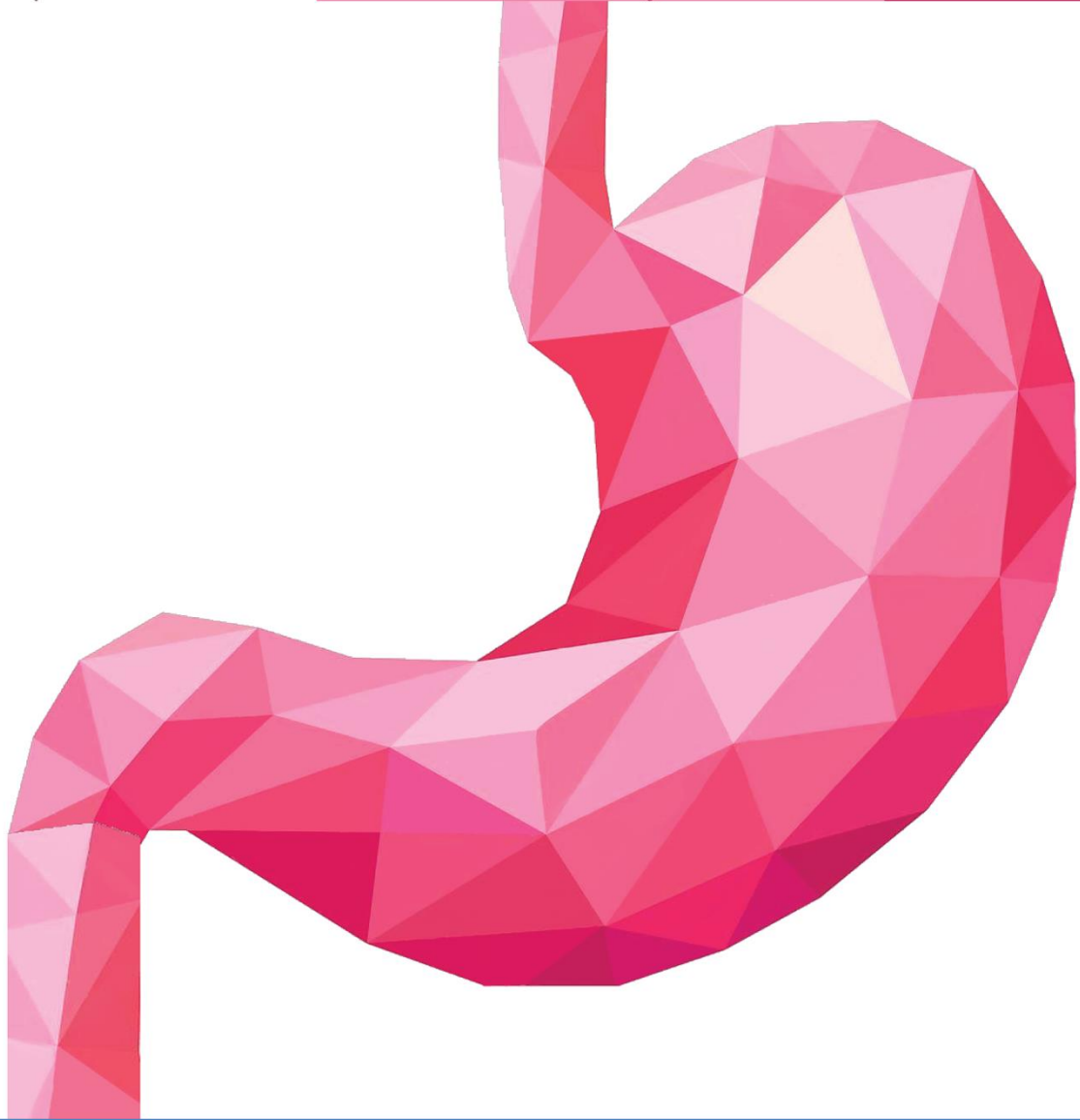




# GIS 14

ANATOMY



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**Scientific Correction: HALA RAED**

**Gramatical Correction: HALA RAED**

**Doctor: ALMOHTASEB**

الشيت طويلة جداااا اكثر من مما تتخيل لذلك ادرسها عجزئين وركز منيح

## Pelvic colon

It involves:-

- 1- the sigmoid colon
- 2- rectum
- 3- upper part of the anal canal (upper 2 cm).

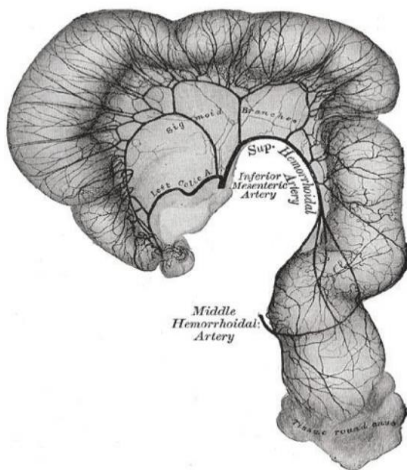
### A-Sigmoid colon

- intrapertoneal (mobile) part of large intestine
- its long is 10-15 inches (25-38) cm
- hangs down into the pelvic cavity in the form of a loop and attached to the posterior pelvic wall by the fan-shaped sigmoid mesocolon
- Begins as a continuation of the descending colon on the left side of the pelvic brim (inlet) it goes to the right and ends at the mid of sacrum anterior to the third sacral vertebra where it continues with the rectum.

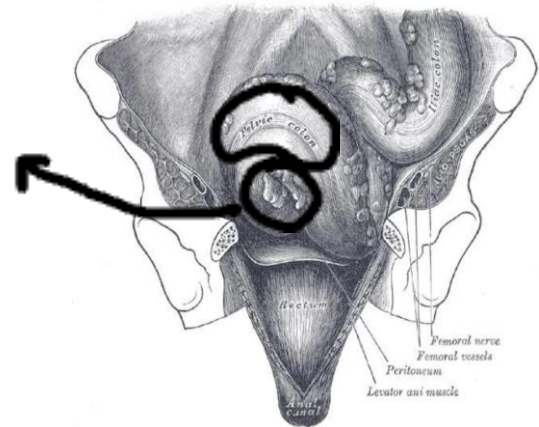
- Has four parts:

- a. The root (mesocolon): has an inverted V-shape attachment.
- b. The lateral limb: contains lower Left Colic artery.
- c. The medial limb: contains Superior Rectal artery (continuation of the inferior mesenteric artery)
- d. The free edge: curved to the right of midline and contains the end of sigmoid colon. (FROM LEFT TO THE RIGHT)

Note: Attachment of mesocolon starts at the middle piece of sacrum THEN goes upward to the left THEN descends downward to attach firstly to the left common iliac artery and THEN to the middle of left external iliac artery .



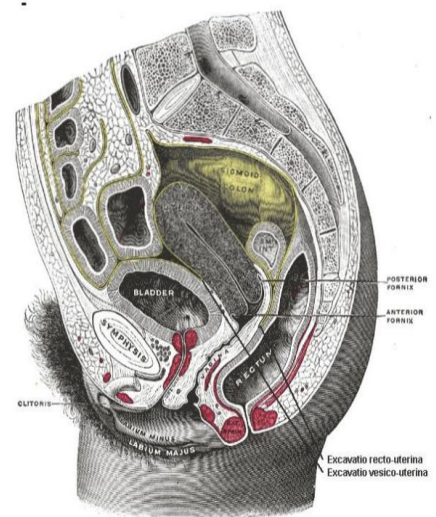
The root



-Has very long appendices epiploicae.

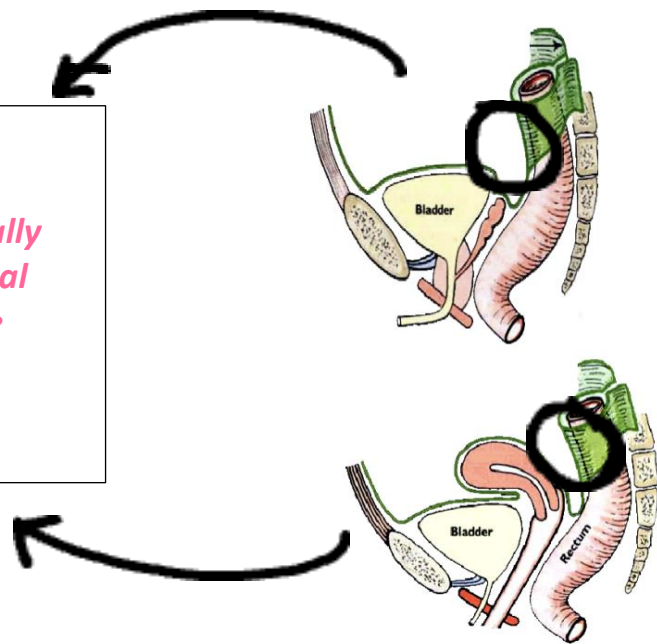
- Relations of sigmoid colon:

- 1• **Left:** left external iliac vessels, lateral wall of pelvis, and vas deference in males or ovary in females.
- 2• **Right:** small intestine
- 3• **Superior:** coils of small intestine
- 4• **Inferior:** urinary bladder in males, uterus in females
- 5• **Posterior:** rectum, sacrum, lower coils of terminal part of ileum, sacral plexus, left piriformis muscle and we have another muscle, left external iliac vessels, left ureter, and left internal common iliac artery.



**\*\* NOTE :-**

*The sigmoid colon usually occupies the rectovesical pouch in males and the rectouterine pouch in females ( Black circles)*

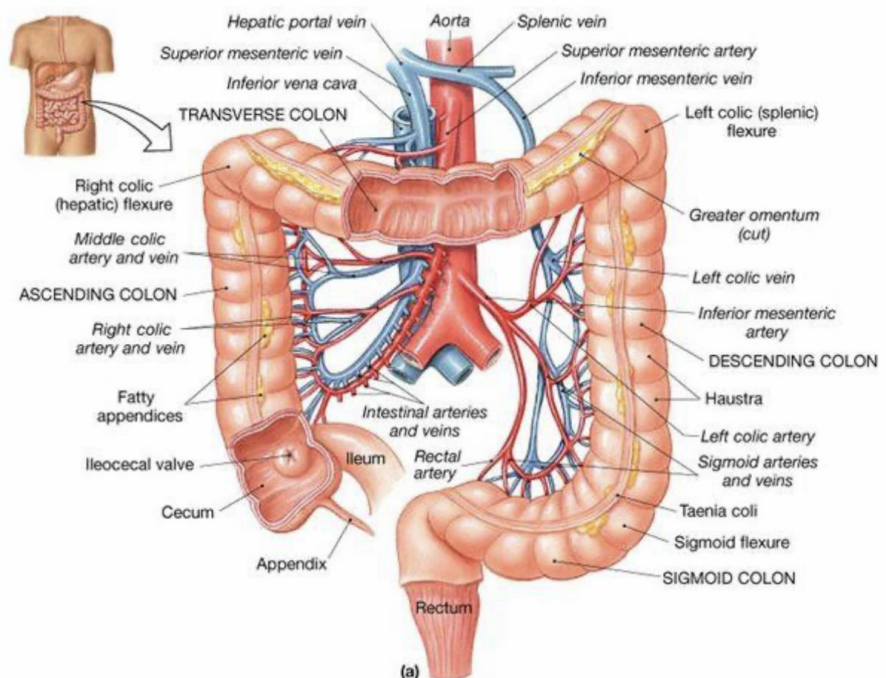


	Arterial supply	Venous drainage	Nerve supply	Lymphatic drainage
The sigmoid colon	<p>1. The inferior mesenteric artery branches to the left colic artery, sigmoidal arteries and continues as the superior rectal artery.</p> <p>2. Sigmoid arteries from the inferior mesenteric artery supplies the sigmoid colon.</p> <p>3. The most superior</p>	<p>Sigmoid veins drain into the inferior mesenteric vein which terminates when reaching the splenic vein, which continues to form the portal vein.</p>	<p>A-The sympathetic and parasympathetic nerves from the inferior hypogastric plexuses.</p> <p>b- Sympathetic from L1 and L2.(inferior mesenteric ganglia)</p> <p>c- The parasympathetic supply is derived from the pelvic splanchnic nerves S2, S3, S4 (Spinal nerves )</p>	<p>The lymph drains into nodes along the course of the sigmoid arteries to the inferior mesenteric nodes (pre-aortic lymph nodes)</p>

sigmoid artery anastomoses with the descending branch of the left colic artery.

**\*\*NOTE:-**

*This picture is very important ( notice that the veins are lateral to the arteries )*



## **B-Rectum**

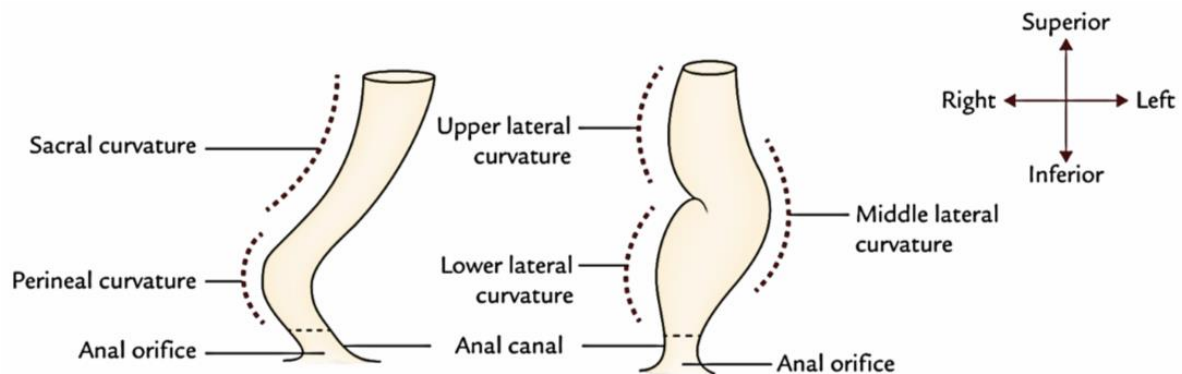
– The rectum is about **5 inches (13 cm)** long.

Begins at **middle piece of sacrum** (at the end of sigmoid colon) in front of the third sacral vertebra as a continuation of the sigmoid colon  
it ends **1 inch beyond the tip of the coccyx** by piercing the pelvic diaphragm and become continuous with the anal canal.

– The lower part of the rectum is dilated to form the **rectal ampulla** -which is a reservoir for stool.

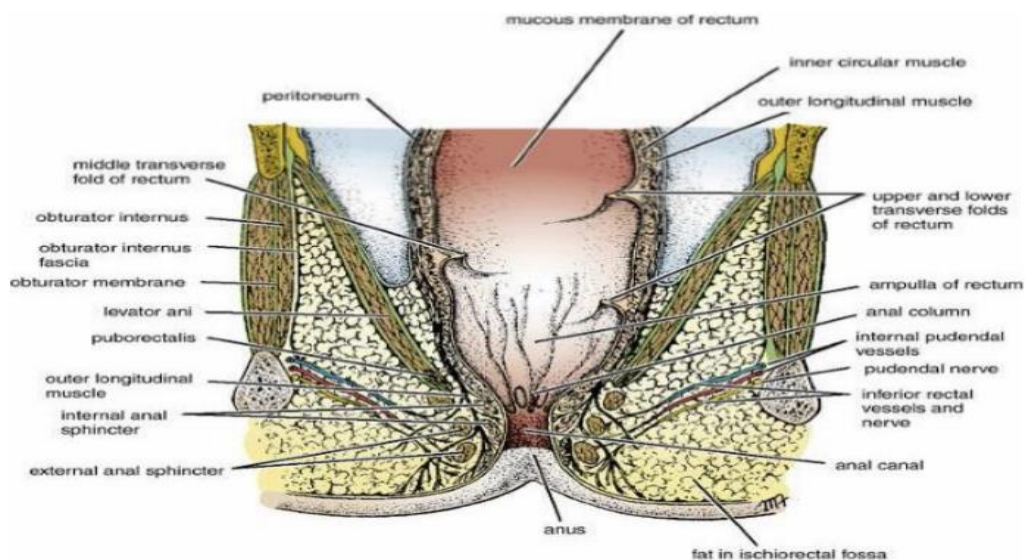
-The rectum deviates to the left, but it quickly returns to the median plane.

-On lateral view, the rectum follows the anterior concavity of the sacrum before bending downward and backward at its junction with the anal canal , if you take a view from sides you will notice that it has two concavity on the left and one concavity on the right.



-The **puborectalis** portion of the **levator ani muscles** (this muscle is very important and it is called the diaphragm of the pelvis form the flor of the pelvis ani coz it attach to anal canal specifically to the junction between the anal canal & rectum ,it pulls it upward levator ) forms a **sling** at the junction of the rectum with the anal canal and pulls this part of the bowel **forward**, producing the anorectal angle and it is an important landmark that separates the rectum from the anal canal .

## Rectum



### \*\*NOTE :-

We should do per rectal examination to every patient in the emergency above 40 years old .

### PR examination (per rectal examination)

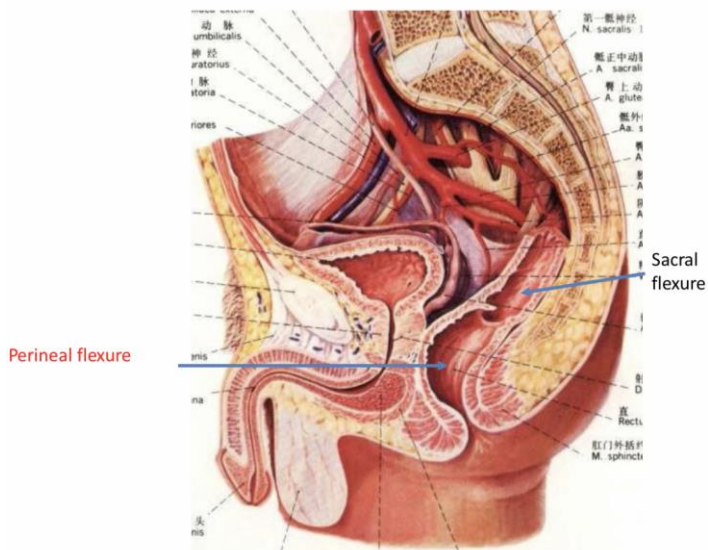
✓ An internal examination where the physician slips a lubricated finger into the rectum through the anus and palpates the inside for a short time. Structures around the anal canal and lower third of rectum can be sensed.

**A-In females**, the physician can sense only the vagina anteriorly.

**B-In males**, the prostate, vas deference, seminal vesicles and urinary bladder can be sensed.

✓ PR examination is a must for male patients of an old age because the prostate in males **over 40** becomes **hypertrophic** and could develop **cancer** .

✓ Normal prostate is soft ( because it is a gland ) but if it is hypertrophic one is hard and firm . When the patient is asked if he uses the bathroom at night he



would say he uses it 4- 6 times and that he lacks the force of the urine flow while urinating. This means that the prostate is **hypertrophic** and compresses the urethra. The patient should be treated or else the urine would move from the bladder to the kidney causing it to become hypertrophic and thus loses his kidney.

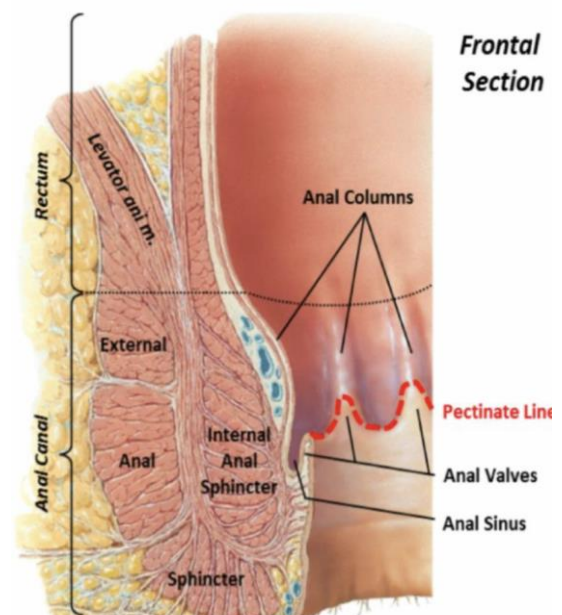
✓ Also, through this examination you can Palpate **the calcification** in vas deferens.

-One of the features of the rectum is the presence of transverse and longitudinal mucosal folds.

1-There are three transverse folds: upper, lower, and middle.

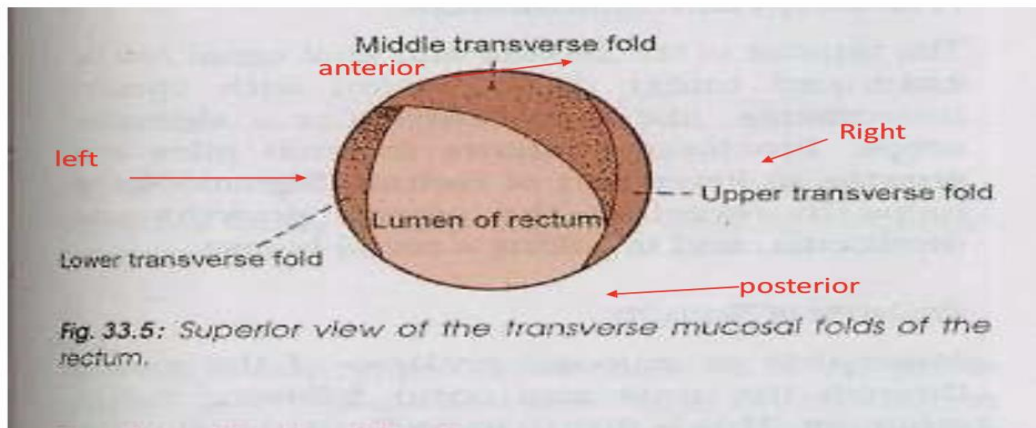
The transverse folds are called **Houston's valve** were upper fold projects from right, middle fold projects from anterior and right wall, and lowest fold projects from left wall.

\*these folds are attached to the wall of the rectum so when they are contracted they pull the wall of the rectum producing **two** concavities on the **left** side and **one** concavity on the **right** side .



2-The longitudinal folds are called **anal columns** and at ends of them they form **anal sinuses (pockets)** and **anal valves( continuations of the mucosa in end of the columns)** . Below them is a line called pectenate line separating upper and lower parts of anal canal.





-At both sides of the rectum and anal canal is the **ischiorectal fossa** (wedge-shaped) which is **filled with fat** to provide space for the rectum and anal canal during defecation (advantages), but this also permits infection causing a recurrent **perianal abscess** in the fossa and it may recur specially if it was **apical** (on the apical surface) (disadvantages)

Now wedge shape that's means it has apex and base

Base = skin around the anal orifice

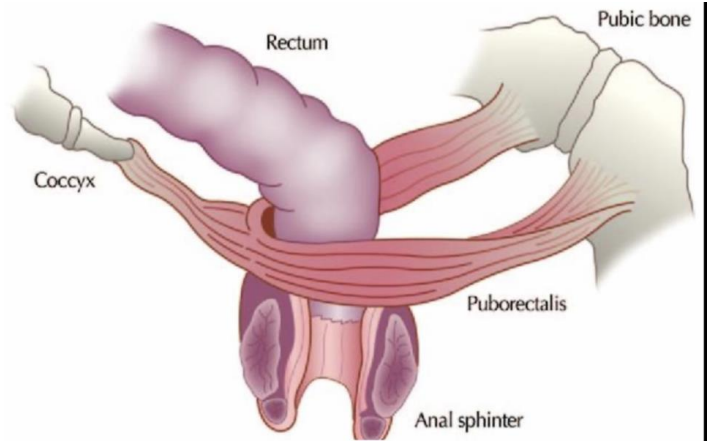
Apex is located between 2 muscles **levator ani** (which is at its end called **puborectalis** at the junction between the rectum & the anal canal) & **obturator internus muscle** and around it obturator fascia forming the lateral wall of ischiorectal fossa .

- In the wall of obturator internus fascia is the **pubudal canal** on the **lateral** side of ischiorectal fossa, it is **crossed** by the **internal pudendal vessels** and **pudendal nerve** which gives the inferior rectal nerve supplying the external anal sphincter.

### Puborectalis muscle:-

✓ The puborectalis portion of the levator ani muscle forms a sling at the junction of the rectum with the anal canal and pulls this part of the bowel forward, producing the anorectal angle. It defines the junction between the rectum and anal canal, and is very important in defecation.

It takes origin from the pubis and goes posteriorly to wrap around the rectoanal junction and back to the pubis like the letter 'U'.



## Structures at the level of anorectal junction :-

- Puborectalis, internal sphincter, deep part of external anal sphincter.
- Any trauma or damage to this area may cause incontinence.

## The peritoneum :-

- 1- **first third** :- covers the **anterior and lateral** surfaces
- 2- **middle third** :- only the **anterior surface**
- 3- **the lower third** :- devoid of peritoneum (found in the pelvis ).

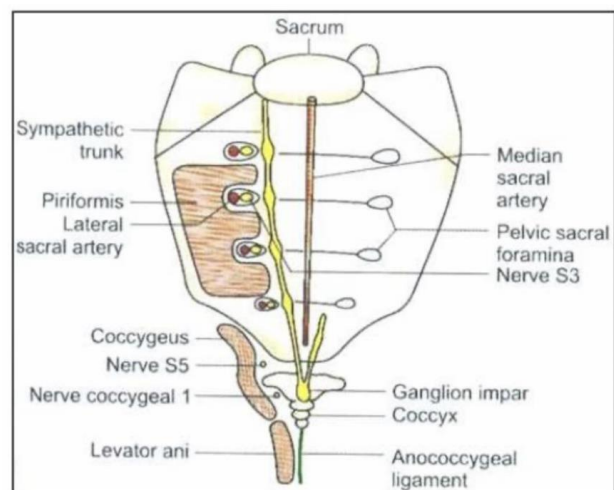
## Relations of the rectum :-

### I. Posteriorly:

The rectum is in contact with the sacrum and coccyx - the piriformis muscle - Coccygeus muscle - levatores ani muscle - the sacral plexus - the sympathetic trunks and anococcygeal body.

### II. Anteriorly:-

In the male

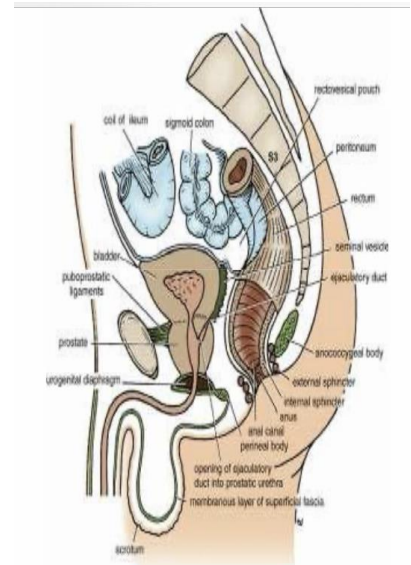


1. The upper two thirds of the rectum: covered by peritoneum and related to the sigmoid colon and coils of ileum that occupy the rectovesical pouch.

2. The lower third of the rectum: devoid of peritoneum, and related to the posterior surface of the bladder, termination of the vas deferens, seminal vesicles on each side, prostate and to the perineal body.

We have 3 parts of the urethra in males :-

- A- Prostatic urethra ( in the urethra )
- B- Membranous urethra (between two membranes )
- C- Penile urethra

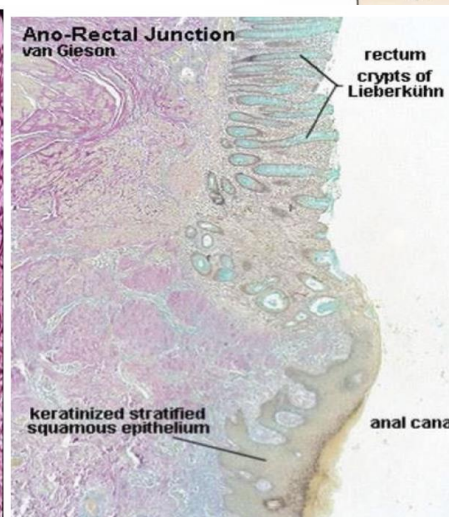
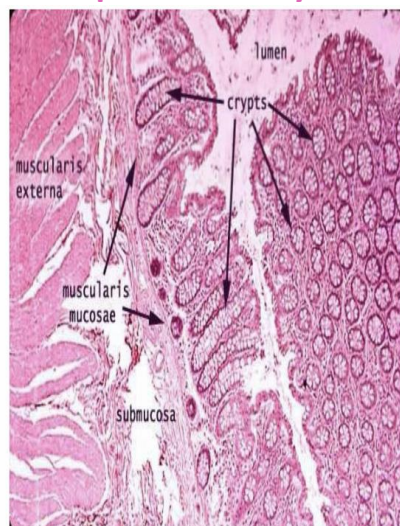
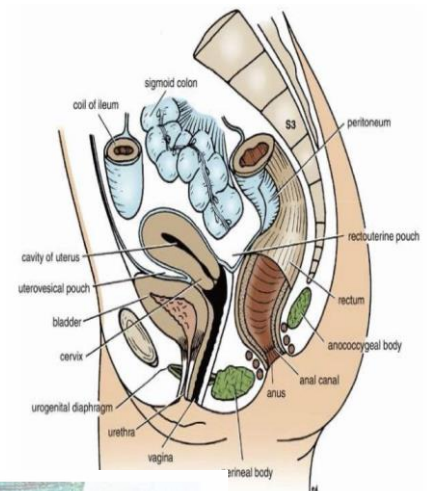


## In the female

1. The upper two thirds of the rectum:-

Covered by peritoneum, related to the sigmoid colon and coils of ileum that occupy the rectouterine pouch (pouch of Douglas).

2. The lower third of the rectum:-  
devoid of peritoneum, related to the posterior surface of the vagina and perineal body.



## Histology of rectum

- o Rectal epithelium is **simple columnar epithelium** with the **upper half** of anal canal with few goblet cells but the **lower half** is almost different in everything **stratified squamous epithelium non keratinized**
- o It forms columns transverse and columns longitudinal
- o Has **crypts of Lieberkühn**.
- o Muscularis externa, outer longitudinal and inner circular lacks tenia coli .

### The muscular coat of the rectum:-

It is arranged in

- 1- outer longitudinal of smooth muscle
- 2 inner circular layers of smooth muscle

- The three taenia coli of the sigmoid colon however, come together so that the longitudinal fibers form a broad band on the anterior and posterior surfaces of the rectum No taenia coli
- transverse fold soft rectum (semicircular permanent folds) The mucous membrane of the rectum+ the circular muscle layer

	Arterial supply	Venous drainage
The rectum	<p>The superior , middle and inferior rectal arteries :- supply the rectum</p> <p><b>1-The superior rectal artery</b></p> <ul style="list-style-type: none"> <li>- It is a direct continuation of the <b>inferior mesenteric artery</b> and is the chief artery supplying the mucous membrane.</li> <li>- It enters the pelvis by descending in the root of the</li> </ul>	<p>The veins of the rectum correspond to the arteries:</p> <p>a-The superior rectal vein is a tributary of the portal circulation and drains into the inferior mesenteric vein to the <b>portal vein</b> .</p> <p>b- The middle rectal vein drains into the internal iliac vein to the <b>inferior vena cava</b>.</p>

sigmoid mesocolon and divides into right and left branches, which pierce the muscular coat and supply the mucous membrane.

- They anastomose with one another and with the middle and inferior rectal arteries.

## 2-The middle rectal artery

-It is a small branch of the anterior division of the internal iliac artery

-it supplies the junction between the rectum and the anal canal .

- It is distributed mainly to the muscular coat.

## 3-The inferior rectal artery

- It is a branch of the internal pudendal artery ( from the

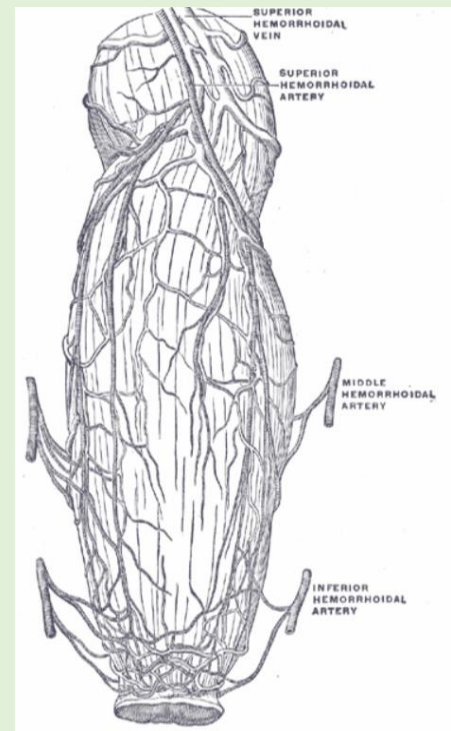
internal iliac artery ) in the perineum.

-supplies the lower half of the anal canal .

- It anastomoses with the middle rectal artery at the anorectal junction.

c- The Inferior rectal vein drains into the internal pudendal veins which drain into the internal iliac vein to the **inferior vena cava**.

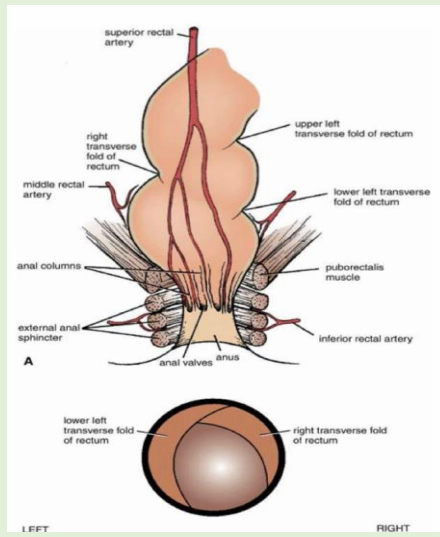
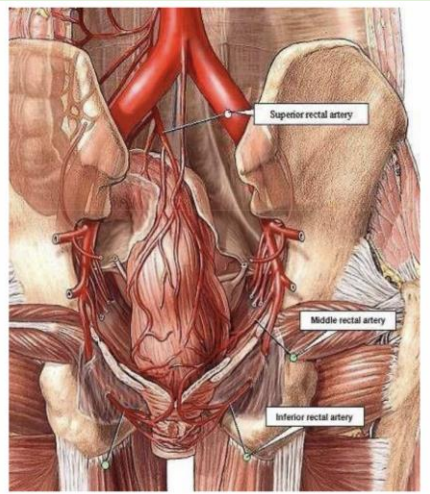
The union between the rectal veins forms an important porto-systemic anastomosis.



The hemorrhoidal plexus (or rectal venous plexus) :-

o It surrounds the rectum, and communicates in front with the vesical venous plexus in the male, and the uterovaginal plexus in the female.

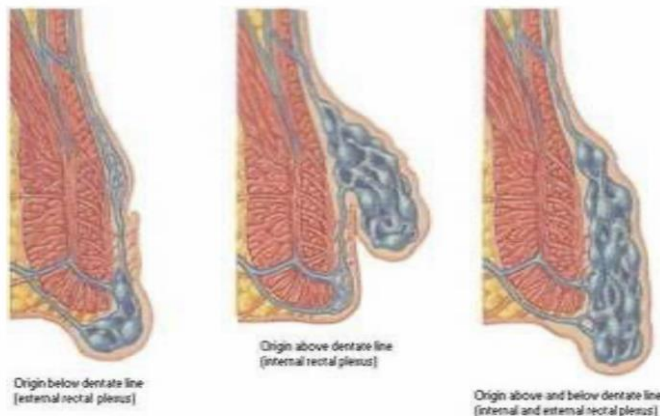
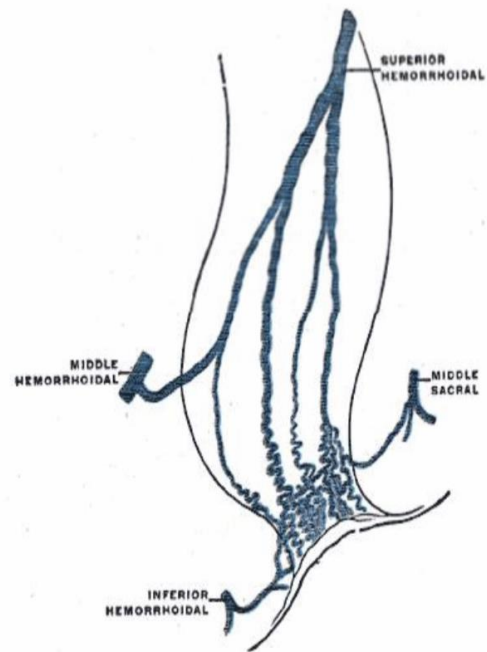
o It forms a free communication between the portal and systemic venous system.



## Rectal plexus and Hemorrhoids

### \*\*NOTE :-

If the portal pressure increases up the blood will enter the the middle and the inferior hemorrhoidal veins



From this picture we can define three types of hemorrhoids :-

- 1- External hemorrhoids
- 2- Internal Hemorrhoids
- 3- External and internal hemorrhoids

### Lymphatic drainage of the rectum

Upper part of the rectum drains into the inferior mesenteric lymph nodes

Lower part of the rectum follows the middle rectal artery drains into the internal iliac lymph nodes then to the common iliac lymph nodes.

**Nerve supply :** the nerve supply is from the sympathetic & parasympathetic nerve from the inferior hypogastric plexuses

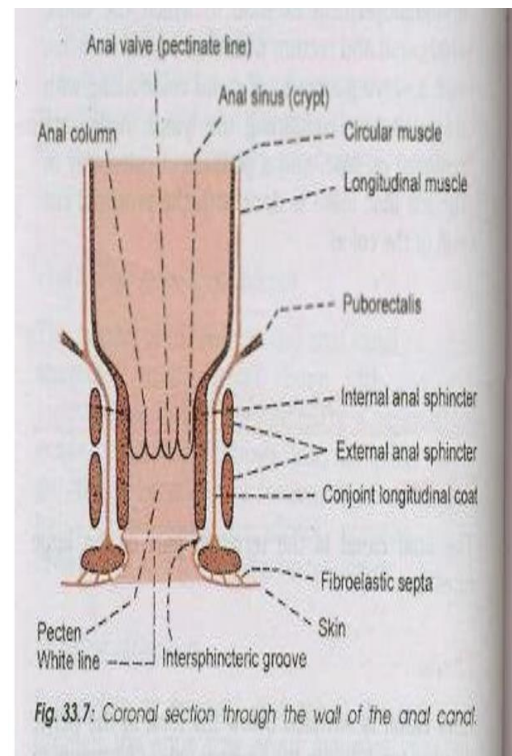
**Notttttttttttttttttttttttte :**

**THE RECTUM & THE UPPER HALF OF THE ANAL CANAL** are sensitive only stretch ! (example when somebody senses the desire for defecation, he senses the stretch of the rectum )

**THE LOWER HALF OF THE ANAL CANAL** is sensitive for pain, temperature, touch So can feel pain

## Anal Canal :-

- It is the terminal part of the large intestine, **4 cm long**, extends from the anorectal junction to the anus, situated below the level of the pelvic diaphragm and lies in the anal triangle of the perineum.
- The anorectal junction is marked by the forward convexity of the perineal- flexure of the rectum, the anus is the surface opening of the anal canal, situated about 4 cm below and in front of the tip of the coccyx in the cleft between the two buttocks.
- the anal canal is divided into **three parts**, but the doctor divides it into two parts only by the pectinate line:



- ✓ Upper 2 cm, originates from **endoderm** in the embryo, **sensitive to stretch** only(autonomic) ( simple columnar epithelium ; like the rectum )
- ✓ Lower 2 cm, originates from **ectoderm** in the embryo, **sensitive to pain somatic** touch and temperature via inferior rectal nerve (S4). The White line further divides the lower part of anal canal to upper and lower parts:

1. The upper part of lower anal canal (1 cm) has stratified squamous non-keratinized epithelium .
2. The lower part of lower anal canal (1 cm) has stratified squamous keratinized epithelium (it has hair follicles , sebaceous glands and sweat glands )



**Anal Canal**  
Internal anatomy

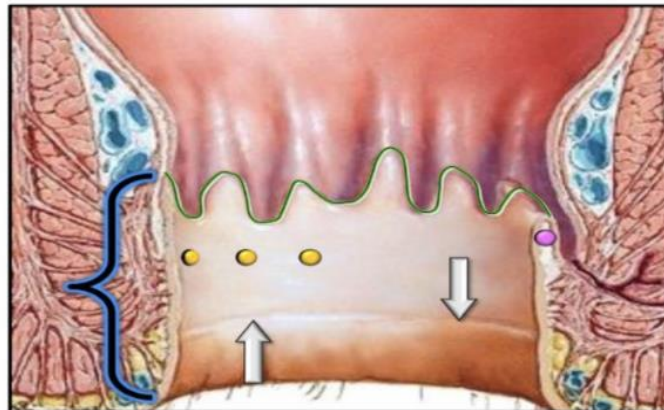
**Inferior anal canal**

Distal to **pectinate line**

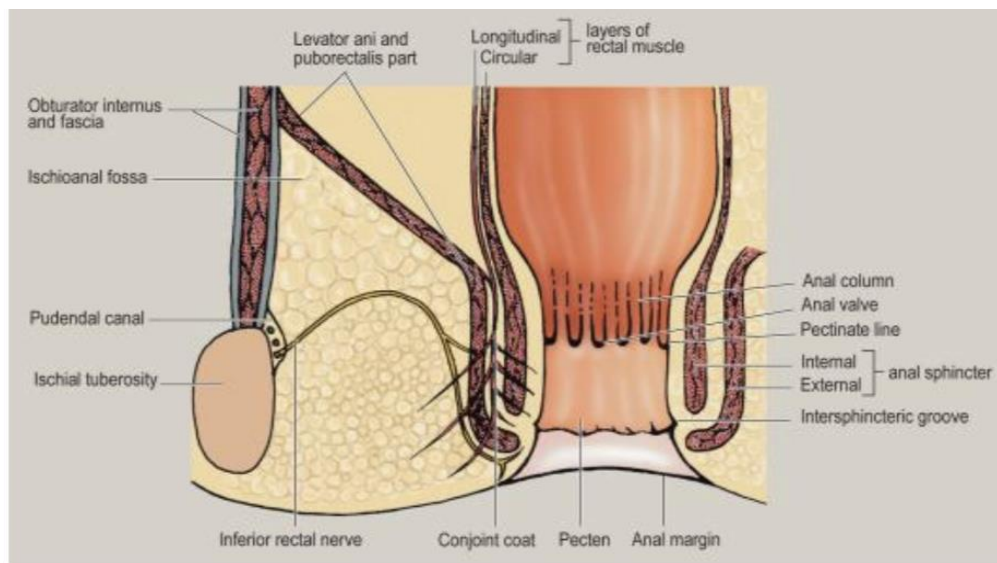
**Anal valves**

**Pecten** ●  
-region of stratified squamous epithelium between pectinate line and intersphincteric groove

**Intersphincteric groove** →  
-(= "anocutaneous line" or "white line")  
-marks transition to skin



-The anorectal ring is a muscular ring present at the anorectal junction formed by the fusion of puborectalis, internal anal sphincter and deep external anal sphincter, which can be felt during rectal examination.



Interior of the anal canal shows many features and can be divided into three parts:

**1. The upper part**

Lined by mucous membrane (endodermal origin). The mucous membrane shows **6 to 10 vertical folds**, these folds are called the anal columns of **Morgagni**.

• The lower ends of the anal columns are united to Each other by short semilunar folds of mucous membrane, these folds are **called the anal valves**.

Above each valve there is a **depression in the mucosa, which is called the anal sinus**, the anal valves together form a transverse line that runs all-round the anal canal, called **pecten line** (which separates the upper half from the lower half of the anal canal )

## 2-The middle part

- It is termed as transitional zone or pecten, it is also lined by mucous membrane.
- The mucosa has a bluish appearance because of **a dense venous plexus that lies beneath.**
- The lower limit of the pecten often has **a whitish appearance** because of which it is referred to as the white line or Hilton's line, is situated at the level the interval between the subcutaneous part of external anal sphincter and the lower border of internal anal sphincter & the color below it becomes **darker**

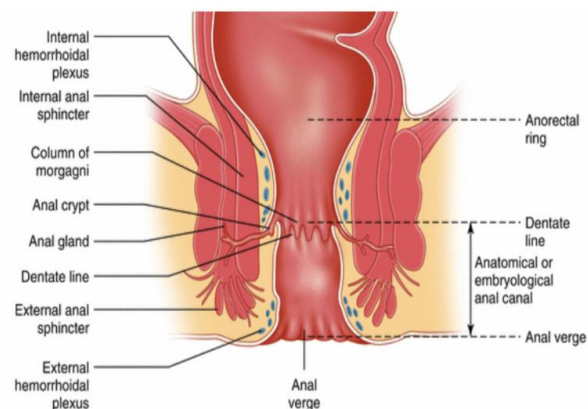
## 3-The lower part:

a cutaneous part, about 8mm long and is lined by true skin containing sweat and sebaceous glands.

### Whiteline

- A landmark for the intermuscular border between internal and external anal sphincter muscles.

- This line represents the transition point from non-keratinized stratified squamous epithelium to keratinized stratified squamous epithelium in the anus and the color is darker in the lower half since it is keratinized and full of hair follicles , glands and skin .



Relations to the anal canal:

### **Anteriorly**

- In **male**: Perineal body, membranous urethra, bulb of penis.
- In **female**: Lower end of the vagina and perineal body

### **Posteriorly**

Anococcygeal ligament and tip of the coccyx.

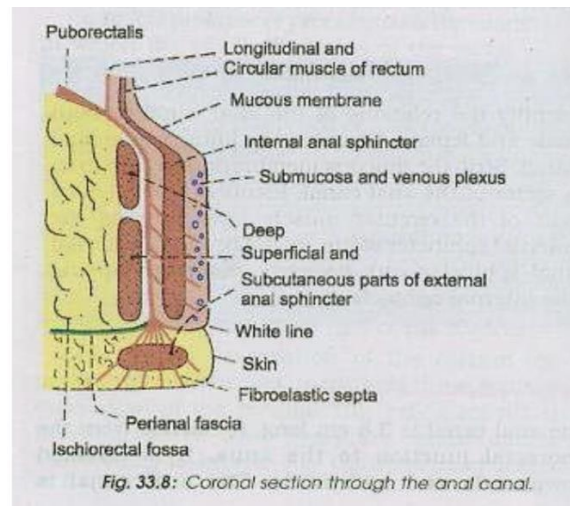
**Laterally**

ischioanal fossae.

## - Musculature of the anal canal:

✓ Internal anal sphincter is involuntary in nature, has autonomic innervation, it is formed by the thickened circular muscle coat of this part of the gut, it is located above

✓ The external anal sphincter is under voluntary control (so it is more important because if the internal was injured we can control the external but if the external is injured we will develop incompetence; the person will not be able to control the defecation process) & has three parts: subcutaneous, superficial and deep parts.



A✓ **Subcutaneous part** lies below the level of internal sphincter and surrounds the lower part of the anal canal.

B✓ **The superficial part** is elliptical in shape and arises from the terminal segment of the coccyx and anococcygeal ligament, the fibers surround the lower part of the internal sphincter and are inserted into the perineal body.

C✓ **The deep part** surrounds the upper part of the internal sphincter and is fused with the puborectalis.

✓ **All anal sphincters do not have a bony attachment except the superficial external anal sphincter.**

	Arterial supply	Venous drainage
Anal Canal	<p>1-the part of the anal canal <b>above the Pectinate line</b> is supplied by the <b>superior rectal artery</b></p> <p>2-the part <b>below the pectinate line</b> is supplied by the <b>inferior rectal artery and middle rectal artery</b> (branches from the internal iliac artery ; either direct like the middle rectal artery or indirect through the internal pudendal artery)</p>	<p>-internal rectal venous plexus drains into <b>superior rectal vein</b></p> <p>- the <b>lower</b> part of the external rectal venous plexus is drained by <b>inferior rectal vein</b> into the internal pudendal vein</p> <p>-the <b>middle</b> part by the <b>middle rectal vein</b> into the internal iliac vein</p> <p>-the <b>upper</b> part by the superior rectal vein in to the <b>inferior mesenteric vein</b>.</p> <p>-The anal vein are arranged radially around the anal margin.</p> <p>-They communicate with the internal rectal plexus and with the inferior rectal vein.</p>

	Lymphatic drainage	Nerve supply
Anal canal	<p>1lymph vessels from the part above the pectinate line drain into the internal iliac nodes.</p> <p>2Vessels from the part below the pectinate</p>	<p>-above the pectinate line, the anal canal is supplied by autonomic nerves (inferior hypogastric plexus and pelvic splanchnic).</p>

	<p>line drain into superficial inguinal nodes.</p>	<p>-Below the pectinate line , it is supplied by somatic (inferior rectal) nerves. Painful as a result of high sensation  - The external sphincter is supplied by inferior rectal Nerve and by branch of the fourth sacral nerve.</p>
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## -Hemorrhoids or Piles

➤ The term hemorrhoids refer to **a condition in which the veins around the anus or lower rectum are swollen, tortuous and inflamed.** They arise from congestion of internal and/or external venous plexuses around the anal canal.

➤ It may result from:

1- Straining to move stool, Congenital weakness of the venous walls, Portal hypertension, Cancer in the rectum, Pregnancy (but after pregnancy it disappears), Food irritation like eating chili.

2- Other contributing factors include aging, chronic constipation or diarrhea, and anal intercourse.

➤ **Superior rectal vein is the most dependent.**

➤ **Two types:**

1-**Hemorrhoids Both inside and above the anus (internal)**

2- **Under the skin around the anus (external).**

### -Internal hemorrhoids (piles):-

- Occur higher up in the anal canal, out of sight. Bleeding is the most common symptom of internal hemorrhoids, and often the only one in mild cases.
- Varicosities of the superior rectal vein.
- **Painless** because this area is sensitive to stretch not to pain, touch, or temperature
- Lies in the anal columns at **3,7,11 o'clock** (lithotomy position).

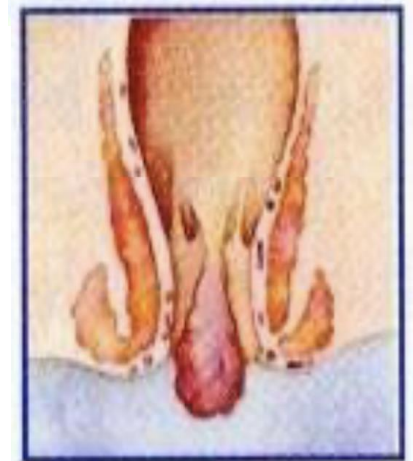


- Sometimes, internal hemorrhoids will come through the anal opening when straining to move your bowels. This is called a prolapsed internal hemorrhoid; it is often difficult to ease back into the rectum and is usually quite painful.



### -External hemorrhoids:-

- Visible, occurring outside the anus.
- Basically, they are skin covered veins that have ballooned and appear blue.
- usually appear without any symptoms .
- Inferior rectal vein is the affected vein.
- When inflamed they become red and tender.
- **Thrombosis is common and very painful.**



- When a blood clot forms inside external hemorrhoid, **it often causes severe pain**. This thrombosed external hemorrhoid can be felt as a firm, tender mass in the anal area, about the size of a pea.

**Surgical classification of hemorrhoids is omitted, we are not asked to know it.**



### -Anal fissure

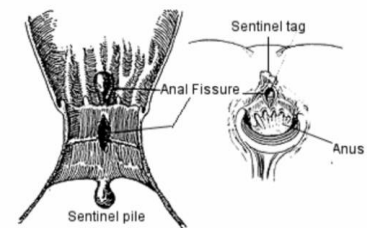
- A thin slit-like tear in the anal tissue, an anal fissure is likely to cause itching, pain, and bleeding during a bowel movement.

- An elongated ulcer is formed

- It is extremely **painful (VIP)**

**-it is treated surgically .**

- Its site is in the midline , either posterior or anteriorly to the superficial part of the external anal sphincter (no support)



### -Perianal abscess

• Its most common cause the fecal trauma to the anal mucosa, which might spread to the sub mucosa

• It's a complication of the anal fissure

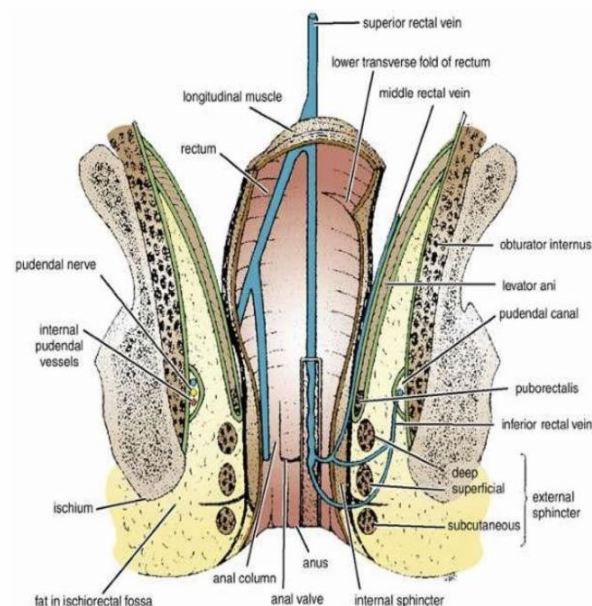
• Its located in relation to the external anal sphincter

• Anal fistula may rise as a result of the spread or inadequate treatment of the anal abscess.

## Ischiorectal fossa :-

The ischiorectal fossa (ischioanal fossa) is a wedge-shaped space located on each side of the anal canal.

The base of the wedge is superficial and formed by the skin. The edge of the wedge is formed by the junction of the medial and lateral walls. The medial wall is formed by the sloping levator ani muscle and the anal canal. The lateral wall is formed by the lower part of the obturator internus muscle, covered with pelvic fascia (obturator fascia) .



## Contents of Fossa :-

The ischioanal fossa is filled with dense fat which supports the anal canal and allows it to distend during defecation.

- The pudendal nerve
- Internal pudendal vessels are embedded in a fascial canal
- The pudendal canal, on the lateral wall of the ischioanal fossa
- On the medial side of the ischial tuberosity, the inferior rectal vessels and nerve cross the fossa to reach the anal canal.

– During operations in this area, an abscess called perianal abscess may form in the ischioanal fossa also known as the dirty region. This abscess needs to be drained and you should be careful with the nerve going to the external sphincter from S4 (inferior rectal nerve) if cut, voluntary control is lost causing incontinence.

– If an abscess forms chances of recurrence are high because it is a dirty area.

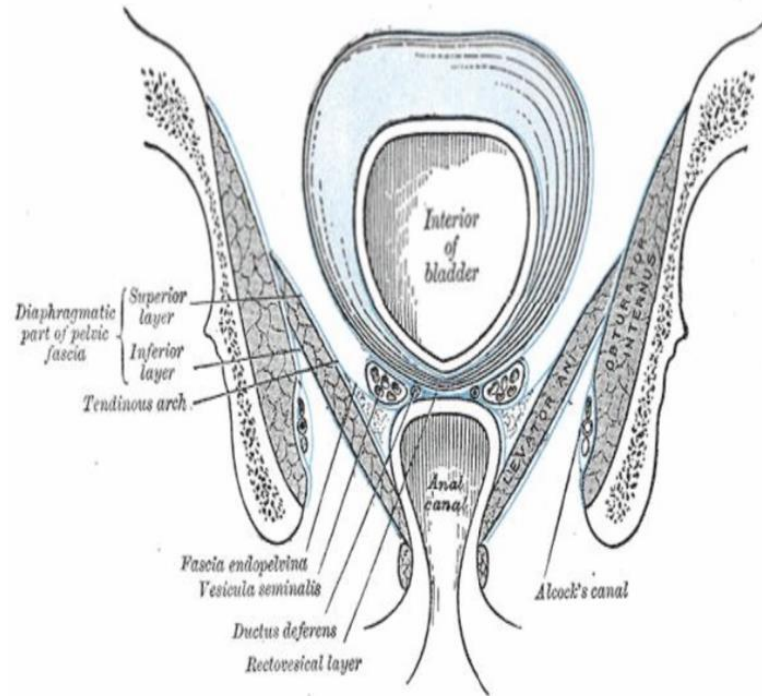
o Perianal sinus open to the skin.

o Perianal fistula open to the anal canal, in this case stool contains pus and blood.



## The pudendal canal :-

- The pudendal canal (also called Alcock's canal) is an anatomical structure in the pelvis formed by the obturator internus fascia
- Runs in the lateral wall of the ischiorectal fossa and **ends in the deep perineal pouch.**
- It contains: **Internal pudendal artery, internal pudendal veins, and Pudendal nerve.**
- These vessels and nerve cross the pelvic surface of the obturator internus.



و هيك بتكون ختمت أناتومي يا قطاعة الله يوفقكم جميعا الرابع عشر من نيسان سنة  
الفين وعشرين الساعة الواحدة و اثنين و خمسين دقيقة صباحا

# The end