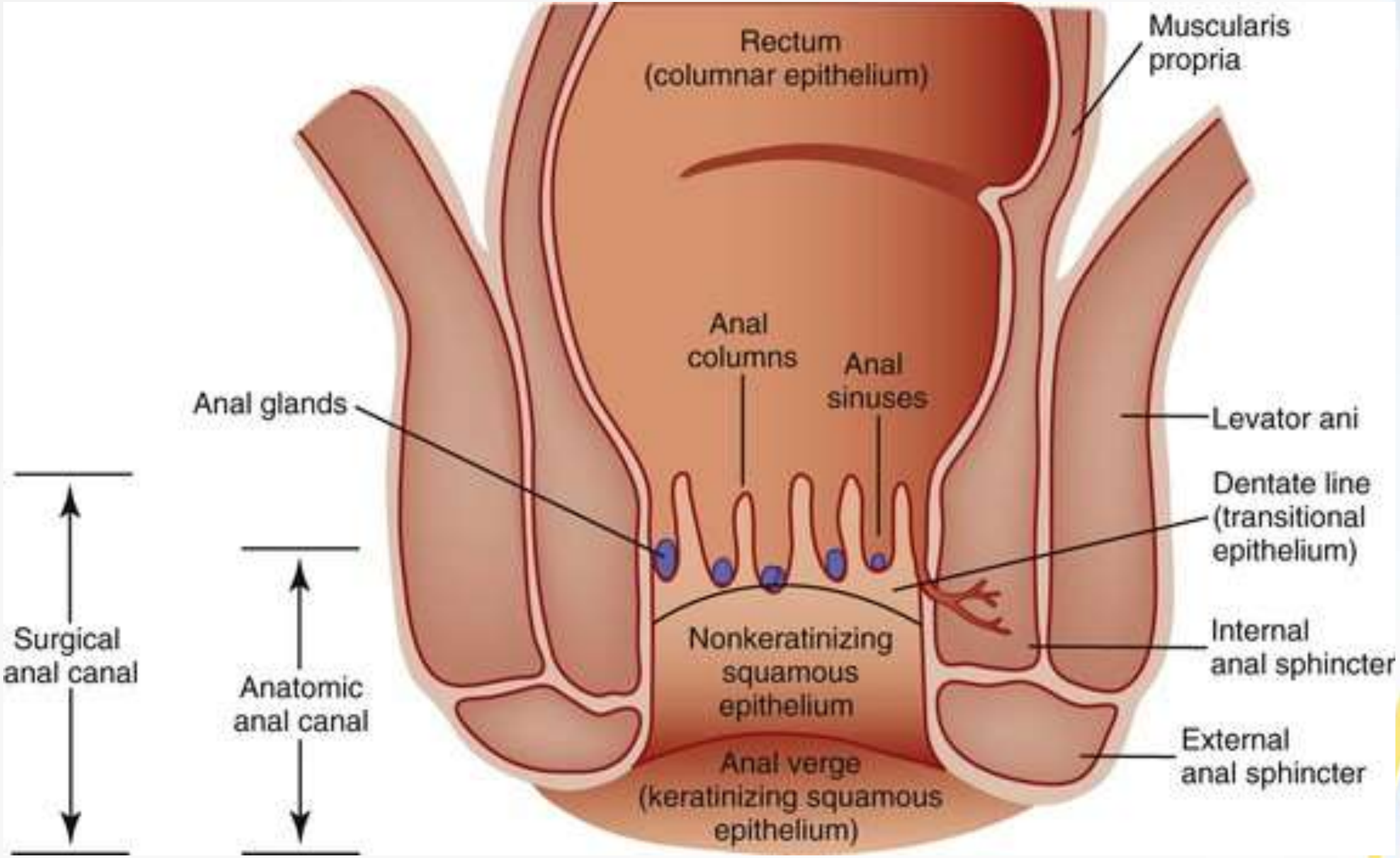
1. **Internal anal sphincter –** surrounds the upper 2/3 of the anal canal. It is formed from a thickening of the involuntary circular smooth muscle in the bowel wall.

2. **External anal sphincter** – voluntary muscle that surrounds the lower 2/3 of the anal canal. It blends superiorly with the puborectalis muscle of the pelvic floor

At the junction of the rectum and the anal canal, there is a muscular ring – known as the **anorectal ring**.


Rectum
Anal canal
Rectal valve
Levator ani
Haemorrhoidal veins
Internal anal sphincter
External anal sphincter
Anal sinuses

- **Internal Structure**
- In the anal canal, the mucosa is organised into longitudinal folds, known as **anal columns**. These are joined together at their inferior ends by **anal valves**. Above the anal valves are small pouches which are referred to as **anal sinuses** – these contain glands that secrete mucus.
- The anal valves collectively form an irregular circle – known as the **pectinate line** (or dentate line). This line divides the anal canal into upper and lower parts, which differ in both structure and neurovascular supply. This is a result of their different embryological origins:


Rectum
(columnar epithelium)
Muscularis
propria
Anal
columns
Anal
sinuses
Anal glands
Levator ani
Dentate line
(transitional
epithelium)
Surgical
anal canal
Anatomic
anal canal
Nonkeratinizing
squamous
epithelium
Internal
anal sphincter
External
anal sphincter
Anal verge
(keratinizing squamous
epithelium)

- **Above the pectinate line** – derived from the embryonic hindgut.
- **Below the pectinate line** – derived from the ectoderm of the proctodeum.

- **Anatomical Relations**

<u>Anteriorly-in males</u>

- Perineal body
- Urogenital diaphragm
- Urethra
- Bulb of the penis

Anteriorly-in females

- Perineal body
- Urogenital diaphragm
- Vagina

Posteriorly-

Anococcygeal ligament

Coccyx and sacrum

Laterally- Ischioanal fossae

Blood supply-

- **Above Pectinate line-** Superior rectal artery (branch of IMA), Anastomosing branches from the middle rectal artery.
- **Below Pectinate line-** Inferior rectal artery (branch of the internal pudendal artery), Anastomosing branches from the middle rectal artery

Venous Drainage-

- **Above Pectinate line-** Superior rectal vein, which empties into the inferior mesenteric vein (portal venous system).
- **Below Pectinate line-** Inferior rectal vein, which empties into the internal pudendal vein (systemic venous system).

Nerve Supply-

Above Pectinate line- Visceral innervation via the inferior hypogastric plexus. Sensitive to stretch.

Below Pectinate line- Somatic innervation via the inferior anal nerves (branches of the pudendal nerve)

- Sensitive to pain, temperature, touch and pressure.

Lymphatics-

- **Above Pectinate line-** Internal iliac lymph nodes

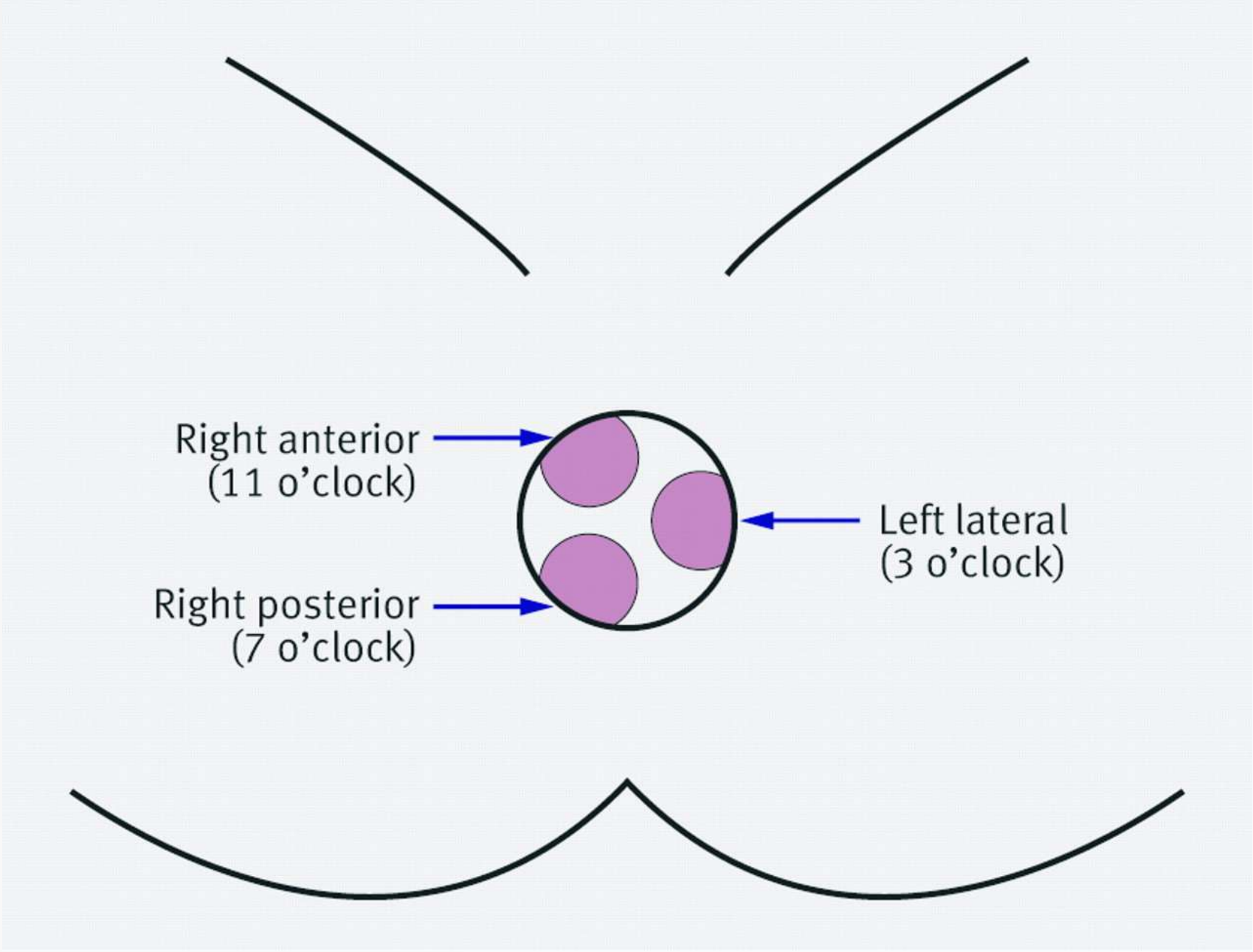
- **Below Pectinate line-** Superficial inguinal lymph nodes

Clinical aspect

Haemorrhoids

- Haemorrhoids are **vascular cushions** found within the anal canal of healthy individuals, which help with the maintenance faecal continence. If they become swollen and distended, they are referred to as pathological haemorrhoids. Also called piles.
- Pathological haemorrhoids are observed in people who suffer from **constipation**, prolonged straining when defecating, or raised intra-abdominal pressure (e.g pregnancy, ascites).

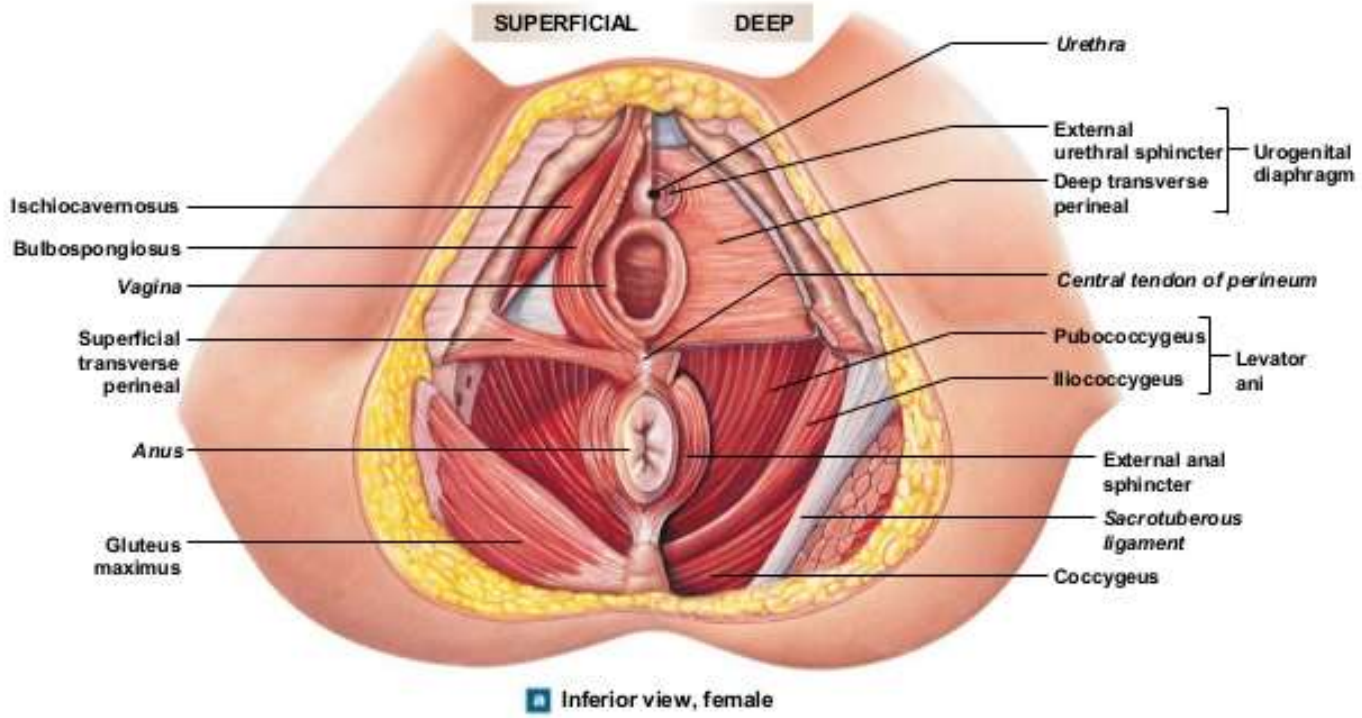
- Upon examination of the anal canal (with the patient in the lithotomy position), the haemorrhoids are typically located at the 3, 7 and 11 o’clock positions.
- They can cause bleeding and itchiness, and depending on the severity, can be managed conservatively or surgically.


Right anterior
(11 o'clock)
Right posterior
(7 o'clock)
Left lateral
(3 o'clock)

Perineum

- anatomical region in the pelvis, located between the thighs, and represents the most inferior part of the pelvic outlet.
- the area between the external genitalia and the anus. The perineum is separated from the pelvic cavity superiorly by the pelvic floor.
- This region contains structures that support the **urogenital** and gastrointestinal systems – and it therefore plays an important role in functions as such micturition, defecation, sexual intercourse and childbirth.

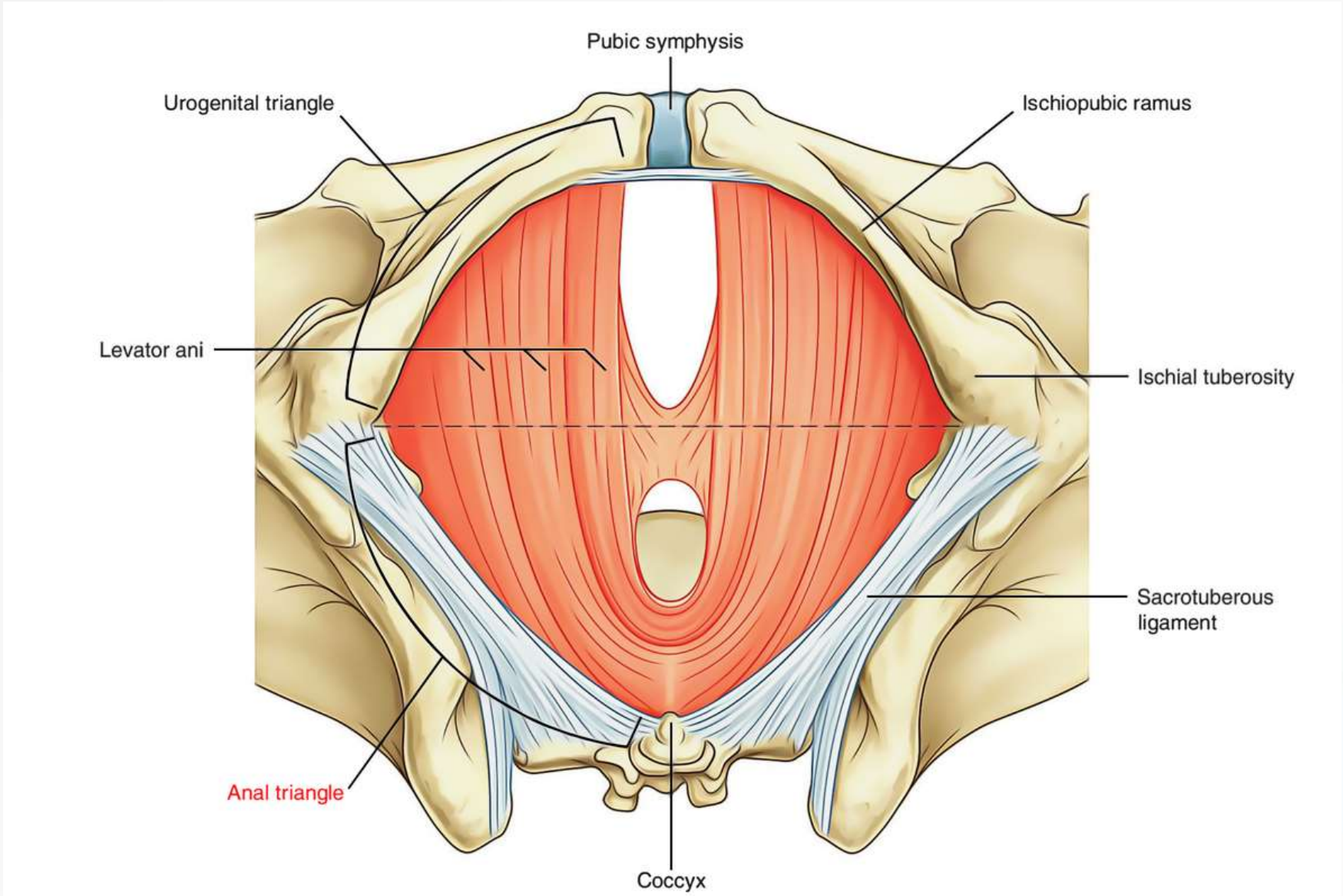
Figure 10.13a Muscles of the Pelvic Floor



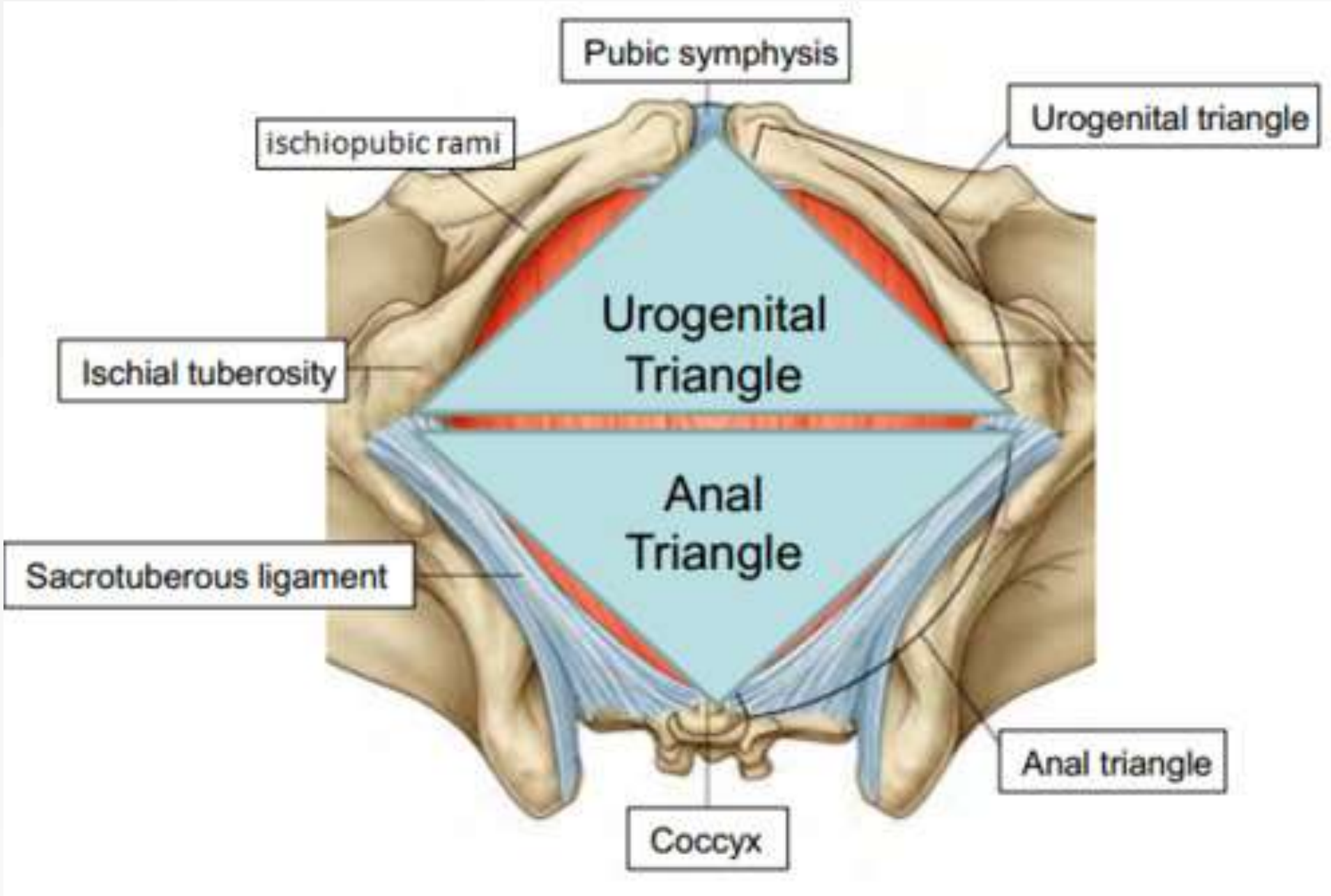
- perineum is a **diamond-shaped** structure.

Boundaries

- **Anterior –** pubic symphysis.
- **Posterior –** tip of the coccyx.
- **Laterally –** inferior pubic rami and inferior ischial rami, and the sacrotuberous ligament.
- **Roof –** pelvic floor.
- **Base –** skin and fascia.


Pubic symphysis
Urogenital triangle
Ischiopubic ramus
Levator ani
Ischial tuberosity
Sacrotuberous ligament
Anal triangle
Coccyx

- The perineum can be subdivided by a theoretical line drawn transversely between the **ischial tuberosities**. This split forms the anterior urogenital triangle and the posterior anal triangle**.**


Pubic symphysis
ischiopubic rami
Urogenital triangle
Urogenital Triangle
Ischial tuberosity
Anal Triangle
Sacrotuberous ligament
Anal triangle
Coccyx

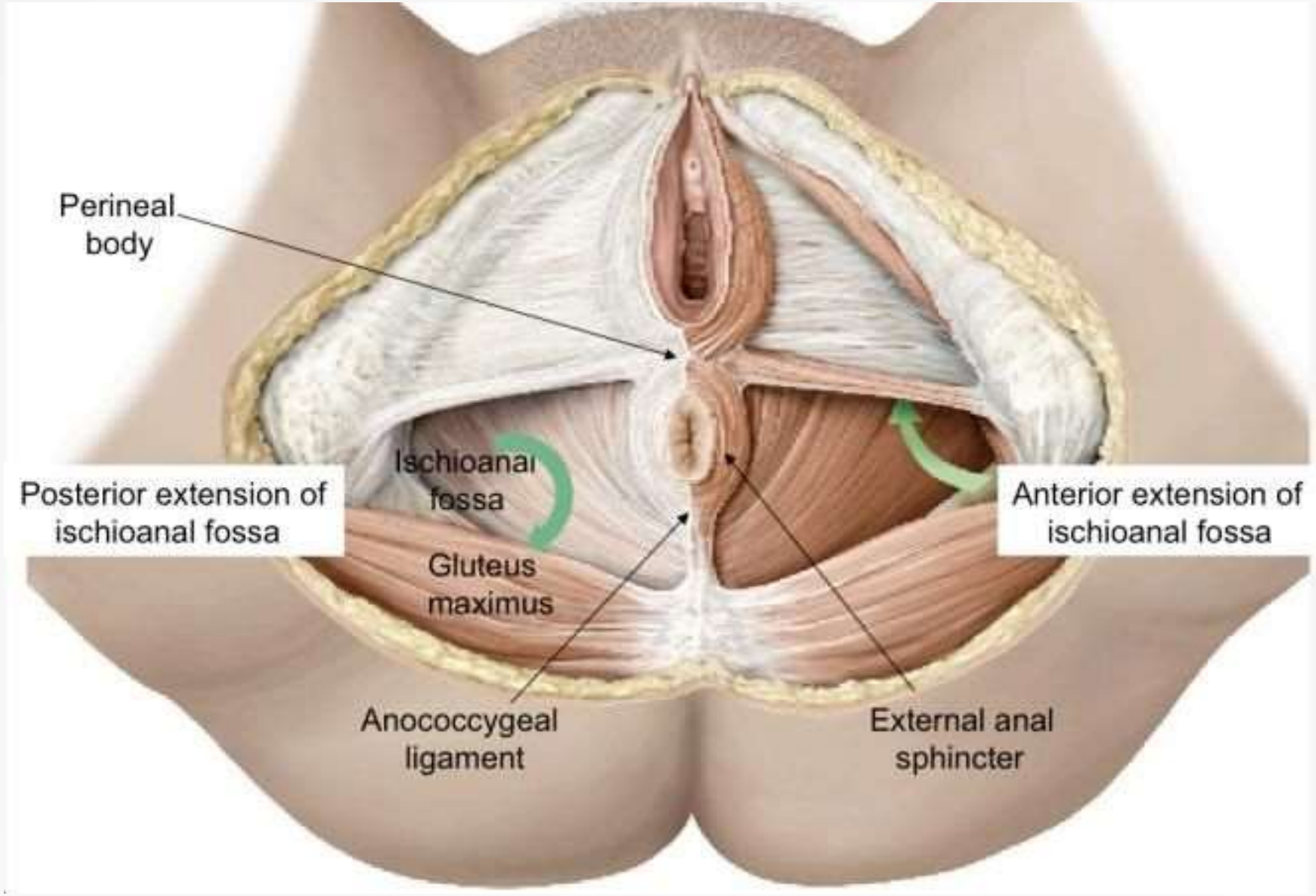
Anal Triangle

posterior half of the perineum. It is bounded by the coccyx, sacrotuberous ligaments, and a theoretical line between the ischial tuberosities.

The main contents of the anal triangle are:

- **Anal aperture**
- **External anal sphincter muscle**
- **Ischioanal fossae** – spaces located laterally to the anus.

- The anal aperture is located centrally in the triangle with the **ischioanal fossae** either side. These fossae contain fat and connective tissue, which allow for expansion of the anal canal during defecation. They extend from the skin of the anal region (inferiorly) to the pelvic diaphragm (superiorly).
- Another important anatomical structure within the anal triangle is the **pudendal nerve**, which supplies the whole perineum with somatic fibers.

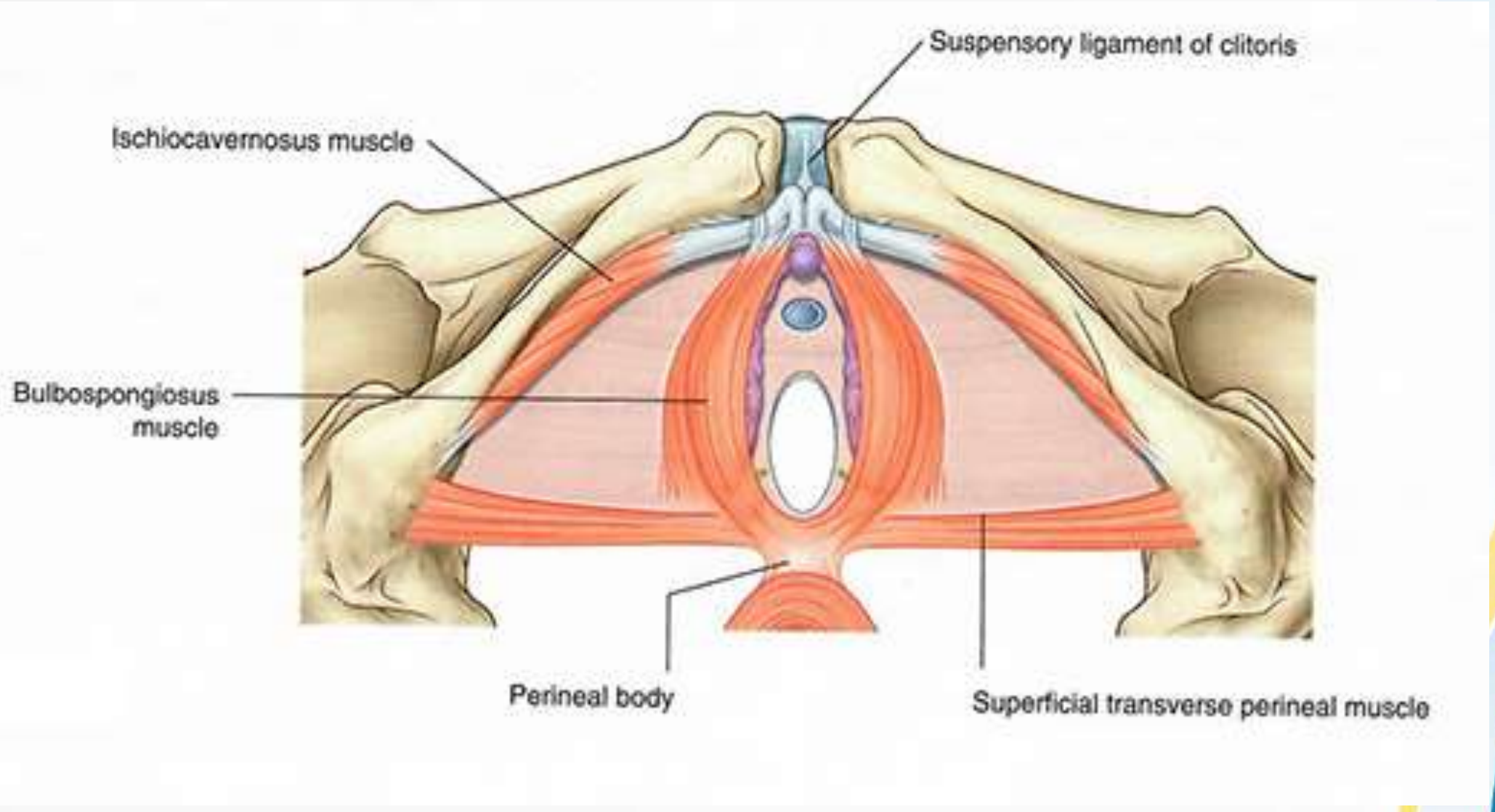

Perineal body
Posterior extension of ischioanal fossa
Ischioanal fossa
Gluteus maximus
Anococcygeal ligament
External anal sphincter
Anterior extension of ischioanal fossa

Urogenital Triangle

- anterior half of the perineum. It is bounded by the pubic symphysis, ischiopubic rami, and a theorectical line between the two ischial tuberosities.
- The triangle is associated with the structures of the urogenital system – the external genitalia and urethra.

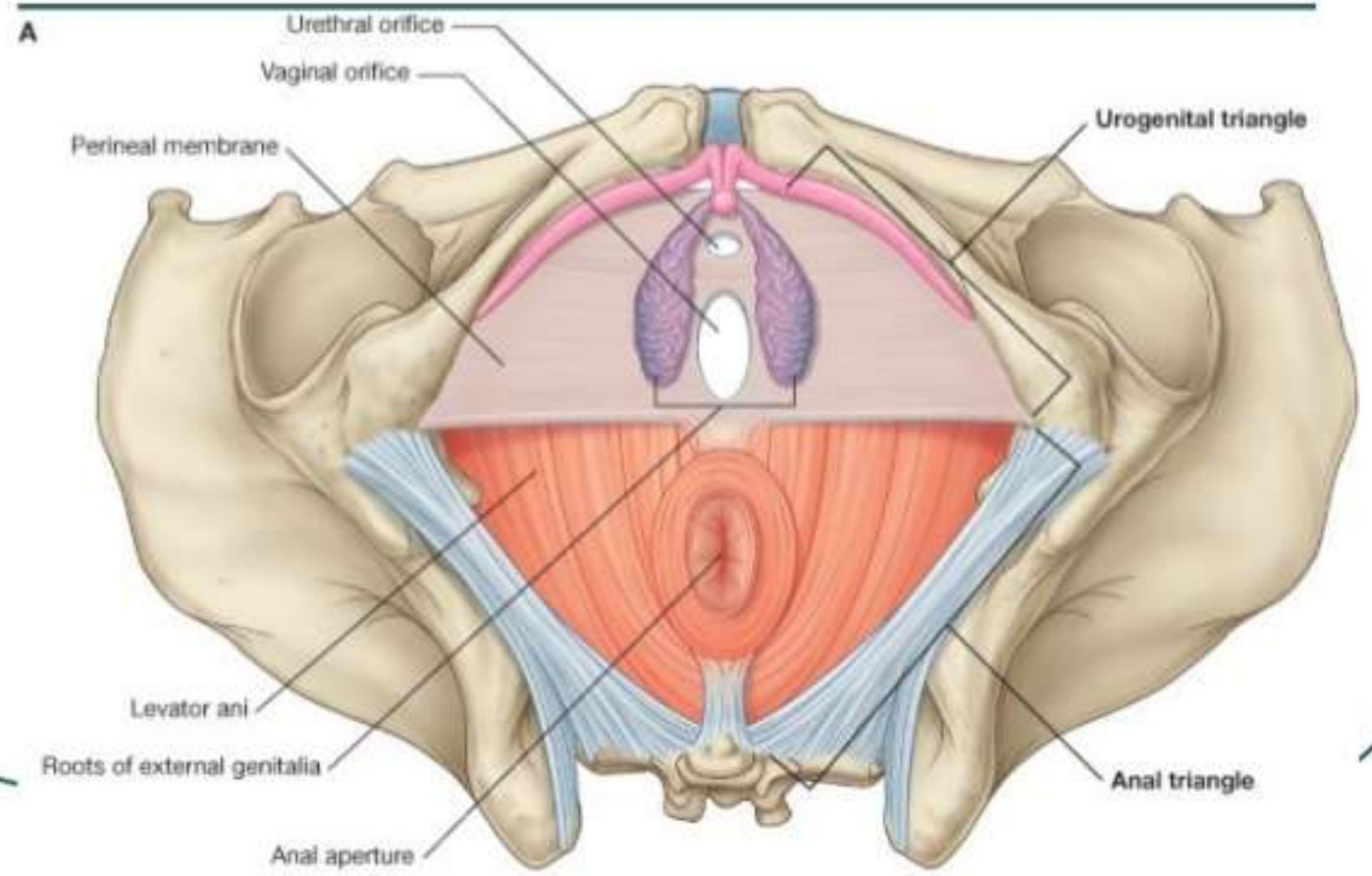
- The layers of the urogenital triangle (deep to superficial):
- **Deep perineal pouch** – a potential space between the deep fascia of the pelvic floor (superiorly) and the perineal membrane (inferiorly). It contains part of the urethra, external urethral sphincter, and the vagina in the female. In males, it also contains the bulbourethral glands and the deep transverse perineal muscles.
- **Superficial perineal pouch** – a potential space between the perineal membrane (superiorly) and the superficial perineal fascia (inferiorly).

- It contains the erectile tissues that form the penis and clitoris, and three muscles – the ischiocavernosus, bulbospongiosus and superficial transverse perineal muscles. The greater vestibular glands (Bartholin’s glands) are also located in the superficial perineal pouch. The pouch is bounded posteriorly to the perineal body.


Suspensory ligament of clitoris
Ischiocavernosus muscle
Bulbospongiosus muscle
Perineal body
Superficial transverse perineal muscle

- **Perineal membrane** – a layer of tough fascia, which is perforated by the urethra (and the vagina in the female). The role of the membrane is to provide attachment for the muscles of the external genitalia.

Perineum-Female



Perineal fascia – a continuity of the abdominal fascia that has two components:

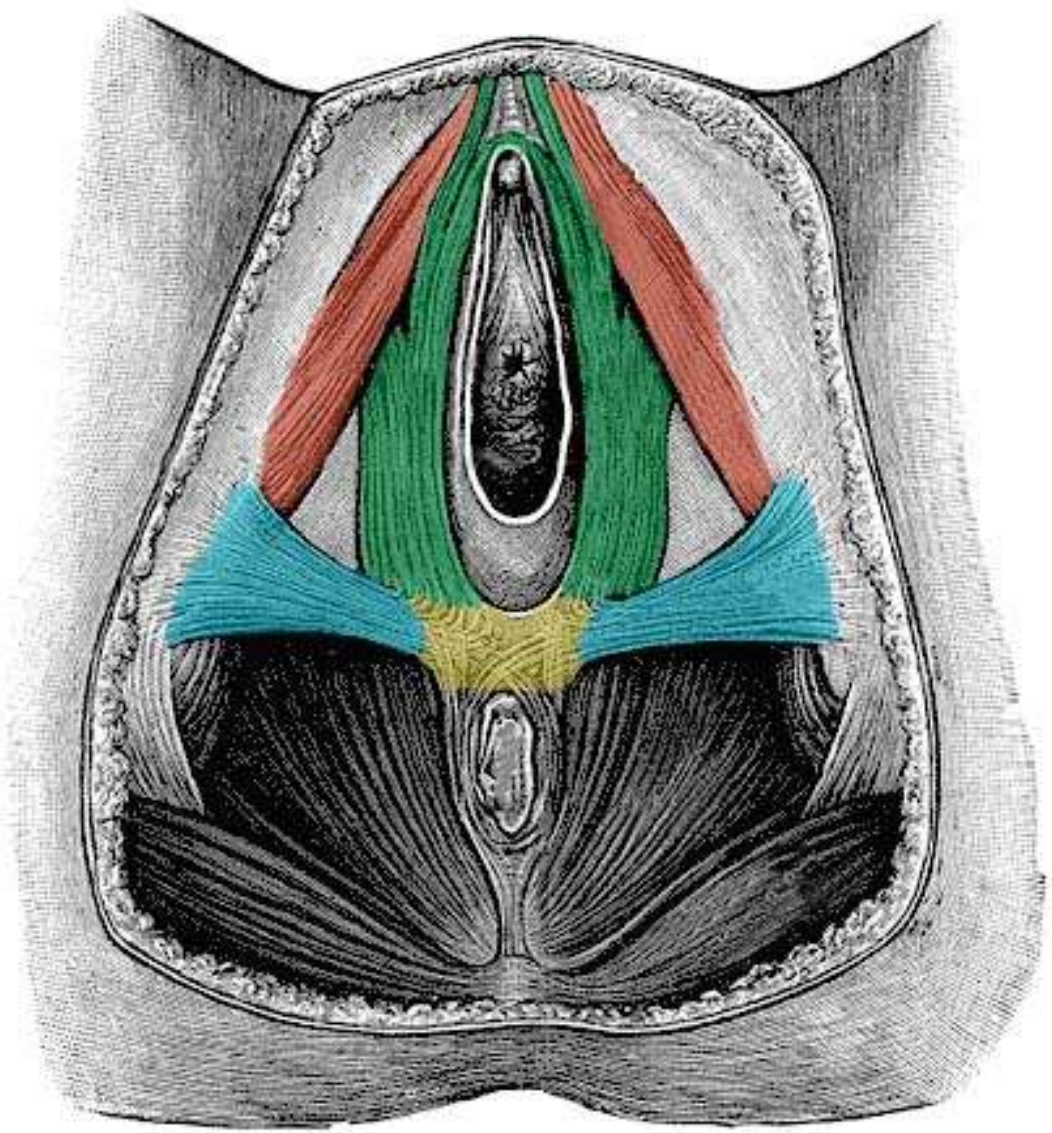
- Deep fascia: covers the superficial perineal muscles and protruding structures (e.g. penis & clitoris).
- Superficial fascia is composed of a further two layers of fascia:
  - Superficial layer – continuous with Camper's fascia of the anterior abdominal wall
  - Deep layer (Colles' fascia) – continuous with Scarpa's fascia of the anterior abdominal wall

Perineal Body

- an irregular fibromuscular mass. It is located at the junction of the urogenital and anal triangles – the central point of the perineum. This structure contains skeletal muscle, smooth muscle and collagen and elastic fibres.
- Anatomically, the perineal body lies just deep to the skin. It acts as a point of **attachment** for muscle fibres from the pelvic floor and the perineum itself:

- Levator ani (part of the pelvic floor).
- Bulbospongiosus muscle.
- Superficial and deep transverse perineal muscles.
- External anal sphincter muscle.
- External urethral sphincter muscle fibres.

In women, it acts as a **tear resistant** body between the vagina and the external anal sphincter, supporting the posterior part of the vaginal wall against prolapse. In the male, it lies between the bulb of penis and the anus.



- Perineal body
- Ischiocavernosus
- Bulbocavernosus
- Transverse perineal

- **Neurovascular Supply**
- The major neurovascular supply to the perineum is from the **pudendal nerve** (S2 to S4) and the **internal pudendal** artery.

- This structure prevents reflux of large bowel contents into the ileum during peristalsis and is thought to function passively, as opposed to be a defined muscular sphincter.
- The other examples are the prostate, pons and pituitary.

- It is formed by condensation of the pelvic fascia behind the rectum. It encloses the superior rectal vessels and lymphatics.

Formative Assesment (10 marks question)

1. Describe the gross anatomy, blood supply, lymphatic drainage, and applied anatomy of the **Colon and appendix**.
2. Write the anatomical features, relations, blood supply, nerve supply, and applied anatomy of the **rectum**.
3. Describe the differences between the small intestine and large intestine (gross features and histology).
4. Write a detailed note on the **anal canal** – its anatomical parts, relations, nerve supply, blood supply, and applied aspects (piles, fissure, fistula).

THANKS