RECTUM & ANAL CANAL

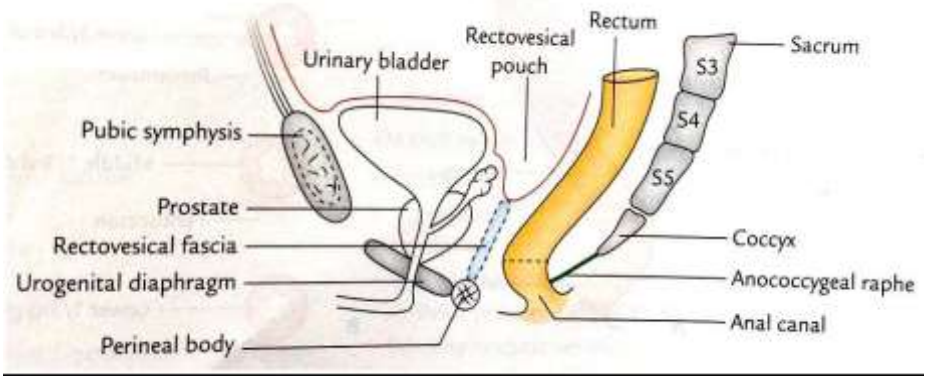
DESCRIBE THE RECTUM AND ANAL CANAL UNDER FOLLOWING HEADINGS A) GROSS ANATOMY B) SUPPORTS C) BLOOD SUPPLY (LE)

A) **Gross features of rectum and anal canal:**

Rectum - Distal part of the large gut.
Placed between the sigmoid colon and anal canal

Situation:

Posterior part of true pelvis
Behind the urinary bladder (male)
Behind the uterus (females)
Situated in front of lower three pieces of sacrum and coccyx



Dimensions:

12 cm long
Diameter - Upper part 4 cm
Lower part is dilated to form rectal ampulla.

Curvatures

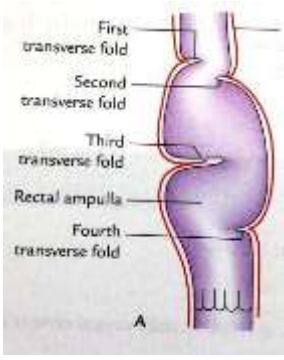
Shows **Antero-posterior & Lateral** curvatures

Antero-posterior curvatures

Sacral curvature
Perineal curvature

Lateral Curvatures

Three in number
2 convexities to the right side
1 convexity to the left side

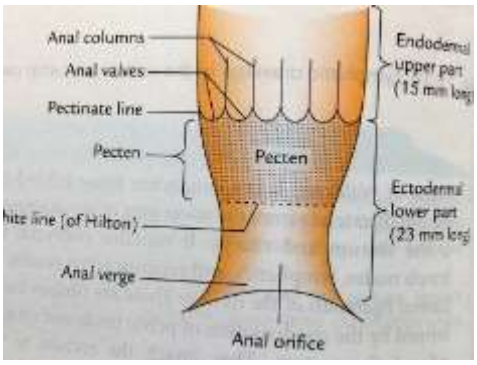


Interior of Rectum

Transverse folds **(Houston's valves)** are permanent folds Four in number.
Third Fold- Largest & most constant
Projects from anterior & right wall
Situated 5 cm above anus

Anal canal is the terminal part of large intestine

Extent : Anorectal junction to 4cm below and in front of tip of coccyx Length is 3.8 cms.



Interior of the anal canal

Divided into three parts
Upper part-15mm
Intermediate part-
15mm Lower part-8mm

Upper Part:

15mm in length

Lined by mucous membrane, simple columnar epithelium

Anal columns of Morgagni- 6-10 longitudinal mucous fold

Anal valves- crescentic folds of mucous membrane connecting lower part of anal columns

Anal sinus- depression above anal valves & in between the anal columns

Pectinate line- demarcates the lower border of upper part and situated at the level of anal valves

Intermediate Part: (PECTEN or Transition zone)

15 mm in length

Lined by thin stratified Squamous non keratinised epithelium which is devoid of sebaceous and sweat glands.

Mucosa-Bluish appearance because of the underlying venous plexus
Lower limit is called -White line of Hilton

Lower Part:

8mm in length
Lined by true skin

Supports:

Pelvic floor.
Fascia of Waldeyer: is a condensation of pelvic fascia & attaches rectal ampulla to sacrum.
Lateral ligaments: condensed fascia between the rectum & the lateral pelvic walls.
Rectovesical fascia of Denonvilliers between the rectum & seminal vesicle and prostate.
Pelvic peritoneum & contained vascular pedicles.
Perineal body with its muscles

Blood Supply:

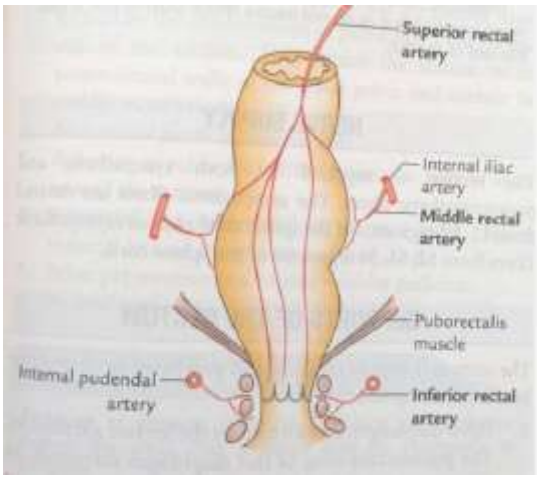
Blood Supply of Rectum:_Arterial supply:

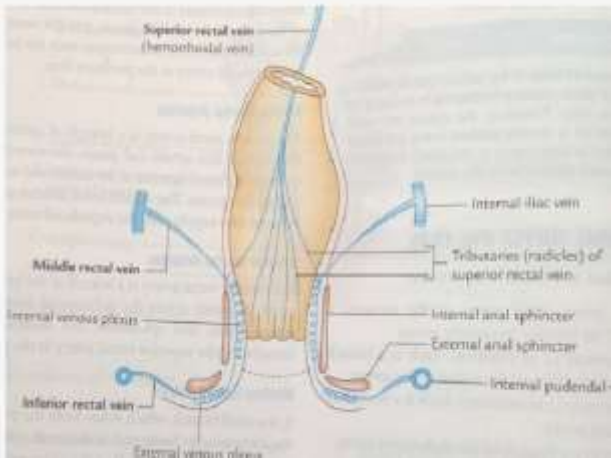
Superior rectal artery - principal artery of rectum.
It is the continuation of inferior mesenteric artery Supply the mucosa upto the anal valves.

Middle rectal arteries- Branch from anterior division of internal iliac artery.

Inferior rectal arteries – Branch from internal pudendal artery
Anastomoses with superior rectal artery at the level of anal valves/pectiante line

Median sacral artery- Dorsal branch of abdominal aorta.





Venous drainage:

Venous plexus is situated around the lower part of rectum and analcanal.
Sets of venous plexus – Internal and external venous plexus.

Internal venous plexus

Situated above the Hilton's line.
Situated between mucous membrane and internal anal sphincter.

External venous plexus-
Surrounds anus
Situated between perianal skin and subcutaneous part of external anal sphincter.

From the **upper part** of venous plexus six veins pass through analcolumns.
These unite to form single vein- **superior rectal vein**
This drains into inferior mesenteric vein (**portal venous system**)

From the **middle part o**f plexus – **middle rectal veins** pass on either side to drain into internal iliac veins (**Systemic veins**)

From the **lower part** of plexus- **inferior rectal veins** pass through ischiorectal fossa to drain into internal pudendal veins (**Systemic veins).**

Blood Supply of Anal Canal:

Pectinate line divides the anal canal into upper part and lower part.

Arterial supply:

Upper area- supplied by Superior rectal artery
Lower area- supplied by inferior rectal artery

Venous Drainage:

Upper area- drains into Superior rectal vein (portal system)
Lower area- drains into inferior rectal vein (caval system)

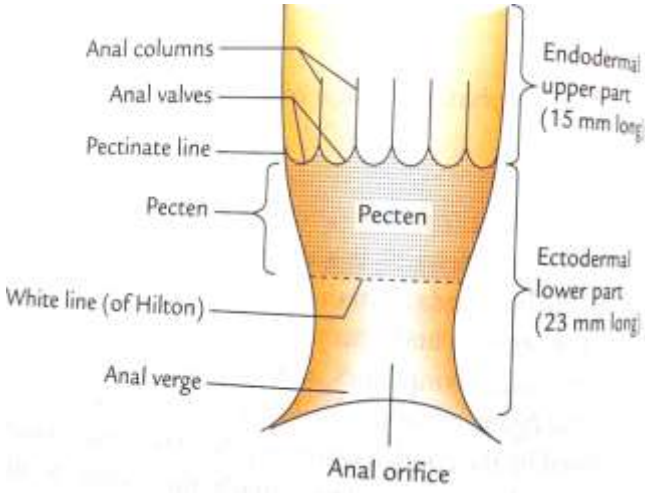
The anastomoses between the 2 sets of veins at the Pectinate line is a site of **portocaval anastomoses in portal hypertension.**

DESCRIBE THE INTERIOR OF ANAL CANAL.ADD A NOTE ON IT'S, DEVELOPMENT, APPLIED ANATOMY. (LE)

Interior canal of Anal:

Interior of anal canal is divided into three parts Upper part-15mm

Intermediate part-
15mm Lower part-8mm



Upper Part:

15mm in length

Lined by mucous membrane, simple columnar epithelium

Anal columns of Morgagni- 6-10 longitudinal mucous fold

Anal valves- crescentic folds of mucous membrane connecting lower part of anal columns

Anal sinus- depression above anal valves & in between the anal columns

Pectinate line- demarcates the lower border of upper part and situated at the level of anal valves

Intermediate Part: (PECTEN or Transition zone)

15 mm in length

Lined by thin stratified Squamous non keratinised epithelium which is devoid of sebaceous and sweat glands.

Mucosa-Bluish appearance because of the underlying venous plexus

Lower limit is called -White line of Hilton

Lower Part:

8mm in length

Lined by true skin

Development of anal canal:

Pectinate line divides the anal canal into upper part and lower part

Anal canal above Pectinate line - Develops from dorsal part of endodermal cloaca Anal canal below Pectinate line

Develops from ectodermal proctodeum

Musculature develops from splanchnic mesoderm

Applied anatomy:

Internal Haemorrhoid

Dilatation of radicles of superior rectal vein above the Pectinate line is known as Internal piles. It is a painless condition.

Anal canal is one of the sites where there is porto-systemic anastomoses
In portal hypertension radicles of superior rectal veins distend. Condition is known as internal hemorrhoids or piles

Primary internal piles- 3, 7 and 11 O' clock position are known as primary position of internal piles

External Haemorrhoid – dilatation of external venous plexus, painful condition.

DESCRIBE THE ANAL CANAL UNDER FOLLOWING HEADINGS

A) EXTENT B) EMBRYO LOGICAL ORIGIN C) INTERNAL FEATURES D) SPHINCTERS E) BLOOD SUPPLY F) LYMPHATIC DRAINAGE G) NERVE SUPPLY H) APPLIED ANATOMY (LE)

A) Extent of anal canal

It is the terminal part of alimentary tract Length: 3.8cm

Extent:

From the anorectal junction (slightly below the tip of coccyx) to Anal opening (4cm below and in front of tip of coccyx)

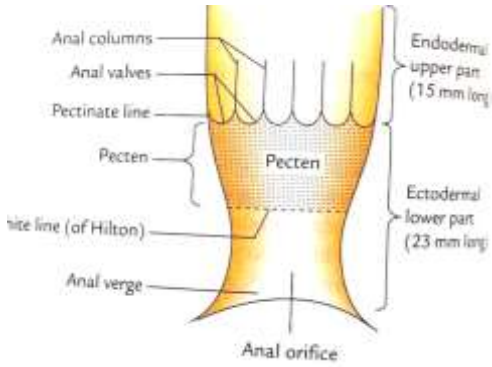
Development of anal canal:

Pectinate line divides the anal canal into upper part and lower part Anal canal above Pectinate line - Develops from dorsal part of endodermal cloaca

Anal canal below Pectinate line - Develops from ectodermal proctodeum Musculature develops from splanchnic mesoderm

Interior canalof Anal :

Interior of anal canal is divided into Three parts
Upper part-15mm
Intermediate part-15mm
Lower part-8mm



Upper Part:

15mm in length

Lined by mucous membrane, simple columnar epithelium

Anal columns of Morgagni- 6-10 longitudinal mucous fold

Anal valves- crescentic folds of mucous membrane connecting lower part of anal columns

Anal sinus- depression above anal valves & in between the anal columns

Pectinate line- demarcates the lower border of upper part and situated at the level of anal valves.

Intermediate Part: (PECTEN or Transition zone)

15 mm in length

Lined by thin stratified Squamous non keratinised epithelium which is devoid of sebaceous and sweat glands.

Mucosa-Bluish appearance because of the underlying venous plexus Lower limit is called -White line of Hilton

Lower Part:

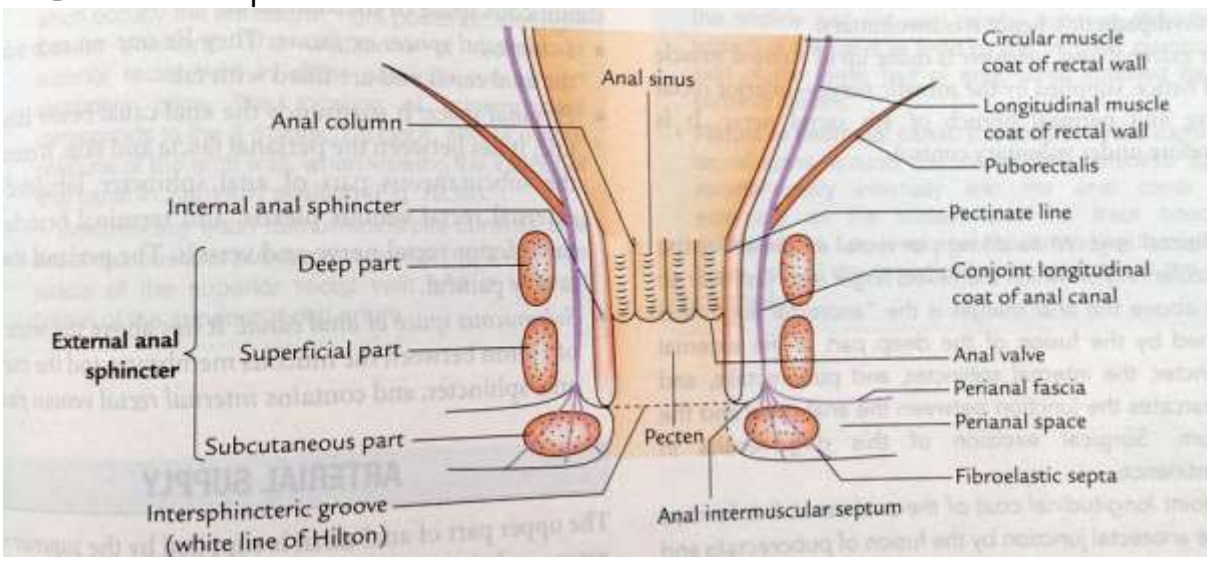
8mm in length
Lined by true skin
Pectinate line divides the anal canal into upper part and lower part.

Sphincters:

Two sphincters surround the anal canal

Internal Anal sphincter

External anal sphincter



Internal anal sphincter:

Involuntary sphincter

Formed by the thickening of circular smooth muscle.

Surrounds the upper 3/4th of anal canal.

Nerve supply: Supplied by sympathetic and parasympathetic nerves.

External anal sphincter:

It is a voluntary sphincter made up of stratified muscle fibres.

Surrounds entire length of anal canal

Consists of 3 parts

Subcutaneous

Superficial

Deep

Nerve supply: Inferior rectal nerve and perineal branch of 4th sacral nerve

Blood supply Arterial supply:

Upper area- supplied by Superior rectal artery Lower area- supplied by inferior rectal artery

Venous Drainage:

Upper area- drains into Superior rectal vein (portal system) Lower area- drains into inferior rectal vein (caval system)

Lymphatic Drainage:

Upper area- drains into Internal iliac LN

Lower area- drains into Horizontal set of superficial inguinal LN

Nerve supply:

Upper area- Autonomic nerves (insensitive)

Lower area- Somatic spinal nerves (Sensitive to cutaneous sensations)

Applied anatomy:

Internal Haemorrhoid

Dilatation of radicles of superior rectal vein above the Pectinate line is known as Internal piles. It is a painless condition.

Anal canal is one of the sites where there is porto- systemic anastomoses
In portal hypertension radicles of superior rectal veins distend.
Condition is known as internal hemorrhoids or piles

Primary internal piles- 3, 7 and 11 O' clock position are known as primary position of internal piles

External Haemorrhoid

Dilatation of external venous plexus, painful condition.

RECTUM- EXTENT & RELATIONS (SE)

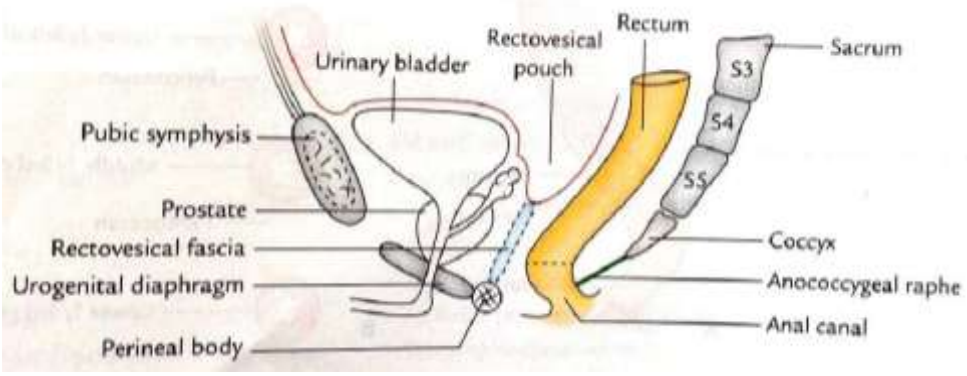
Rectum Extent:

Extends from Recto-sigmoid junction at the level of S3 vertebra to
2-3cm in front & little below the tip of coccyx where it continues as anal canal.

Relations:

I) **Peritoneal Relations**:

Upper 1/3rd covered with peritoneum in front & on the sides.
Middle 1/3rd covered only in front.
Lower 3rd which forms rectal ampulla is devoid of peritoneum.



Visceral Relations:

Anteriorly:

In Males:

Upper 2/3rd - related to rectovesical pouch with coils of intestine & sigmoid colon
Lower 3rd - related to Denonvillier's fascia which separates it from the
Base of urinary bladder,
Terminal parts of Ureters,
Seminal vesicles,
Vas Deferens
& Prostate

In Females:

Upper 2/3rd - related to rectouterine pouch (with coils of intestines and sigmoid colon).

Lower 1/3rd - related to lower part of vagina

Posterior relations are same in males and females.

lower 3 pieces of sacrum, coccyx & anococcygeal ligament

- piriformis, coccygeus and levator ani
- median sacral artery, superior rectal & lower lateral sacral vessels.
- sympathetic chain with ganglion impar.
- pelvic splanchnic nerves, lymph nodes, lymphatics & fat.

CURVATURES OF RECTUM (SE)

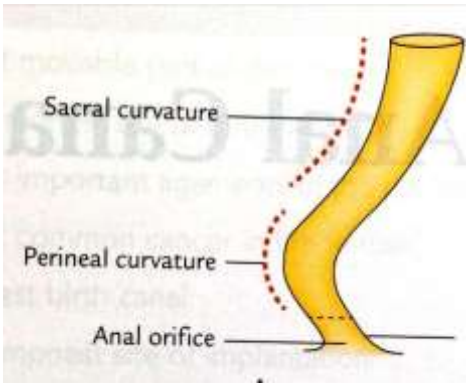
Recum shows Antero-Posterior & Lateral curvatures.

Antero-posterior curvatures

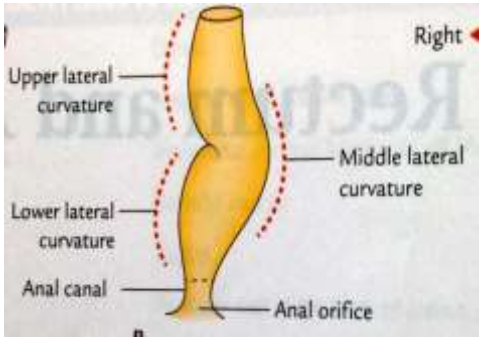
Sacral curvature: Convex backward, follows curvature of sacrum

Perineal curvature: Convex forwards at ano-rectal junction

It is maintained by pubo-rectal sling of levator ani muscle



Lateral Curvatures:



Three in number

2 convexities to the right side

1 convexity to the left side

Upper lateral curve :

Convex to right

Situated at S3/S4 junction

Middle lateral curve :

Convex to left

Situated at Sacro-coccygeal junction Most prominent curvature

Lower lateral curve :

Convex to right

Situated at Tip of coccyx

Along the concavities of the curves Houston's valves project into the interior of rectum.

BLOOD SUPPLY AND DEVELOPMENT OF RECTUM AND ANAL CANAL(SE)

Blood Supply of Rectum:

Arterial supply:

Superior rectal artery - principal artery of rectum.

It is the continuation of inferior mesenteric artery

Supply the mucosa upto the anal valves.

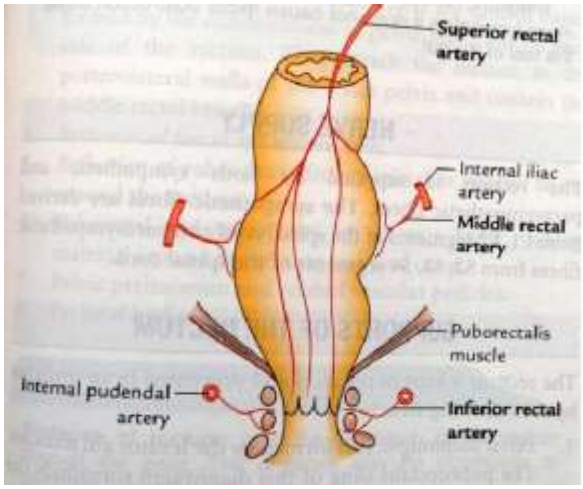
Middle rectal arteries- Branch from anterior division of internal iliac artery.

Supplies lower part of rectum

Inferior rectal arteries – Branch from internal pudendal artery

Anastomoses with superior rectal artery at the level of anal valves/pectiante line

Median sacral artery- Dorsal branch of abdominal aorta.



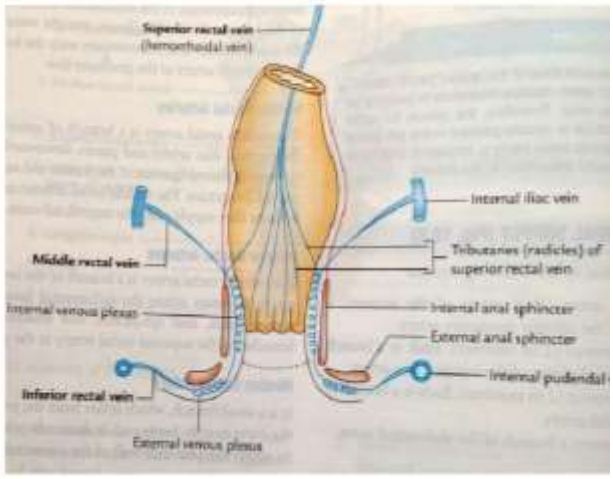


Diagram showing blood supply of rectum and anal canal

Venous drainage:

Venous plexus is situated around the lower part of rectum and anal canal. 2 sets of venous plexus – Internal and external venous plexus.

Internal venous plexus –

Situated above the Hilton's line.

Situated between mucous membrane and internal anal sphincter.

External venous plexus-

Surrounds anus

Situated between perianal skin and subcutaneous part of external anal sphincter.

From the **upper part** of venous plexus six veins pass through anal columns. These unite to form single vein- **superior rectal vein**

This drains into inferior mesenteric vein (**portal venous system**)

From the **middle part o**f plexus – **middle rectal veins** pass on either side to drain into internal iliac veins (**Systemic veins**)

From the **lower part** of plexus- **inferior rectal veins** pass through ischiorectal fossa to drain into internal pudendal veins (**Systemic veins).**

<u>Blood Supply of Anal Canal:</u>

Pectinate line divides the anal canal into upper part and lower part.

Arterial supply:

Upper area- supplied by Superior rectal artery

Lower area- supplied by inferior rectal artery

Venous Drainage:

Upper area- drains into Superior rectal vein (portal system)

Lower area- drains into inferior rectal vein (caval system)

The anastomoses between the 2 sets of veins at the Pectinate line is a site of **portocaval anastomoses in portal hypertension.**

Development of rectum and anal canal:

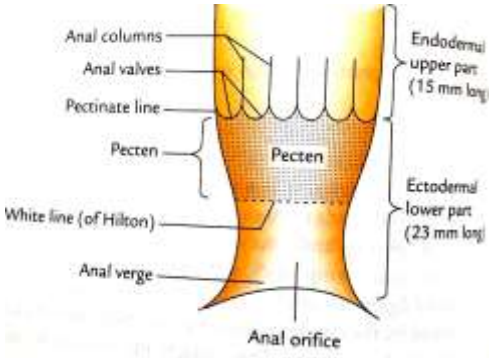
Rectum above the Houston's third valve – Develops from Preallantoic part of hindgut.
Rectum below the Houston's third valve- Develops from dorsal part of endodermal cloaca.
Anal canal above Pectinate line - Develops from dorsal part of endodermal cloaca Anal canal below Pectinate line - Develops from ectodermal proctodeum

Musculature develops from splanchnic mesoderm.

ANAL CANAL- LOCATION, INTERIOR, BLOOD SUPPLY, LYMPHATIC DRAINAGE AND DEVELOPMENT (SE)

Anal Canal begins at ano-rectal junction ,where rectal ampulla suddenly becomes narrow Length is 3.8 cms

Extent: Recto-sigmoid junction to 4cm below and in front of tip of coccyx to the anal opening



Interior:

Interior of anal canal is divided into Three parts Upper part-15mm

Intermediate part-
15mm Lower part-8mm

Upper Part:

15mm in length

Lined by mucous membrane, simple columnar epithelium Anal columns of Morgagni- 6-10 longitudinal mucous fold

Anal valves- crescentic folds of mucous membrane connecting lower part of anal columns Anal sinus- depression above anal valves & in between the anal columns

Pectinate line- demarcates the lower border of upper part and situated at the level of anal valves.

Intermediate Part: (PECTEN or Transition zone)

15 mm in length

Lined by thin stratified Squamous non keratinised epithelium which is devoid of sebaceous and sweat gland
Mucosa-Bluish appearance because of the underlying venous plexus Lower limit is called -White line of Hilton

Lower Part:

8mm in length
Lined by true skin
Pectinate line divides the anal canal into upper part and lower part.

Blood supply of anal canal Arterial supply:

Upper area- supplied by Superior rectal artery Lower area- supplied by inferior rectal artery

Venous Drainage:

Upper area- drains into Superior rectal vein (portal system) Lower area- drains into inferior rectal vein (caval system)

Lymphatic Drainage:

Upper area- drains into Internal iliac LN

Lower area- drains into Horizontal set of superficial inguinal LN

Development:

Upper area- develops from endodermal cloaca

Lower area- develops from ectodermal proctodeum

EXTERNAL ANAL SPHINCTER (SE)

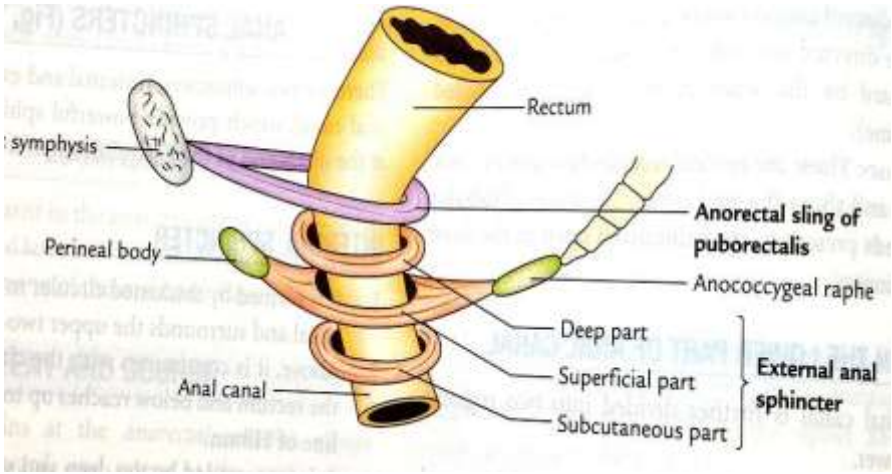
It is a voluntary sphincter made up of stratified muscle fibres. Surrounds entire length of anal canal

Consists of 3 parts

Subcutaneous

Superficial

Deep



Subcutaneous Part:

Flattened band around the anus

Separated from the perianal skin by external venous plexus.

Superficial Part:

Elliptical in shape

Arises from tip of coccyx and inserted to perineal body

Deep Part:

Annular in shape

Surrounds anorectal junction

No bony attachment, inserted to perineal body

The three loops together perform effective anal closure (Anal continence).

Nerve supply: Inferior rectal nerve and perineal branch of 4th sacral nerve

WHAT ARE HOUSTON'S VALVES AND WHAT IS ITS FUNCTION (SA)

Houston's valves are semilunar transverse folds in the interior of rectum.

They are situated against the concavities of lateral curvatures of rectum. Formed by reduplication of mucous membrane.

They are 4 in number.

First fold/ valve: projects from right or left wall Situated at rectosigmoid junction

Second fold/ valve: projects from left wall Situated 2.5 cm above third valve.

Third fold/ valve: the most important, constant and largest fold projects from anterior and right wall

Fourth fold/ valve: projects from left wall Situated 2.5 cm below third valve.

Function: they provide support to hold faeces and prevent excessive distension of rectal ampulla.

LINING EPITHELIUM OF DIFFERENT REGIONS OF ANAL CANAL (SA)

Interior of anal canal is divided into three regions:

Upper 15 mm: It is lined by simple columnar epithelium.

Shows 6-10 longitudinal mucosal folds – Anal columns.

Anal valves- crescentic folds of mucous membrane connecting the lower ends of anal columns

Anal sinuses- depression above anal valves &in between the anal columns.

Intermediate 15mm: Lined by stratified squamous nonkeratinised epithelium.

It is devoid of sweat and sebaceous glands

Lower 8mm: It is lined by stratified squamous keratinised epithelium.

PECTINATE LINE – IMPORTANCE (SA)

Pectinate line- forms the muco-cutaneous junction of anal canal

Corresponds with the position of anal valves.

Situated at the middle of internal anal sphincter.

Pectinate line divides the anal canal into upper and lower areas which are different in ;

Development

Blood supply

Lymphatic drainage

Nerve supply

HILTONS LINE—IMPORTANCE (SA)

White line of Hilton- marks the lower limit of intermediate part of anal canal. Situated at the lower limit of internal anal sphincter.

Anal intermuscular septum is attached here

Anal fascia and lunate fasciae extend upto this line.

DIFFERENCES ABOVE AND BELOW THE PECTINATE LINE OF ANAL CANAL (SA)

Pectinate line divides the anal canal into upper part and lower part.

Arterial supply:

Upper area- supplied by Superior rectal artery Lower area- supplied by inferior rectal artery

Venous Drainage:

Upper area- drains into Superior rectal vein (portal system) Lower area- drains into inferior rectal vein (caval system)

Lymphatic Drainage:

Upper area- drains into Internal iliac LN

Lower area- drains into Horizontal set of superficial inguinal LN

Nerve supply:

Upper area- Autonomic nerves (insensitive)

Lower area- Somatic spinal nerves (Sensitive to cutaneous sensations)

Lining epithelium:

Upper area- lined by simple columnar epithelium

Lower area- lined by stratified squamous epithelium

Development:

Upper area- develops from endodermal cloaca

Lower area- develops from ectodermal proctodeum

SPHINCTER ANI EXTERNUS (SA)

It is a voluntary sphincter made up of stratified muscle fibres. Surrounds entire length of anal canal

Consists of 3 parts

Subcutaneous

Superficial

Deep

Nerve supply: Inferior rectal nerve and perineal branch of 4^{th} sacral nerve

WHAT ARE THE CAUSES & TYPES OF HAEMORRHOIDS IN THE ANAL CANAL (SA)

Rectal veins are important sites of porto-caval anastomoses in portal hypertension

Radicles of superior rectal veins are devoid of valves; hence in portal hypertension these veins are likely to be distended. The trunk of superior rectal vein pierces posterior wall of rectum. So if there is prolonged straining during defecation the radicles of the superior rectal vein may be distended.

Types

Internal Hemorrhoids-Dilatation of radicles of superior rectal vein above the Pectinate line is known as Internal piles. painless condition

External Hemorrhoids- Dilatation of external venous plexus, painful condition.