Digestive System

University of Jordan

Faculty of Medicine

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Medical Committee
The University of Jordan

◯ Slide ● Sheet ◯ Handout ◯ Other

☒ Anatomy ☐ Embryology

☐ Physiology ☐ Histology

☐ Pathology ☐ Pharmacology

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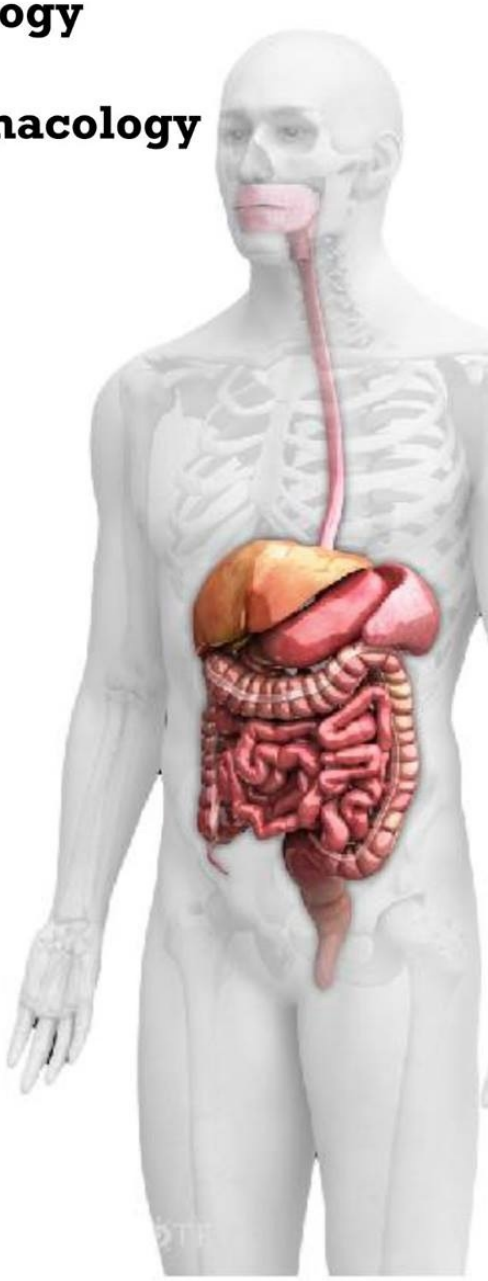

Sheet #: 12

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DESIGNED BY: TAMER ALTAMIMI "SMILE"

Posterior Abdominal Wall –cont.

-Lumbar Plexus :

It is formed by the anterior rami of the upper four lumbar spinal nerves , they all are 5 in number (L1 , L2 , L3 ,L4 ,L5) and have a relation with psoas major muscle . So the formation of lumber plexus occurs in the psoas major muscle, and again it is formed only by the upper four lumbar spinal nerves (L1 ,L2 ,L3 , L4).

** L5 & a branch from L4 form what is called the lumbosacral trunk, which participate in the formation of sacral plexus.

** Sacral & Lumbar plexuses are both found in the posterior abdominal wall.

We are already familiar with some branches of the plexus : just as Ilioinguinal & Iliohypogastric nerves (from L1) , Lateral cutaneous nerve of the thigh (from L2 &L3) ,Femoral & Obturator nerves from (L2 &L3 &L4) .

- Examples on nerves found in the posterior abdominal wall :

1- Iliohypogastric nerve (from L1) will supply the skin over the lower part of the anterior abdominal wall just above the symphysis pubis .

2-Ilioinguinal nerve (from L1) which pass through the inguinal canal to supply the skin of scrotum and groin in males & labia majora in females .

3-Lateral cutaneous nerve of the thigh (from L2 & L3) which is close to the ASIS and supply the skin over the lateral surface of the thigh .

4-Femoral nerve which is a posterior division from the anterior primary rami of L2&L3 &L4 ; and as we took before , in the lower limb , this nerve

gives off many branches : some of which are **cutaneous**(for the skin of the thigh and the medial side of the leg) ,others are **muscular** (muscles in the thigh + Iliacus muscle in the pelvis).

** **Important : Femoral nerve descends in a groove between two muscles (Iliacus & Psoas major)**

5-Obturator nerve which is an anterior devision from the anterior primary rami of L2&L3&L4 ; it passes through the obturator foramen in the pelvis then goes to the adductor compartment of the thigh (supplying the adductor muscles) , and will give a branch for the knee joint . Also it gives a cutaneous branch for a small area over the medial side of the thigh .

6-Genitofemoral nerve (from L1&L2) which divides into Femoral & Genital branches . The femoral branch, which is found below the inguinal ligament , will supply the skin over the thigh , whereas the genital branch ,which is one of the contents of the spermatic cord in males , will pass through the inguinal canal (deep ring → superficial ring) to supply the cremasteric muscle

Important : the innervation of Genital branch of genitofemoral nerve to cremasteric muscle will give the (Cremasteric Reflex)

What is cremasteric muscle ? when there is itching on the upper medial side in the skin of the thigh ,this will induce contraction in the cremasteric muscle and thus pulling the testis upward

So this reflex related is to "L1 & L2" → femoral branch will take the sensation of itching from the upper medial side of the thigh →genital branch will induce the contraction in the cremasteric muscle, as a motor activity .

Sympathetic chain (trunk)

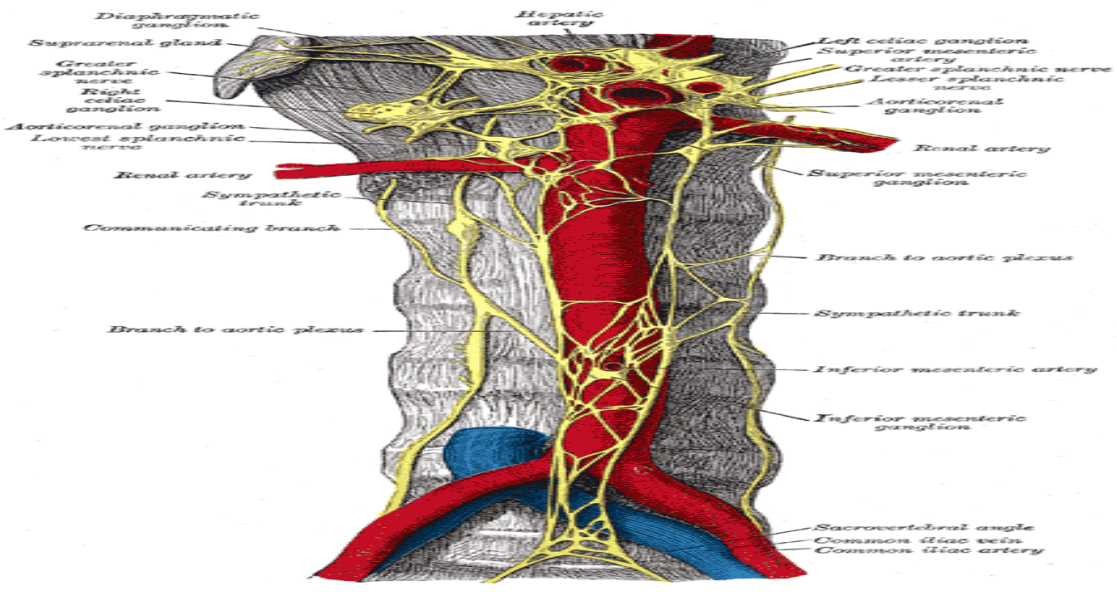
We can find it in chest , abdomen & pelvis ; but we will focus on the abdominal sympathetic chain ,which is a continuation for the thoracic part and will continue downward to reach the pelvis .

**Important relations:

→Sympathetic Chain enters the abdomen Behind the medial arcuate ligament of the diaphragm ; and it enters the pelvis Behind the common iliac vessels of the pelvis .

→ Abdominal Sympathetic Chain will run downward on the Medial border of psoas major muscle , on the bodies of lumbar vertebra .

→Difference between right and left Sympathetic chain : the right one rises behind IVC "Inferior Vena Cava" , while the left one passes behind the edge of abdominal aorta

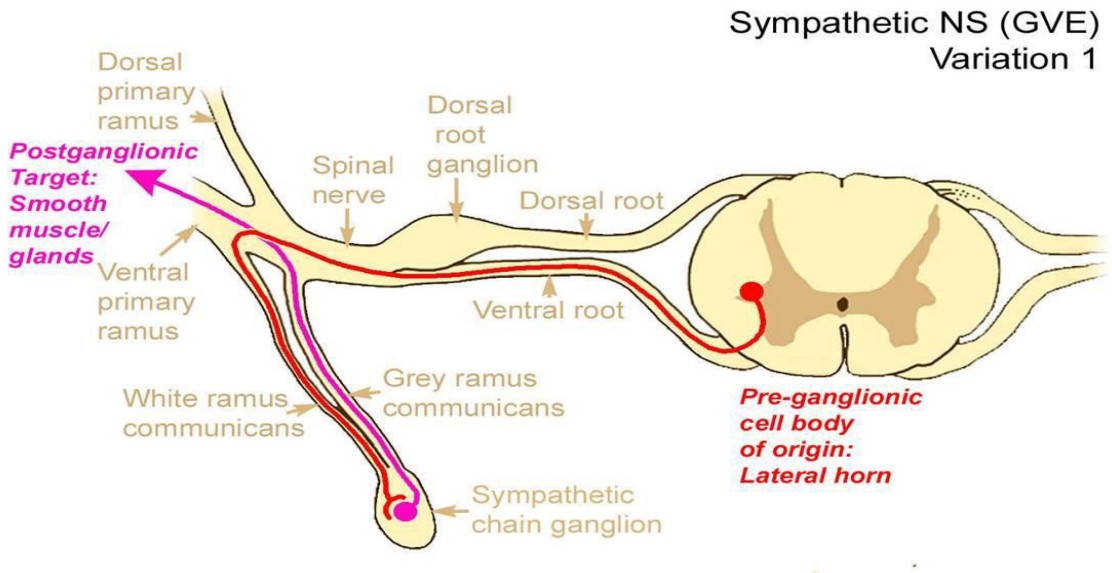


-Sympathetic trunk

→ will make sympathetic ganglia

→ has a thoracolumbar origin (from lateral horn of spinal cord) , and the lateral horns are from all the 12th thoracic spinal segments and " L1 &L2" spinal segments; so it takes from 14 lateral horns in origin (12 thoracic & 2 lumbar)

The nerve that arises from the lateral horn of spinal cord called preganglionic sympathetic fibers , and those fibers run along with the anterior root of spinal nerve , then run along with the spinal nerve .



- Then , a branch enters the ganglia (so it is preganglionic sympathetic fibers & have afferent "sensory" fibers) called the White Ramus (its origin from the lateral horn of the thoracolumbar spinal cords) ,which runs along with the spinal cord and ends by synapsing in the sympathetic ganglia .

→Now , how many white rami do we have ?? .... They are 14 in number (just the same as the origin " 14 lateral horns gives 14 white rami")

- The one that leaves the ganglia (so it is postganglionic sympathetic fibers) called Gray Ramus, which goes back to the spinal nerve. So it communicates the ganglia with the corresponding spinal nerves

→How many gray rami do we have ?? .... They are 31 pairs in number (just the same as the NO. of spinal nerves).

**Important : Every spinal nerve has gray ramus

**Important : don't forget that we have sympathetic chains on Both sides of the vertebral column(right & left) , so when we talk that we have 14 white rami , for example , we mean that we have 14 branch on left and another 14 branch on right .

" abdominal sympathetic chain" :

We **only** have 2 white rami " L1 & L2 " and 5 gray rami . The white rami communicants (joins) the first two ganglia to the first two lumbar spinal nerves ; whereas the gray ramus contain postganglionic nerve fibers distributed to blood vessels, sweet gland and skin.

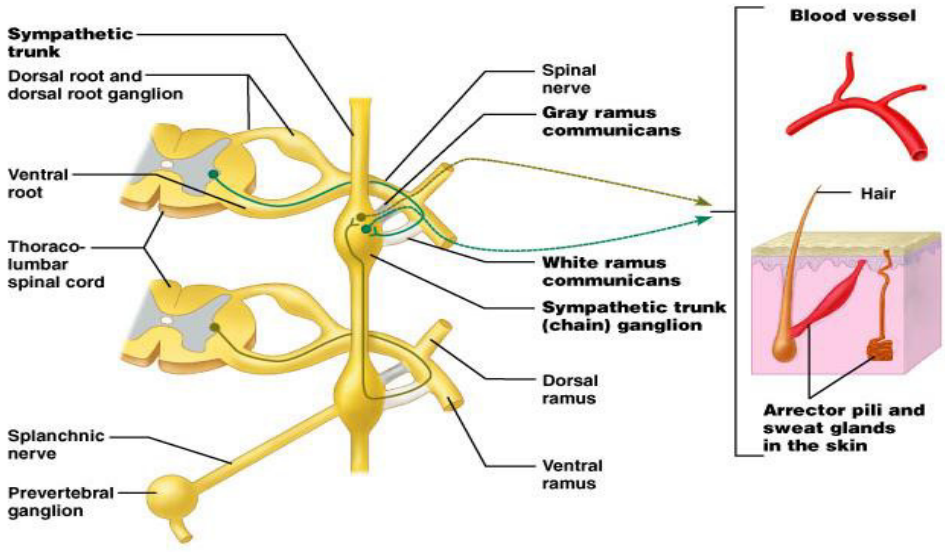
NOW , The fibers of the sympathetic chains in the abdomen make plexuses called the splanchnic nerves . We will discuss the white ramus and its possibilities >> what are these possibilities ?

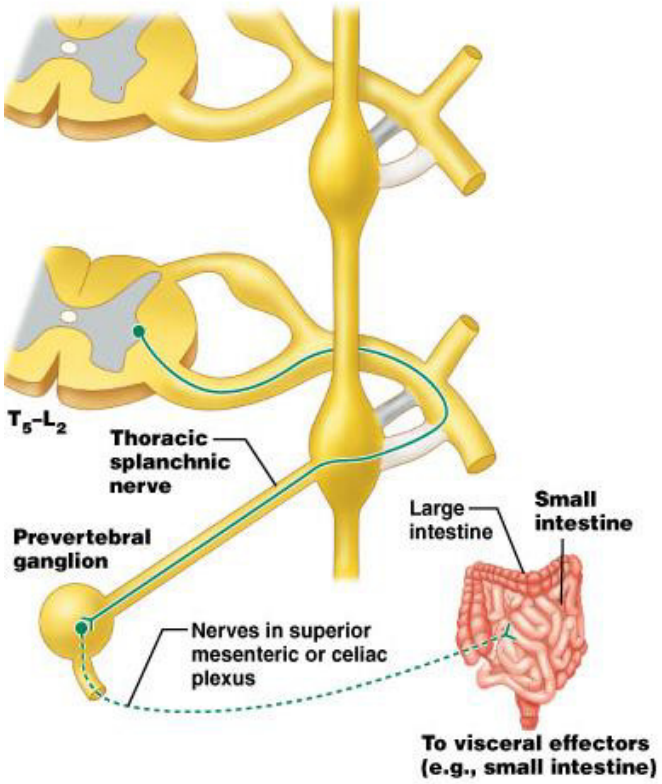
1- it might **synapse** in the corresponding ganglia (e.g : white ramus from L1 synapses with #1 sympathetic ganglia in the abdomen)
2- it might **ascend** upward to other ganglia (e.g : instead of the synapsing in the L1 ganglia , it can ascend upward and synapse with cervical sympathetic ganglia)
3- it might **descend** downward (e.g : synapse with L5 sympathetic ganglia instead of L1)
4- or it might **not synapse** in the sympathetic ganglia at all , instead synapse in the ganglia around the abdominal aorta " like : **Celiac**, **Renal** , **Superior** and **Inferior** mesenteric ganglia " , those called the **Para Aortic** ganglia .

In the pic. below (which represents these possibilities) :

-The green nerve (which is the upper most one)represent the first possibility (synapse in the corresponding ganglia)

- The brown nerve (which is the middle one) represent the second possibility (ascend upward then synapses)





Here , the pic. represents the fourth possibility of the white ramus ,which is the **splanchnic nerve** , here there is no synapsing in the sympathetic chain , instead synapsing occurs in the para aortic ganglia (prevertebral ganglia).

Aortic Plexus :

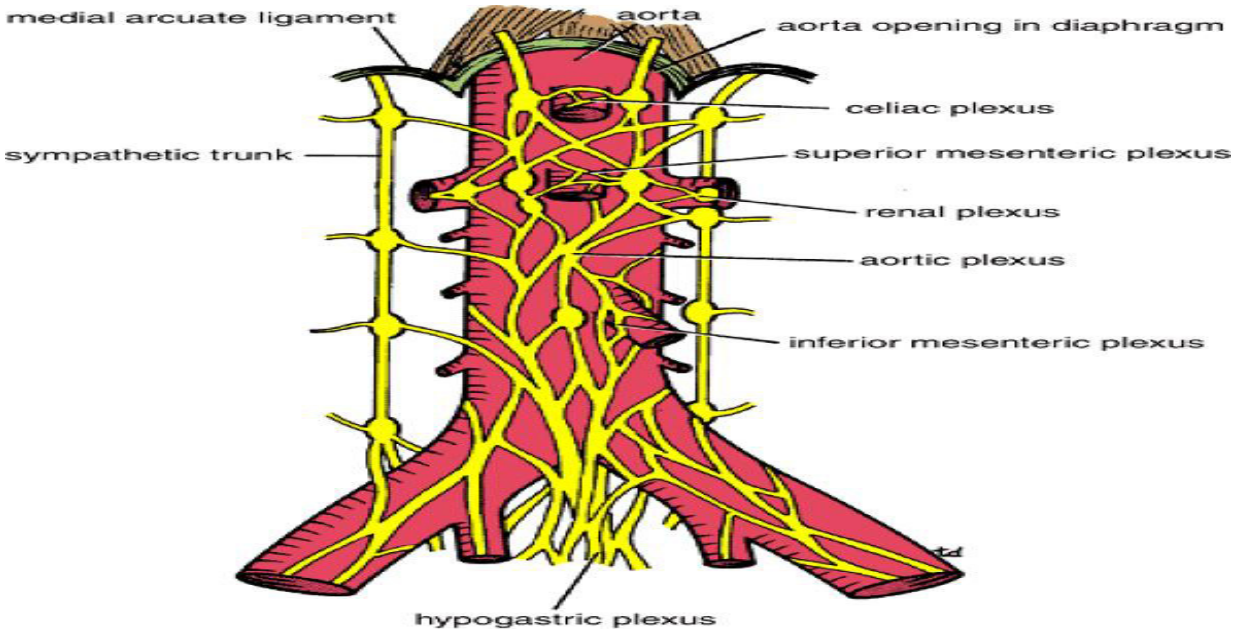
a plexus of nerves around the aorta , it has:

- Sympathetic part (from postganglionic " from sympathetic chain ganglia" or splanchnic nerve)
- Parasympathetic part (from :1- "right and left vagus nerves" → supply before the distal third of the Transverse colon , 2- " S2 +S3 +S4 nerves" → supply after the distal third of the T-colon) .

::Remember:: a splanchnic nerve doesn't synapse at the sympathetic ganglia ,which lies on both sides of the vertebral column , but instead it will synapse at celiac , renal , superior mesenteric or inferior mesenteric plexuses .

Aortic (para aortic) plexus devides into :

1. Celiac plexus : found around the celiac trunk and its branches , so it will supply the organs .
2. Superior mesenteric plexus : around the superior mesenteric artery and its branches .
3. Inferior mesenteric plexus : around the inferior mesenteric artery and its branches .
4. Renal plexus : around the renal vessels.



::Remember:: that when we say plexus → we mean both Sympathetic & Parasympathetic .

To Sum Up : Sympathetic" preganglionic & postganglionic nerves" and parasympathetic nerves form plexuses around the abdominal aorta

- What is the difference between the sympathetic and parasympathetic ?

Parasympathetic nerves are preganglionic and synapse in the walls of organs in the Myenteric plexus (between the inner circular & outer longitudinal muscles " remember in muscularis layer") , whereas the sympathetic is already postganglionic so there is no other synapse in but it will pass through the myenteric plexus to reach the organs . Any organ in the GI has both sympathetic and parasympathetic innervations by plexuses of nerves .

Sympathetic Chain (trunk) :

-It is two longitudinal chains, extend from the neck to the coccyx and is divided to many of ganglia , that found on both sides of vertebral column .

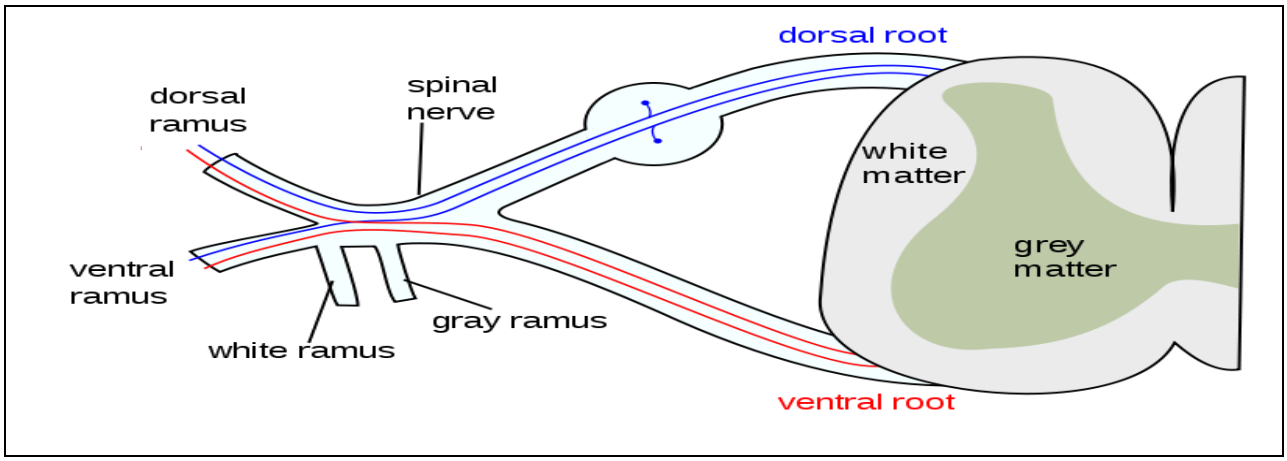
-In the Cervical Region (neck): we have 3 sympathetic ganglia on both sides (left and right) : Superior , Middle & Inferior .

-In the Thoracic Region: we have 12 sympathetic ganglia on both sides of thoracic vertebra (in most books it is 12 , but you can find them 10 , 11 or 12).

-In the Abdominal Region :we have 4 to 5 sympathetic ganglia (Note : in the slide : it is written 4 , but the dr. said that we can find them 5) .

-In the Pelvic Region :→ we have 4 to 5 sacrum sympathetic ganglia " on both sides" & → we have ganglion impar in the coccygeal region , which is only one ganglia on the midline (not at both sides) .

Here , in the pic. below , we can see the grey matter and the lateral horn ,that gives the preganglionic nerve which goes along with the ventral root , then as white ramus that goes to the sympathetic chain .



-Branches that leaves the Sympathetic Chain :

1 – from the Gray rami ,

According to the * Cervical region →The postganglionic fibers are with the cranial nerves {Superior Cervical Sympathetic Chain "S.C.S.C" → lower 4 cranial N. + upper 4 cervical N.} ,

{ Middle Cervical Sympathetic Chain "M.C.S.C." → 5^{th} & 6^{th} cranial N.} ,

{Inferior Cervical Sympathetic Chain "I.C.S.C" → 7^{th} & 8^{th} cranial N.} .

Also the *Thoracic , *lumbar & *Sacral ganglia receive branches from them .

2- Visceral branches :

a) found around the internal & external carotid arteries.

b) pharyngeal branch : from S.C.S.G pharyngeal plexus.

c) pulmonary nerves : 2^{nd} , 3^{rd}& 4^{th} thoracic ganglia.

d) cardiac nerves : 2^{nd} , 3^{rd}& 4^{th} thoracic ganglia + 3 cervical ganglia.

e) splanchnic nerves : greater, lesser and lowest splanchnic nerves ; they come from thorax to reach the abdomen, and they synapse in the para aortic ganglia NOT in the sympathetic thoracic ganglia .

**Important : all of them are plexuses so they contain sympathetic (what we talking about above here) and parasympathetic nerves .

✓ **Splanchnic nerves** (they are going from the thorax to the abdomen):

1- Greater nerves : from T5 to T9, pierces the crus of diaphragm, ends in the celiac ganglia, post ganglionic fibers follow the branches of celiac artery to reach the smooth muscle , gland of stomach.
2- Lesser nerves : from T9 or T10 or T11, pierces the crus of diaphragm ,end in the Sup. Mesenteric ganglia, post ganglionic fibers goes with the branches of superior mesenteric artery to supply the smooth muscles, glands of small intestine, ascending and transverse parts of colon (just until the distal third)
3- Lowest nerves : it might be there , from T12. , pierces the diaphragm , goes around the renal arteries and reaches the suprarenal glands .

✓ **Lumber splanchnic branch**:

→Sympathetic part : from L1 & L2 , no synapse in the sympathetic chain , but instead synapse in the inferior mesenteric ganglia. It will form the hypogastric plexus , which is distributed to the rectum , gallbladder and genitalia .

→Parasympathetic part : from S2 & S3 & S4 .

Thoracic sympathetic chain :

-It enters the abdomen and descends deep to medial arcuate ligament, there are 10 to 12 ganglia , which give branches and splanchnic nerves .

-In the abdomen , the most important thing is the aortic plexus . In the thorax it will give visceral branches , for example , for the lung, esophagus & heart (it has cardiac plexus of nerves { sympathetic nerves → tachycardia , parasympathetic nerves → bradycardia}) .

-Splanchnic nerves go mostly for the GI tract , more than the thorax .

- All Abdominal viscera have afferent " sensory " fibers to sense the pain (just like intestinal colic or abdominal colic).

Afferent fibers are divided into visceral (general sensation : sense the pain , stretch , temp. , ... etc) and somatic .

-There is special sensation we will take it ensha2allah next year with CNS .

THE END

Thanks for Yara Al-Kayed

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" إنّ قِمّة الجبال تستحِقُ لا جَرَم "