Pelvic mesocolon

Begins:

 begins as a continuation of the descending colon Lt side of pelvic brim(inlet of pelvic)

- Parts of the pelvic mesocolon
 - Sigmoid colon
 - Rectum
 - Upper part of the anal canal

Sigmoid Colon

Location and Description

- The sigmoid colon is 10 15 in. (25 to 38 cm)long
- It is a part of large intestine in pelvic cavity
- **Begin**: Lt. side of the pelvic brim(inlet of the pelvis)
- **End**: it becomes continuous with the rectum in front of the third sacral vertebra(mid of the sacrum).

Parts:

- Lateral limb→ contains lower Lt. colic artery
- -Medial limb \rightarrow contains sup.Rectal artery
- Free margin \rightarrow curved to Rt. of mid line
- Root → has an inverted V shape attachment



Pelvic colon.....cont

- The sigmoid colon is mobile and hangs down into the pelvic cavity in the form of a loop.
- It is attached to the posterior pelvic wall by the fan-shaped sigmoid mesocolon.

Attachment of the root of mesocolon

- At middle piece of sacrum
- Bifurcation of Lt.common iliac artery
- Middle of Lt.Ext.iliac artery
- The appendices epiploicae (omental appendages) are very long in the sigmoid colon



- Relations of sigmoid c
- Left
- Lt.Ext. iliac vesseles
- Lat.wall of pelvis
- Vas defferance or ovary
- Right
- Small intestines

Superior

- Coils of small intestine Inferior
- In mal: urinary blabber
- In femal : uterus

Relations of sigmoid colon

• **Posteriorly:**

- The rectum
- the sacrum.
- the lower coils of the terminal part of the ileum
- Sacral plexus
- Lt.periformis muscle
- Lt. external iliac vessels
- Lt.Ureter
- Lt. internal common iliac artery
- The sigmoid colon usually occupies the **rectovesical pouch in males** and the **rectouterine pouch in females**

Blood Supply of sigmoid colon

- <u>Arteries</u>
- Sigmoid branches of the inferior mesenteric artery.
- The most superior sigmoid artery anastomoses with the descending branch of the left colic artery.

• <u>Veins</u>

 The veins drain → the inferior mesenteric vein → the portal venous system.

Blood supply for sigmoid colon

Lymph Drainage of sigmoid colon

 The lymph drains into nodes along the course of the sigmoid arteries → the inferior mesenteric nodes.

Nerve Supply of sigmoid colon

- The sympathetic and parasympathetic nerves from the inferior hypogastric plexuses
- The parasympathetic supply is derived from the pelvic splanchnic nerves

Rectum

Location and Description

- The rectum is about 5 in. (13 cm) long
- begins in front of the third sacral vertebra as a continuation of the sigmoid colon.
- ends in front of the tip of the coccyx by piercing the pelvic diaphragm and becoming continuous with the anal canal.
- The lower part of the rectum is dilated to form the **rectal ampulla**.
- 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
- The puborectalis portion of the levator ani muscles 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.

Rectum

Middle left curve

Fig. 33.2: Curvatures of the rectum. (A) Anteroposterior curves; and (B) side to side (lateral) curves.

Mucosal folds: the transverse or horizontal folds or Houston'valve: upper fold projects from right, middle fold projects from anterior and right wall, lowest fold projects from left wall.

rectum.....cont

- <u>The peritoneum</u>
- first third → covers the anterior and lateral surfaces
- middle third → only the anterior surface of the
- the lower third \rightarrow devoid of peritoneum .

Relations of rectum

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.
- <u>Anteriorly:</u>

1- In the male

the upper two thirds of the rectum

- It is covered by peritoneum
- It is related to the sigmoid colon and coils of ileum that occupy the rectovesical pouch.

The lower third of the rectum

- It is devoid of peritoneum
- It is related to the posterior surface of the bladder
- to the termination of the vas deferens
- the seminal vesicles on each side
- and to the prostate

Relations of rectum....cont

Anteriorly:

2- In the female

the upper two thirds of the rectum

- It is covered by peritoneum
- It is related to the sigmoid colon and coils of ileum that occupy the rectouterine pouch (pouch of Douglas).

The lower third of the rectum

- It is devoid of peritoneum
- It is related to the posterior surface of the vagina.

Fig. 33.4: Posterior relations of the rectum (below the level of the middle of the third piece of the sacrum).

Blood Supply of rectum

• <u>Arteries</u>

• The superior, middle, and inferior rectal arteries → supply the rectum.

1- The superior rectal artery

- It is a direct continuation of the inferior mesenteric artery and is the chief artery supplying the mucous membrane.
- It enters the pelvis by descending in the root of the 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.

Blood supply of rectum

2- The middle rectal artery

- -It is a small branch of the internal iliac artery
- It is distributed mainly to the muscular coat.

3- The inferior rectal artery

- It is a branch of the internal pudendal artery in the perineum.
- It anastomoses with the middle rectal artery at the anorectal junction.

Blood supply of rectum

- <u>Veins</u>
- The veins of the rectum correspond to the arteries.
- The superior rectal vein is a tributary of the portal circulation and drains into the inferior mesenteric vein.
- The middle rectal vein \rightarrow the internal vein
- inferior rectal vein \rightarrow internal pudendal veins
- The union between the rectal veins forms an important portal systemic anastomosis .

Blood supply of rectum

The hemorrhoidal plexus (or rectal venous plexus)

- surrounds the rectum, and communicates in front with the vesical venous plexus in the male, and the uterovaginal plexus in the female.
- A free communication between the portal and systemic venous systems is established through the hemorrhoidal plexus.

Rectal plexus & Hemorrhoids

Origin below dentate line [external rectal plexus]

Origin above dentate line (internal rectal plexus)

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

Lymph Drainage of rectum

- the upper part drain →into the pararectal nodes → then into inferior mesenteric nodes.
- the lower part follow the middle rectal artery→ to the internal iliac nodes.

Nerve Supply of rectum

- The nerve supply is from the sympathetic and parasympathetic nerves from the inferior hypogastric plexuses.
- The rectum is sensitive only to stretch.

Anal canal

The anal canal

It is the terminal part of the large intestine.
It is situated below the level of the pelvic diaphragm and lies in anal triangle of perineum.

-The anal canal is 3.8cm long

- It extends from the anorectal junction to the anus.

-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 4cm below and in front of the tip of the coccyx in the cleft between two buttocks.

• Anorectal ring:

- this is a muscular ring presentat at the anorectal junction.
- It is formed by the fusion of the puborectalis, deep external sphincter and the internal sphincter, which can be felt on rectal examination.

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

1- upper part is lined by mucous membrane, & is of 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 .this is pectinate line.

2- The middle part of anal canal

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.

3- Lower cutaneous part

is about 8mm long and is lined by true skin containing sweat and sebaceous glands.

White line

- 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.

Relations of anal canal Anteriorly In male

- perineal body
- membranous urethra
- bulb of penis

In female

lower end of the vagina

Posteriorly

- anococcygeal ligaent
- tip of the coccyx
 laterally
- ischiorectal fossae.

Musculature of the anal canal:

- **1.internal anal sphincter** is involuntary in nature,
- It is formed by the thickened circular muscle coat of this part of the gut.
- 2.the external anal sphincter is under voluntary control.& has three parts: subcutaneous ,superficial and deep parts.
- subcutaneous part lies below the level of internal sphincter and surrounds the lower part of the anal canal. The superficial part is elliptical in shape and arises from the terminal segment of the coccyx and anococcygeal ligament, the fibres surround the lower part of the internal sphincter and are inserted into the perineal body. The deep part surrounds the upper part of the internal sphincter and is fused with the puborectalis.

Mucous membrane

. Internal anal sphincter

-- Submucosa and venous plexus

Deep Superficial and Subcutaneous parts of external anal sphincter

White line

- Skin

o

Fibroelastic septa

Perlanal fascia Ischiorectal fossa

Fig. 33.8: Coronal section through the anal canal.
Blood supply of anal canal

Arterial supply:

- the part of the anal canal above the Pectinate line is supplied by the superior rectal artery
- the part below the pectinate line is supplied by the inferior rectal artery.

- Venous drainage:
- internal rectal venous plexus drains into superior rectal vein
- the lower part of the external rectal venous plexus is drained by inferior rectal vein into the internal pudendal vein
- the middle part by the middle rectal vein into the internal iliac vein
- upper part by the superior rectal vein into the inferior mesenteric vein.
- The anal vein are arranged radially around the anal margin. They communicate with the internal rectal plexus and with the inferior rectal vein.

Anal Hemorrhoids

- Internal hemorrhoids
- External hemorrhoids



• What Are Hemorrhoids?

- The term hemorrhoids refers to a condition in which the veins around the anus or lower rectum are swollen and inflamed.
- Hemorrhoids may result from
- 1- straining to move stool.
- 2- Other contributing factors include **pregnancy, aging**, **chronic constipation or diarrhea**, **and anal intercourse**.

Two types

- 1- Hemorrhoids are both inside and above the anus (internal)
- **2-** Under the skin around the anus (external).

Hemorrhoids (piles) arise from congestion of internal and/or external venous plexuses around the anal canal

- 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 sup. Rectal vein
- Lies in the anal columns at 3,7,11 o'clock (lithotomy position)



- <u>External hemorrhoids</u> are visible-occurring out side the anus. They are basically skincovered veins that have ballooned and appear blue.
- Usually they appear without any symptoms. When inflamed, however, they become red and tender.
- Inferior rectal vein
- Thrombosis is common



Causes for hemorroids

- Congenital weakness of the venous walls
- Superior rectal vein is the most dependant and valvless
- Chronic constipation and cough
- Pregnancies
- Portal hypertension
- Cancer in the rectum

• 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.

 When a blood clot forms inside an 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.





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
- Its site is in the midline , either posterior or interiorly 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 ext. anal sphincter
- Anal fistula may rise as a result of the spread or inadequate treatment of the anal abcess

PR examination

- Finger is in the rectum canal:
- In the female the vagina lies anteriorly, while in the male the urinary bladder and the superior vena cava, ampulla vas difference, prostate
- The sacrum and the coccyx lies posteriorly, while the ischiolateral fossae lie laterally

Lymphatic drainage of anal canal:

- 1- lymph vessels from the part above the pectinate line drain into the internal iliac nodes.
- 2- Vessels from the part below the pectinate line drain into superficial inguinal nodes.

Nerve supply of anal canal

- above the pectinate line, the anal canal is supplied by autonomic nerves (inferior hypogastric plexus and pelvic splanchnic).
- 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.

Nerves on the Posterior Abdominal Wall

Lumbar Plexus

- The lumbar plexus, which is one of the main nervous pathways supplying the lower limb, is formed in the psoas muscle from the anterior rami of the upper four lumbar nerves
- The anterior rami receive gray rami communicates from the sympathetic trunk,
- The upper two only give off white rami communicates to the sympathetic trunk.
- The branches of the plexus emerge from the lateral and medial borders of the muscle and from its anterior surface.
- The iliohypogastric nerve, ilioinguinal nerve, lateral cutaneous nerve of the thigh, and femoral nerve emerge from the lateral border of the psoas, in that order from above downward.
- The iliohypogastric and ilioinguinal nerves (L1) enter the lateral and anterior abdominal walls



Nerves on the Posterior Abdominal Wall

- The iliohypogastric nerve
- supplies the skin of the lower part of the anterior abdominal wall,
- <u>The ilioinguinal nerve</u>
- passes through the inguinal canal to supply the skin of the groin and the scrotum or labium majus.
- <u>The lateral cutaneous nerve</u> of the thig
- Crosses the iliac fossa in front of the iliacus muscle and enters the thigh behind the lateral end of the inguinal ligament.
- It supplies the skin over the lateral surface of the thigh.



Medscape ®

Lumber plexus.....cont

- <u>The femoral nerve (L2, 3, and 4)</u>
- It is the largest branch of the lumbar plexus.
- It runs downward and laterally between the psoas and the iliacus muscles and enters the thigh behind the inguinal ligament and lateral to the femoral vessels and the femoral sheath.
- In the abdomen it supplies the iliacus muscle.





Lumber plexus.....cont

- The Obturator nerve and the fourth lumbar root of the lumbosacral trunk
- Emerge from the medial border of the psoas at the brim of the pelvis.
- The Obturator nerve (L2, 3, and 4) crosses the pelvic brim in front of the sacroiliac joint and behind the common iliac vessels.
- It leaves the pelvis by passing through the Obturator foramen into the thigh.
- The fourth lumbar root of the lumbosacral trunk takes part in the formation of the sacral plexus . It descends anterior to the ala of the sacrum and joins the first sacral nerve.



Lumber plexus.....cont

- The genitofemoral nerve (L1 and 2)
- Emerges on the anterior surface of the psoas.
- It runs downward in front of the muscle and divides into :
- 1- A genital branch, which enters the spermatic cord and supplies the Cremasteric muscle
- 2- A femoral branch, which supplies a small area of the skin of the thigh.

Cremasteric reflex

- It is the nervous pathway, in which stimulation of the skin of the thigh in the male results in reflex contraction of the cremaster muscle and the drawing upward of the testis within the scrotum.
- Cremasteric reflex may be absent with: testicular torsion, upper and lower motor neuron disorders, as well as a spine injury of L1-L2. It can also occur if the ilioinguinal nerve is accidentally cut during a hernia repair

Sympathetic Trunk (Abdominal Part)

- The abdominal part of the sympathetic trunk is continuous above with the thoracic and below with the pelvic parts of the sympathetic trunk.
- It runs downward along the medial border of the psoas muscle on the bodies of the lumbar vertebrae.
- It enters the abdomen from behind the medial arcuate ligament and gains entrance to the pelvis below by passing behind the common iliac vessels.
- The right sympathetic trunk lies behind the right border of the inferior vena cava; the left sympathetic trunk lies close to the left border of the aorta.
- The sympathetic trunk possesses four or five segmentaly arranged ganglia, the first and second often being fused together.



Sympathetic trunk....Abdominal part

- Branches
- White rami
 - communicantes join the first two ganglia to the first two lumbar spinal nerves.
 - A white ramus contains Preganglionic nerve fibers and afferent sensory nerve fibers.
- Gray rami
- communicantes join each ganglion to a corresponding lumbar spinal nerve.
- A gray ramus contains postganglionic nerve fibers distributed to blood vessels, sweet gland and skin

Sympathetic.....Abdominal part

Post gangilionic fibers.....cont

- Distributed through the branches of the spinal nerves to the blood vessels, sweat glands, and arrector pili muscles of the skin.
- Fibers pass medially to the sympathetic plexuses on the abdominal aorta and its branches. (These plexuses also receive fibers from splanchnic nerves and the vagus.)
- Fibers pass downward and medially in front of the common iliac vessels into the pelvis, where, together with branches from sympathetic nerves in front of the aorta, they form a large bundle of fibers called the superior hypogastric plexus.



Aortic Plexuses

- Preganglionic and postganglionic sympathetic fibers
- Preganglionic parasympathetic fibers, and visceral afferent fibers form a plexus of Nerves, the aortic plexus, around the abdominal part of the aorta.
- Regional concentrations of this plexus around the origins of the celiac, renal arteries
- Superior mesenteric \rightarrow celiac plexus
- Inferior mesenteric plexus \rightarrow Renal plexus
- <u>1- The celiac plexus</u> consists mainly of two celiac ganglia connected together by a large network of fibers that surrounds the origin of the celiac artery.
- The ganglia receive the greater and lesser splanchnic nerves (Preganglionic sympathetic fibers).
- Postganglionic branches accompany the branches of the celiac artery and follow them to their distribution.
- Parasympathetic vagal fibers also accompany the branches of the artery.
- <u>2- The renal plexuses</u> are smaller than the celiac plexus. They are distributed along the branches of the corresponding arteries. The inferior mesenteric plexus is similar but receives parasympathetic fibers from the sacral parasympathetic.







- 2 chains extend from level of atlas till coccyx
- Number of ganglia (in pairs)
- C = 3
- Th. = 10 -12 (11)
- L = 4
- S = 4
- Coccygeal = 1(ganglion impar)



Sympathetic chain....cont

Pregangilonic fibers:

- **Origin:** sympathetic nucleus present in lat. Horn cell of thoracic and upper 2 lumber region of spinal cord = 14
- Leave the spinal cord throw the ant. Root and then leave the spinal nerve as white rami to join the symp.chain (14 white rami)
- Preganglionic fibers when it enters the sympathetic chain may :
- 1- Synapse with cells in the ganglia it enters (e.g. middle.Th.. Segm)
- 2- Pass up to synapse in higher ganglia (upper Th. Segm \rightarrow 3 cerv. Segm)
- 3- Pass down to synapse in lower ganglia (lower Th & upper 2 lumber go to lumber & sacral ganglia)
- 4- May not synapse in sympathetic chain & continue as preganglionic fibers to form (splanchnic nerves)



Synapse in chain ganglia at same level or different level



Pass through ganglia and synapse in prevertebral ganglion



Sympathetic chain....cont

- Nerves which leave the sympathetic chain:
- A- gray rami (31 post ganglionic fibers join spinal nerves to reach sweat glands, errectore papillae & blood vessels
- S.C.S.G \rightarrow lower 4 cranial nerves + upper 4 cervical
- M.C.S.G \rightarrow 5th , 6th cervical nerves
- I.C.S.G \rightarrow 7th , 8th cervical nerves
- Thoracic , lumber, sacral ganglia to corresponding nerves

B- visceral nerves

- 1- Int, & Ext. carotid nerves from S.C.S.G to corresponding arteries
- 2- pharyngeal branch : from S.C.S.G to pharyngeal plexus
- 3- pulmonary nerves : 2^{nd} , $3^{rd\&}$ 4th thoracic ganglia
- 4- cardiac nerves : 2nd , 3^{rd&} 4th thoracic ganglia + 3 cervical ganglia
- 5- splanchnic nerves : greater, lesser and lowest splanchnic nerves



Greater splanchnic nerves:

- Arise from ganglia (5-9th) or 10th
- Pierce the cruss of the diaphragm
- End in the coeliac ganglia
- Post. ganglia fibers follow the branches of coeliac artery to reach the smooth muscle, gland of stomach



Lesser splanchnic nerves:

- Arise from the 9th & 10th Th.ganglia
- Pierces the cruss of diaphragm
- End in the sup.
 Mesenteric ganglia
- Post. Ganglia fibers supply the smooth muscles, glands of small intestine, ascending and transverse parts of colon



Lowest splanchnic nerves:

- May be absent, if present arises from the last one or two th.ganglia
- Pierces the diaphragm to end in renal plexus
Lumber splanchnic branch

- Arise from L1& L2 ganglia
- Ends in inferior mesenteric ganglia
- Post. Gangilionic fibers go to sigmoid and pelvic colon, other post. Gangilionic fibers form the descending hypogastric plexus to supply bladder, rectum and genetalia
- Branches from sacral part of the chain go to pelvic viscera

Thoracic sympathetic chain:

- Site: enters the thorax in front of neck of 1st rib and leaves it by passing behind the medial arcuate ligament
- In the upper part it lies on the necks of the ribs while in the lower part it lies on the side of the bodies of vertebrae
- **Ganglia**: (10 -12),1st sometimes fuses with the I.C.S.G → stellate ganglia
- Branches:
- A- Gray & white rami communicants
- B- 2nd, 3rd & 4th ganglia (cardiac & pulmonary)
- C- The upper five ganglia give aortic oesophageal branches
- D- Greater, lesser and lowest splanchnic nerves



This image demonstrates the sympathetic chains running down the back of the chest cavity over the heads of the ribs. The arrows indicate the typical levels at which we cut the sympathetic chain for palmar and axillary hyperhidrosis.

Sympathetic chain



Splanchnic nerve



Visceral sensory system



Visceral sensory and autonomic neurons participate in *visceral reflex arcs*

- Many are spinal reflexes such as defecation and micturition
 reflexes
- Some only

 involve peripheral
 neurons: spinal
 cord not involved
 (not shown)*



*e.g. "enteric" nervous system: 3 neuron reflex arcs entirely within the wall of the gut 78

Thank you