

Anatomy of Sigmoid colon, rectum, anal canal

For each organ, we will mention:

1. Structure
2. Relations
3. Arterial Blood Supply
4. Venous drainage
5. Lymphatic drainage
6. Nerve Supply

Relax, the sheet isn't that long, it is just the font and spacing is large to make it easier to read :)

Sigmoid Colon

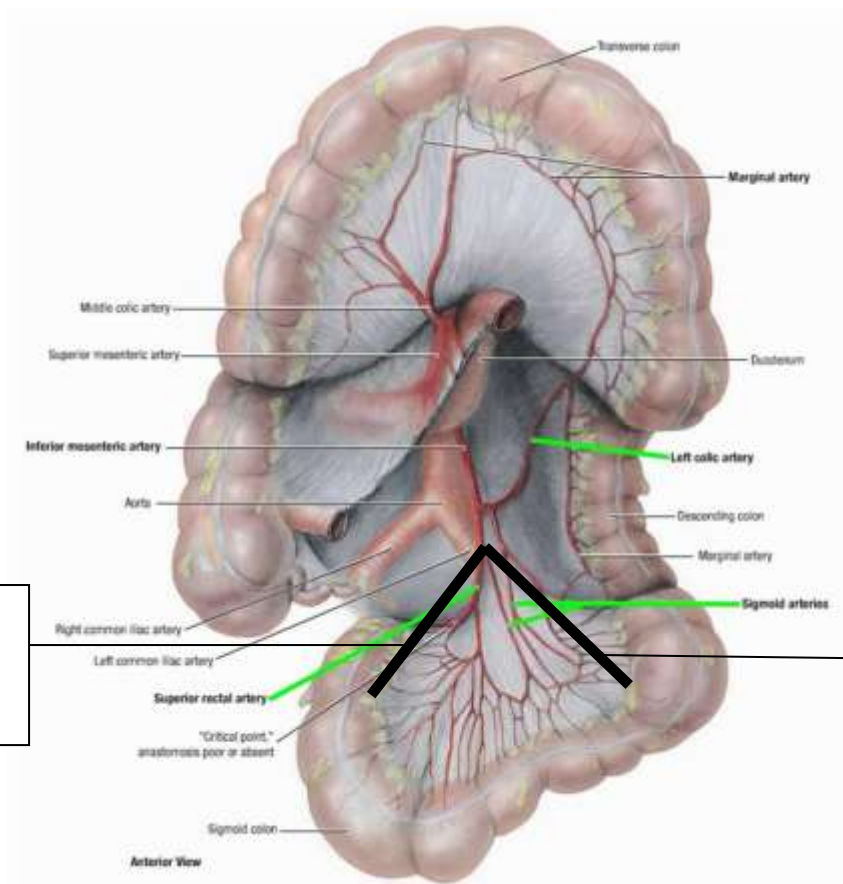
-Structure:

- 10-15 inches long (variation exists)
 - Continuation of descending colon
 - Located in the pelvic region on the **left** side at iliac crest or bifurcation of common iliac artery
 - Ends as rectum in front of **middle** part of sacrum (3rd piece of sacrum)
 - Have **long** tags of fat (epiploic appedices) and taenia coli
 - Situated inside rectovesical pouch in males and rectouterine pouch (Douglas pouch) in females
 - Intraperitoneal with a mesocolon attaching it to the post. abdominal wall
- **Mesocolon of Sigmoid (also called Pelvic Mesocolon)**
- Continuation of descending colon*
 - Inverted V - shaped peritoneum attached to pelvis
 - Its **root**** have a lateral and a medial limb

*I think the Dr. meant sigmoid colon

** Root: attachment of the mesocolon (or mesentery)

- The **Lateral** limb is attached to the *left* external iliac artery by blending with the artery's outer layer. It contains the lower left colic artery.
- The **Medial** limb descends in front of the sacrum till the sacrum's **middle** piece. It contains superior rectal artery (continuation of inferior mesenteric artery)



Notice the inverted V-shaped mesocoln.

Medial limb (notice sup. rectal artery)

Lateral limb (notice the left colic artery in its contents)

-Relations

To the **Left** of the sigmoid colon:

- External Iliac vessels
- Lateral wall of pelvis
- Vas deferens or ovary

To the **Right**: small intestine

Superiorly: pouch containing coils of small intestine

Inferiorly: Urinary bladder in males / Uterus in females

Posteriorly:

- Rectum
- Sacrum
- Small intestine
- Sacral plexus
- Piriformis (origin: anterior surface of middle 3 pieces of sacrum)
- External iliac vessels
- Left ureter
- Left Internal common iliac artery*

-Blood Supply

Sigmoidal Arteries (branches from inferior mesenteric artery) and between them marginal artery**

-Venous Drainage

Sigmoid colon follows the hindgut, so to **Inferior Mesenteric** vein which is part of portal circulation.

-Lymphatic Drainage

Follow the inferior mesenteric vessels and drains in the **inferior mesenteric** lymph nodes which drain to the **pre-aortic** lymph nodes

*I believe it is the same as the "internal iliac artery"

** Marginal artery: an anastomosis between Rt, middle and Lt. colic arteries, check gray's 336, so I wonder if the Dr. is referring to the same one...

-Nerve Supply

Parasympathetic and sympathetic innervations are provided from the inferior hypogastric plexus*, with parasympathetic originating from S2, S3, S4 (from the pelvic splanchnic nerves)

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Rectum

-Structure

- 5 inches, 13 cm
- Continuation of sigmoid colon
- Start from middle piece of sacrum (from end of sigmoid)
- End 1 inch beyond tip of coccyx
- Descends downwards, backwards and deviates to the left
- If viewed Ant. / post. , it is moving along concavity of sacrum, so have **1 anterior concavity***
- Lateral view: on the **left 2** concavities and on the **right 1** concavity so like the number 4 in Arabic**
- End of rectum is dilated and called **ampulla of rectum**
- Histology: continuation of GIT (simple columnar epithelial cells): mucosa, submucosa, muscular layer, peritoneum or adventia
- **No taenia coli, no sacculations, no tags of fat**
- Have **transverse** folds of mucosa

Levator Ani muscle is an important muscle of the pelvis and forms the pelvic diaphragm (diaphragma pelvis). A part of this muscle surrounds the ano-rectal junction at end of rectum (part where rectum continues as anal canal), this muscle part is called PuboRectalis muscle and it pulls the rectum anteriorly to form an angulation. ***

* In the slides, it is written a "lateral view" instead of "ant. / post." but we checked with the Dr it is ant./post.

** Concavity is the dent (like a small depression), so differentiate it from "curves"

*** Helps control defecation

- Rectum divided into **3** parts: upper, middle and lower.
 - Peritoneum and the rectum
 - Upper third completely covered by peritoneum on anterior surface and lateral sides but not present on the strip of posterior surface (retroperitoneal)
 - Middle third covered only on the anterior surface
 - Lower third is devoid (lacks) of peritoneum
 - The peritoneum covering the anterior surface of the rectum (upper 2/3) is related to making the rectovesical pouch in males or Douglas pouch in females
 - The lower third is important for the PR (per rectal) examination (mentioned later)

-Relations

Posteriorly to the rectum:

- Sacrum
- Tip of coccyx and piriformis muscle (after asking the Dr. about the post. relations of the rectum)
- (In the record the Dr. mentioned the **anococcygeal body*** however after rechecking with him he said it is only post. to **anal canal**)

Anteriorly:

- (In the record the Dr. mentioned the **perineal body**** however after rechecking with him he said it is only ant. to **anal canal**)
- Rectovesical/ Rectouterine pouch containing sigmoid colon

*Anococcygeal body or ligament is a hard fibrous tissue located post. To the anal canal

**Perineal body is a hard fibrous tissue located ant. To the anal canal and post. to the urinary bladder

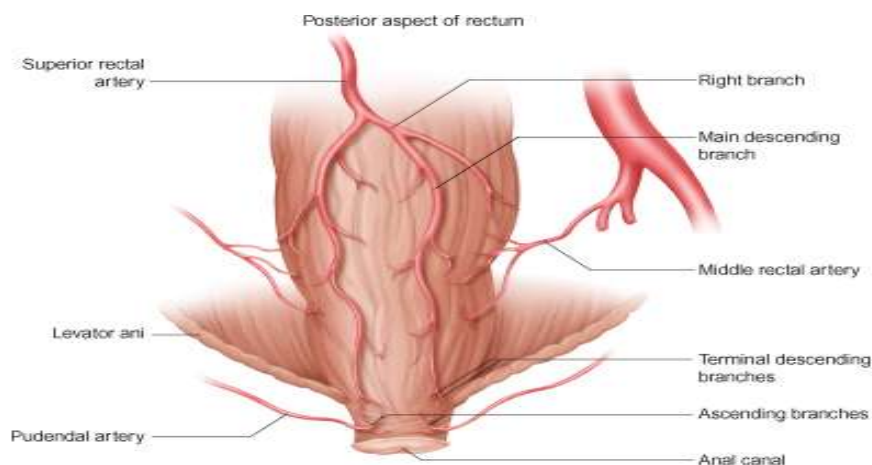
- At the **lower third** of rectum in **males**:
 - Post. surface of urinary bladder
 - Seminal vesicles (especially apparent if calcified)
 - Ampulla of vas deferens (ampulla: termination of vas deferens)
 - Prostate gland
- Lower third in females: Post. surface of vagina

On either sides of the Rectum: Ischio-rectal fossa (to be explained later)

-Blood Supply

Shared with **anal canal**.

1. **Superior rectal artery**: Continuation of inferior mesenteric artery. Its branches reaches between the mucosa and submucosa of the rectum and anastomose with branches from **middle** and **inferior** rectal arteries
2. **Middle rectal artery**: A **direct** branch from the anterior division of the internal iliac artery
3. **Inferior rectal artery**: A branch from **internal pudendal artery** which is a branch from the internal iliac artery. It goes to anorectal junction.



Notice the sup., middle rectal arteries and remember the pudental artery gives rise to inf. rectal artery

-Venous Drainage

The rectum is a site for **porto-systemic circulation** anastomosis.

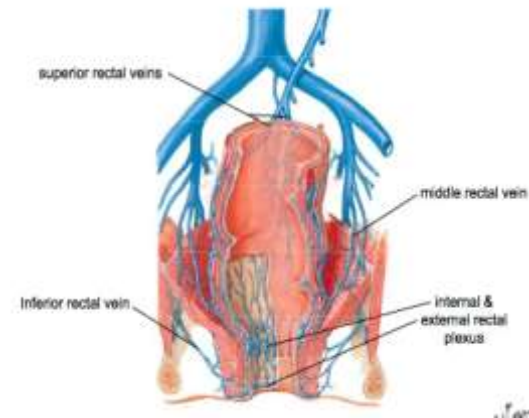
Share venous drainage with **anal canal**.

The veins correspond to the arteries.

The rectal veins are also called **hemorrhoidal veins** and their anastomosis is called **hemorrhoidal plexus**.

Notice the position of the internal and external rectal plexuses

1. Superior rectal vein which drains into inferior mesenteric vein which drains into the portal vein (portal part).
2. Middle and inferior rectal veins which drains into the internal iliac vein which drains into **inferior vena cava** (middle and inf. rectal veins on left drain into **left renal vein**) (systemic part)



Clinical Application: Hemorrhoids

In case of portal hypertension, **hemorrhoids** (also named piles) can occur in the veins and their plexuses which is a tortuous dilatation and engorgement of the veins and a **thrombosis** could occur in them.

1. **Internal** hemorrhoid is one that occurs in the superior rectal veins related to upper part of anal canal and lower end of rectum:
 - It is usually painless (unless inflamed or infected), and usually doesn't budge outside the anal orifice, however can elongate and appear outside the anal orifice.

2. **External** hemorrhoid is one that occurs in the inferior rectal veins or plexus in the lower part of anal canal and usually appears outside the anal orifice with time and after defecation, and especially if thrombosis occurs:

-It is very painful, and severely tender, so require faster surgical intervention than the internal hemorrhoid.

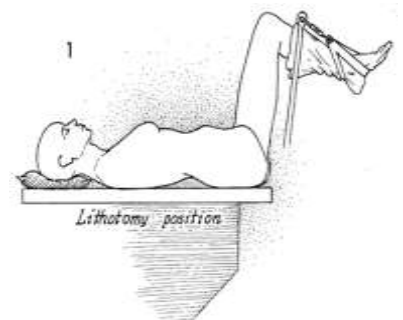
Causes of Hemorrhoids:

- "Cancer Rectum"
- Portal Hypertension
- Pregnancy, due to stagnation of blood in lower limb and pelvis (relieved after delivery)
- Chronic cough and constipation(strain by ant. abdominal wall)
- Agents causing sensitivity at that region (irritates mucosa), example: hot sauce
- Congenital weakness in walls of the veins

The surgical classification of hemorrhoids is **not** required.

Common Locations of Hemorrhoids:

The patient is to be in the **lithotomy position** where the knees are moved toward the anterior abdominal wall and the anal canal and lower rectum will be visible as a circular "clock hour", and the most common locations of hemorrhoids will be at **3, 7, and 11** o' clock.



-Lymphatic Drainage

Through the inferior mesenteric lymph nodes till the pre- aortic lymph nodes (same like upper half of anal canal as well, while lower half of anal canal to the superficial inguinal lymph nodes).

A "cancer rectum" will cause enlargement in pre- aortic lymph nodes while a cancer in lower half of anal canal will cause enlargement of superficial inguinal lymph nodes.

-Nerve Supply

- Parasympathetic and sympathetic innervations are provided from the inferior hypogastric plexus, with parasympathetic originating from S2, S3, and S4 (from the pelvic splanchnic nerves)

- The rectum is sensitive only to stretch; there is no pain, temperature or touch sensations, only an achy pain when the rectum is stretched.

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Anal Canal

-Structure

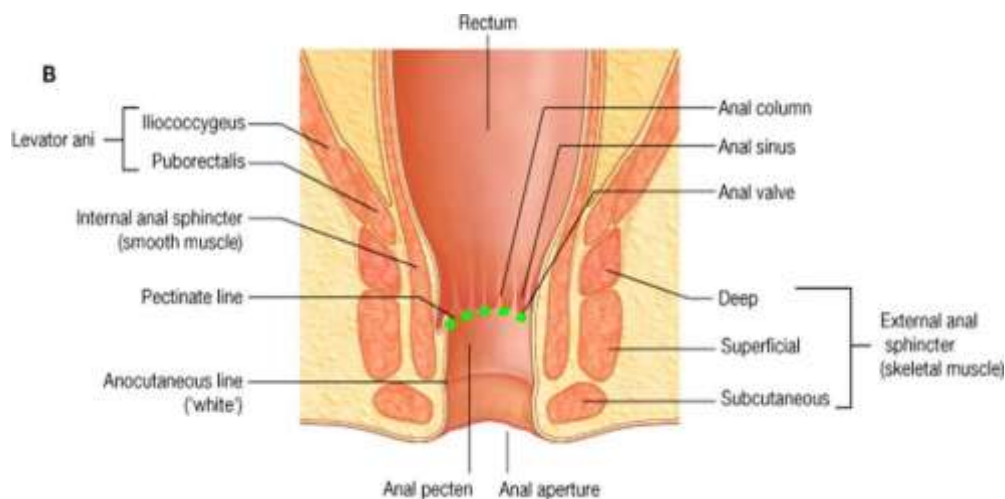
- Continuation of the rectum
- Start 1 inch beyond coccyx (from end of rectum)
- Descends downward and backward
- Ends at the anal orifice
- 4-5 cm, but actually 1.5 inch = 3.8 cm -_-
- Contains longitudinal folds of mucosa called **anal columns** or **columns of Morgagni** which ends as a small pouch

called anal **sinus** or **valve***. The anal valves form a circular line around the canal called **pectinate line**.

- The Dr. said it is enough for us to divide the anal canal into **upper half** and **lower half**, which are separated by the **pectinate line** which also marks the end of the hindgut (lower half of anal canal is not from hindgut).
- The upper half epithelium consists of **simple columnar** cells while lower half epithelium is stratified squamous
- The origin of the upper half is **endodermal** while the origin of the lower half is **ectodermal**
- The lower half of the anal canal is divided by a white line called **Hilton's white line**. The stratified epithelium above this line is **non-keratinized** while below it the epithelium is **keratinized**, and hence these two parts have different colors.
- The upper half of the anal canal is like the rectum; it is sensitive only to stretch and have **autonomic** innervations while the lower half have **somatic** innervations from the **inferior rectal nerve** from **S4** hence have sensation of touch, pain and temperature as well.
- There is an **internal anal sphincter** just under the mucosa and especially around the ano-rectal ring; it is **involuntary**

Clinical Application:
Sometimes a hard large piece of feces can tract the anal pouch downwards causing a longitudinal ulcer called **anal fissure**, which is very painful. The patient can't bare a PR examination, and requires a surgical treatment.

- There is an **external anal sphincter** and it is **voluntary** (innervated by inferior rectal nerve) and has 3 parts:
 - Deep
 - Superficial: the **only** part among them that has a bony attachment to the **coccyx**...it also attaches to the anococcygeal ligament, surrounds lower part of the internal sphincter and inserts into the perineal body
 - Subcutaneous



- Around the anal orifice, there are hair follicles

-Relations

Anteriorly:

In males:

- Perineal Body
- Origin or bulb of penis

In females: End of vagina

At the junction between the anal canal and rectum there is the **ano-rectal ring**.

The ring is formed by:

- PuboRectalis muscle (part of levator ani) which makes an angulation by pulling the junction forward (anteriorly)
- Internal anal sphincter
- Deep part of external sphincter

The ring can be felt during PR examination.

Posteriorly:

- Anococcygeal ligament
- Tip of coccyx

Laterally: Ischiorectal fossa

-Blood Supply

- Superior rectal Artery especially to upper half
- Middle and Inferior rectal arteries to lower half

-Venous Drainage

Corresponds to arteries and same drainage as in the rectum.

Remember: the **superior** rectal vein forms the **internal** rectal plexus and the **inferior** rectal vein forms the **external** rectal plexus and are sites of hemorrhoids.

-Lymphatic Drainage

Upper half is drained to the inferior mesenteric lymph nodes

Lower half is drained to the superficial inguinal lymph nodes

-Nerve Supply

Upper half autonomic innervations

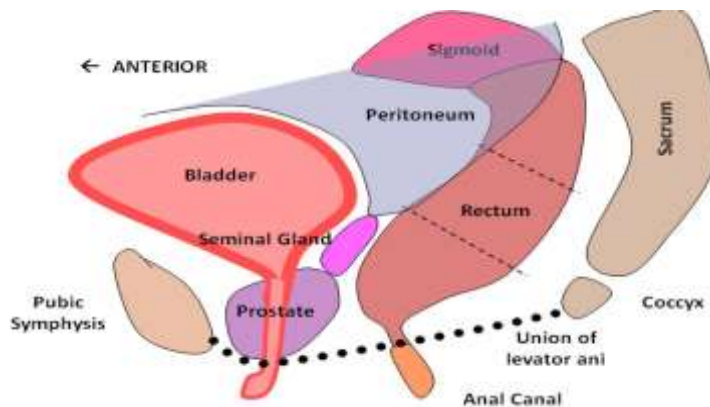
Lower half somatic innervations

Clinical Application: Per Rectal (PR) examination

The index finger is inserted through the anal orifice to examine the anterior relations of the anal canal and lower third of the rectum.

Structures examined:

- **Prostate**: especially for men above age of 40 where prostate hypertrophy and tumor are common which appear hard upon examination especially the tumor which can cause narrowing of the prostatic urethra so the patient suffer from urination problems especially at night.
- **Seminal Vesicles** which can be calcified, **vas deferens** and its ampulla, and both of these structures are located at the posterior surface of the urinary bladder
- Post. surface of **vagina** in females



Notice how the rectum is divided to third parts and the relations of the lower third part.

Ischiorectal Fossa

Note: We will be taking the anal triangle in more detail in the urogenital system; however Dr. mentioned it includes **urethra** and **anal canal**.

A fossa between the ischial tuberosity and rectum, and located at the sides of the rectum and anal canal.

It is full of fat which allows dilatation of the rectum.

Hair follicles on the perianal skin open to the inside of the fossa.

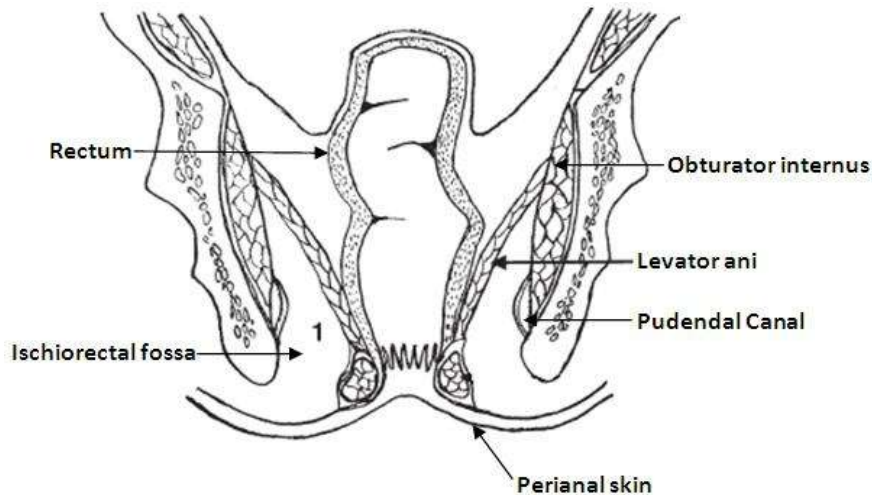
The fossa is wedge-shaped with apex and a base (base opens on perianal skin)

- Medial border: **Levator ani** extends from lateral pelvis to rectum and forms the medial border of the fossa. The rectum, anal canal, and anal sphincter (especially the external sphincter) lie medially as well.
- Lateral border: **Fascia of obturator internus** (The obturator internus and externus lie to the lateral of the fascia respectively).

On the lateral border, there is also the **pubendal canal (Alcock's canal)** which is a defect in the obturator internus fascia, and it contains the:

-**Internal pubendal vessels** (artery and vein), **pubendal nerve, nerve to obturator internus**, fascia and lymphatics.

Contents: The contents of the pubendal canal in addition to the **inferior rectal nerve and vessels**. (Remember the inferior rectal nerve provide the somatic innervations to the external sphincter and lower half of anal canal)



Remember: The obturator externus is lateral to the obturator internus.

Clinical Application: Perianal Abscess

The Ischioanal fossa is a "dirty area" as the hair follicles on the perianal skin open to the inside of the fat filled fossa and this makes it a common site for **infection** and formation of **perianal abscess**, and hence must be kept clean.

The perianal abscess could be **superficial** (near the skin), **deep** or **more deep** (above levator ani muscle). When the perianal abscess is deeper, recurrent infections are common and it is more dangerous. The abscess must be drained.

The abscess can cause a **fistula** or a **sinus**.

Fistula: opening between 2 cavities in the body. The fistula will be from the fossa to the anal canal, so pus and blood will come out with the feces.

Sinus: opening on the perianal skin.

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Sorry if I missed out anything and good luck everyone in your exams :)