



MSS

A N A T O M Y

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The doctor said that this lec is just an introduction to the GI system and we are going to take it again there in a few weeks, so don't go on details and focus on muscle's characteristics, origin and insertion for the sake of this system's exam, and you can find that in a table in the last 3 pages.

Abdominal wall

Abdomen is the region of the trunk that lies between the diaphragm above, and the inlet of the pelvis below. It's separated from the thoracic cavity by the diaphragm.

Borders of the abdomen:

- **Superiorly:** costal cartilages 7-12 and xiphoid process (end of sternum). (The 9th costal cartilage is the most palpable one).
- **Inferiorly:** pubic bone and iliac crest at the level of L4.

From the front, the pubis.

From the sides, the iliac crest, which is considered a landmark that separates the abdominal from the pelvic cavity.

- **Umbilicus:** at the level of intervertebral disc L3-L4. It is found in the midline (sagittal cut) of the abdomen, it comes from the umbilical cord.

After birth this cord is cut.

Abdominal quadrants:

The abdomen is divided into 4 parts, formed by two intersecting lines: vertical and horizontal.

They intersect at the umbilicus.

Upper left, Upper right, Lower left and Lower right.

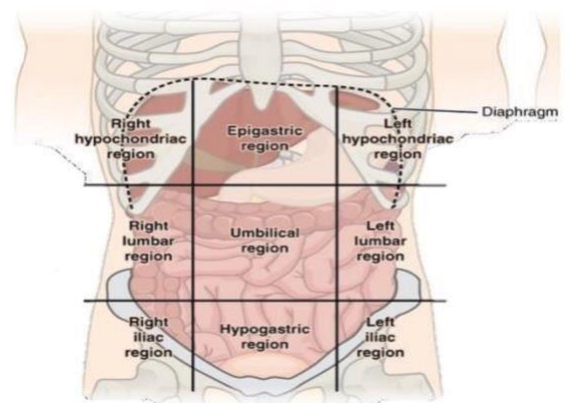
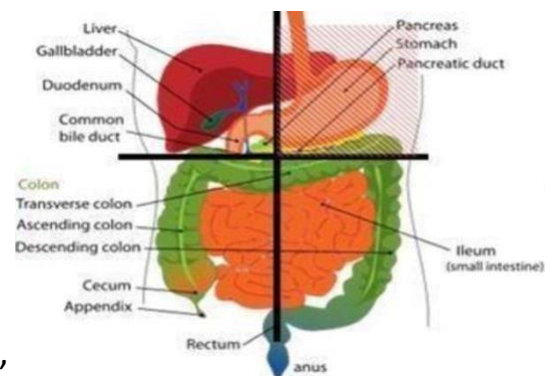
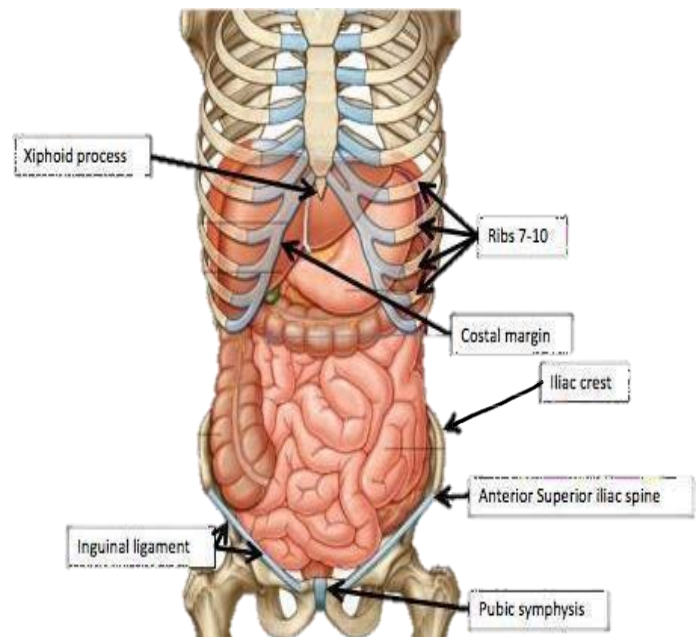
It was divided into quadrants to help doctors in diagnosis, complains from a severe pain in the lower right quadrant, it indicates appendicitis.

Abdominal Regions:

However, nowadays it's further divided into **9 regions** by two pairs of planes: Two vertical planes and two horizontal planes.

The 2 vertical planes: left and right lateral planes both are midclavicular planes (from the midline of the clavicle, descending along the abdomen).

They also pass through the midpoint between the anterior superior iliac spine and symphysis pubis.

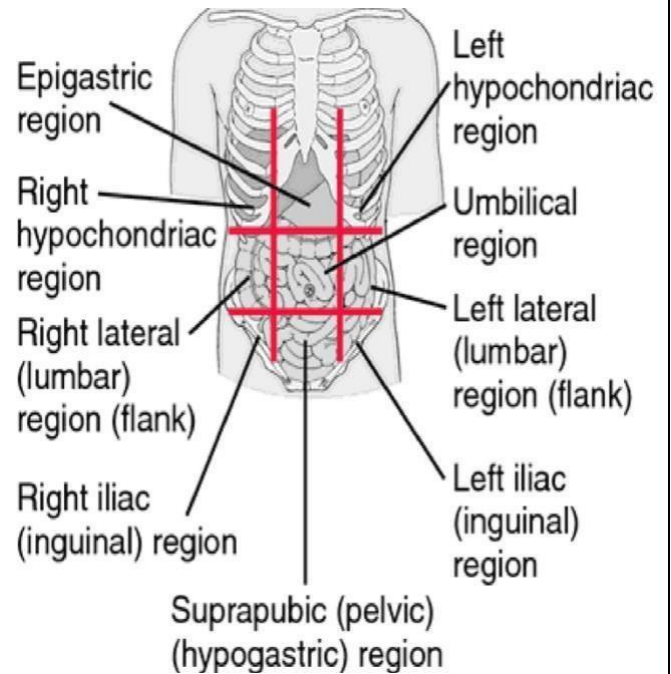


The 2 horizontal planes:

1-Subcostal plane: at level of L3 vertebra.(touches the 9th costal cartilage). Joins the lower end of costal cartilage on each side.

2-Intertubercular plane: at the level of L5 vertebra, through the right and left tubercles of iliac crests (hip bone).

- Starting with the **epigastric region**, it lies anterior to the stomach. So, pressing hard on this region is used to test the stomach.
- The **right hypochondriac region** is in front of the **liver** and **gallbladder**.
- The **left hypochondriac region** is in front of the **spleen**. It's a quite **dangerous** region since sometimes urgent operations are required like splenectomy.
- The **umbilical region** is anterior to the small Intestine and a small part of **pancreas**.
- The **right and left lumbar (lateral) regions (flanks)** are anterior to the right and left **kidneys** (Diagnosis of renal colic).
- The **right and left iliac (inguinal) regions**. Iliac: since it's in front of the iliac fossa. And inguinal: since it's in front of the inguinal canal, inguinal hernia is common in this region. **Now, if we want to diagnose appendicitis we can refer to the region as the right iliac region.**
- The **suprapubic (pelvic, hypogastric) region** is anterior to the **urinary bladder**.



The abdominal wall is divided into:

Anterior abdominal wall and Posterior abdominal wall.

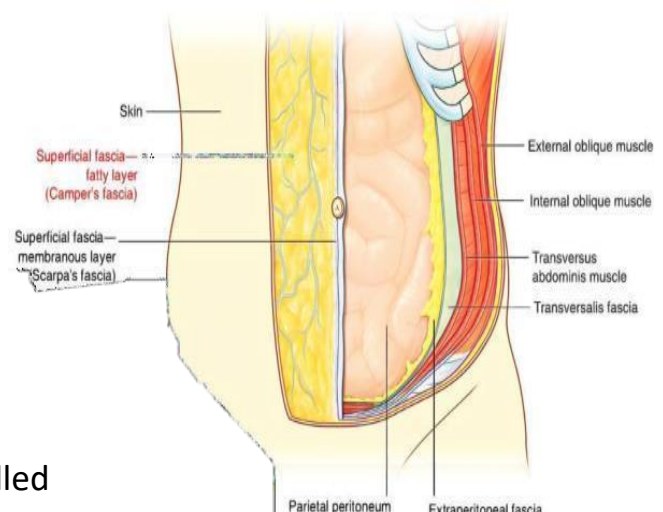
The layers of the anterior abdominal wall:

- ✓ Skin.
- ✓ Superficial fascia.
- ✓ Deep fascia.
- ✓ Muscular layer.
- ✓ Transversalis fascia.
- ✓ Extraperitoneal fascia.
- ✓ Parietal peritoneum.

-In the superficial fascia:

Above the umbilicus there's one layer and it's called "**camper's fascia**", it's a fatty layer of the superficial fascia.

Below the umbilicus, there are two layers, the "**camper's fascia**" and another deep membranous layer which is called "**scarpa's fascia**".



▪ The camper's fascia: is a fatty layer and in males gives the **dartos muscle**.

▪ The scarpa's fascia: is a membranous layer and in males it forms the **scrotum** is referred to as **colle's fascia**. The superficial fascia of the anterior abdominal wall in females extends and reaches the **labia majora** and there it surrounds the round ligament of uterus.

▪ Attachments of the scarpa's fascia (membranous fascia):

- Inferiorly: fascia lata.
- From the sides: pubic arch.
- Posteriorly: perineal body.

The fascia lata links with deep fascia, it lies 2 fingers below the inguinal ligament in the lower limb. The scarpa's fascia also surrounds the urethra. It keeps the urine inside and prevents it from descending downwards to the lower limb.

So, **the rupture of the penile urethra leads to extravasations of urine into (scrotum, perineum, penis & abdomen [till umbilicus]).**

The perineal body is a fibrous body in the perineum lies between the anal canal (posterior) and symphysis pubis (anterior).

- **The deep fascia** is a thin layer of connective tissue covering the muscle.

Most of the times the deep fascia is absent especially in females. So, it wouldn't prevent the expansion of the uterus during pregnancy. However, it can be present but it would very thin.

- **The transversalis fascia** is a thin membrane that lies deep to the transverse abdominal muscle, it's also one of the contents of the femoral sheath.

- **The extraperitoneal fascia** usually it is in the form of adipose tissue located superficial to the parietal peritoneum, and deep to the transversalis fascia.

- **The parietal peritoneum** surrounds the abdominal cavity, we can't reach the abdominal viscera without opening it. The visceral peritoneum surrounds the abdominal viscera and it's adherent to the visceral organs.

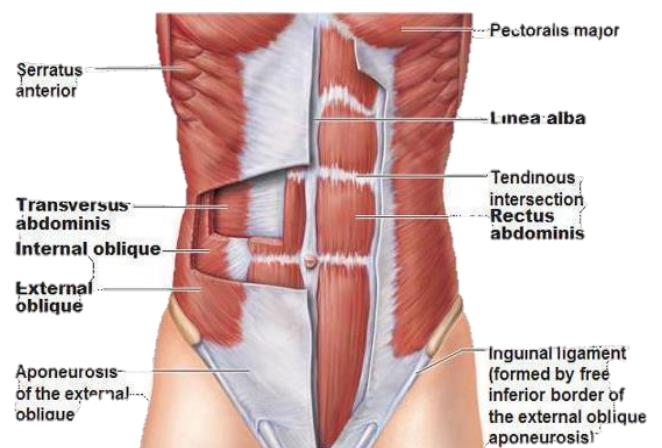
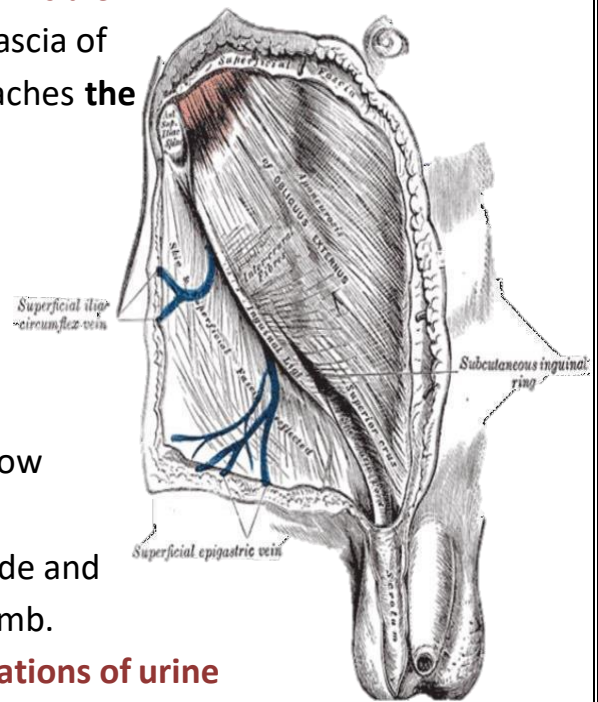
The muscles of the anterior abdominal wall

- ✓ Rectus abdominis.
- ✓ External oblique muscle.
- ✓ Internal oblique muscle.
- ✓ Transverse abdominal muscle.

They are very strong muscles.

The last three muscles' aponeurosis form the rectus sheath. Inside this sheath we have the rectus abdominis.

They all lay in the anterior abdominal wall.



1- The external oblique: it's a broad and thin muscle.

Direction of the fibers	Origin	Insertion	Nerve supply
Downward forward and medial.	Outer surface of lower 8 ribs (since the diaphragm is in the inner surface).	Xiphoid process, linea alba , pubic crest, pubic tubercle, iliac crest (anterior half).	The lower 6 th thoracic nerves. The 1 st lumbar nerve (with it's 2 branches; iliohypogastric and ilioinguinal nerves).



- The linea alba extends from the xiphoid process to symphysis pubis.
- The insertion is the **aponeurosis** which is a fibrous tissue that form these contributions: (the importance of it)

1- Superficial inguinal ring

- ✓ Triangular shape.
- ✓ Defect (opening) in the external oblique muscle.
- ✓ Lies immediately above and medial to the pubic tubercle (opposite to femoral ring).
- ✓ It's considered an opening for the passage of **spermatic cord** in males and for the for the **round ligament** of uterus in females.

This ring marks the end of the inguinal canal, and the following ligaments make the rest of the boundaries.

2- Inguinal ligament

- ✓ Folded backward on itself in the lower border of aponeurosis of external muscle.
- ✓ Lies between the anterior superior iliac spine and the pubic tubercle.

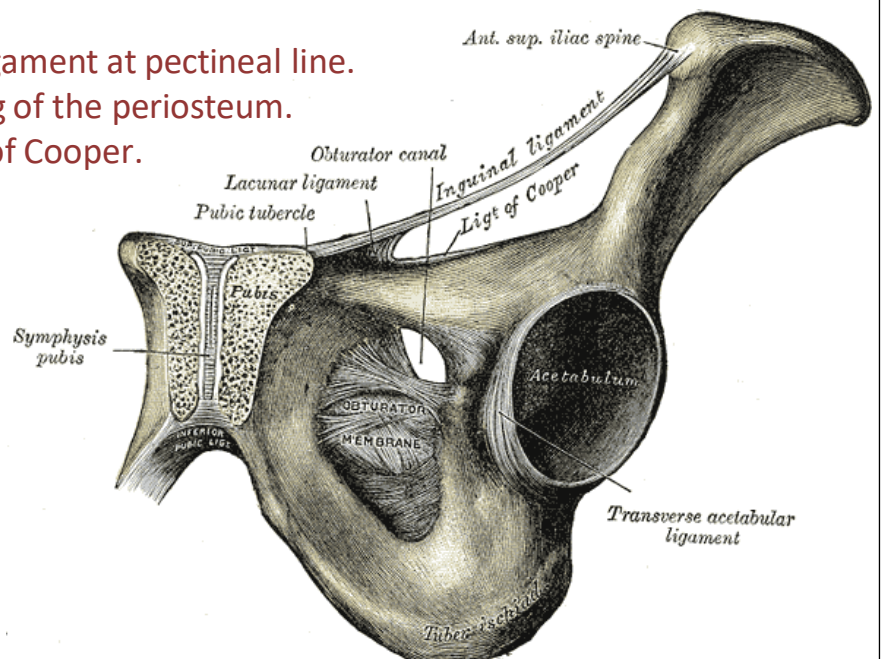
3- Lacunar ligament

- ✓ Extension of aponeurosis of external muscle backward and to the pectineal line upward.
- ✓ Extends from the inguinal ligament to the superior ramus of pubis (pubic tubercle).
- ✓ It's sharp, free crescentic edge forms the medial margin of the femoral ring.

4- Pectineal ligament

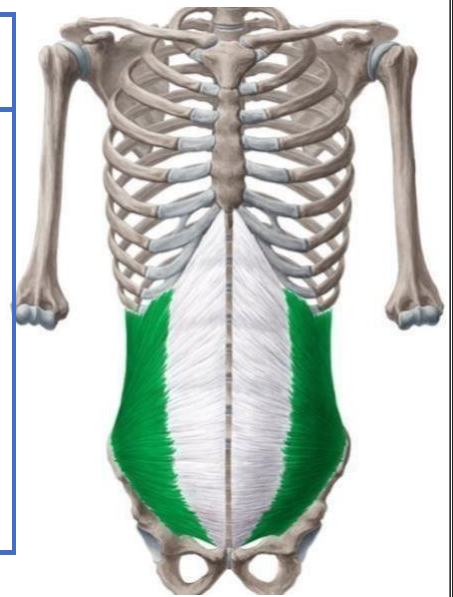
- ✓ Continuation of the lacunar ligament at pectineal line.
- ✓ Continuation with a thickening of the periosteum.
- ✓ Also called inguinal ligament of Cooper.

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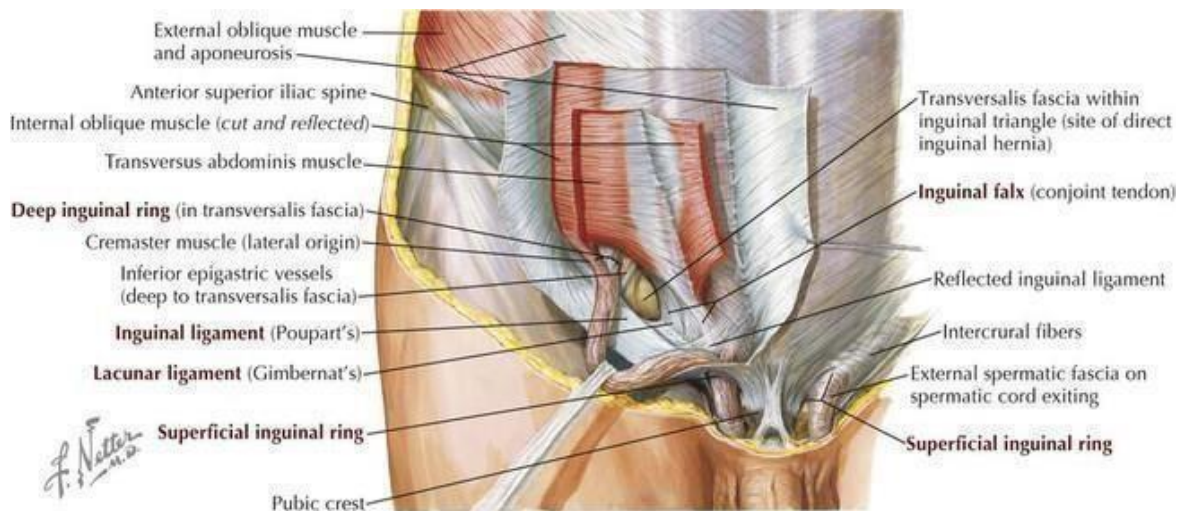
2- The internal oblique muscle:

Direction of the fibers	Origin	Insertion	Nerve supply
Upward forward and medial.	Lumbar fascia, <u>anterior 2/3</u> iliac crest, <u>lateral two thirds of</u> inguinal ligament.	Lower three ribs and costal cartilage, xiphoid process, linea alba, symphysis pubis.	The lower 6 th thoracic nerves. The 1 st lumbar nerve (with it's 2 branches; iliohypogastric and ilioinguinal nerves).

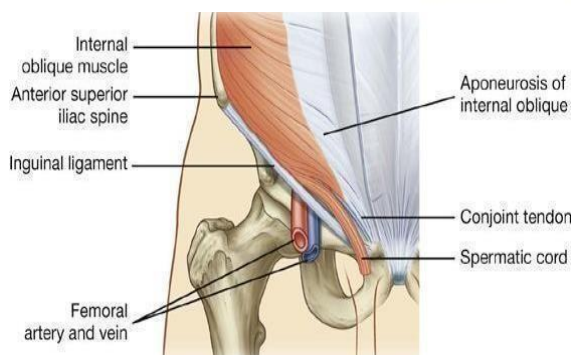


The contributions of this muscle:

- ✓ **Conjoint tendon** it's the fusion of the lowest tendinous fibers of **internal oblique** and **transversalis abdominis** muscle.
 - It's attached medially to linea alba and it also supports the inguinal canal.
 - It has a lateral free border.
 - It's important in hernia treatment (herniorrhaphy), as it's important in making stitches for treating indirect hernia since it's a very strong tendon.
 - It's inserted into the pubic crest and pectineal line.
- ✓ **Cremasteric fascia** and muscle:
 - The internal oblique muscle has free lower border arches over the spermatic cord in males or ligament of uterus in females.
 - Assists in the formation of the roof of the inguinal canal.

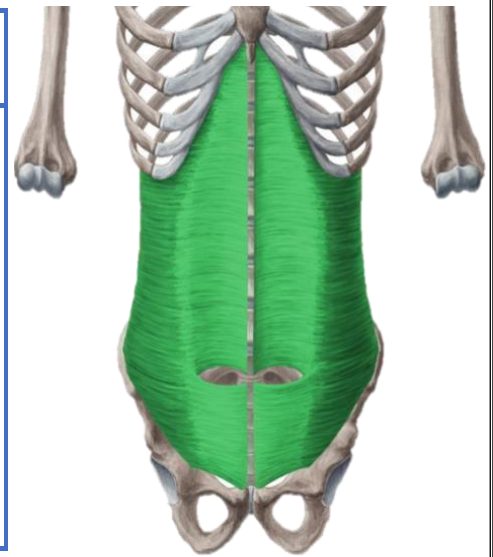


Anterior view



3- Transversus abdominis:

Direction of the fibers	Origin	Insertion	Nerve supply
Horizontally forward under the internal oblique.	Inner surface of lower six costal cartilage, lumbar fascia, <u>anterior two thirds</u> of iliac crest, lateral third of inguinal ligament.	Linea alba (from xiphoid process to symphysis pubis).	The lower 6 th thoracic nerves. The 1 st lumbar nerve (with it's 2 branches; iliohypogastric and ilioinguinal nerves).



Assists in the formation of:

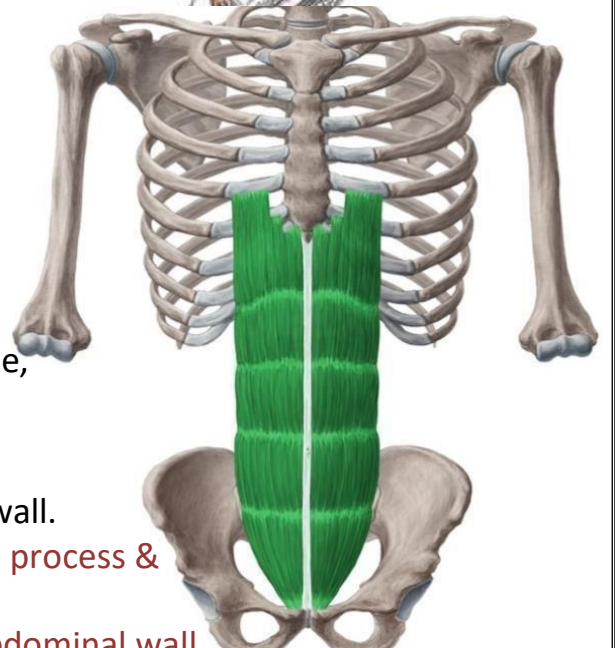
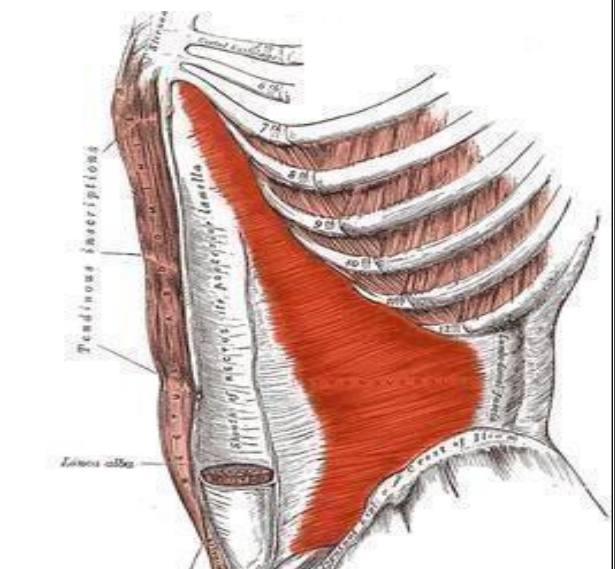
Conjoint tendon and Rectus sheath.

The lower part fuses with internal oblique to form conjoint tendon which attach to pupic crest and pectineal line.

4- Rectus abdominis muscle.

- ✓ Long strap muscle.
- ✓ Extends along the whole length of the anterior abdominal wall.
- ✓ Found in the rectus sheath (between linea alba and semilunaris).
- ✓ It has tendinous intersections.
- ✓ Six pack muscle and attaches only anteriorly.

Direction of the fibers	Origin	Insertion	Nerve supply
Vertical.	Symphysis pubis, pubis crest.	5 th , 6 th and 7 th costal cartilages & xiphoid process.	The lower 6 th thoracic nerves.



Note: the 1st lumbar nerve doesn't innervate this muscle, since rectus abdominis is included in the rectus sheath.

Linea alba:

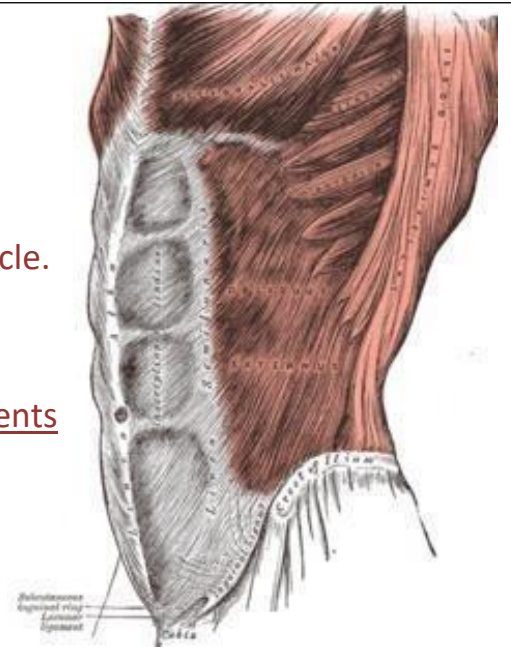
- Lines and land marks of the anterior abdominal wall.
- ☒ Located along the midline. (Between the xiphoid process & symphysis pupis)
- Formed by the fusion of aponeurosis of three abdominal wall muscles (external, internal oblique and transversus abdominis).
- The **advantage** of this fibrous line is that it provides wild field for large operations, since there is less bleeding because of the low blood supply.
- The **disadvantage** of it that it requires long time of healing after the surgery because of the low blood supply.

Linea semilunaris:

- Formed by the lateral margins of the rectus abdominis muscle.
- Can be palpated.
- Extends from the 9th costal cartilage to the pubic tubercle.

Tendinous intersection: linea transverses.

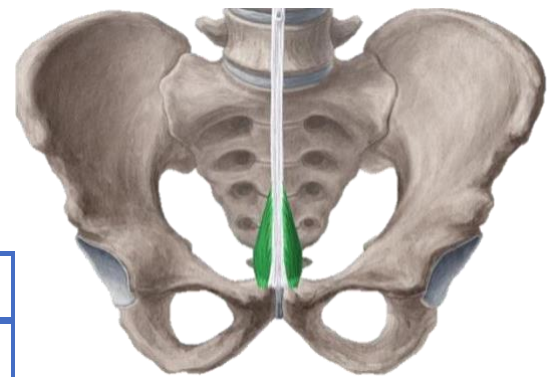
- 3 transverse fibrous bands.
- divide the rectus abdominis muscle into distinct segments (squares):
 - 1- one at level of xiphoid process.
 - 2- one at level of umbilicus.
 - 3- one half way between these two.
- They can be palpated as a transverse depressions.



In the embryology, these tendinous intersections come from myotome (group of muscles that a single spinal nerve innervates), but then they continue as a separated myotome.

5- The pyramidalis muscle:

- ✓ A very short and a very small muscle.
- ✓ Sometimes it is absent.
- ✓ It lies in front of the lower part of the rectus abdominis muscle (in the rectus sheath).





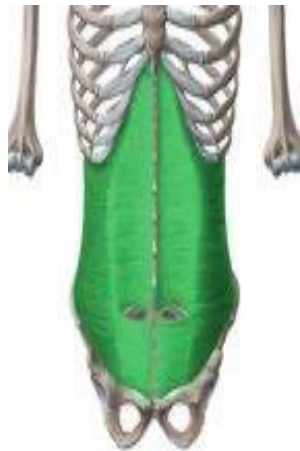
Origin	Insertion	Nerve supply
Anterior surface of pubis.	-Linea alba (it tenses the linea alba). -It lies in front of the lower part of the rectus abdominis muscle	12 th subcostal nerve (T12)

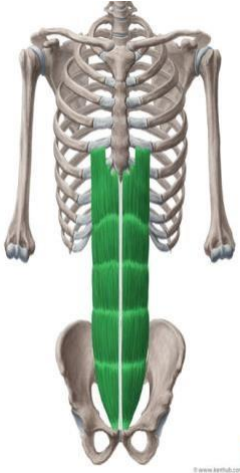
Note: all the previous muscles' insertion is the linea alba.

By now we took that inside the rectus sheath there is:

- 1- Pyramidalis muscle.
- 2- Rectus abdominis.
- 3- Lower 6th thoracic nerves.

Because it's sometimes absent , we can use it in **Reconstructive operation.**

The muscle's name	Origin	Insertion	Nerve supply	Special characteristics	Image
External oblique	Outer surface of lower 8 ribs.	Xiphoid process, linea alba, pubic crest, pubic tubercle, iliac crest (anterior half).	-The lower 6 th Thoracic nerves. -The 1 st lumbar nerve (with it's 2 branches; iliohypogastric and ilioinguinal nerves).	-Broad. -Thin. -Its fibers are directed downward forward medially. -its aponeurosis forms a lot of structures. ¹	
Internal oblique	Lumbar Fascia, Anterior two thirds of the iliac crest, lateral two thirds of inguinal ligament.	Lower three ribs & costal cartilage, Xiphoid process, Linea alba, symphysis pubis.	-The lower 6 th Thoracic nerves. -The 1 st lumbar nerve (with it's 2 branches; iliohypogastric and ilioinguinal nerves).	-Its fibers are directed upward forward medially. -It contributes with forming conjoint tendon and cremasteric fascia. ²	
Transversus abdominis	Inner surface of lower six costal cartilage, lumbar fascia, anterior two thirds of iliac crest, lateral third of inguinal ligament.	Linea alba (from xiphoid process to symphysis pubis).	The lower 6 th thoracic nerves. The 1 st lumbar nerve (with it's 2 branches; iliohypogastric and ilioinguinal nerves).	-Its fibers run horizontally forward under the internal oblique. -Its lower part fuses with internal oblique to form conjoint tendon which attach to pupic crest and pectineal line.(Assist in the formation of Conjoint tendon and Rectus sheath).	

<p>Rectus abdominis</p>	<p>Symphysis pubis, pubic crest.</p>	<p>5th, 6th and 7th costal cartilage & xiphoid process.</p>	<p>The lower 6th thoracic nerves.</p>	<p>- Long strap muscle. - Extends along the whole length of the anterior abdominal wall. - In the rectus sheath. -It forms Linea semilunaris and Tendinous intersection. ³</p>	
<p>pyramidalis muscle</p>	<p>Anterior Surface of the pupis.</p>	<p>-Linea alba. -It lies in front of the lower part of the rectus abdominis muscle.</p>	<p>12th subcostal nerve.</p>		

¹ **Aponeurosis of external oblique muscle forms:**

- Superficial inguinal ring.
- Inguinal ligament.
- Lacunar ligament.
- Pectineal ligament.
- Boundaries of inguinal canal.
- Formation of rectus sheath.

² Internal oblique muscle contributes in the formation of :

Conjoint tendon

- The lowest tendinous fibers of internal oblique which joint with transversus abdominis.
- Attach medially to linea alba.
- Support the inguinal canal.
- Has lateral free border.

Cremastric fascia

Internal oblique has free lower border arches over the spermatic cord or ligament of uterus.

- Cremastric muscle.
- Fascia.
- Internal abdominal muscle assist in the formation of the Roof of the inguinal canal.

3 Linea alba:

- Is located along the midline.
- Between the xiphoid process & symphysis pubis.
- It's formed by the fusion of aponeuroses of three abdominal wall (external oblique, internal oblique and transversus abdominis)

Linea semilunaris:

- Lateral margins of rectus abdominis muscle
- Can be palpated.
- Extends from the 9th costal cartilage to the pubic tubercle.

Tendinous intersection: =Linea Transverses:

- 3 transverse fibrous bands.
- divide the rectus abdominis muscle into distinct segments:
 1. one at level of xiphoid process.
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 3. one half way between these two.
- They can be palpated as a transverse depressions.

GOOD LUCK 