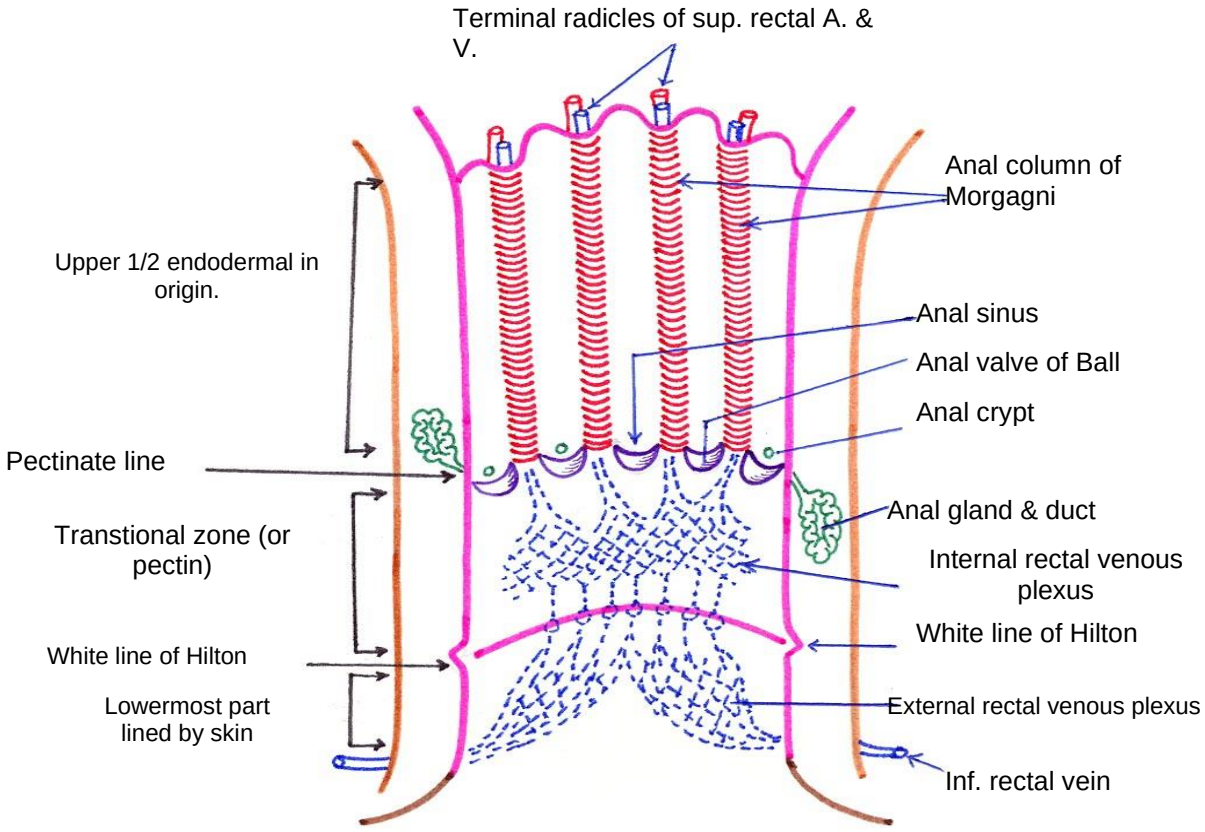
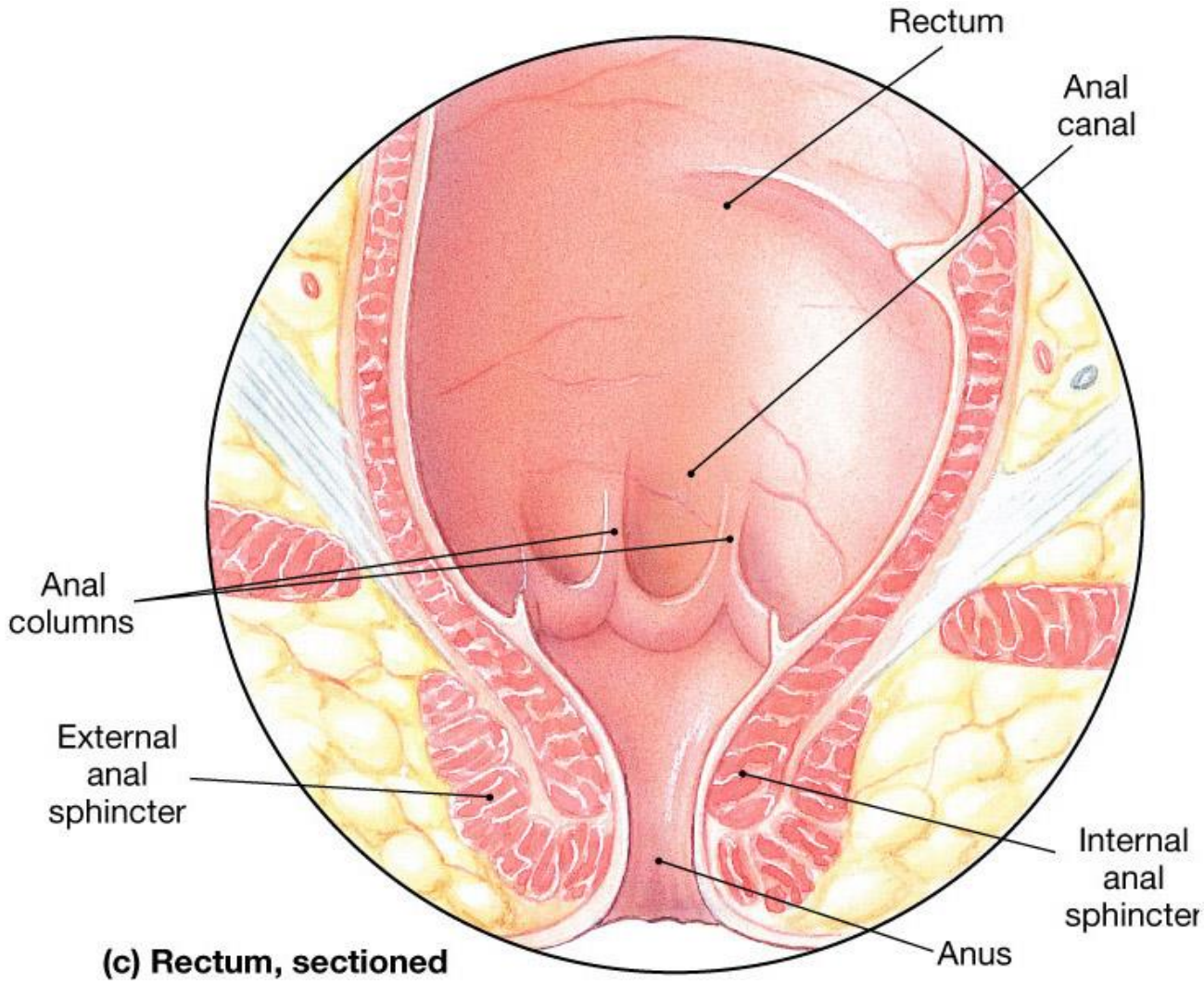
ANAL CANAL

* **It begins** at the anorectal ring one inch below & in front of the tip of coccyx, passes backwards & downwards into the perineum where it opens on the exterior at the anus.
* It is 1.5 inches long (4 cm).
* **Cavity**: pectinate (dentate) line divides the anal canal into 2 halves. Attached to pectinate line are anal valves (crescentic mucosal folds), above each valve are anal sinuses. At anal sinuses, anal glands open into depressions called anal crypts .Sometimes small epithelial projections (anal papillae) are present on the edge of the valves.

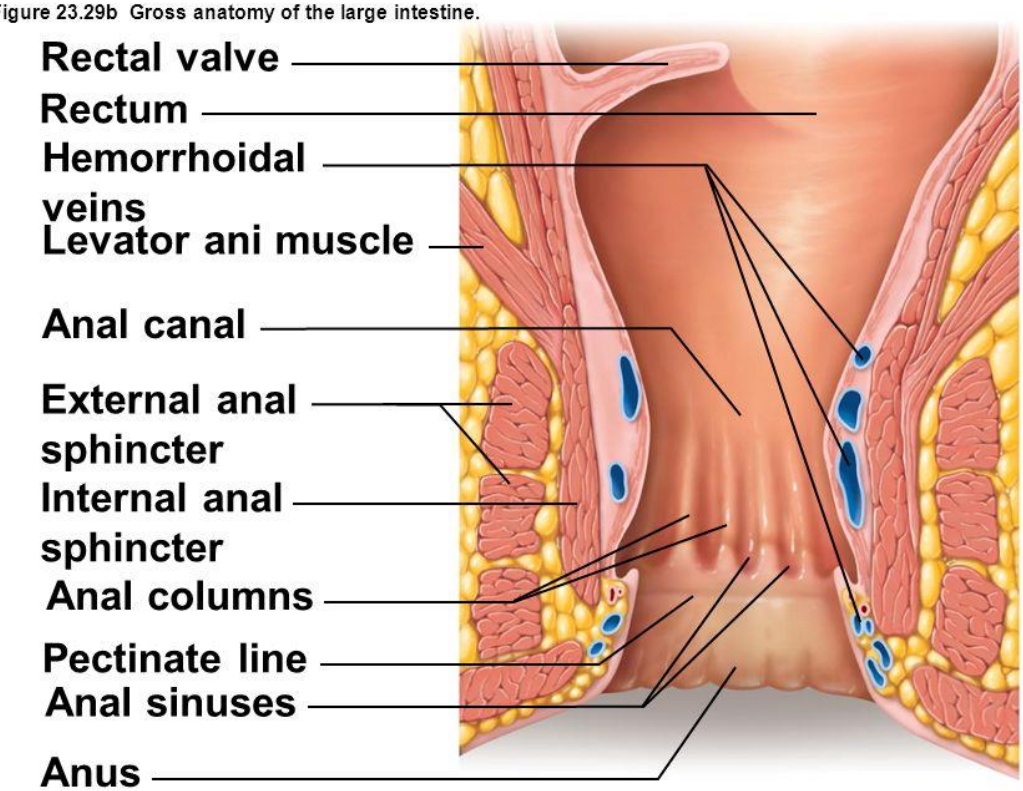


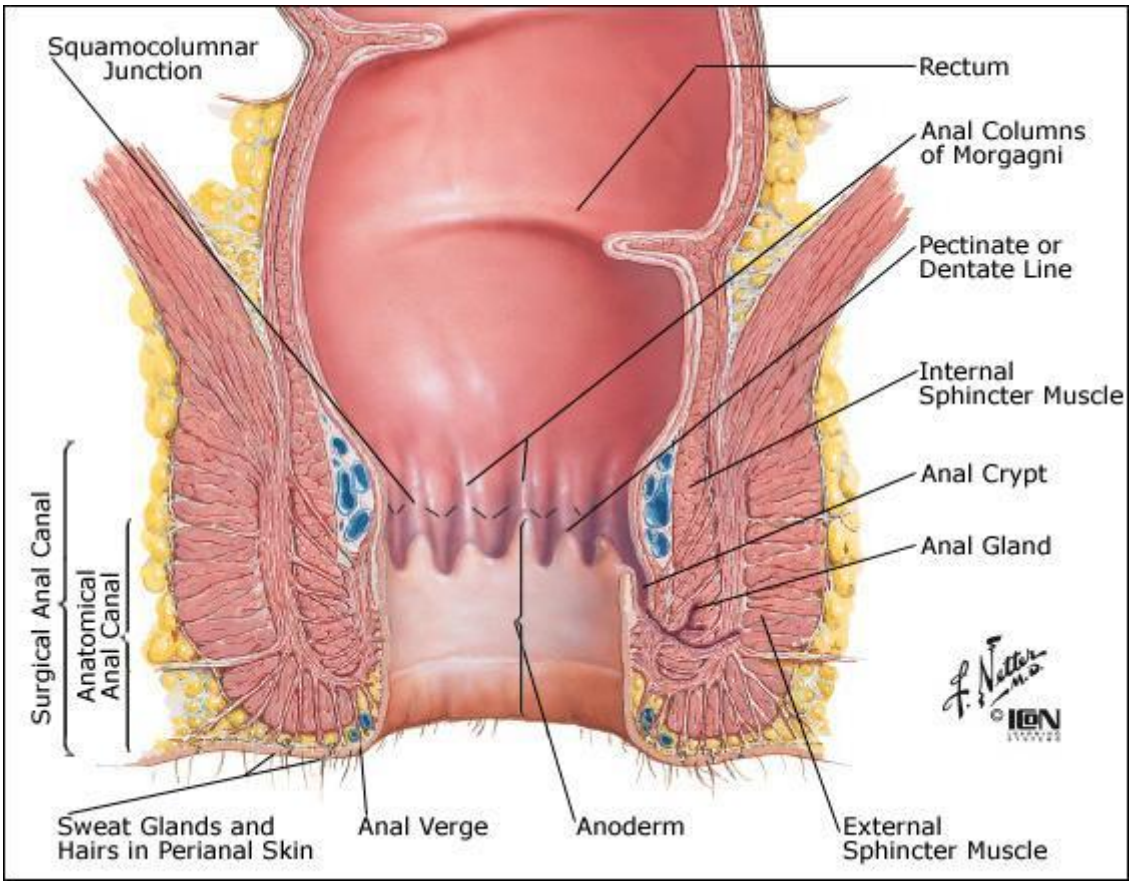
Longitudinal section in the Anal canal showing its mucous membrane (M.M.)



(c) Rectum, sectioned

Figure 23.29b Gross anatomy of the large intestine.





	Upper half	Lower half
1- Site	• Above the pectinate line	• below the pectinate line.
2- Origin	• Enodermal (from distal part of hind gut i.e.cloaca)	• Ectodermal (from proctoderm).
3- Lining	• Simple columnar epithelium with columns of Morgagni (each of which lodges a branch of sup. rectal artery & vein)	• Between pectinate line & Hiltons line, is a transittional zone lined by stratified epithelium. (Inter-mediate thickness & devoid of sweat glands) • Below Hilton's white line ,it's lined by true skin which contains sweat & sebaceous glands. • No columns of Morgagni.
4- Nerve supply	• Autonomic nerve supply, Insensitive to pain.	• Somatic nerve supply (inf. gluteal nerve), sensitive to pain.
5- Arterial supply	• superior rectal artery	• Inferior rectal artery.
6- Venous drainge	• Tributeres of superior rectal vein form the internal haemorrhoidal venous plexus in the s.m (portal)	• Tributeres of inferior rectal vein form the external haemorrhoidal venous plexus(systemic).
7- Lymphatic drainge	• Internal iliac lymph nodes.	• superficial inguinal lymph nodes.

* **Relations:**

a. Anterior :

1. Males: perineal body & bulb of penis.
2. In females: perineal body & vagina.

b) Posterior : Ano-coccygeal body separating it from tip of coocyx.

c) Lateral : Ischio-rectal fossa (Contains ischiorectal fat).

Sagittal section in Male Pelvis:

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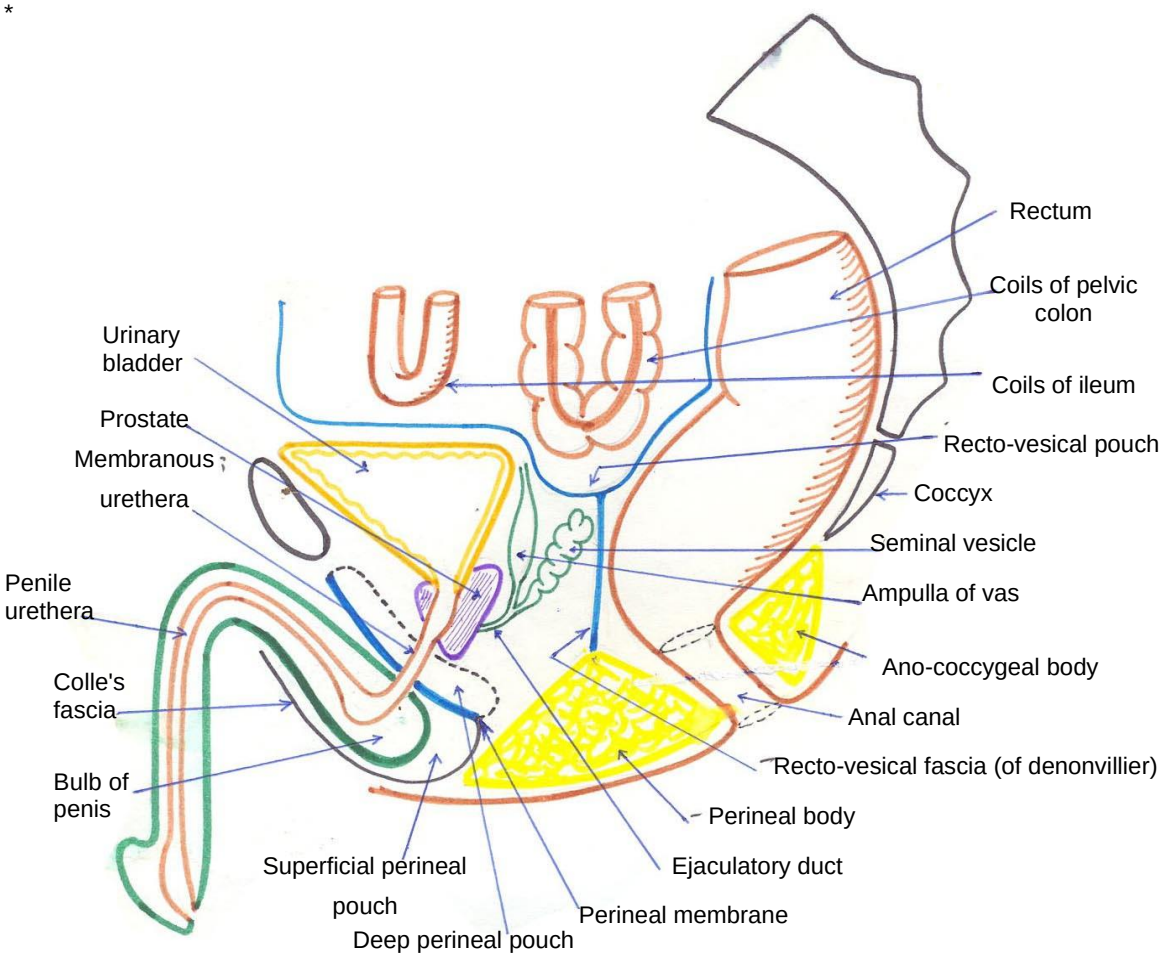
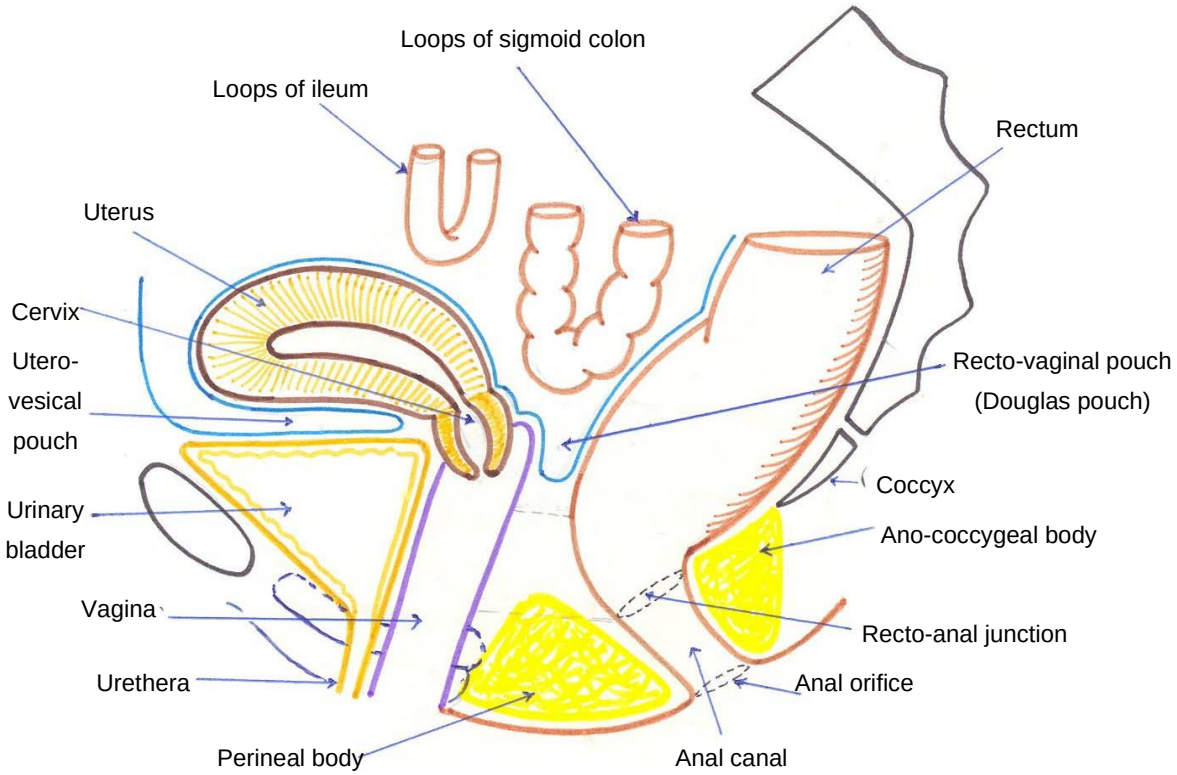




*Anal sphincters :

1. ***Internal anal sphincter:*** It is the continuation of circular muscle layer of the gut. It has autonomic nerve supply → involuntary. It shows reflex spasm in any painful anal conditions e.g. anal fissure.
   - Its division (sphincterotomy) relieves spasm, pain & improve drainage with no bad effects.
2. ***External anal sphincter:*** It lies outside internal anal sphincter. It consists of 3 parts: deep, superficial & subcutaneous. Its deep part fuses with the puborectalis (part of levator ani). It has somatic n. supply (inferior rectal nerve) → voluntary & responsible for continence (anal control). Complete division of its deep part produce incontinence but subcutaneous & superficial parts can be divided (but never the deep part). The plane between the internal & external anal sphincers is called inter-sphincteric plane.
3. ***Ano-rectal ring:*** is a muscular ring at the junction between the rectum & anal canal formed by fusion of 4 structures, internal anal sphincter, longitudinal muscle layer., deep part of extenal sphincter & Pubo-rectalis part of levator ani . It marks junction of rectum & anal canal. Its complete division produces incontinence.

- On P-R exam., it is felt as a ridge more marked posteriorly & laterally.

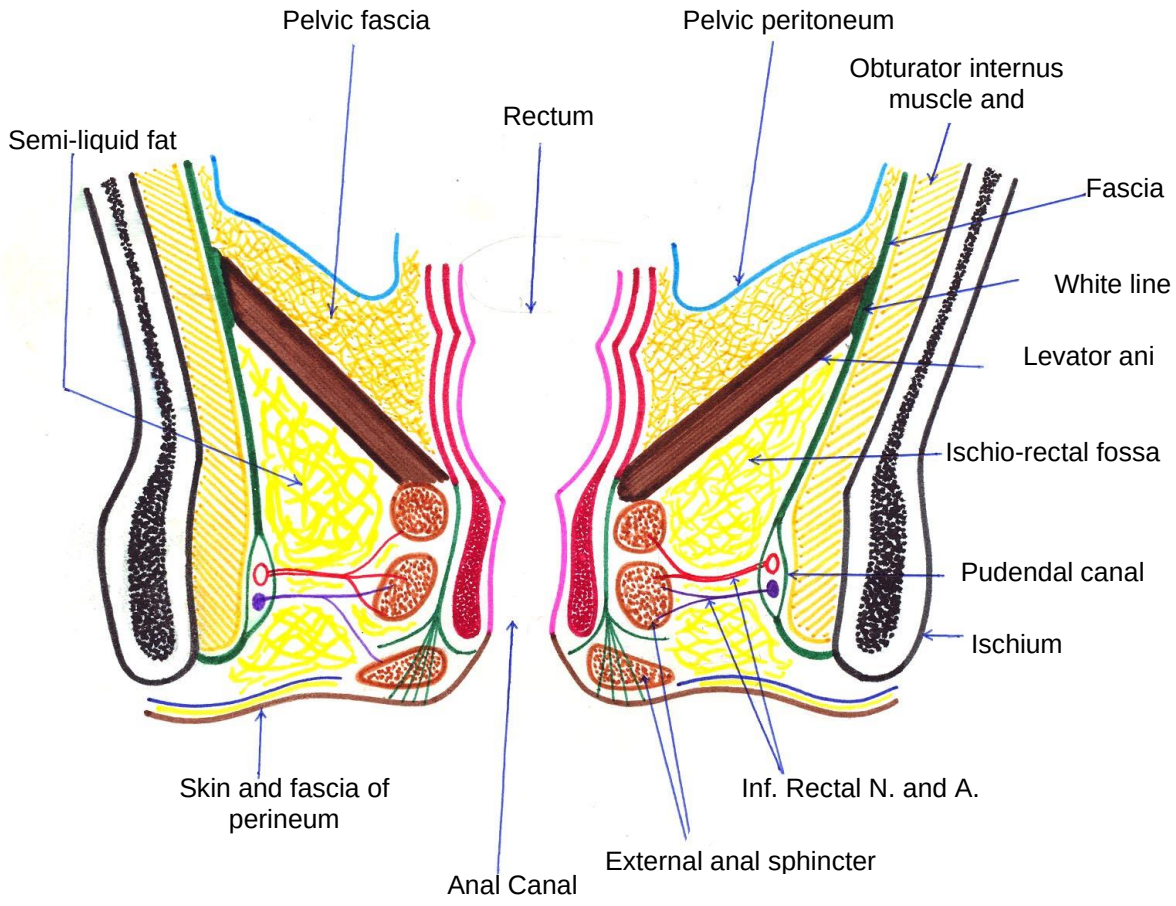
* **Anorectal spaces:**

1. ***Perianal space: surrounds lower 1/3 of anal canal.***
   - ***Boundaries:***
     a. **Superficially**: skin.
     b. **Deeply**: fascia prolonged laterally from longitudinal muscle layer of the gut.
     c. **Medially**: lower 1/3 of anal canal surrounded by s.c. part of external anal sphincter.
     d. **Laterally**: it is continuous with superficial fascia of buttocks.
2. ***Ischio-rectal spaces: surrounds upper 2/3 of anal canal.***
   - ***Boundaries:***
     a. **Superficially**: It is separated from perianal space by fascial prolonged laterally from longitudinal muscle layer of the gut.
     b. **Deeply**: levator ani.

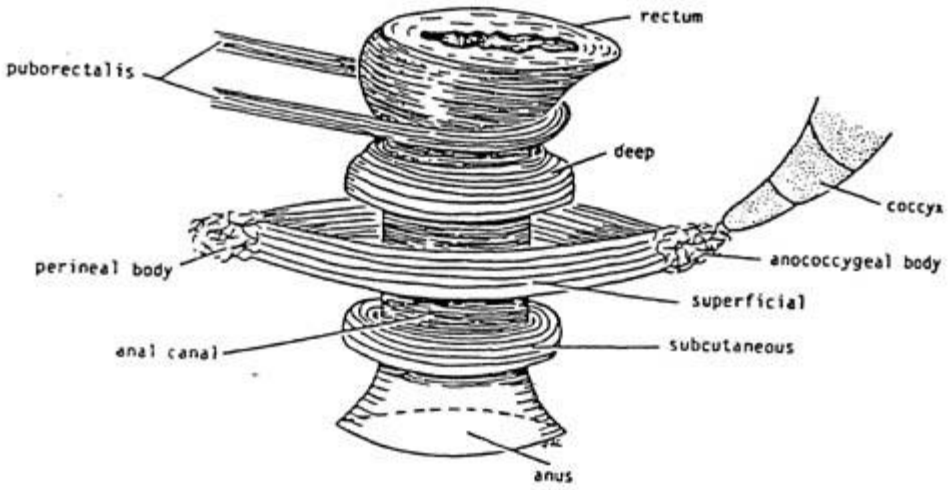
c. **Medial**: upper 2/3 of anal canal with superficial & deep parts of external anal sphincter around it.
d. **Laterally**: Ischium covered with obturator internus muscle & its fascia.

- **N.B.:** Perianal space + ischiorectal space are called ischiorectal fossa.

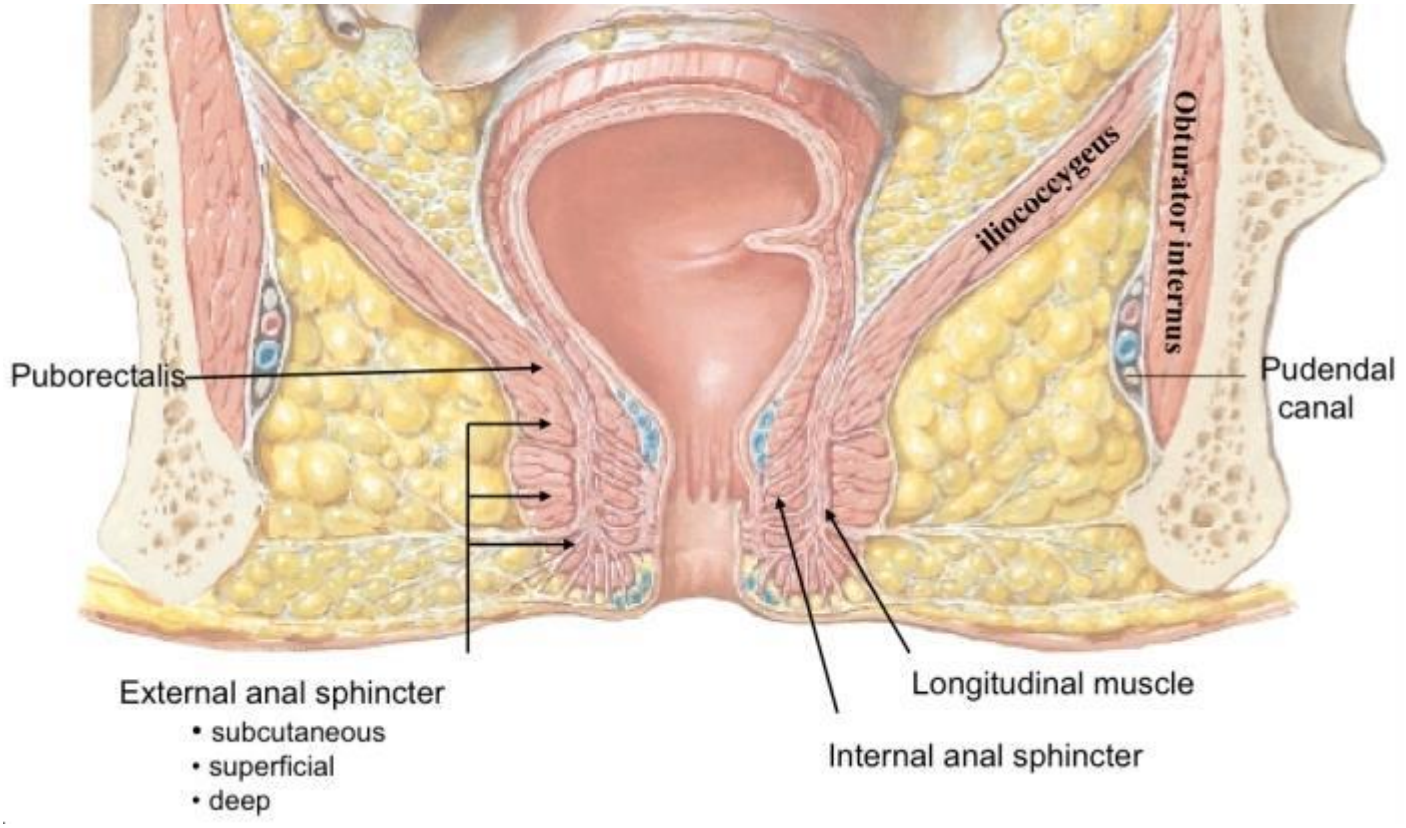
3. ***Submucous space:*** lies between mucosa & internal anal sphincter (actually it is submucosa of anal canal). It is continuous above with submucosa of rectum**.**
4. ***Pelvi-rectal space:*** Surrounds lower part of rectum above pelvic floor.
   - **Boundaries:**
     a) **Medially**: lower part of rectum.
     b) **Laterally & below**: levator ani.
     c) **Above**: pelvic peritoneum.



Coronal Section of the Perineum Ischio-Rectal Fossa



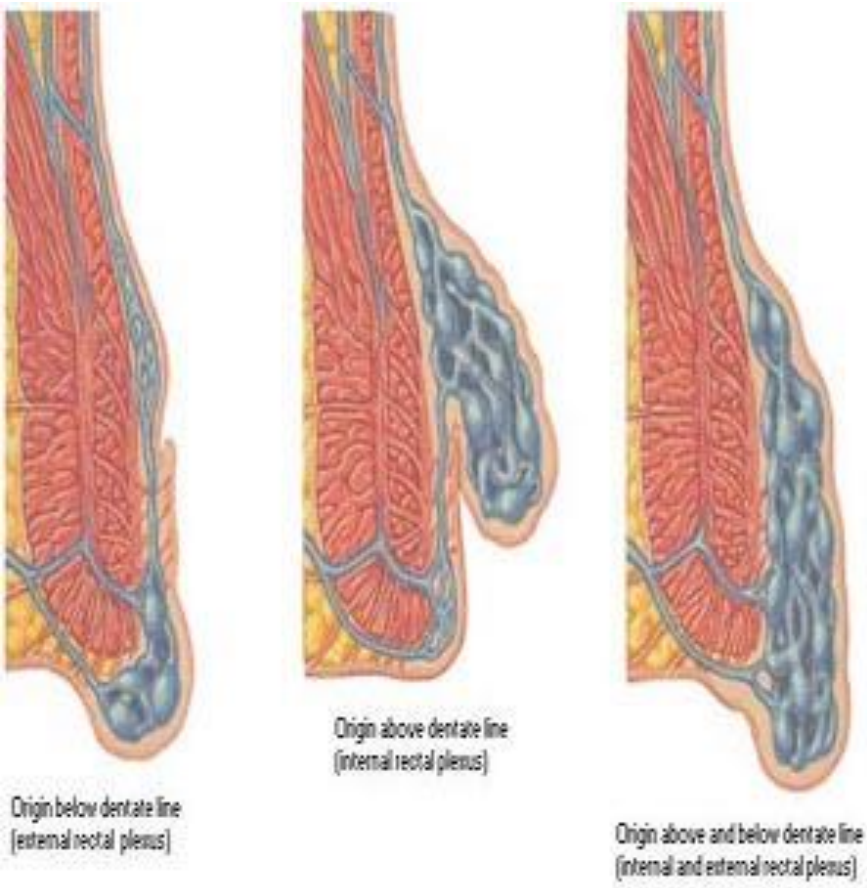
***External anal sphincter ***

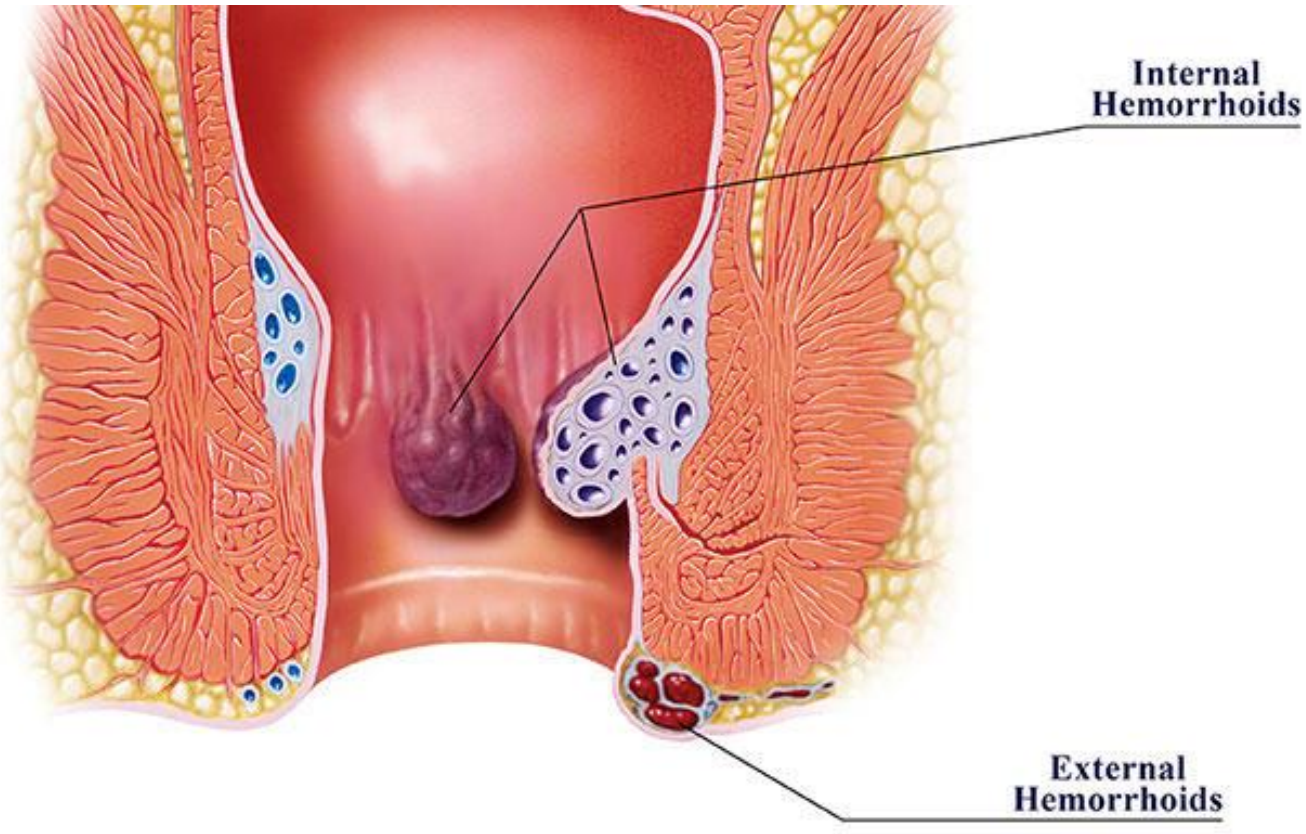


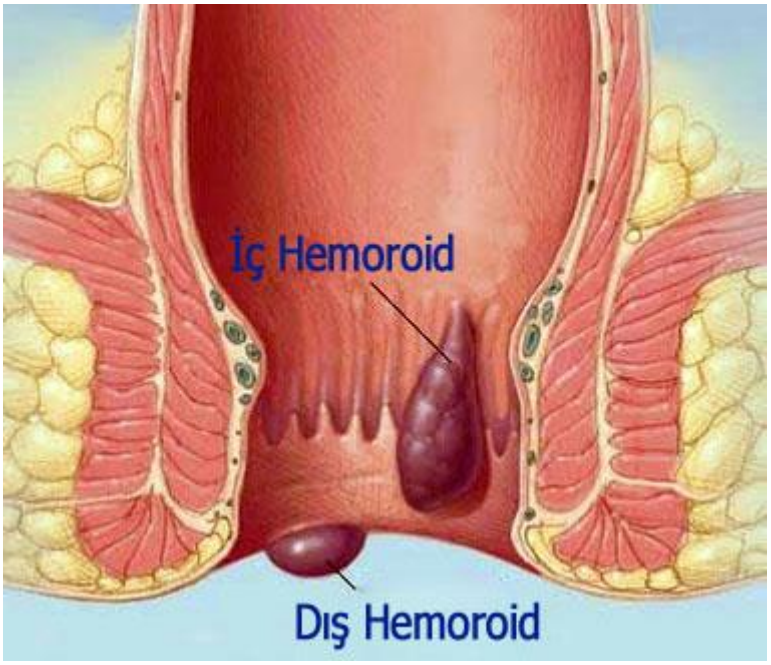
Coronal Section of the Perineum Ischio-Rectal Fossa

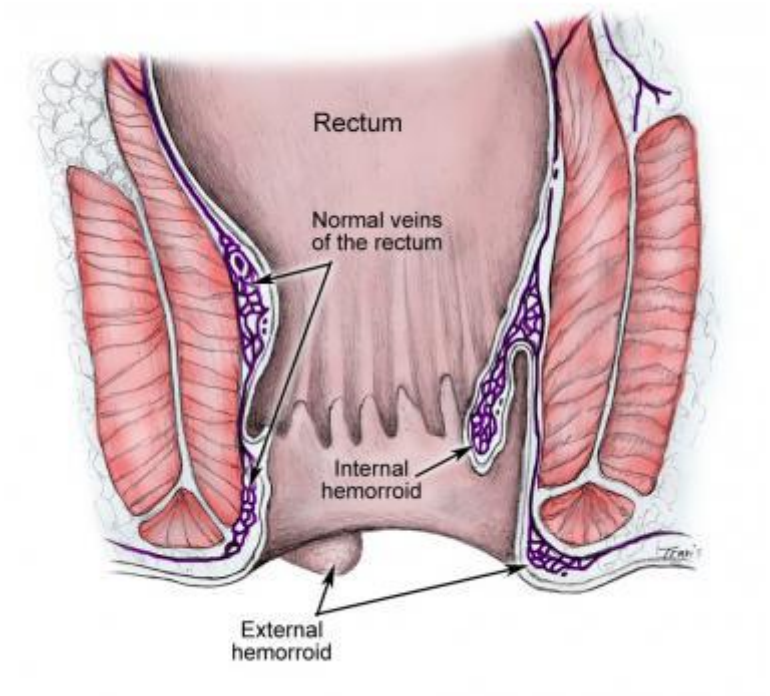
★ Applied anatomy:

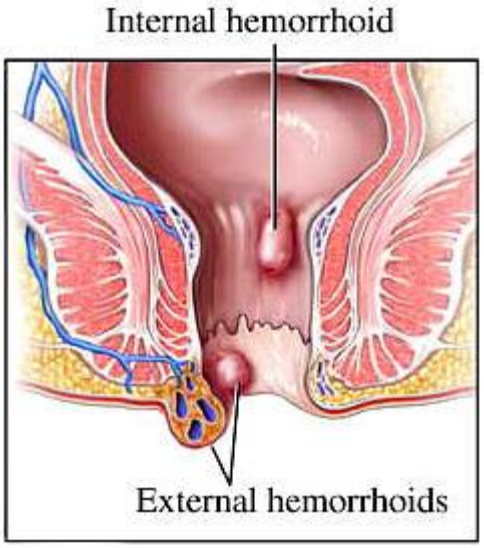
1. Varicosities of internal haemorrhoidal venous plexus (tributaries of sup. rectal vein), in the lower part of the rectum and upper 1/2 of anal canal above the dentate line → **internal piles** which are covered by columnar epithelium.
2. **Anatomical factors predisposing to primary internal piles**:
   - The veins of internal haemorrhoidal venous plexus are arranged vertically unsupported in the loose submucosa at the lowest part of valveless portal circulation.
   - The passage of the veins through the muscular wall of the rectum → repeated contractions in the **chronic constipation** compress the veins → congestion in the internal haemorrhoidal venous plexus.
3. There are 3 mother internal piles at 3, 7 & 11 o'clock, corresponding to the 3 main tributaries of superior rectal vein, and 5 daughter piles corresponding to the 5 minor tributaries of superior rectal vein.
4. Varicosities of external haemorrhoidal venous plexus (tributaries of inf. rectal vein), in the lower part of anal canal below the dentate line → **external piles** which are covered by modified and normal skin (stratified squameous epithelium).
5. **Thrombosis of internal piles** is dangerous as it may progress in the valveless portal circulation → portal vein thrombosis and portal pyemia → portal hypertension and jaundice.
6. Anastomosis between tributaries of superior rectal vein (portal) and tributaries of middle and inferior rectal veins (systemic), in the lower part of the rectum and upper part of anal canal, is an important site for **porto-systemic anastomosis** which may dilate in portal hypertension → secondary piles.

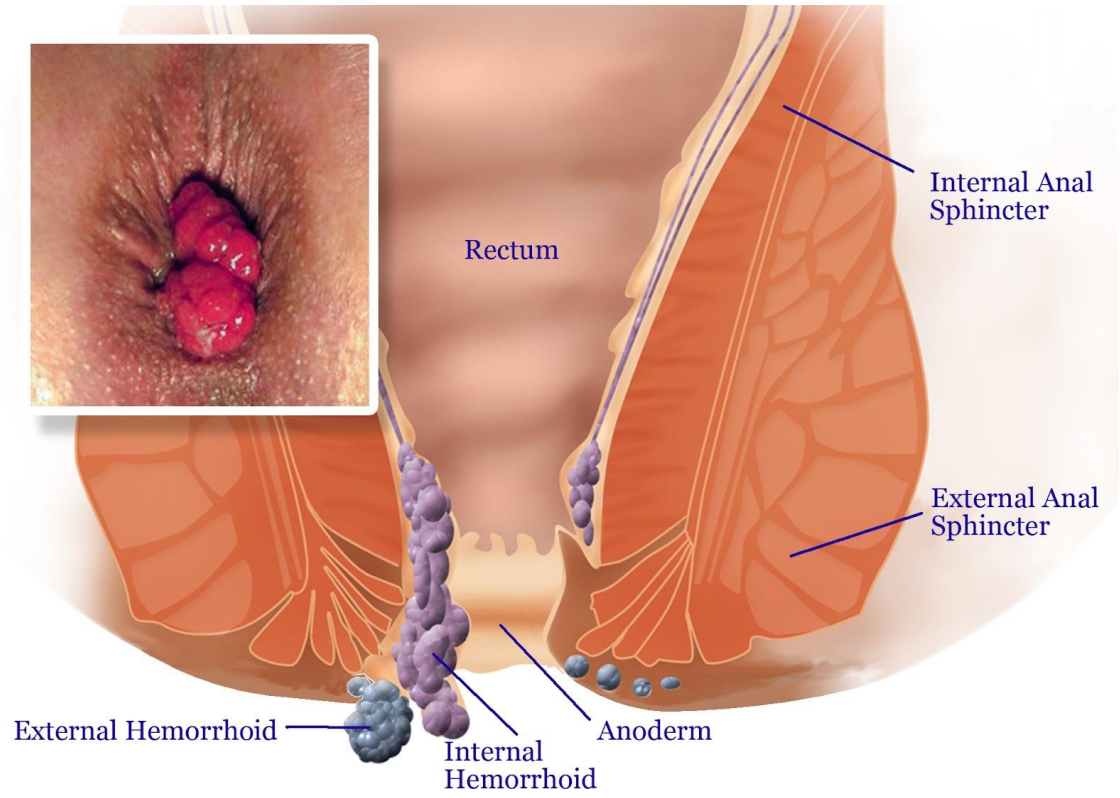

Origin below dentate line
(external rectal plexus)
Origin above dentate line
(internal rectal plexus)
Origin above and below dentate line
(internal and external rectal plexus)


Internal
Hemorrhoids
External
Hemorrhoids


İç Hemoroid
Dış Hemoroid

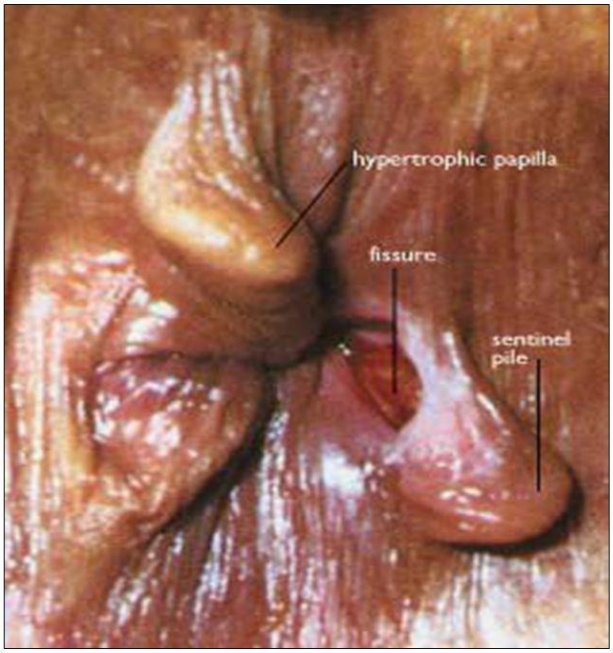

Rectum
Normal veins of the rectum
Internal hemorroid
External hemorroid


Internal hemorrhoid
External hemorrhoids



7. Over stretch of the anal canal (usually in chronic constipation or complete perineal tear during child birth), produce a longitudinal tear in the m.m of anal canal below dentate line, known as **anal fissure**.
8. **90% of anal fissures occurs in the midline posteriorly** because:
    - Anal canal meets the rectum at **an angle** → posterior wall of anal canal receives trauma by hard stool.
    - **Mucosa** of posterior wall of anal canal is less supported and is liable to over stretch.

- Chronic fissure:
    - Lasting more than 8 to 12 weeks
    - Edema and fibrosis.
    - Sentinel pile (Skin tag) at distal fissure margin
    - Hypertrophied anal papilla in proximal to fissure.



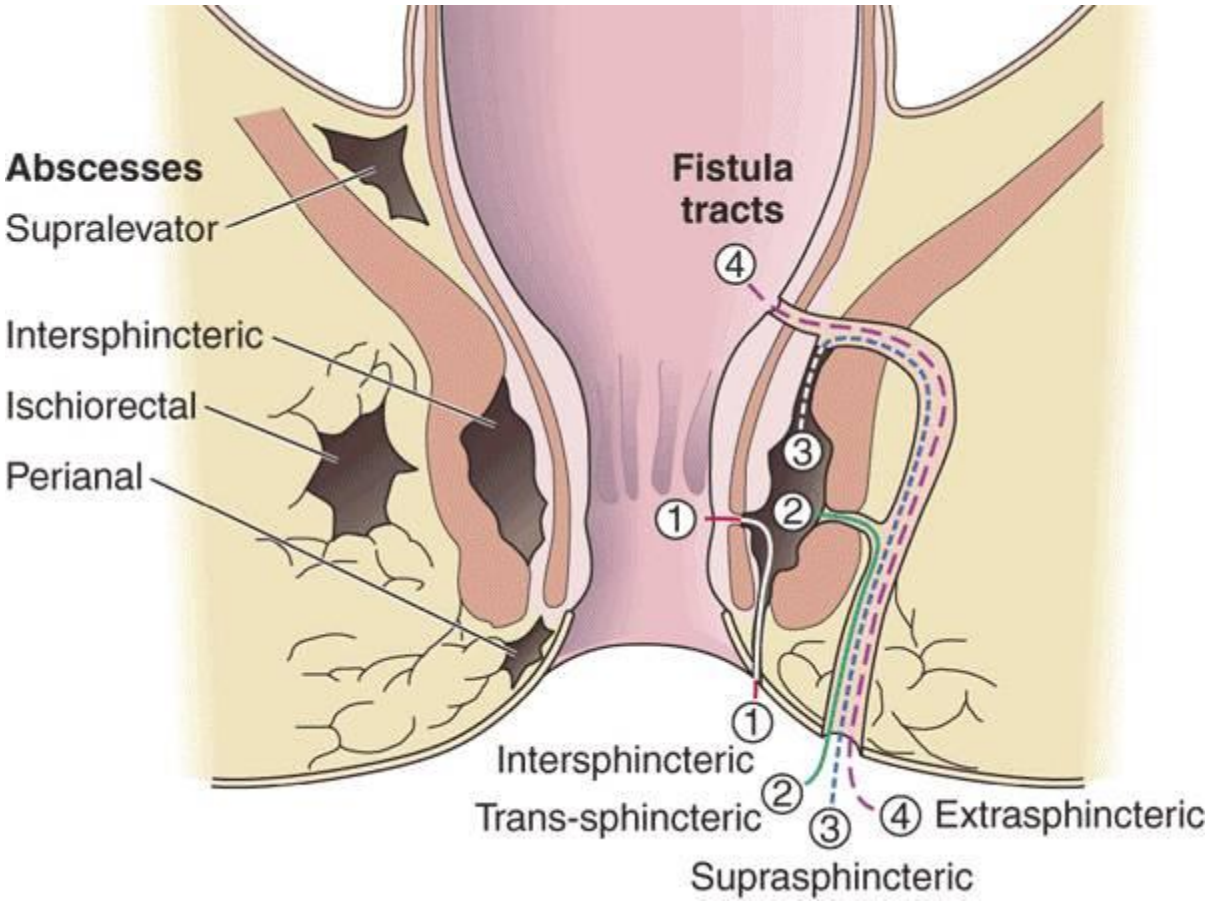
9. Infection in ano-rectal spaces → **ano-rectal suppuration** which is usually due to infected anal glands or infected fissure.

10. **Ano-rectal suppuration may be**:

- Perinal abscess (60%).
- Ischeo-rectal abscess (30%).
- Submucous abscess (5%).
- Pelvi-rectal abscess (5%).

11. Spread of infection and rupture of ano-rectal abscess → **anal fistula**.

12. **Anal fistula** is a chronic tract usually connecting the anal canal (rarely rectum) with the perianal skin.



13. The anal canal **above the dentate** is supplied by autonomic nerves → an incision or needle insertion in this region (as injection treatment of piles) is ***painless*** and needs no anaesthesia .

14. The anal canal **below the dentate line** is supplied by somatic nerves (inferior rectal nerve) → this area is ***very sensetive for pain*** and any lesion (as anal fissure) or operation (eg. Haemorrhoidectomy) → sever pain→ reflex spasm of internal anal sphincter → constipation.
15. **During anal operations**, the internal canal sphincter as well as, subcutaneous part and superficial part of external anal sphincter can be ***divided safely*** without affection of fecal continence but division of deep part of external anal sphincter or ano-rectal ring → fecal incontinence .