

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Anal Canal

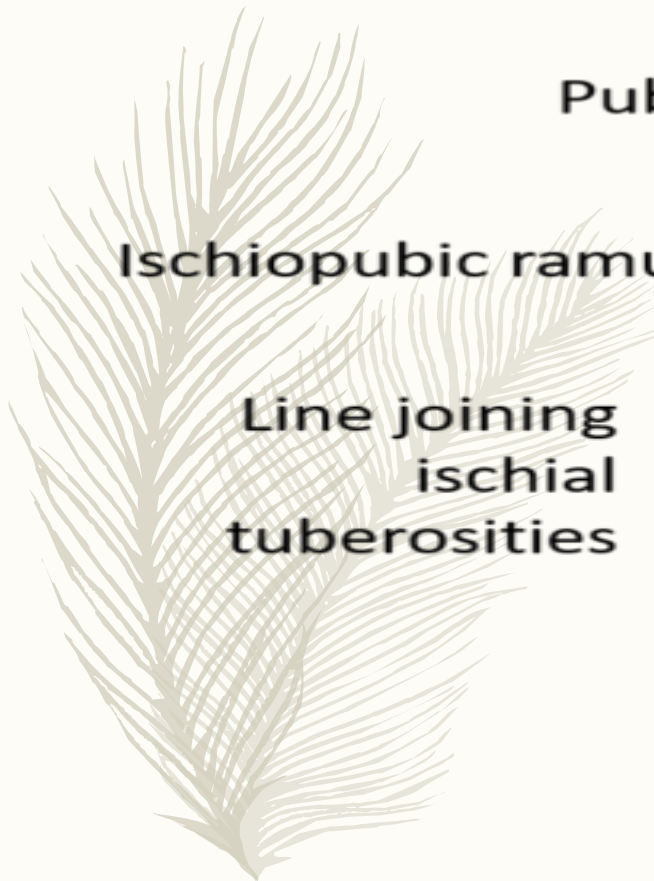
Dr. Mahvish Javed

- The **anal canal** is the terminal part of the [large intestine](#). It is situated between the [rectum](#) and [anus](#), below the level of the [pelvic diaphragm](#). In humans it is approximately 2.5 to 4 cm (0.98-1.58 in) 38mm long. It lies in the [anal triangle](#) of [perineum](#) in between the right and left [ischioanal fossa](#).
- The anal canal is the short terminal portion of the rectum through which wastes from the large intestine are excreted from the body. The ring at the terminal portion of the anal canal is called the anus.

PERINEAL BODY



- How is the perineal body formed?
- The perineal body is formed by fusion of the levator ani, transverse perineii, and the external sphincter muscles. Together with the anococcygeal ligament, they act as anchors to give the funnel shape of the pelvic diaphragm

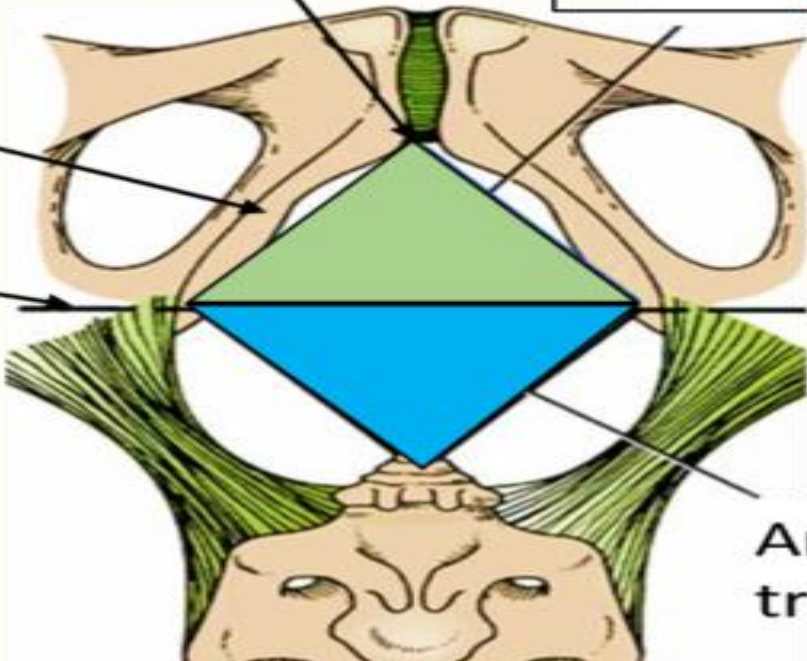


Pubic symphysis

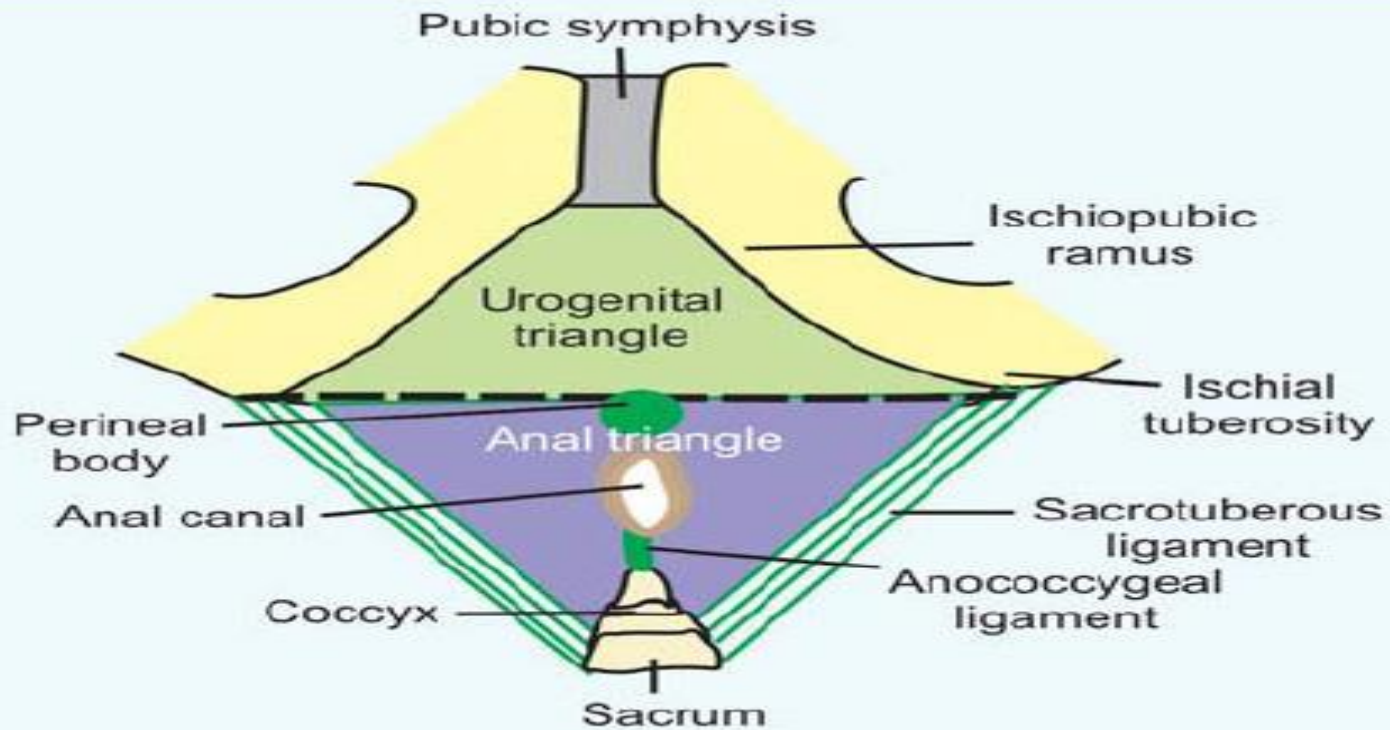
Urogenital Triangle


Ischiopubic ramus

Line joining ischial tuberosities



Anal triangle



- 
-
- In humans it is approximately 38mm long, extending from the anorectal junction to the [anus](#). It is directed downwards and backwards. It is surrounded by inner involuntary and outer voluntary sphincters which keep the [lumen](#) closed in the form of an anteroposterior slit.

- The external anal sphincter muscle is the voluntary muscle that surrounds and adheres to the anus at the lower margin of the anal canal. This muscle is in a state of tonic contraction, but during defecation, it relaxes to allow the release of feces.
- Movement of the feces is also controlled by the involuntarily controlled internal anal sphincter which is an extension of the circular muscle surrounding the anal canal. It relaxes to expel feces from the rectum and anal canal.

- Anal canal is divided into three parts.
- The zona columnaris is the upper half of the canal and is lined by simple columnar epithelium. The middle half of the anal canal is also called as pectin or transitional zone, extends below the pectinate line, separated by Hilton's white line from lower half. it is lined by stratified squamous non-keratinized. The lower half also called as cutaneous zone is lined by stratified squamous keratinized epithelium, respectively.

- Behind this lies the anal gland which secretes lymphal discharge and built up fecal matter from the colon lining.
- It is differentiated from the rectum by the transition of the internal surface from endodermal to skin like ectodermal tissue.

Relations

- The [ischioanal fossa](#) lies on each side of the anal canal.
- The [perianal space](#) surrounds the anal canal below the white line.
- The submucous space of the canal lies above the white line between the mucous membrane and [internal anal sphincter muscle](#).

RELATIONS

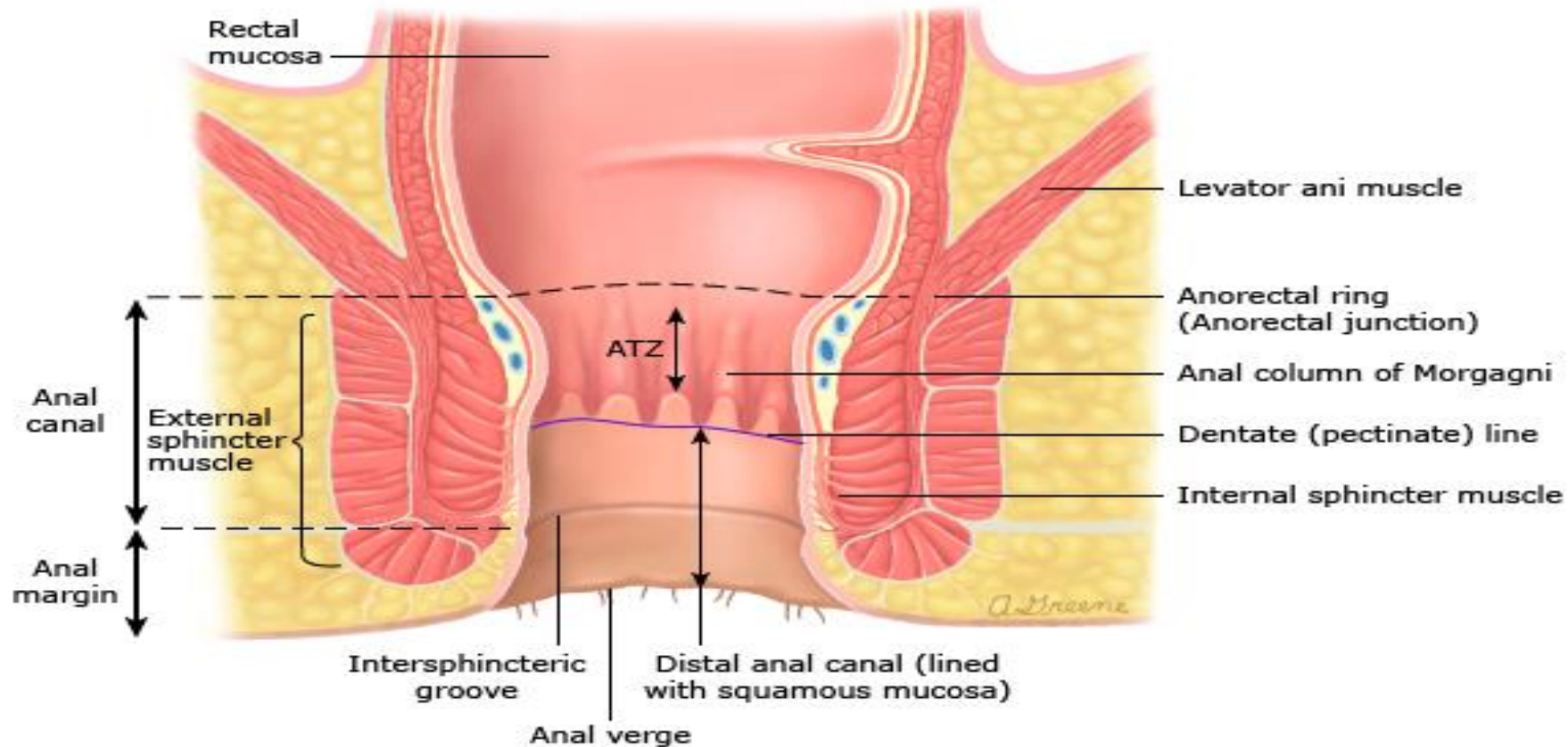
Relations

- ■■ **Posteriorly:** The **anococcygeal body**, which is a mass of fibrous tissue lying between the anal canal and the coccyx.
- ■■ **Laterally:** The fat-filled ischiorectal fossae.
- ■■ **Anteriorly:** In the male, the perineal body, the urogenital diaphragm, the membranous part of the urethra, and the bulb of the penis. In the female, the perineal body, the urogenital diaphragm, and the lower part of the vagina.

ANORECTAL RING



- At the junction of the rectum and anal canal, the internal sphincter, the deep part of the external sphincter, and the puborectalis muscles form a distinct ring, called the **anorectal ring**, which can be felt on rectal examination.



BLOOD SUPPLY & LYMPH DRAINAGE & NERVE SUPPLY

Blood Supply

Arteries

- The superior artery supplies the upper half and the inferior artery supplies the lower half.

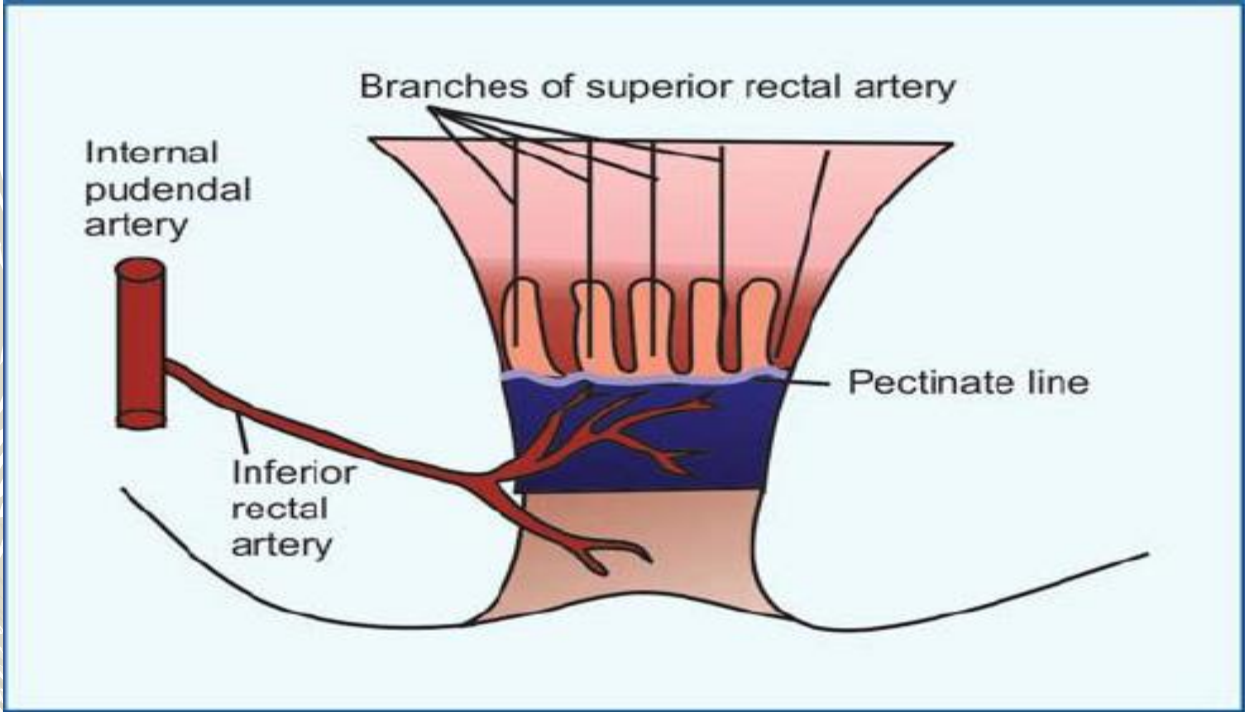
- **Veins** :- The upper half is drained by the superior rectal vein into the inferior mesenteric vein, and the lower half is drained by the inferior rectal vein into the internal pudendal vein.

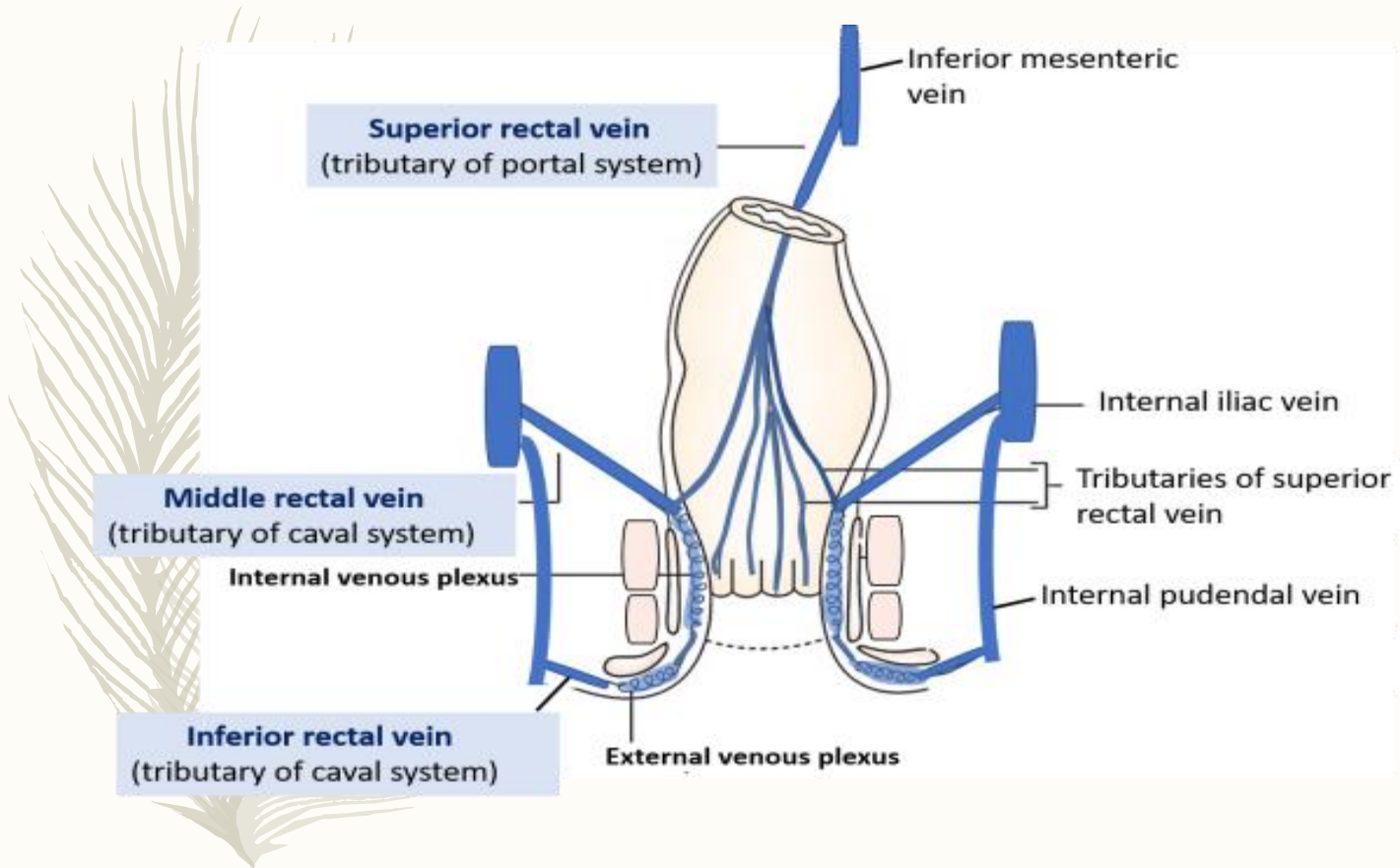
Lymph Drainage

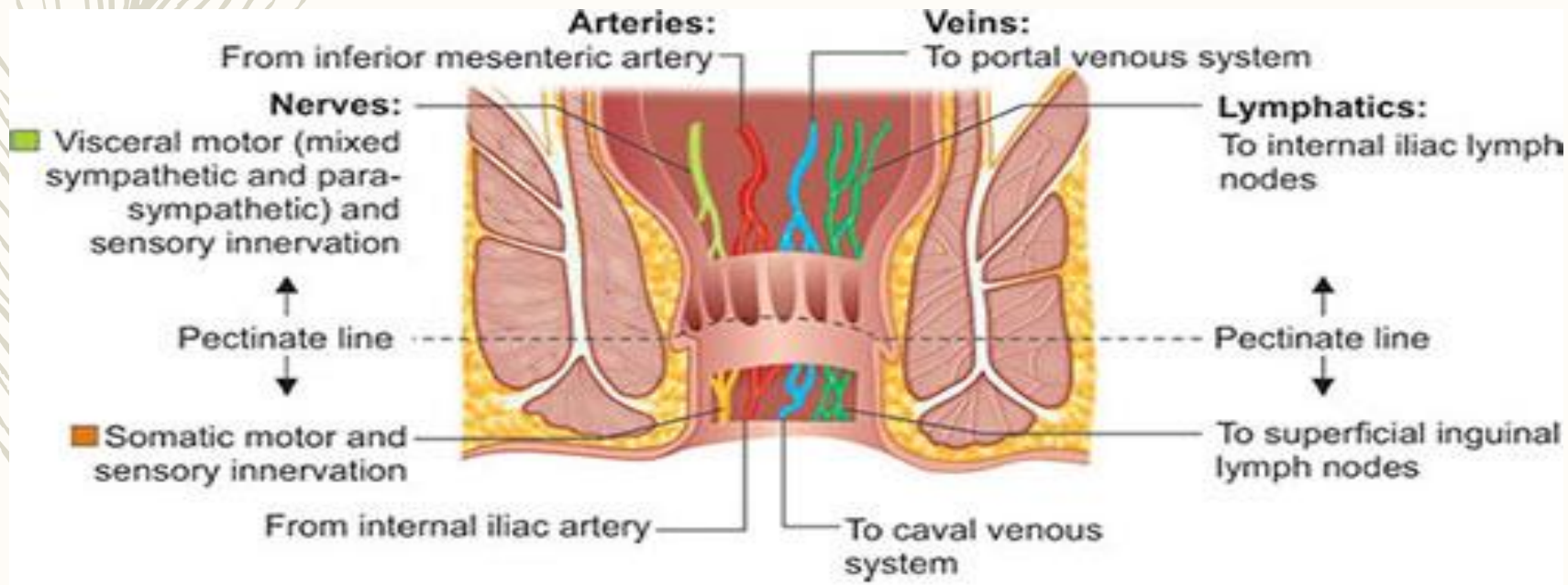
- The upper half of the anal canal drains into the pararectal nodes and then the inferior mesenteric nodes. The lower half drains into the medial group of superficial inguinal nodes .

Nerve Supply

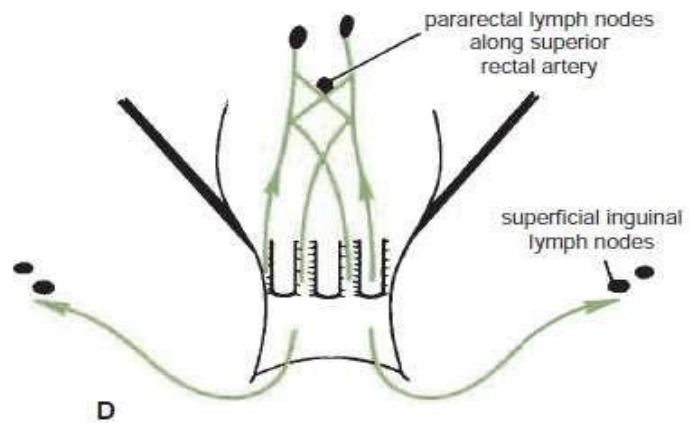
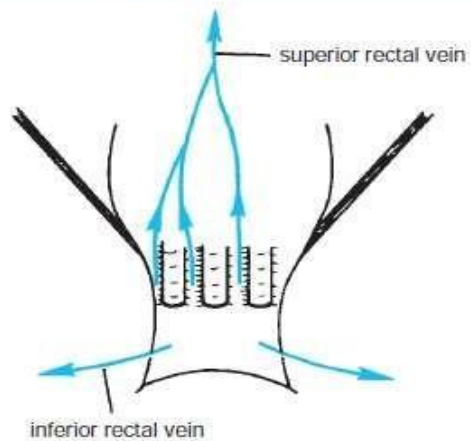
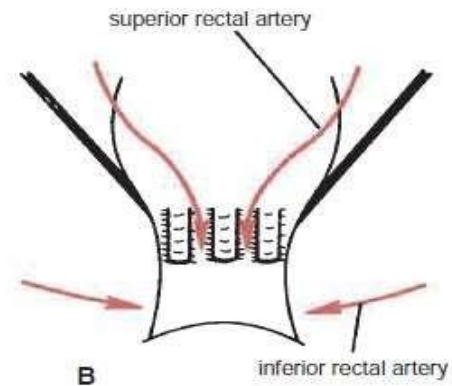
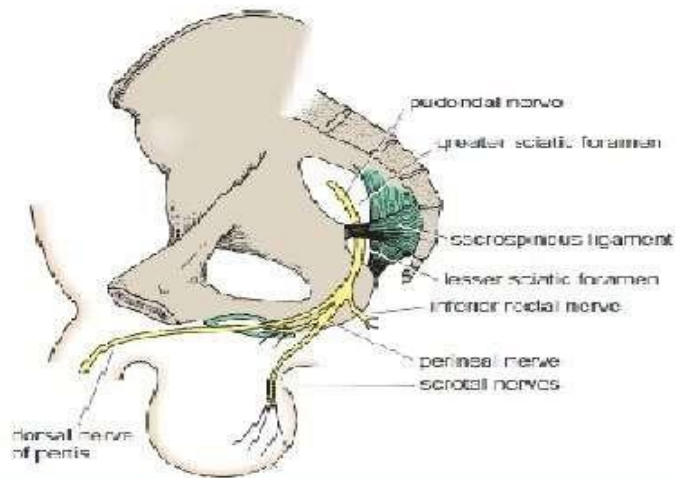
- The mucous membrane of the upper half is sensitive to stretch and is innervated by sensory fibers that ascend through the hypogastric plexuses. The lower half is sensitive to pain, temperature, touch, and pressure and is innervated by the inferior rectal nerves. The involuntary internal sphincter is supplied by sympathetic fibers from







Separation of 'visceral' and 'parietal' at the pectinate line



Anal Canal – Extent & Course

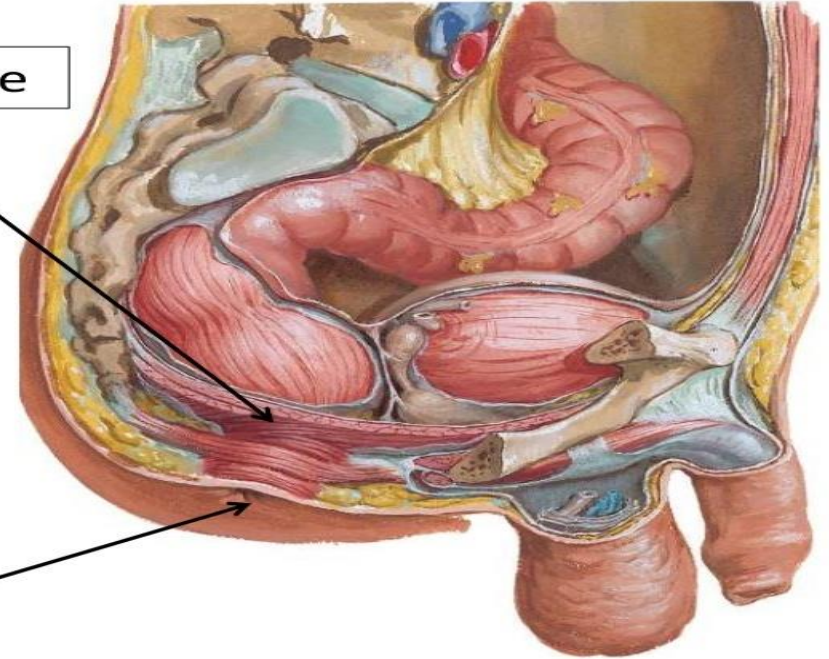
Terminal part of Large Intestine

Begins at ano-rectal jn

At a point 2-3cm in front & little below tip of coccyx

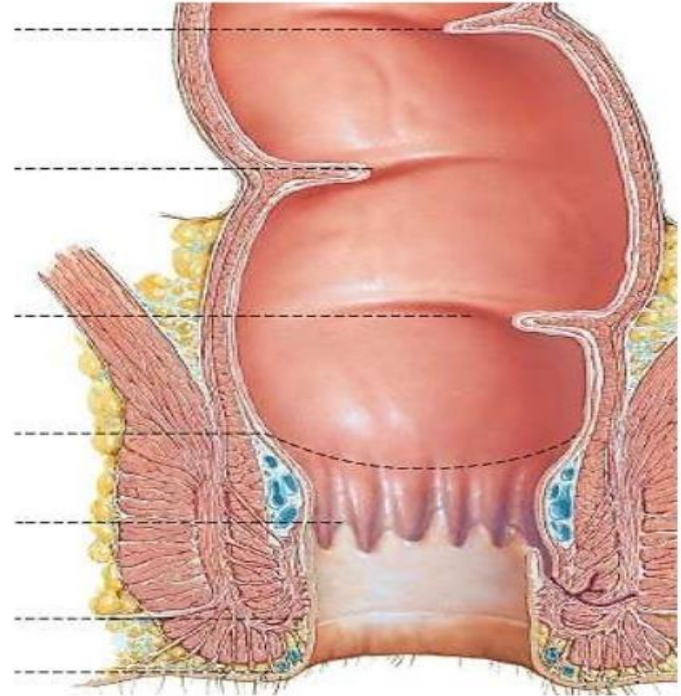
Downwards & Backwards

Opens at anal orifice –
4cm below & in front of tip
of coccyx



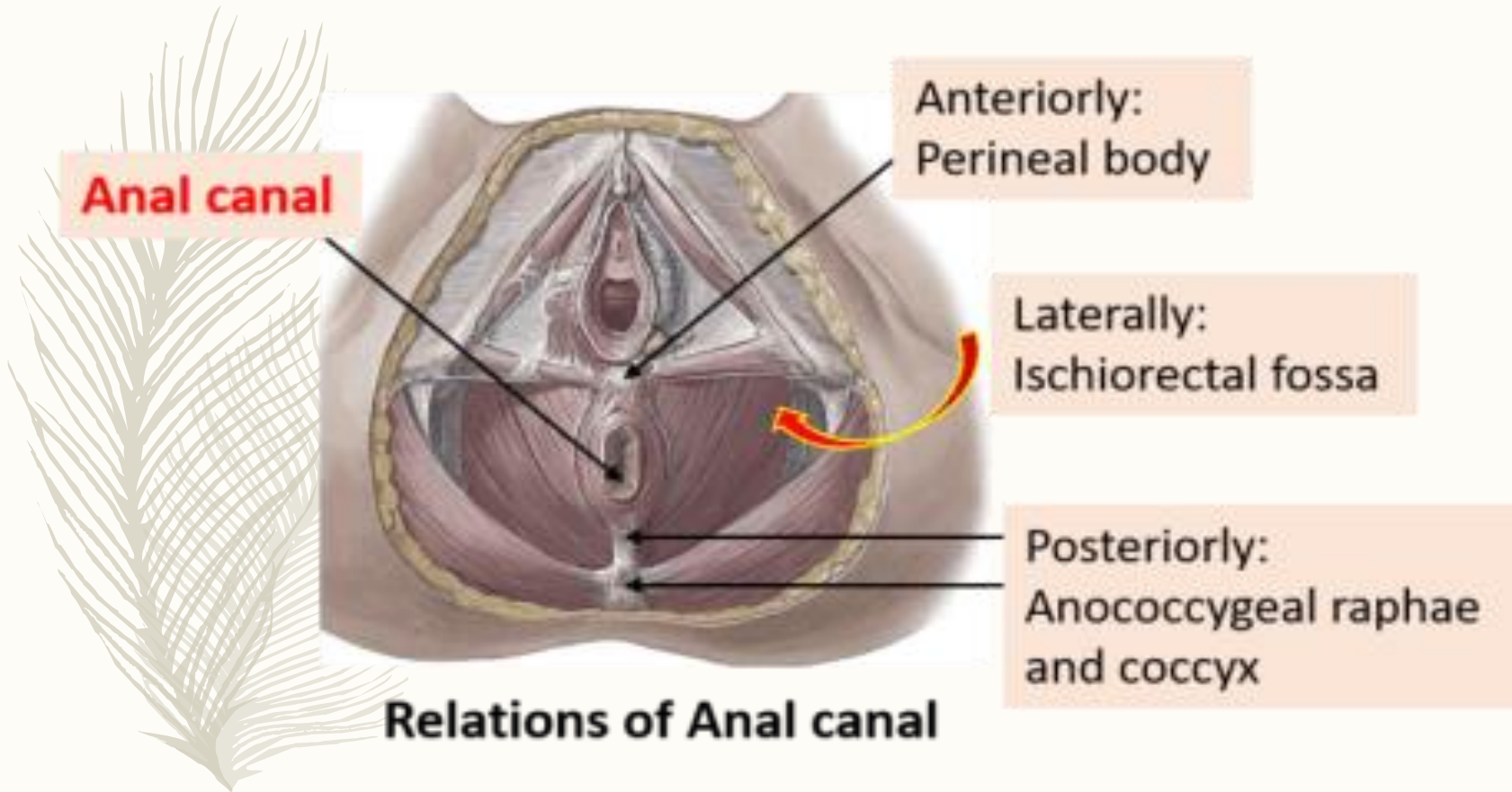
Anal Canal- Measurements

- Length = 3.8cm
 - Breadth
 - When empty – lateral wall approximated
- Antero-posterior slit



Relations

- **Anteriorly:** Perineal body
Males: membranous urethra
bulb of penis
Females: lower end of vagina
- **Posteriorly:** Anococcygeal ligament
Tip of coccyx
- **Laterally:** Ischiorectal fossae
- **All round:** Sphincteric muscles, tone of which keeps the anal closed...



Anal canal

Anteriorly:
Perineal body

Laterally:
Ischioanal fossa

Posteriorly:
Anococcygeal raphae
and coccyx

Relations of Anal canal

STRUCTURE

- The **mucous membrane of the upper half of the anal canal**
- is derived from hindgut endoderm. It has the following important anatomic features:
 - ■■ It is lined by columnar epithelium.
 - ■■ It is thrown into vertical folds called **anal columns**, which are joined together at their lower ends by small semilunar folds called **anal valves** (remains of proctodeal membrane).
 - ■■ The **nerve supply** is the same as that for the rectal mucosa and is derived from the autonomic hypogastric plexuses. It is sensitive only to stretch.
 - ■■ The **arterial supply** is that of the hindgut—namely, the superior rectal artery, a branch of the inferior mesenteric artery. The venous drainage is mainly

STRUCTURE

by the superior rectal vein, a tributary of the inferior mesenteric vein, and the portal vein.

- ■■ **The lymphatic drainage** is mainly
- upward along the superior rectal artery
- to the pararectal nodes and then
- eventually to the inferior mesenteric
- nodes.

Cont,,,,,

- The **mucous membrane of the lower half of the anal canal** is derived from ectoderm of the ectoderm. It has the following important features:
 - ■■ It is lined by stratified squamous epithelium, which gradually merges at the anus with the perianal epidermis.
 - ■■ There are no anal columns.
 - ■■ **The nerve supply** is from the somatic inferior rectal nerve; it is thus sensitive to pain, temperature, touch, and pressure.
 - ■■ The **arterial supply** is the inferior rectal artery, a branch of the internal pudendal artery. The venous drainage is by the inferior rectal vein, a tributary of the internal pudendal vein, which drains into the internal iliac vein.
 - ■■ **The lymph drainage** is downward to the medial group of superficial inguinal nodes.
- The **pectinate line** indicates the level where the upper half of the anal canal joins the lower half .

Structure

- The anal canal is divided into two unequal sections, upper and lower.
- The upper 2/3 has longitudinal folds or elevations of tunica mucosa. Its mucosa is lined by simple columnar epithelium. Its lower ends are joined together by folds of mucous membrane called anal valves. The upper 2/3 of the anal canal is supplied by the superior rectal artery which is a branch of the inferior mesenteric artery.
- The lower 1/3 of the anal canal is lined by stratified squamous epithelium that blends with the skin. The lower third of the anal canal is supplied by the inferior rectal artery which is a branch of the internal pudendal artery.

Structure Contd

- A whitish line called Hilton's white line indicates the junction between keratinized stratified squamous epithelium and non-keratinized stratified squamous epithelium.

Interior of Anal Canal

Divided in to 3 parts

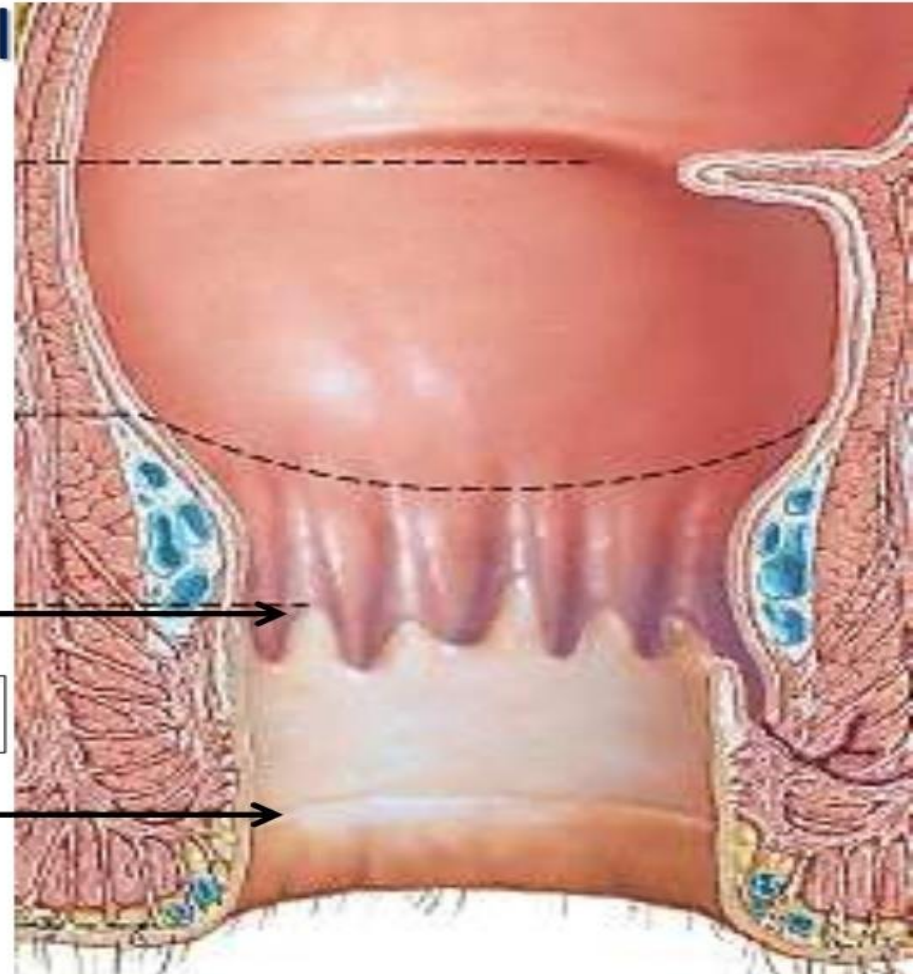
Upper area

Pectinate Line

Intermediate area / Pecten

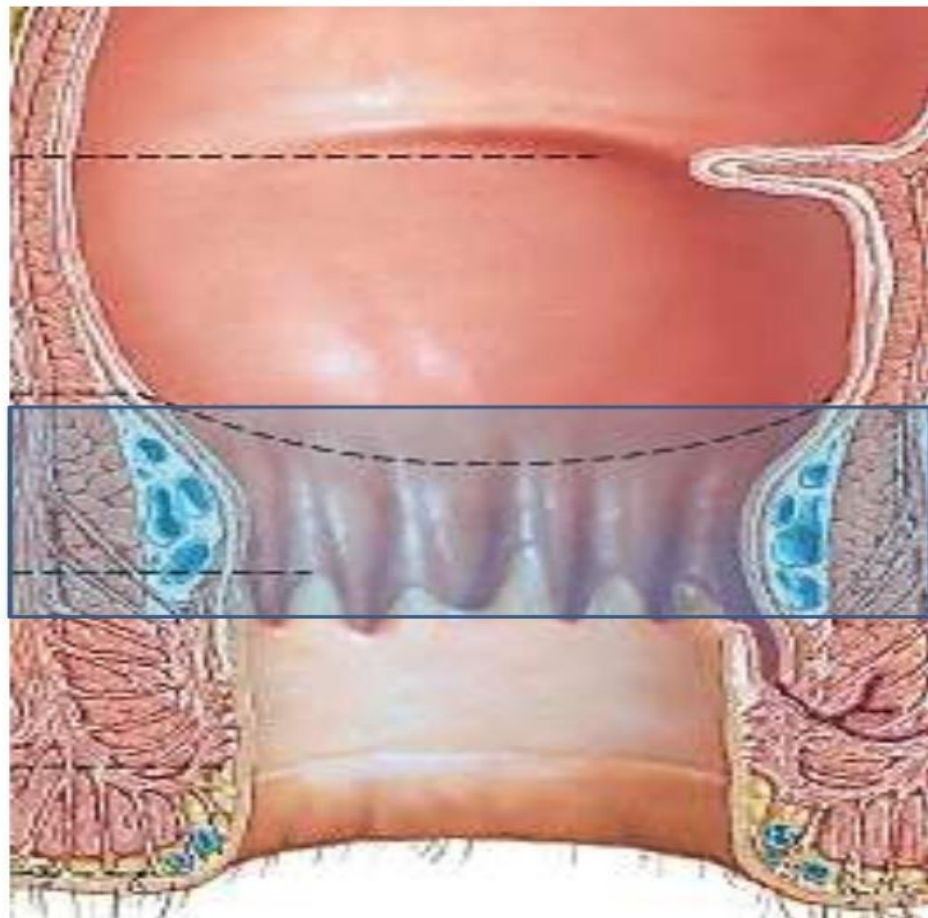
Hilton's White Line

Lower area / Anal Verge



Upper Muscular part

- 15 mm
- Endodermal origin
- Lined by semitransparent mucous membrane
 - Simple columnar / Stratified columnar or squamous
- Plum red due to?



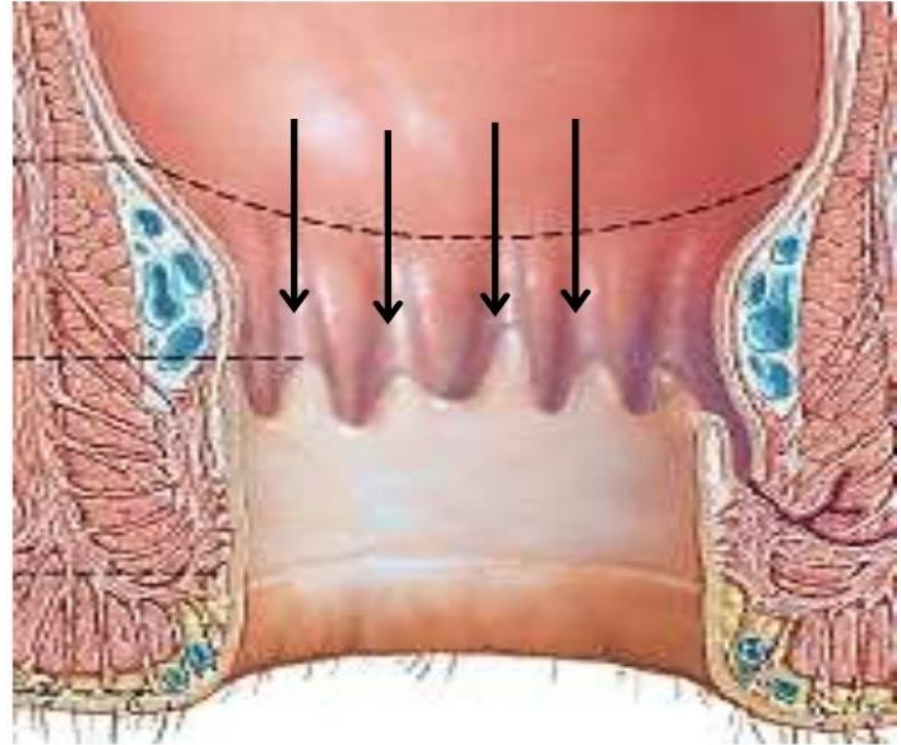
Upper Muscular part - Features

Anal Columns / Columns of Morgagni

Permanent longitudinal mucosal folds

Reduplication of mucous membrane

Contains Radicals of Sup rectal veins



Upper Muscular part - Features

Injury – Anal Fissure

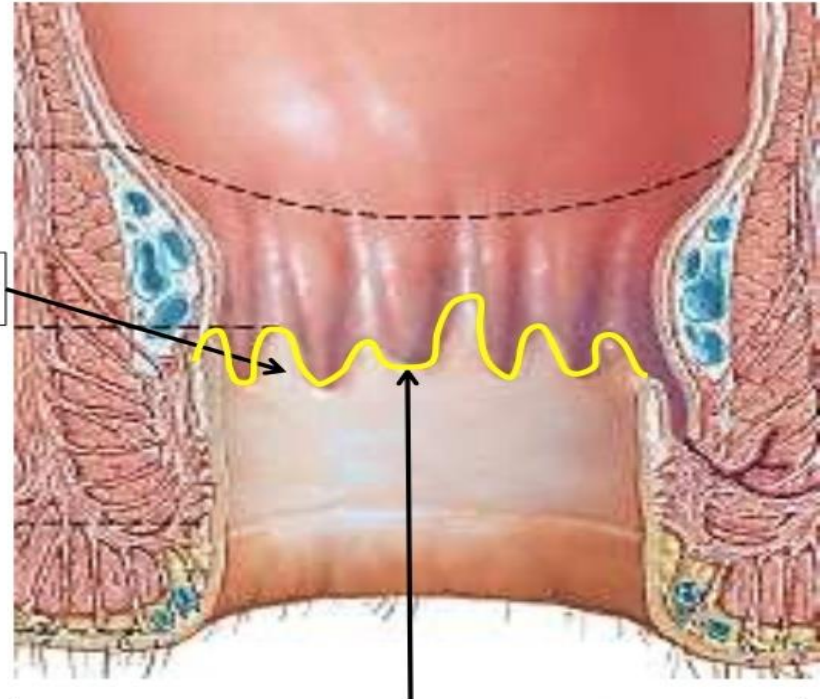
Anal Valves / Valves of Ball

Crescentic mucosal folds

Connect lower ends of
anal columns

Upper surface

Lower surface



Pectinate Line / Dentate Line

Importance of Pectinate Line

Divide canal in to Upper & Lower Areas

Development

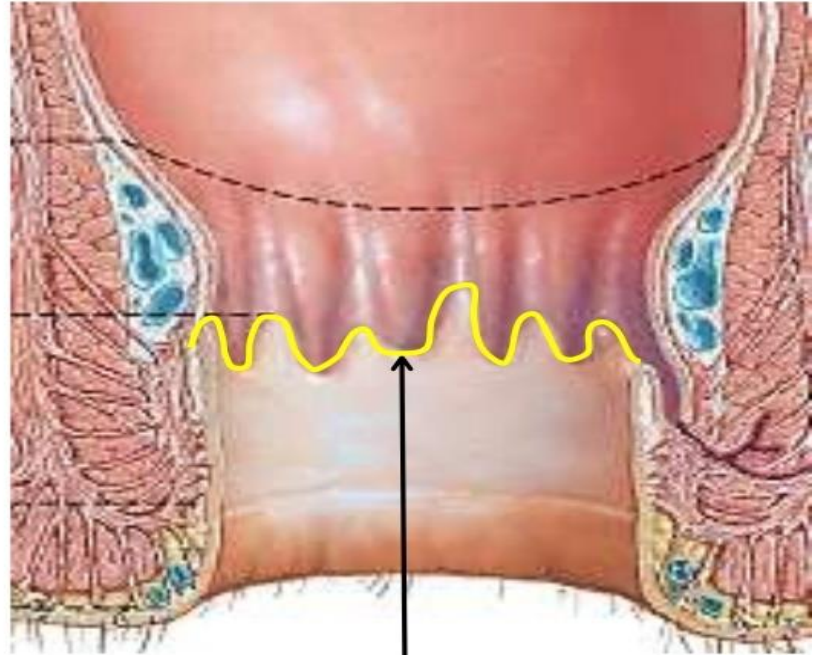
Arterial Supply

Venous Drainage

Lymphatic Drainage

Nerve Supply

85% diseases starts here



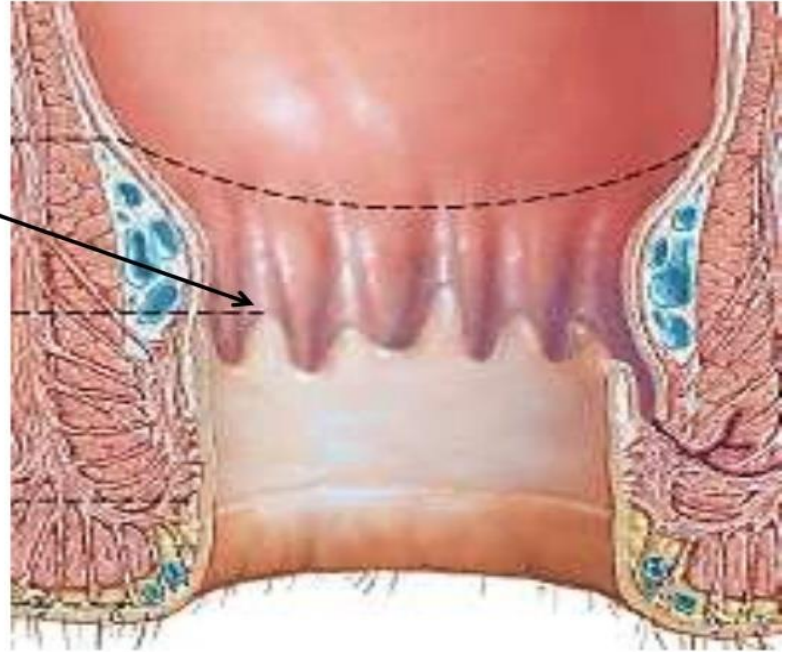
Pectinate Line / Dentate Line

Upper Muscular part - Features

Anal Papillae

Epithelial processes

Remnant of anal membrane

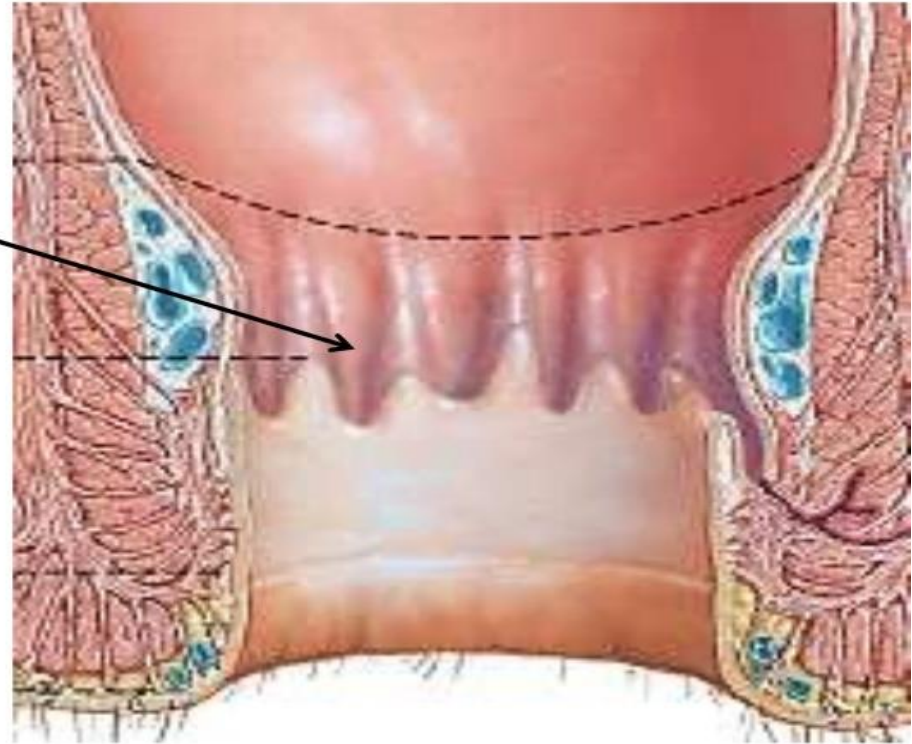


Upper Muscular part - Features

Anal Sinuses

Recesses above valves
between anal columns

Foreign body

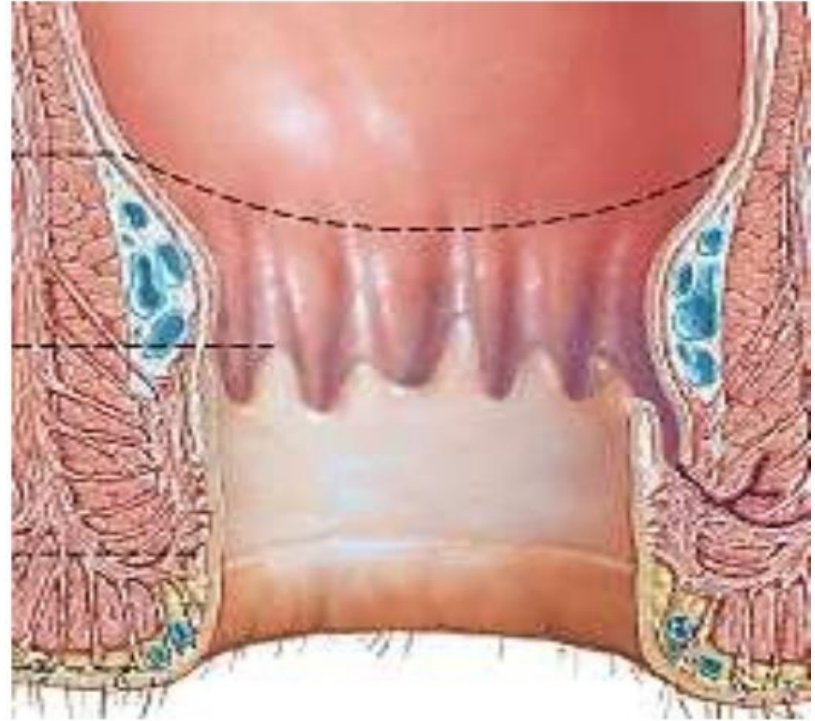


Upper Muscular part - Features

Anal Glands

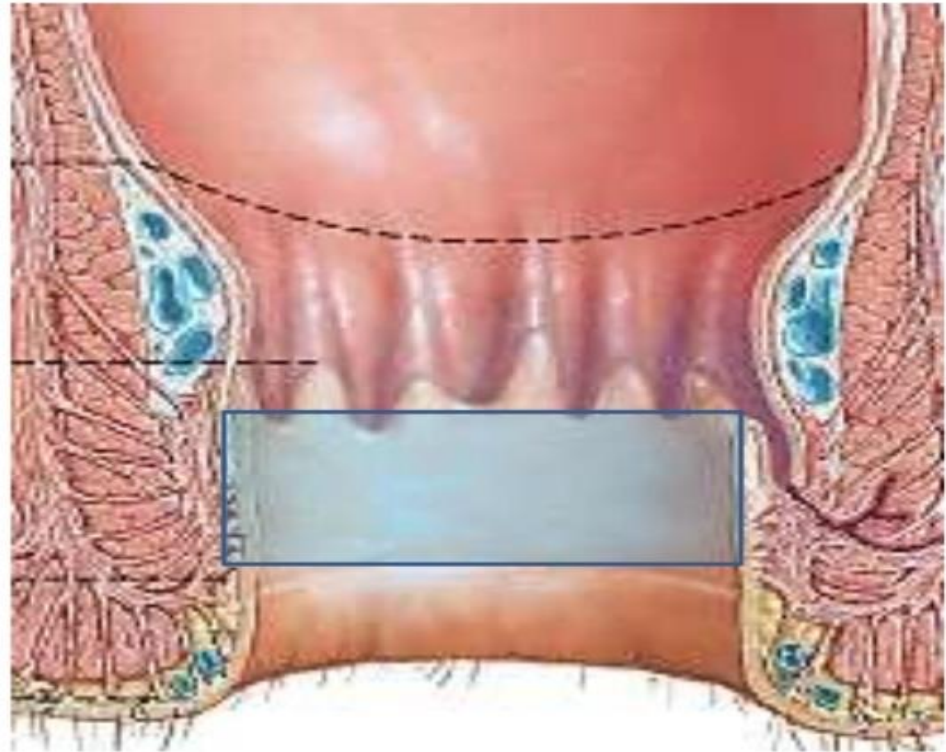
Open in floor of sinuses

Infection - Fistula



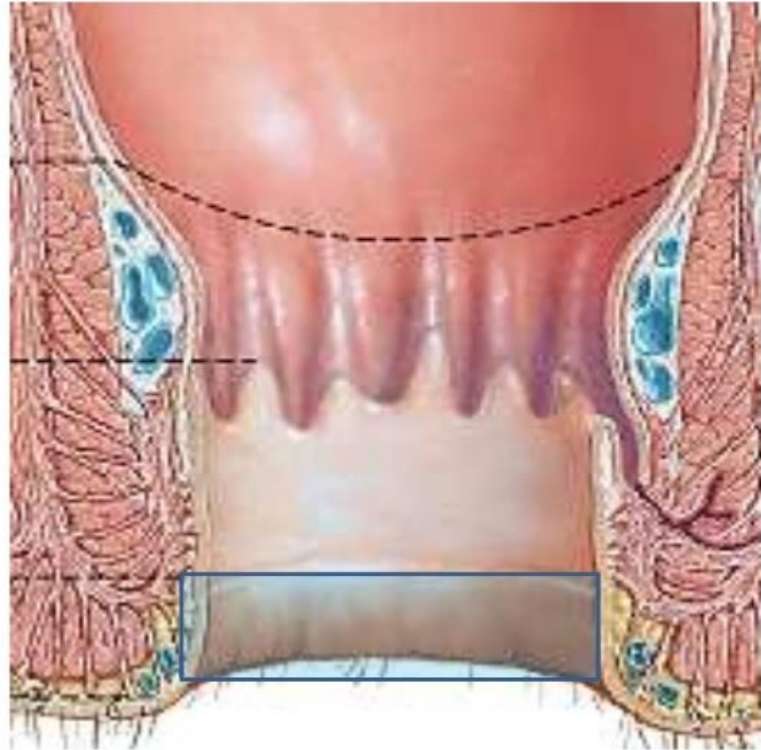
Intermediate area / Area of Pectane

- 15 mm
- Ectodermal origin
- Anal column: Absent
- Bluish pink appearance of mucosa
- St sq epithelium
- **No** sweat / Sebaceous gland



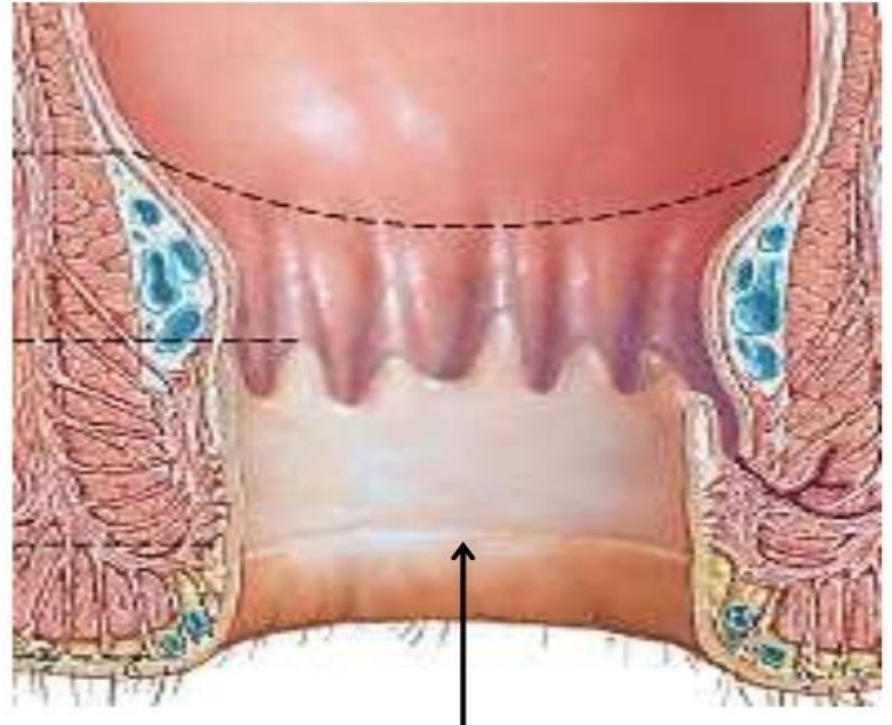
Lower area / Anal Verge

- 8 mm
- Ectodermal origin
- True skin with pigmentation
- Corrugation due to corrugator cutis ani
- Course hairs

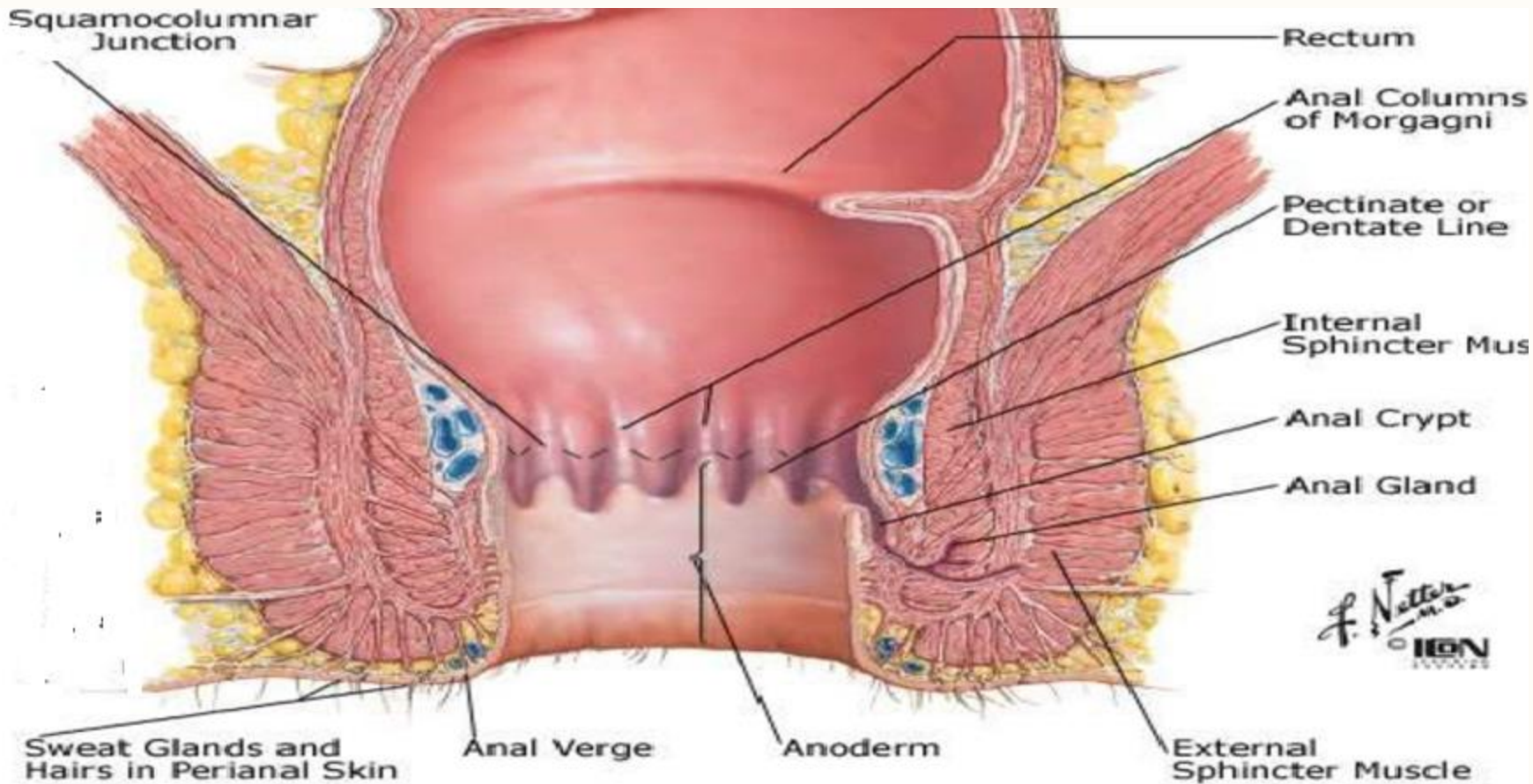


Intermediate area / Area of Pectane

- Color contrast between
Bluish pink mucosa above
& black skin below
- Lies at lower end of
internal anal sphincter



White line of Hilton



Musculature of Rectum

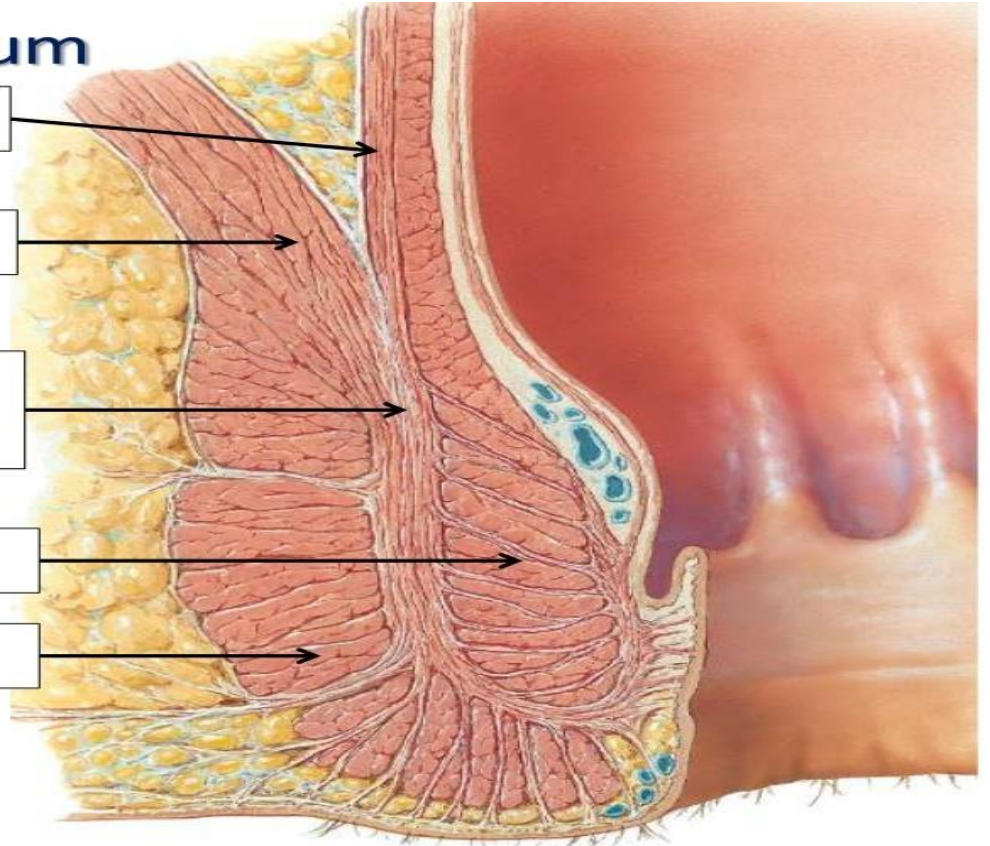
Longitudinal Muscle

Pubo-rectalis / Levator Ani

Conjoint Fibro-elastic sheath

Internal Anal Sphincter

External Anal Sphincter



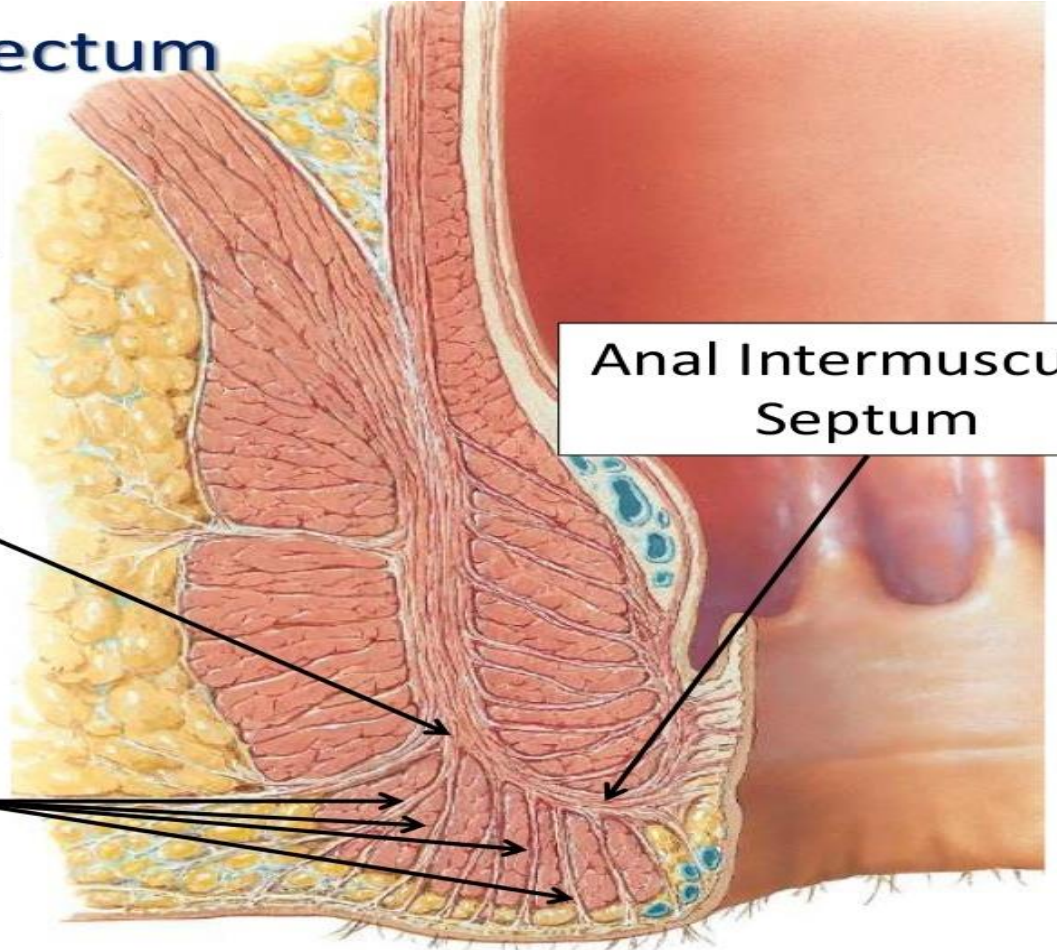
Musculature of Rectum

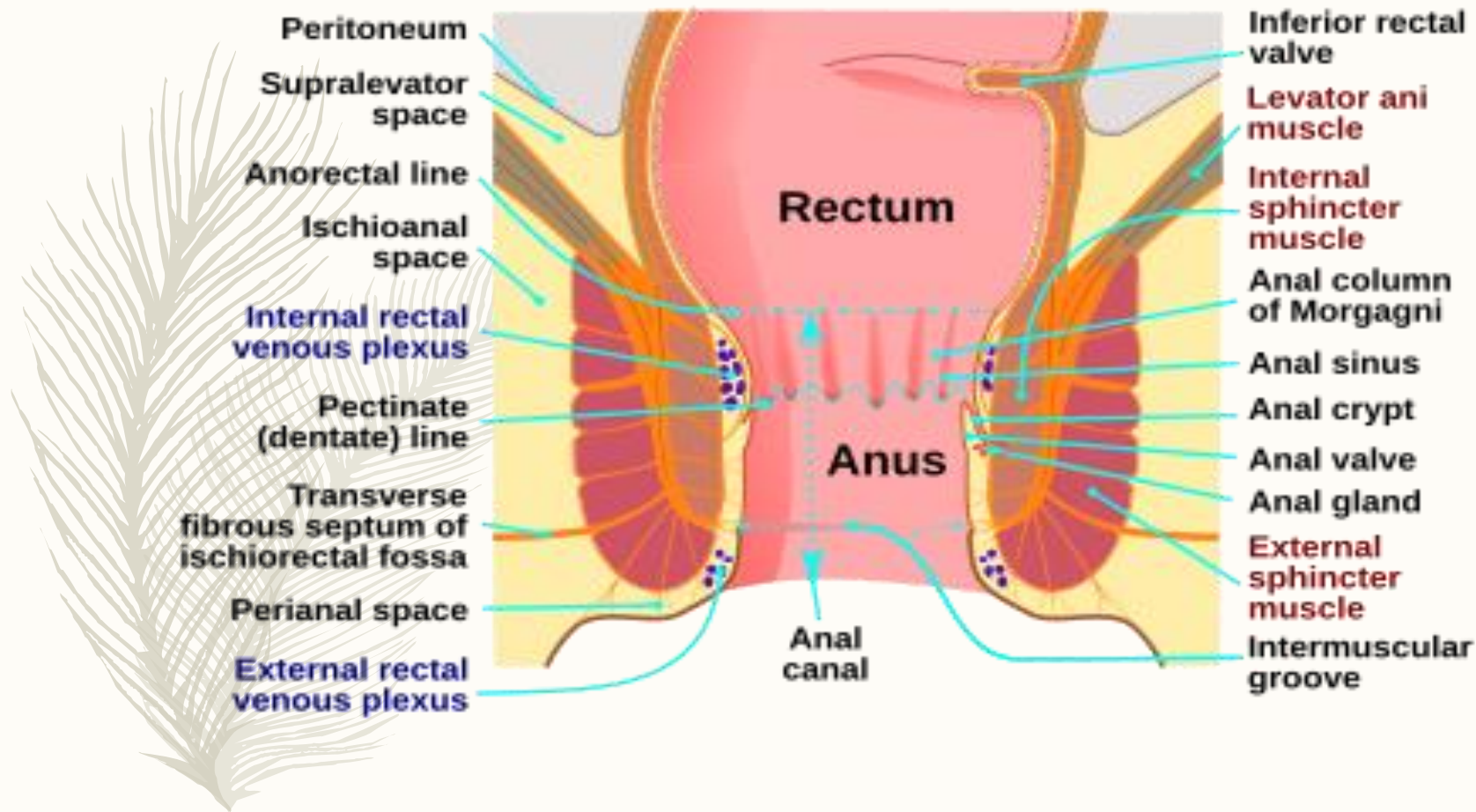
Conjoint Fibro-elastic sheath

Splits into
number of septa

Corrugator Cutis
Ani

Anal Intermuscular
Septum





STRUCTURE

Muscle Coat

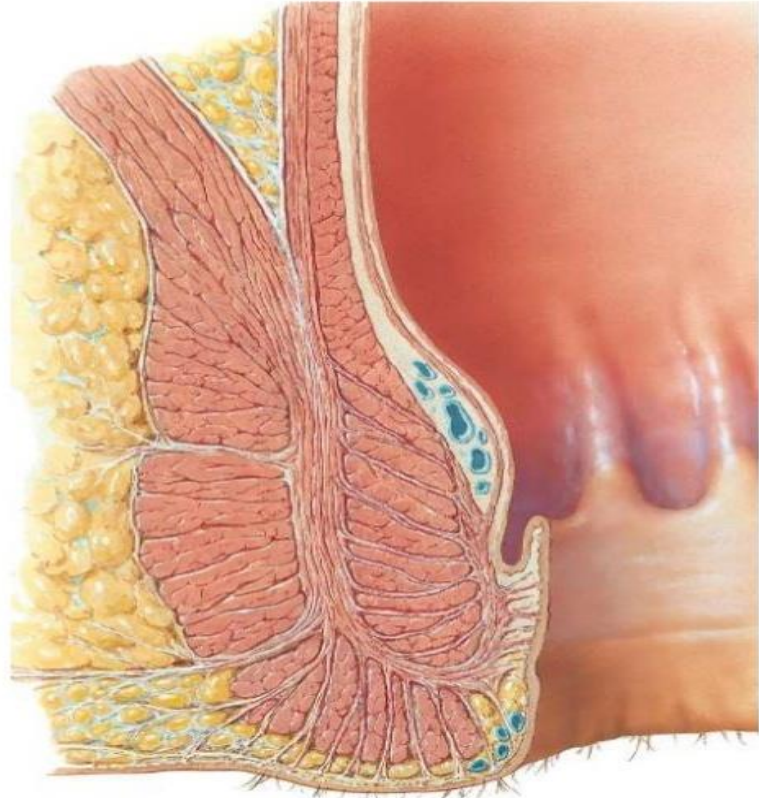
- As in the upper parts of the intestinal tract, it is divided into an outer longitudinal and an inner circular layer of smooth muscle **Anal Sphincters** The anal canal has an involuntary internal sphincter and a voluntary external sphincter. The **internal sphincter** is formed from a thickening of the smooth muscle of the circular coat at the upper end of the anal canal. The internal sphincter is enclosed by a sheath of striped muscle that forms the voluntary external sphincter The **external sphincter** can be divided into three parts:
 - ■■ A **subcutaneous part**, which encircles the lower end of the anal canal and has no bony attachments
 - ■■ A **superficial part**, which is attached to the coccyx behind and the perineal body in front

STRUCTURE

- ■■ A **deep part**, which encircles the upper end of the anal canal and has no bony attachments
- The **puborectalis** fibers of the two levatores ani muscles blend with the deep part of the external sphincter. The puborectalis fibers of the two sides form a sling, which is attached in front to the pubic bones and passes around the junction of the rectum and the anal canal, pulling the two forward at an acute angle.
- The longitudinal smooth muscle of the anal canal is continuous above with that of the rectum. It forms a continuous coat around the anal canal and descends in the interval between the internal and external anal sphincters. Some of the longitudinal fibers are attached to the mucous membrane of the anal canal, whereas others pass laterally into the ischiorectal fossa or are attached to the perianal skin

Musculature Anal Canal

- **Anal Sphincters:**
- **Internal:**
 - Thickened lower circular muscle of rectum
 - Involuntary
- **External:**
 - Striated muscles
 - Voluntary,
 - 3 parts:
 - 1) **Subcutaneous**
 - 2) **Superficial**
 - 3) **Deep**



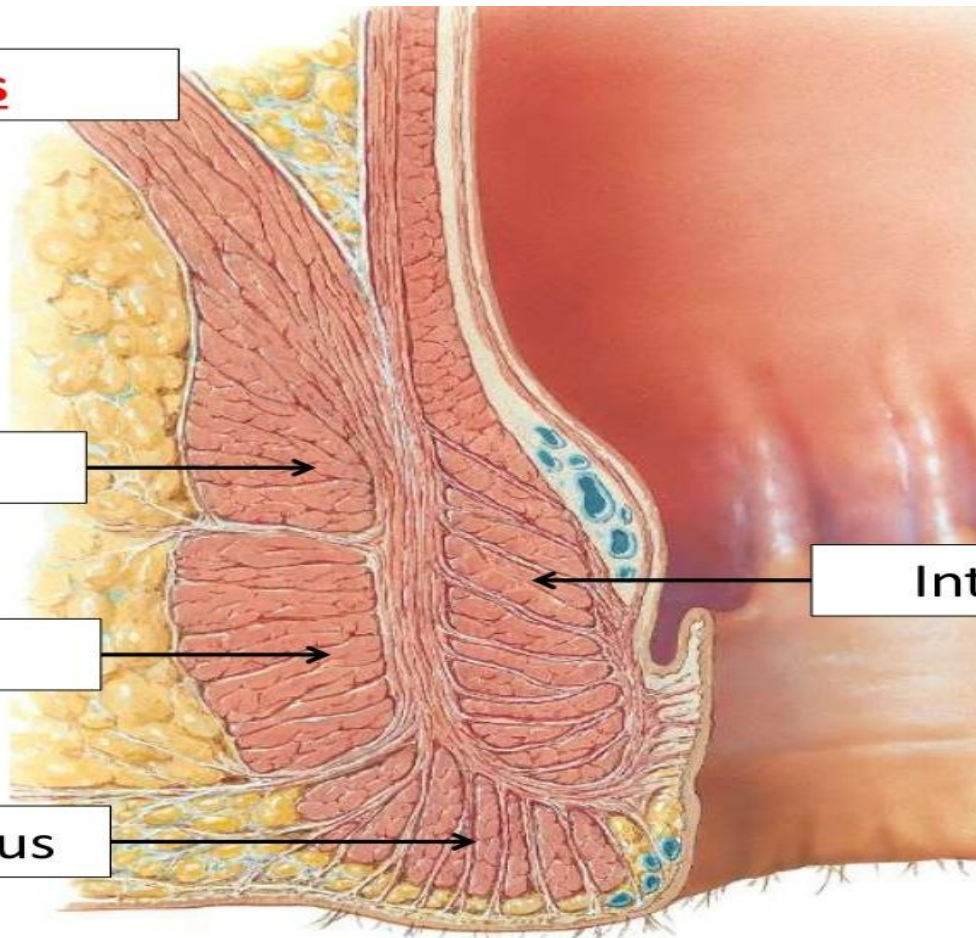
Sphincters

Deep

Superficial

Subcutaneous

Internal



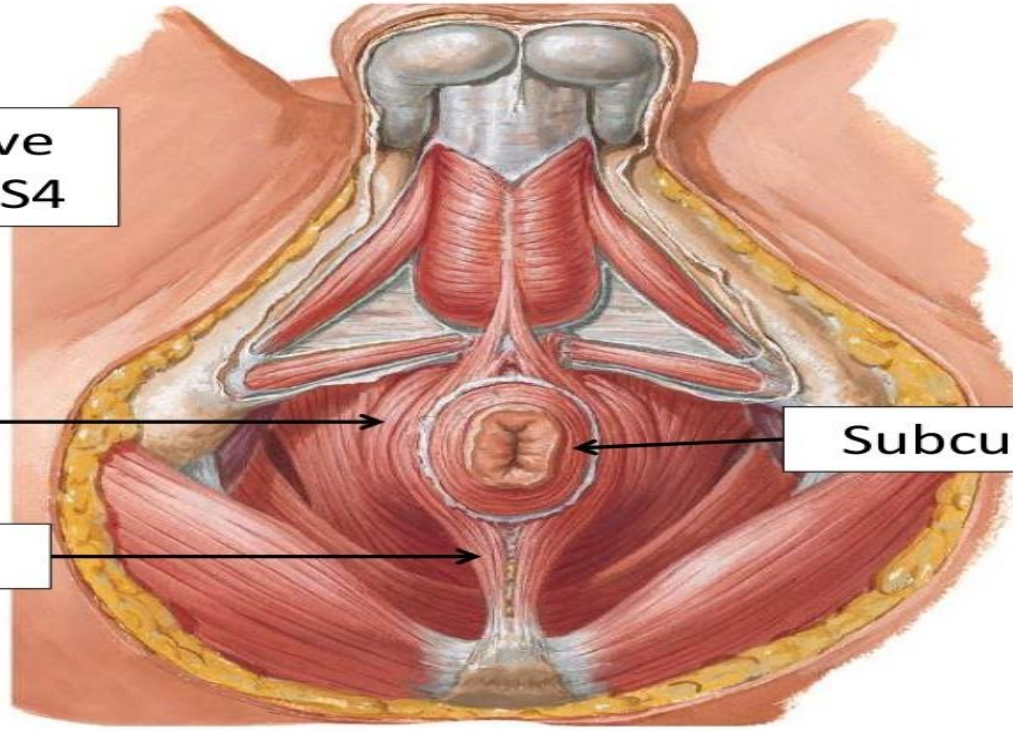
External Anal Sphincter

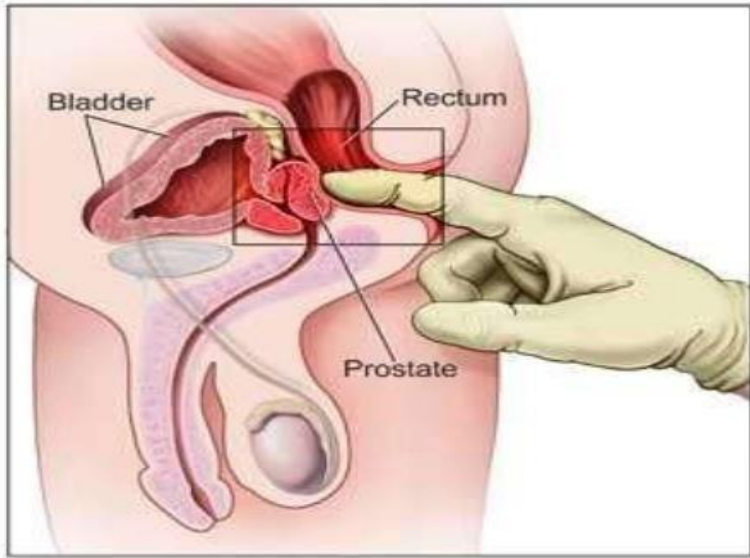
Inf Rectal nerve
Perineal Br of S4

Deep

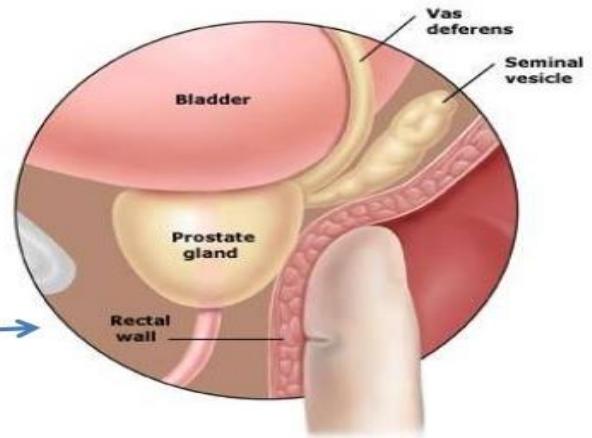
Superficial

Subcutaneous





DPRE





Incomplete/Mucosal

Complete/Procidentia

Prolapsed
rectum

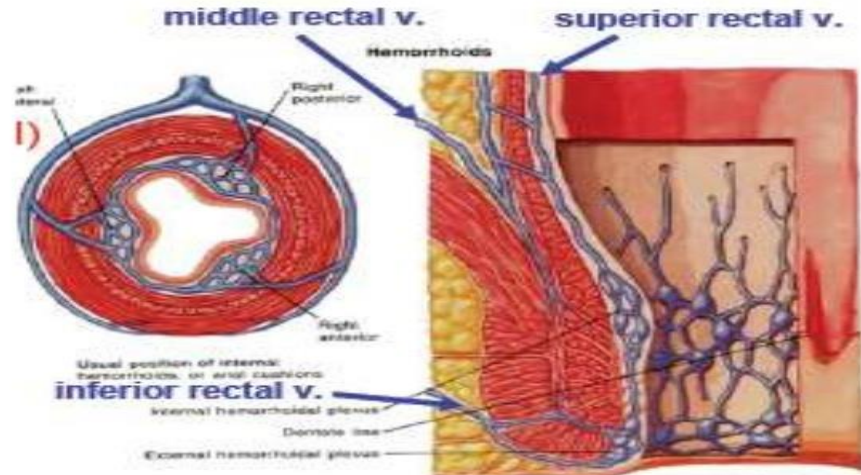
Hemorrhoids / Piles

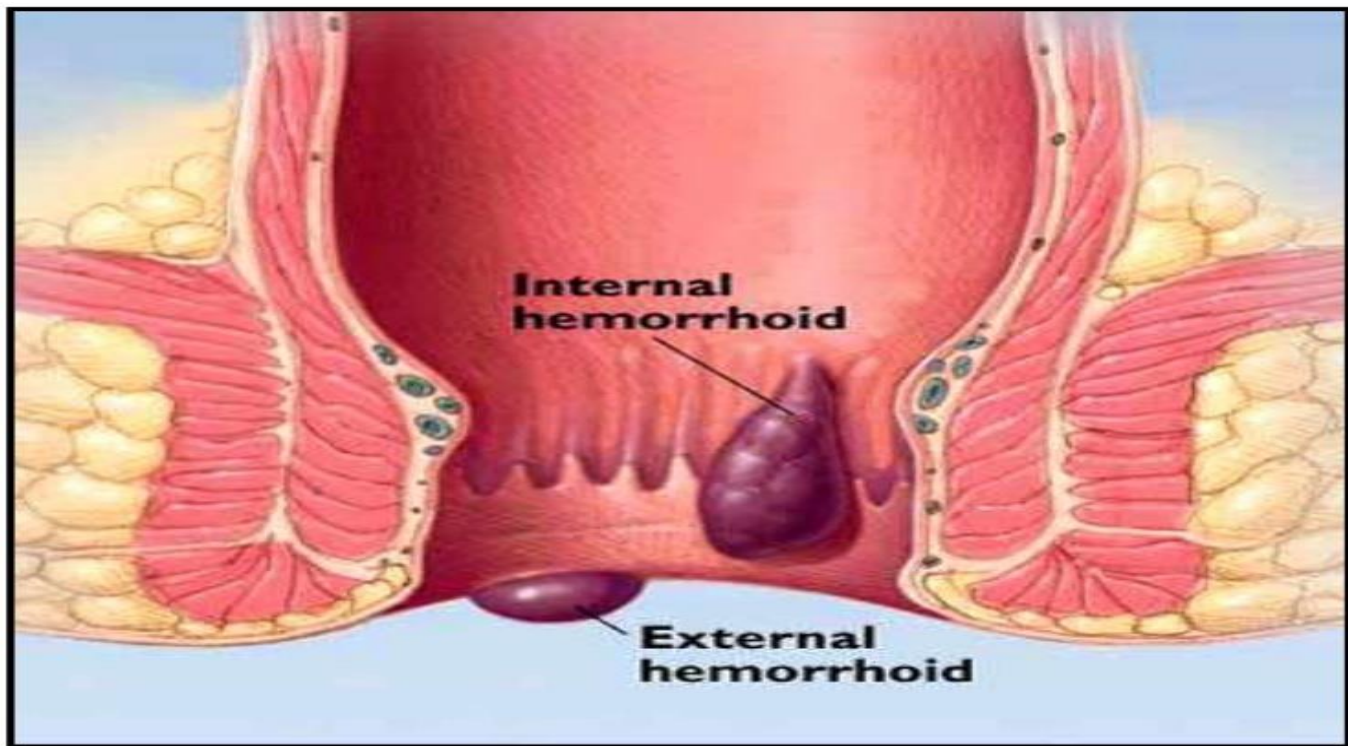
Internal hemorrhoids:

- Tributary of sup rectal
- Above white line
- Generally painless

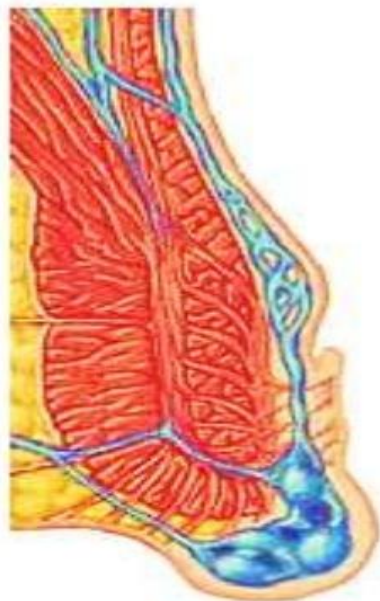
External hemorrhoids:

- Tributary of inf rectal
- Below white line
- Generally painful





External hemorrhoid



Origin below dentate line
(external rectal plexus)

Internal hemorrhoid

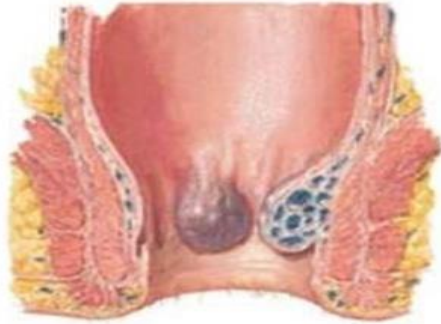


Origin above dentate line
(internal rectal plexus)

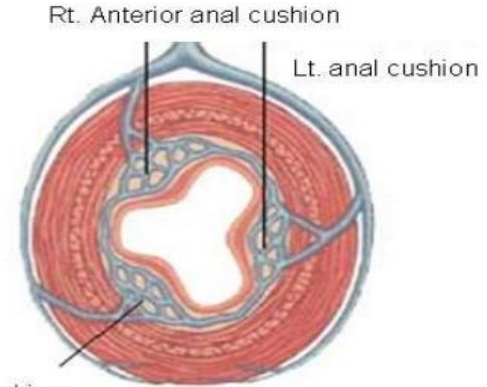
Mixed hemorrhoid



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

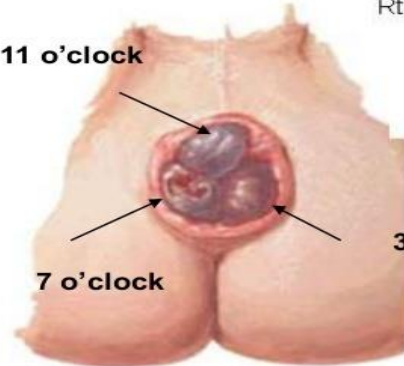


Enlarged anal cushions



Rt. Posterior anal cushion

11 o'clock



7 o'clock

3 o'clock

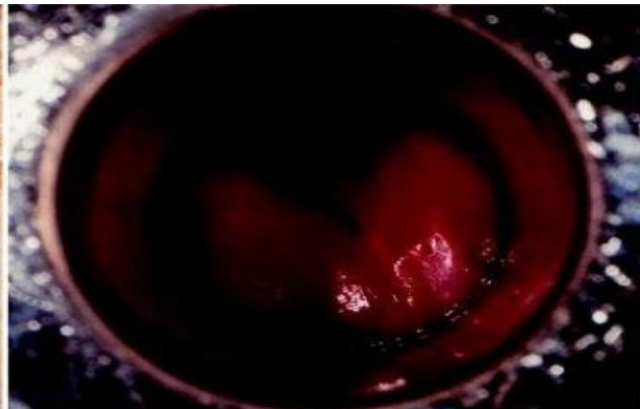
Prolapsed "rosette" of internal hemorrhoids

Usual position of anal cushions and sites of prolapse for internal hemorrhoids

Internal Hemorrhoids



A



B



C



D

Anal Fissure

Rupture of
anal valves

Painful



Anal Fissure



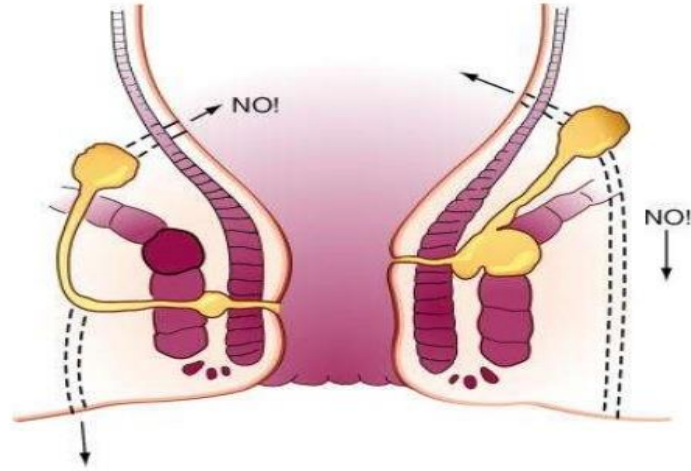
Drainage of Perianal abscess



Fistula in Ano

A fistula-in-ano is a hollow tract lined with granulation tissue connecting a primary opening inside the anal canal to a secondary opening in the perianal skin.

Secondary tracts may be multiple and from the same primary opening.



THANK YOU