

L(5) - Anterior Abdominal Wall & Rectus sheath.

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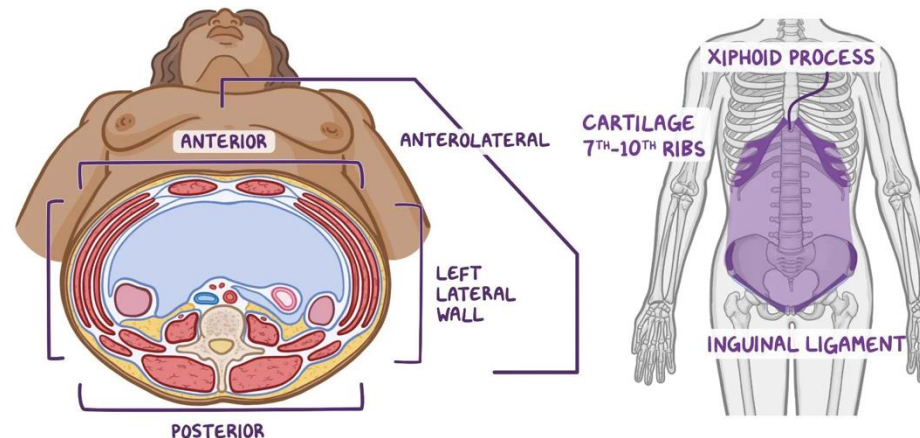
Reviewed by: Aya Wajdi

1- The Abdomen

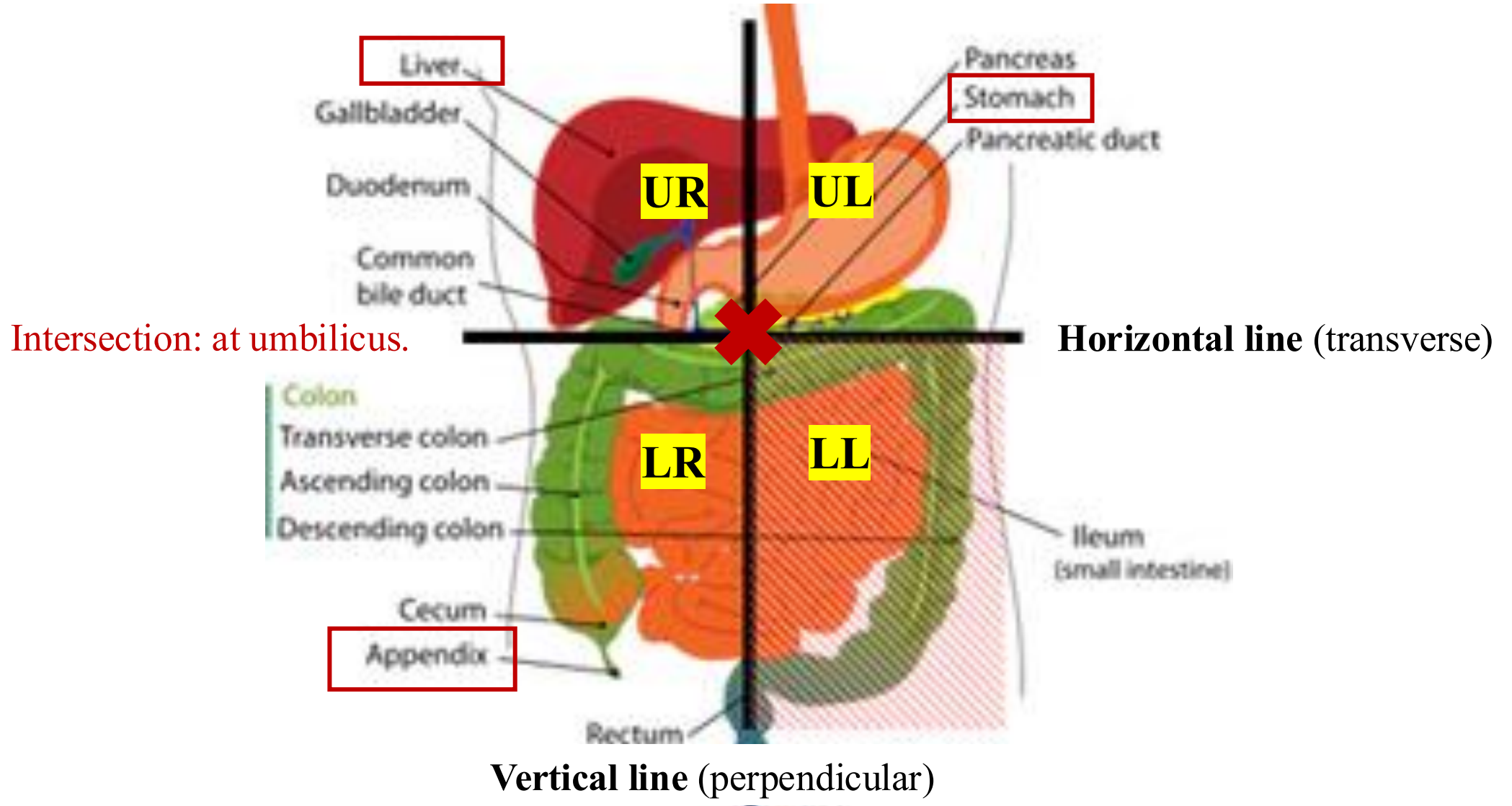
- The **abdomen** is the region of the trunk situated between the **diaphragm above** and the **pelvic inlet below**.
 - It is **separated superiorly** from the thoracic cavity by the **diaphragm**.
 - It is **continuous inferiorly** with the **pelvic cavity**.

Border	Structures	Notes
Superior	• Xiphoid process	At the midline of the body
	• Lower 6 costal cartilages (ribs 7–12)	Located on both lateral sides
Inferior	Pubic bone and iliac crest	At the level of L4 vertebra
Umbilical Level	Umbilicus	Lies between L3–L4

- Abdominal wall divided into:-
 - **Anterior abdominal wall**
 - **Posterior abdominal wall**

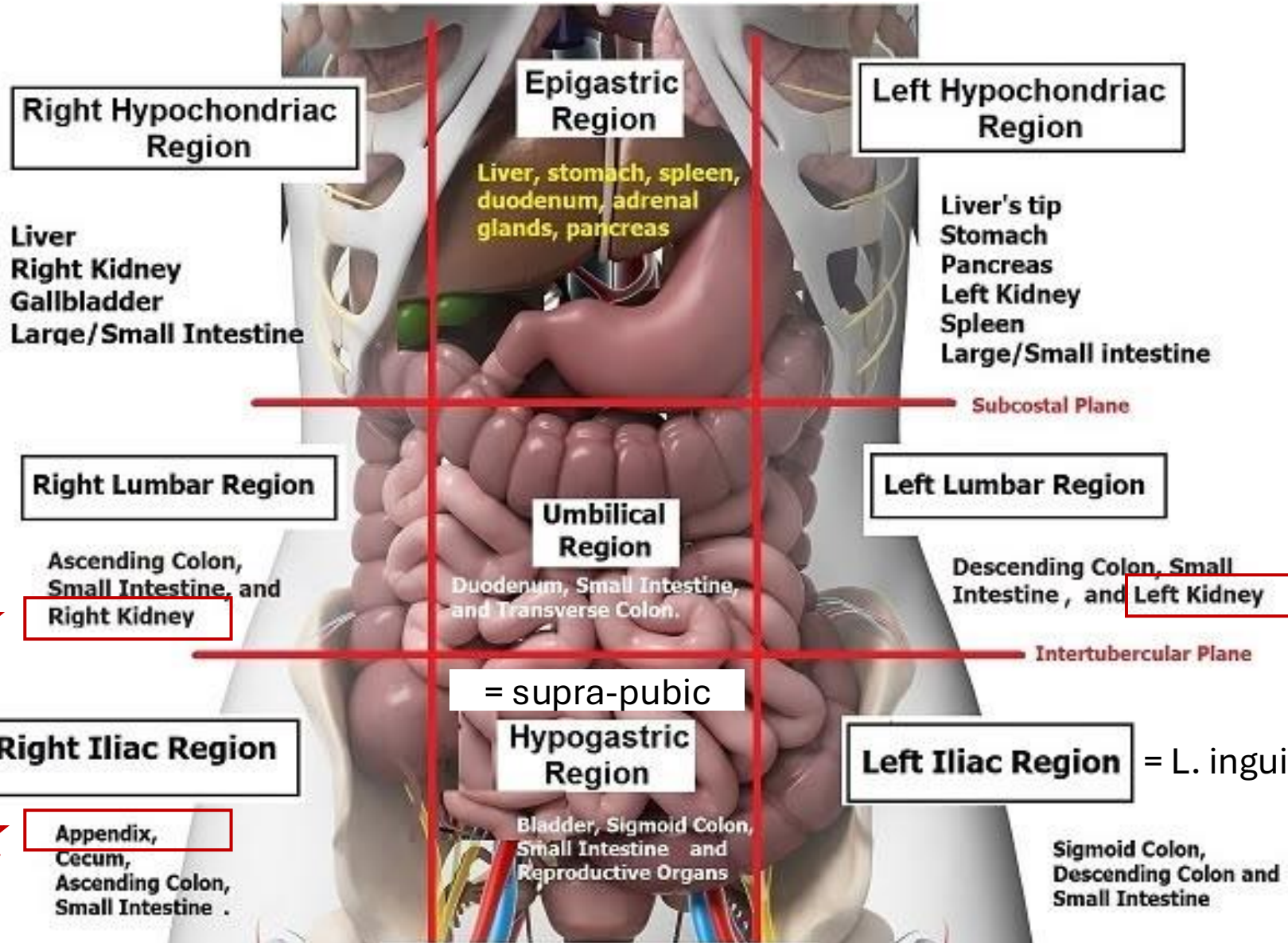


2- Abdominal quadrants



2- Abdominal quadrants

*Chondriac = costal cartilage



☹️ Renal colic ☆

☆ ☹️ Renal colic

R. inguinal =

= L. inguinal

= supra-pubic

2- Abdominal quadrants

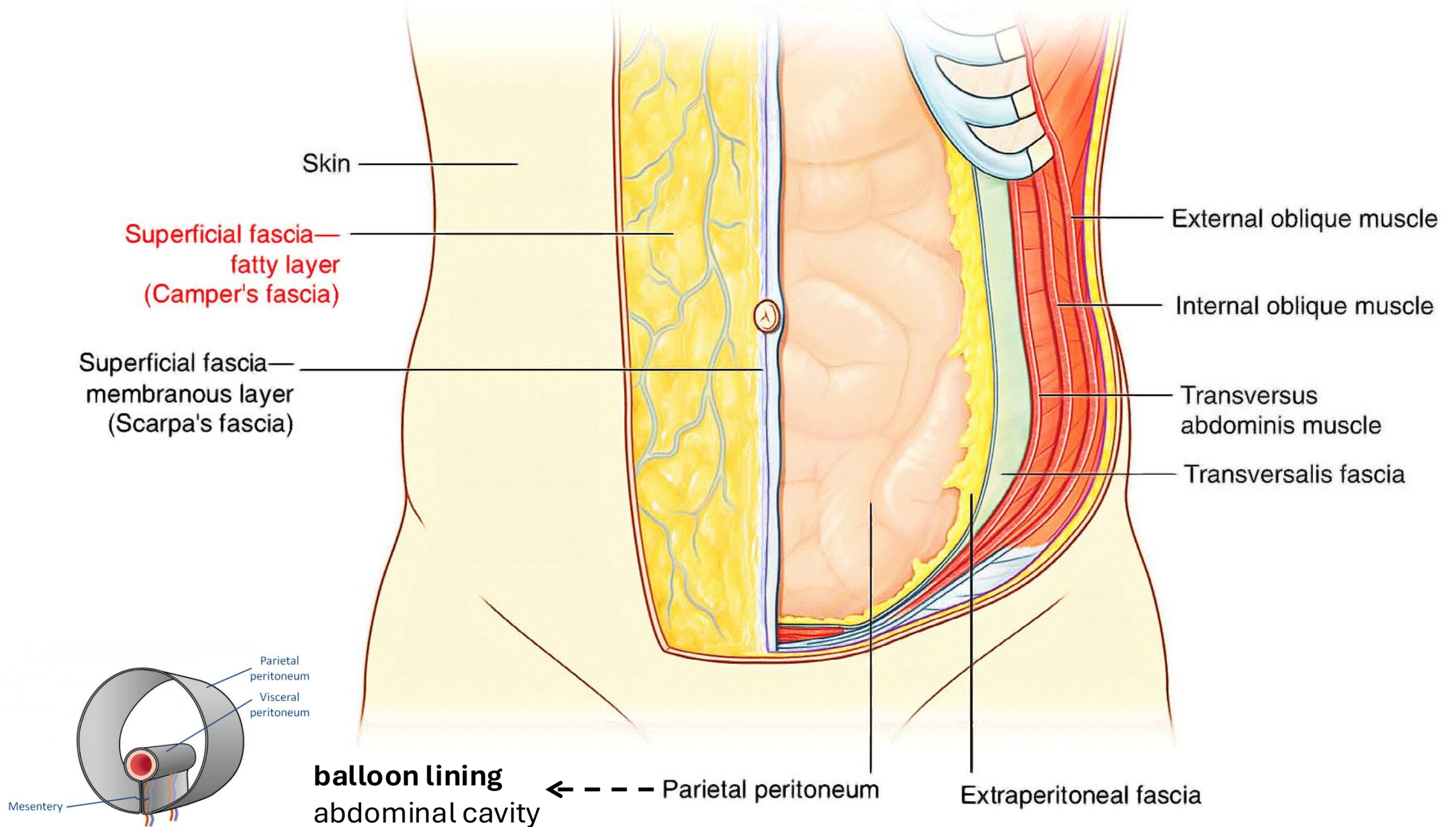
- Abdomen is divided into **9 quadrants** by:

Plane Type	Name	Description & Landmarks
Vertical Planes	R & L Midclavicular Planes or Right & Left lateral planes	<ul style="list-style-type: none">- Pass vertically through the midpoint of each clavicle (superiorly)
Horizontal Planes	Subcostal Plane	<ul style="list-style-type: none">- At the level of L3 vertebra- Lies just below the 9th rib
	Intertubercular Plane	<ul style="list-style-type: none">- At the level of L5 vertebra- Passes through the tubercles of the iliac crests of the hip bones

3- The Anterior abdominal wall

- Layers of the Anterior Abdominal Wall (from superficial to deep):

Layer	Details
1. Skin	Outermost protective layer of the body.
2. Superficial Fascia !	<ul style="list-style-type: none"> Above the umbilicus → One layer: - Camper's fascia Below the umbilicus → Two layers: - Camper's fascia (superficial fatty) - Scarpa's fascia (deep membranous)
3. Deep Fascia	<ul style="list-style-type: none"> Thin connective tissue covering the muscles May be absent in females to allow uterine expansion during pregnancy. Present in males as a thin CT layer
4. Muscular Layer !	<ul style="list-style-type: none"> External oblique & Internal oblique Transversus abdominis & Rectus abdominis
5. Transversalis Fascia	<ul style="list-style-type: none"> Cont. to diaphragm, forms part of the femoral sheath & deep inguinal ring.
6. Extraperitoneal Fascia	<ul style="list-style-type: none"> Loose connective tissue and fat between transversalis fascia and peritoneum
7. Parietal Peritoneum	<ul style="list-style-type: none"> Serous membrane lining the abdominal cavity Must be incised during surgery to access intraperitoneal organs.



Superficial fascia—
fatty layer
(Camper's fascia)

Superficial fascia—
membranous layer
(Scarpa's fascia)

External oblique muscle

Internal oblique muscle

Transversus
abdominis muscle

Transversalis fascia

Parietal
peritoneum
Visceral
peritoneum

Mesentery

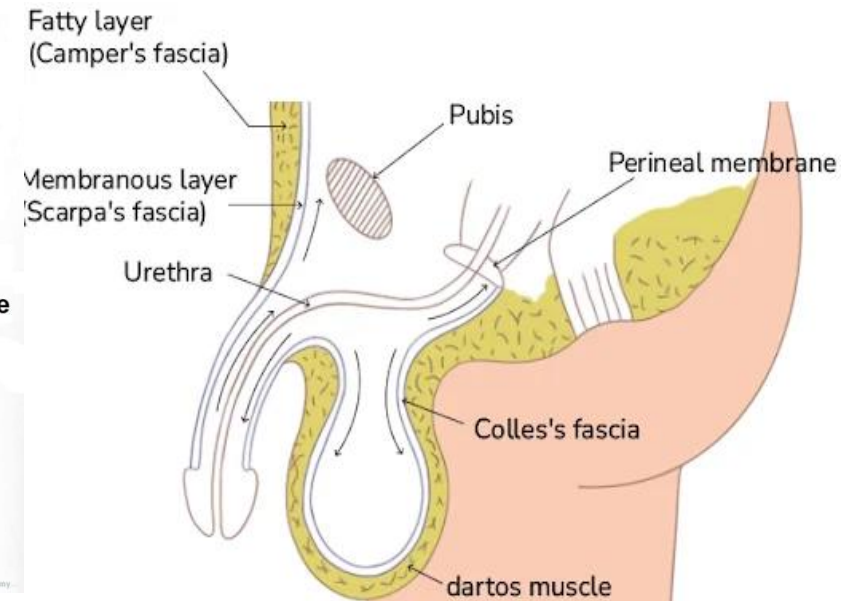
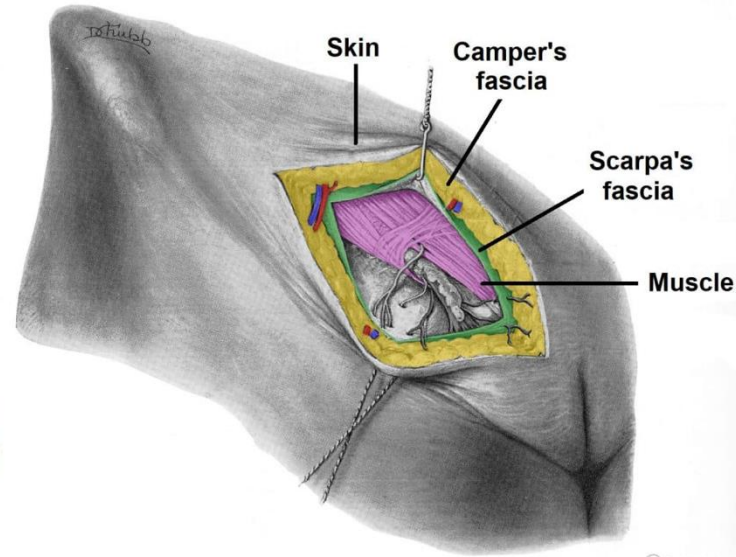
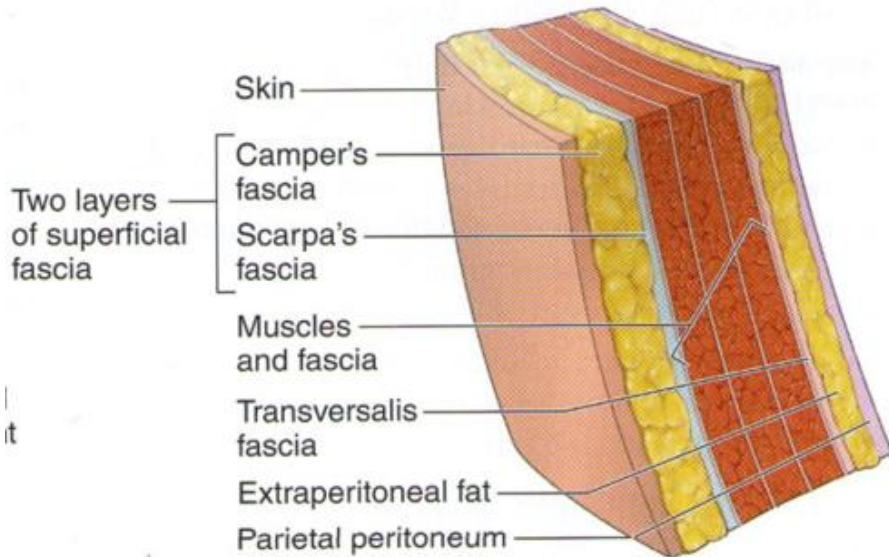
balloon lining
abdominal cavity

← - - - Parietal peritoneum

Extraperitoneal fascia

4- Superficial Fascia

Layer	Description
Camper's Fascia	<ul style="list-style-type: none"> - Fatty superficial layer - Present above and below the umbilicus - Continues into the scrotum in males as the Dartos muscle
Scarpa's Fascia	<ul style="list-style-type: none"> - Membranous deep layer, - Present only below the umbilicus - Continues into the perineum as Colles' fascia

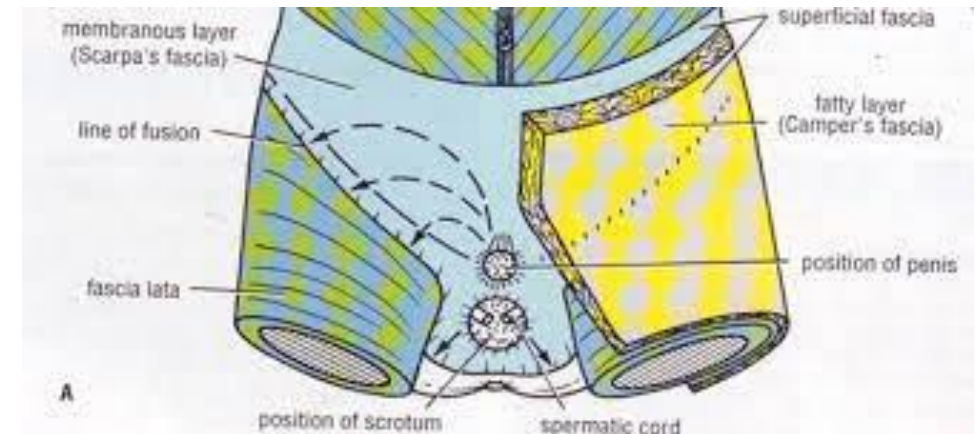


4- Superficial Fascia

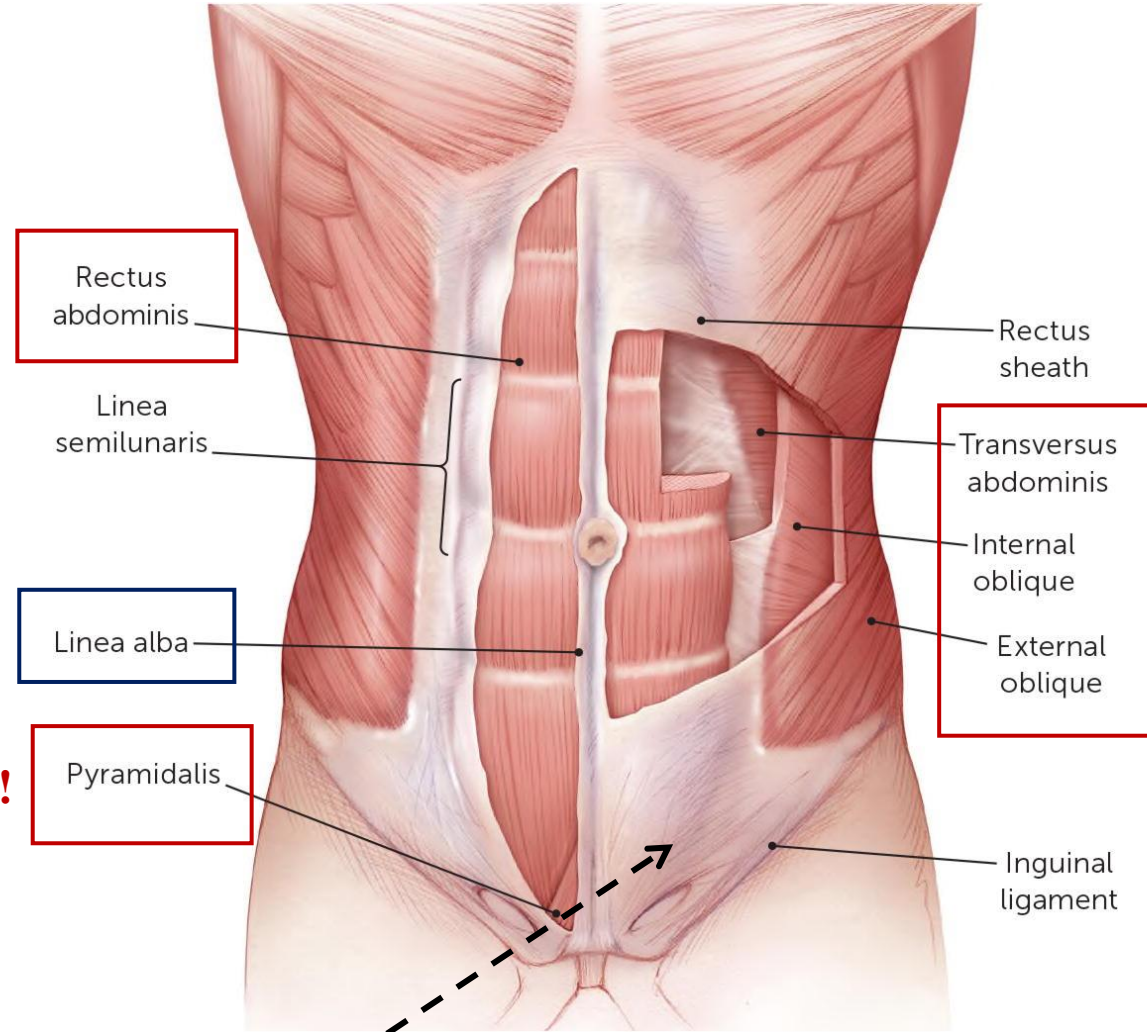
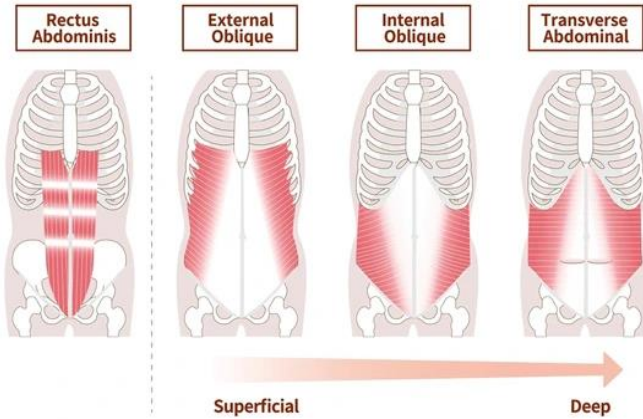
▪ Attachments of Scarpa's Fascia

Location	Attachment Point	Function
Inferiorly	Fascia lata (4 cm below inguinal ligament)	Prevents urine/fluid from spreading into the thigh. By closing the space above the membranous layer.*
Laterally	Pubic arch	Secures fascia at the sides
Posteriorly	Perineal body (fibrous mass in the perineum)	Closes the fascia posteriorly

When the ☹ **penile urethra ruptures**, urine leaks out of the urethra and collects deep to **Scarpa's fascia**, the extravasated urine can spread into the **scrotum, penis, perineum, and even into the lower anterior abdominal wall up to the level of the umbilicus**. However, the spread is limited and does not extend into the **thigh**. This is because Scarpa's fascia is firmly attached inferiorly to the **fascia lata***.



5- Muscular layer - Overview



Common insertion:

Muscle - Could be absent!

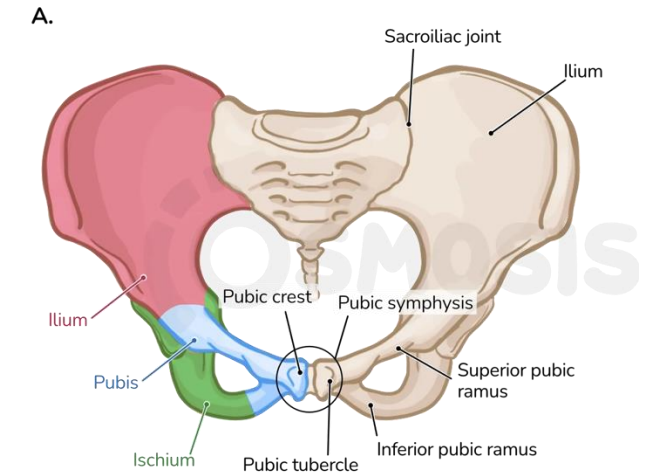
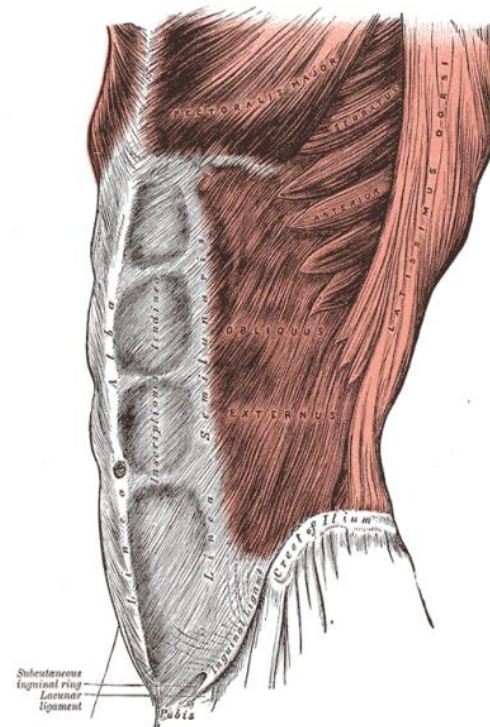
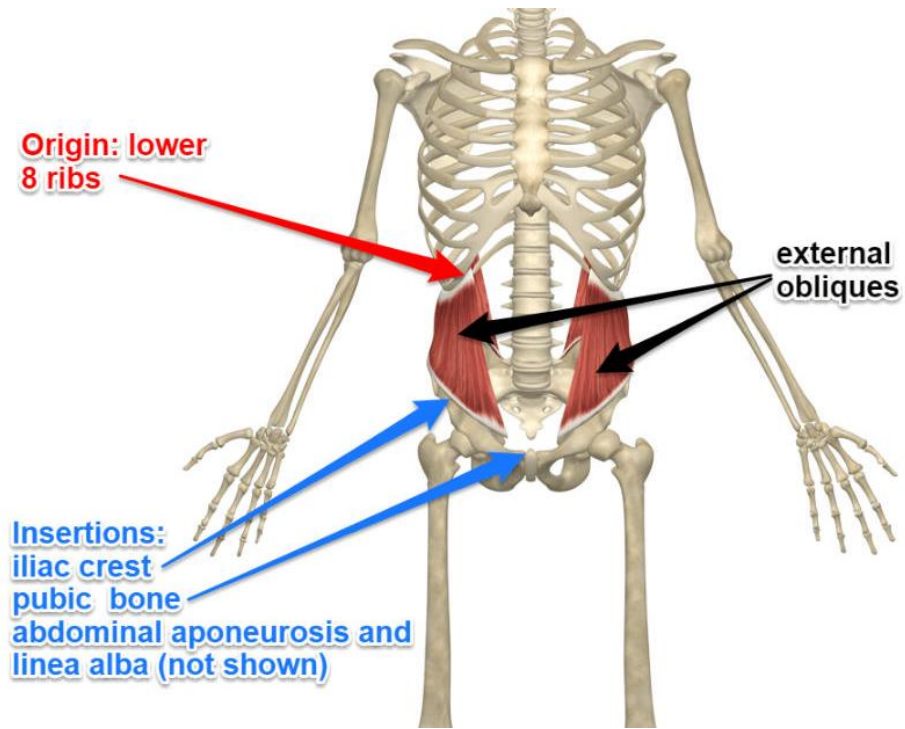
4 main muscles:

- Strong muscular network
- Originate as fleshy fibers
- terminate as aponeuroses

White indicates CT/aponeurosis

6- External oblique muscle

Fiber Direction	Origin	Insertion	Nerve Supply
Downward, forward, medially (as if placing hands in pockets)	Outer surface of lower 8 ribs	Xiphoid process, symphysis pubis, Linea alba, pubic crest, pubic tubercle, iliac crest	Lower 6 thoracic nerves, L1 (iliohypogastric & ilioinguinal nerves)



7 - External oblique Muscle aponeurosis

The **aponeurosis of the external oblique muscle forms or contributes** to the following structures:

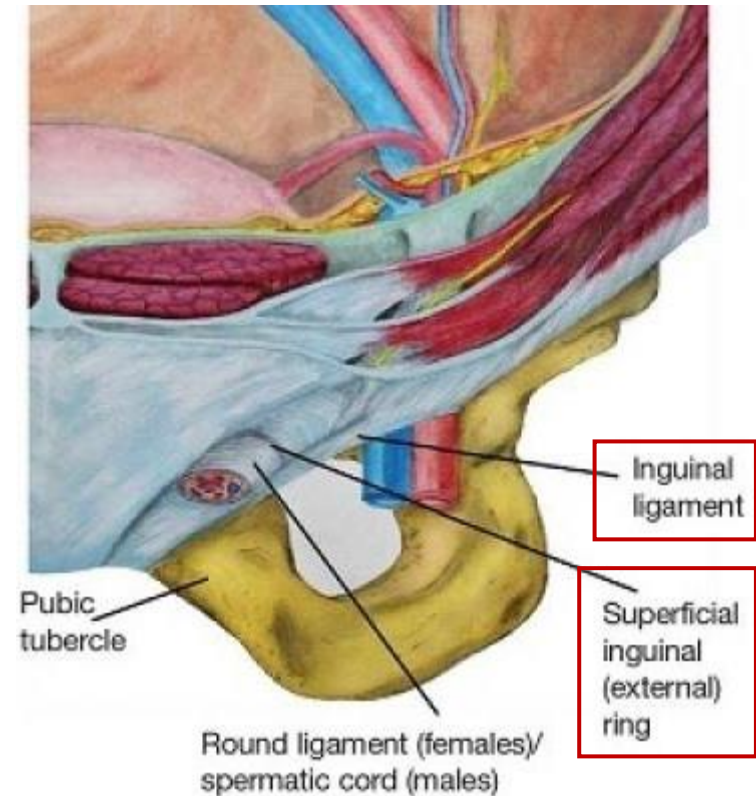
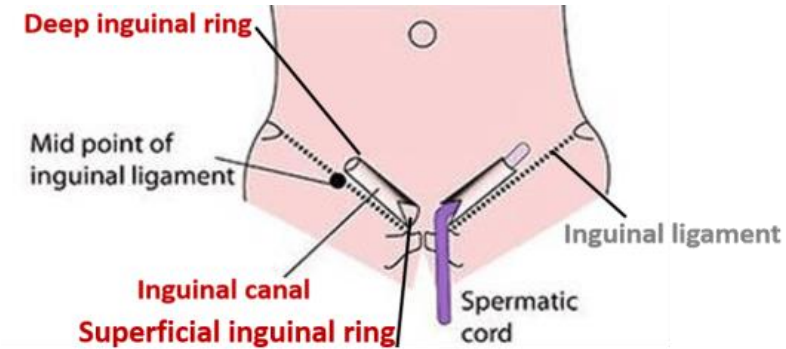
1. Anterior Wall of the Inguinal Canal

2. Superficial Inguinal Ring

- A **triangular defect** in the external oblique aponeurosis.
- Lies immediately above and **medial to the pubic tubercle**.
- Function: Serves as the **exit of the inguinal canal**, transmitting:
 - The **spermatic cord** in males.
 - The **round ligament** of the uterus in females (to the labia majora).

3. Inguinal Ligament

- Created by the folding backward of the lower border of the external oblique aponeurosis. (folding on itself)
- Extent: Stretches between:
 - The **anterior superior iliac spine (ASIS)** and
 - The **pubic tubercle**.



7 - External oblique Muscle aponeurosis

4. Lacunar Ligament

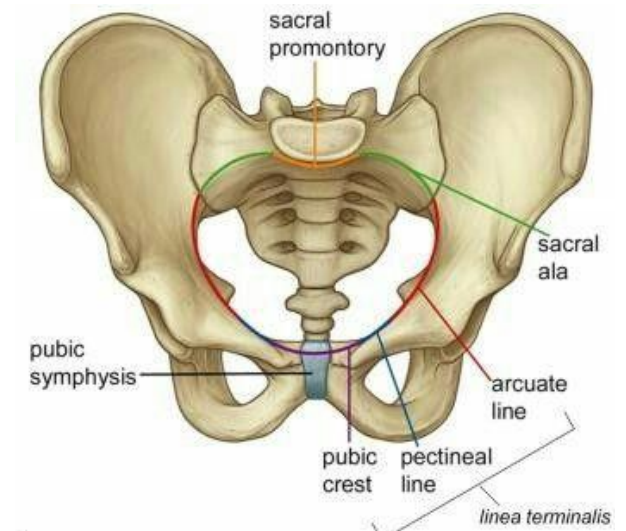
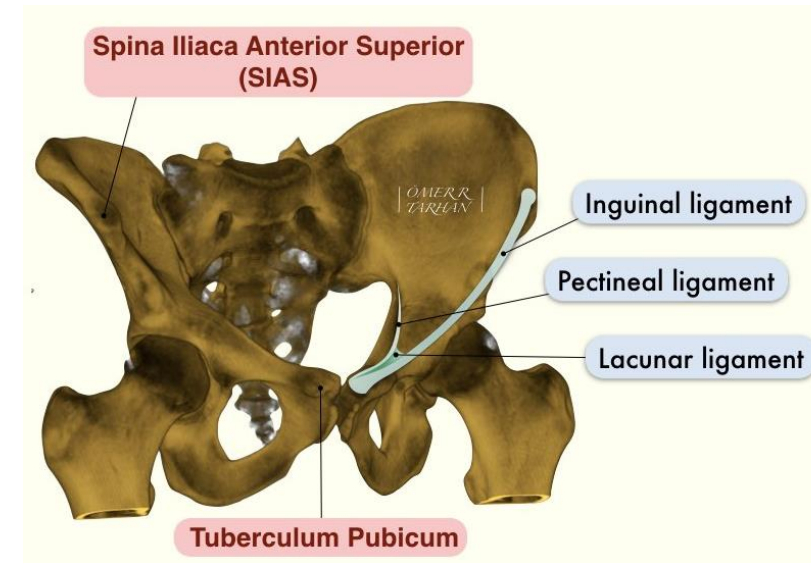
- Extension of the external oblique aponeurosis.
- Passes backward and upward to reach the pectineal line.
- Lies on the superior ramus of the pubis.
- Attached to the pectineal line
- Forms a sharp, crescent-shaped edge, which is the **medial margin of the femoral ring**.
- Considered part of the inguinal ligament.

5. Pectineal Ligament

- A continuation of the lacunar ligament.
- Attached: to the pectineal line of the pubis as
- continuation with the periosteum.

6. Rectus Sheath

- The aponeurosis of the external oblique, along with that of the internal oblique and transversus abdominis, contributes to the formation of the rectus sheath.



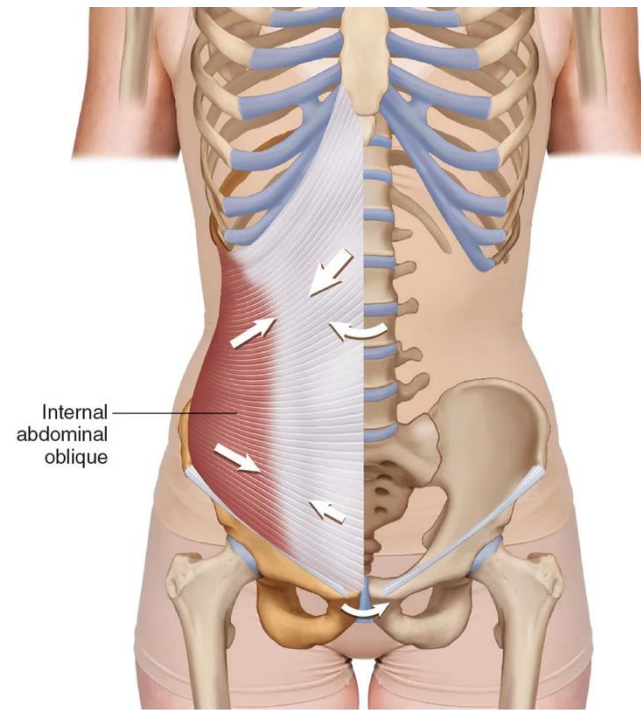
8 - Internal oblique Muscle

Fiber Direction	Origin	Insertion	Nerve Supply
Upward, forward, medially	Lumbar fascia, iliac crest, inguinal ligament	Lower 3 ribs & costal cartilages, xiphoid process, linea alba.	Lower 6 thoracic nerves, L1 (iliohypogastric & ilioinguinal nerves)

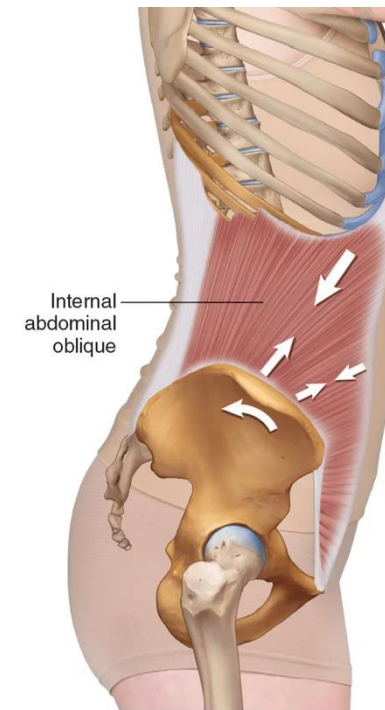
Assist in the formation of:

- **Conjoint tendon**
- **Cremasteric Fascia**
- **Rectus sheath**

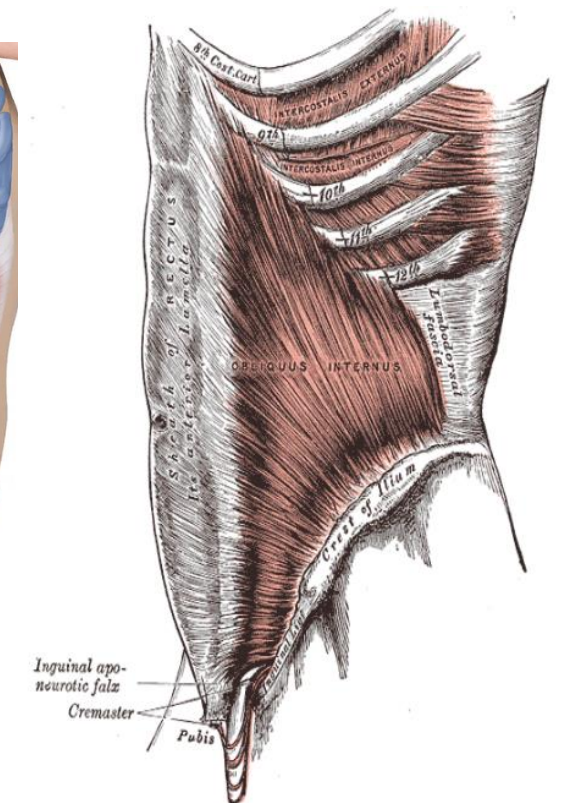
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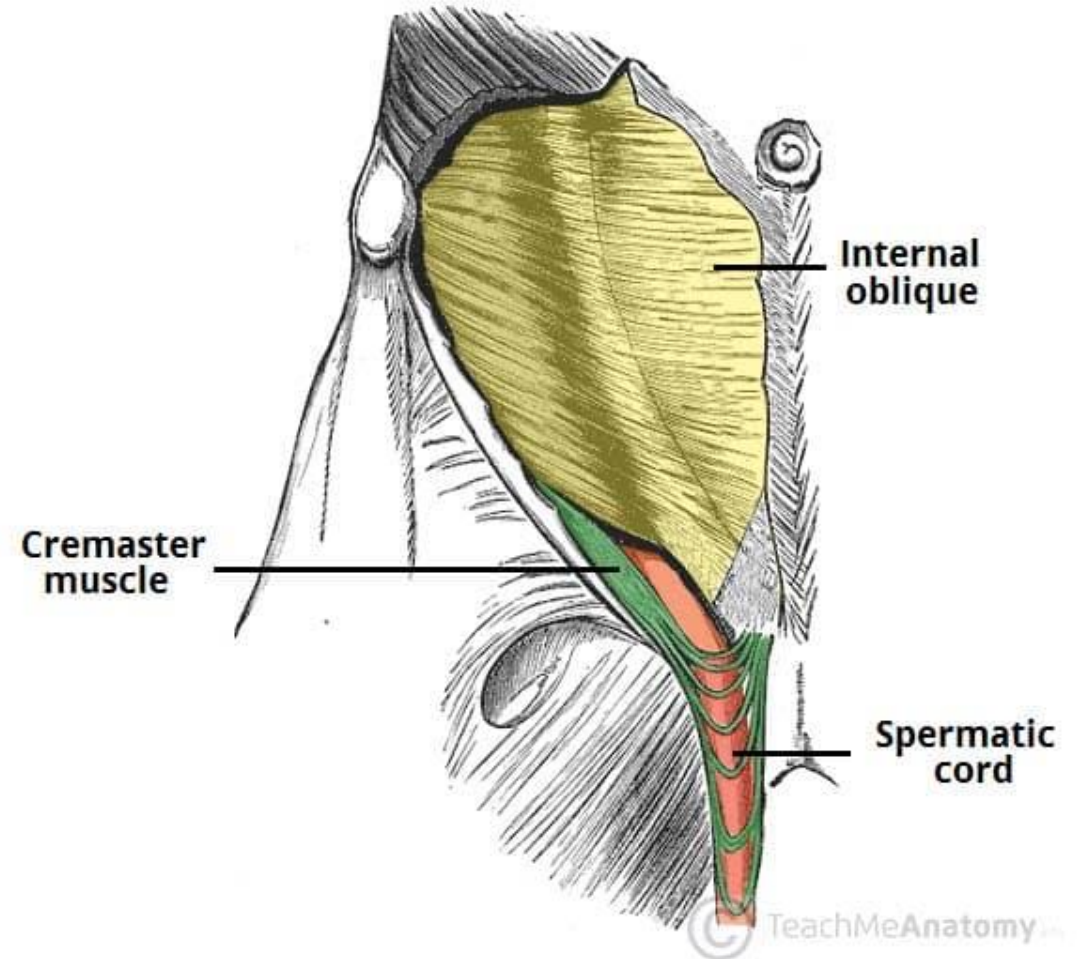
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8- Internal oblique Muscle

- **Cremasteric Fascia & Muscle**

- The internal oblique muscle's lower free border arches over the spermatic cord or ligament of the uterus in the inguinal canal.
- Forms part of the **cremasteric fascia**, which covers the spermatic cord and contributes to the **cremasteric muscle** (responsible for raising and lowering the testes in males).
- It helps form the **roof of the inguinal canal**.



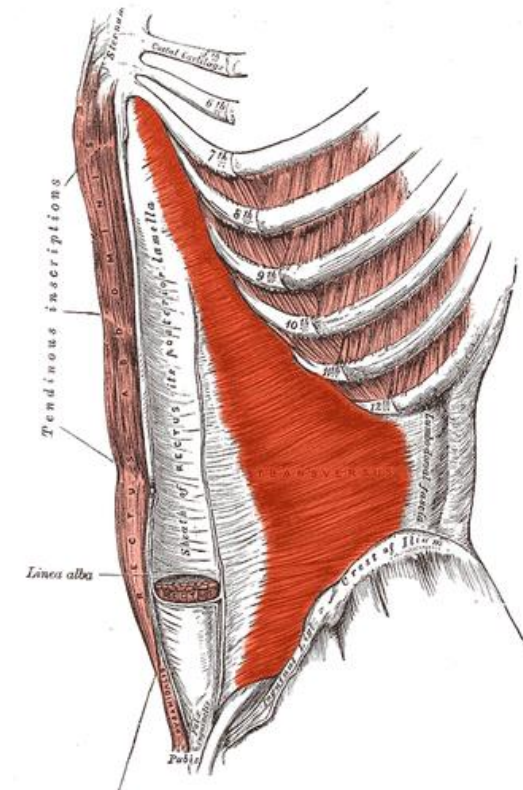
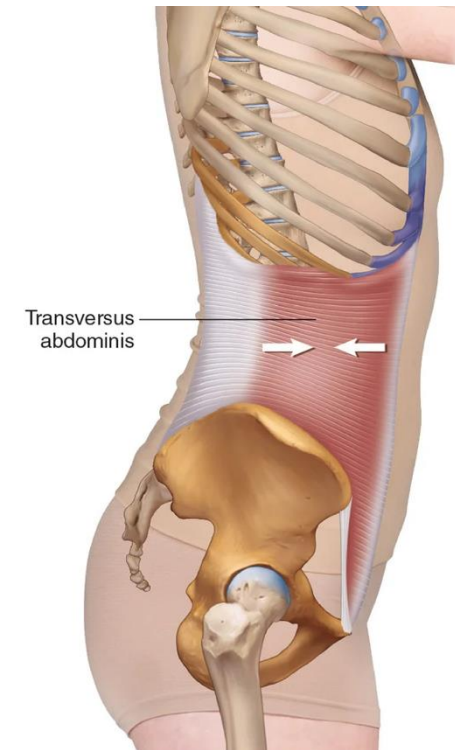
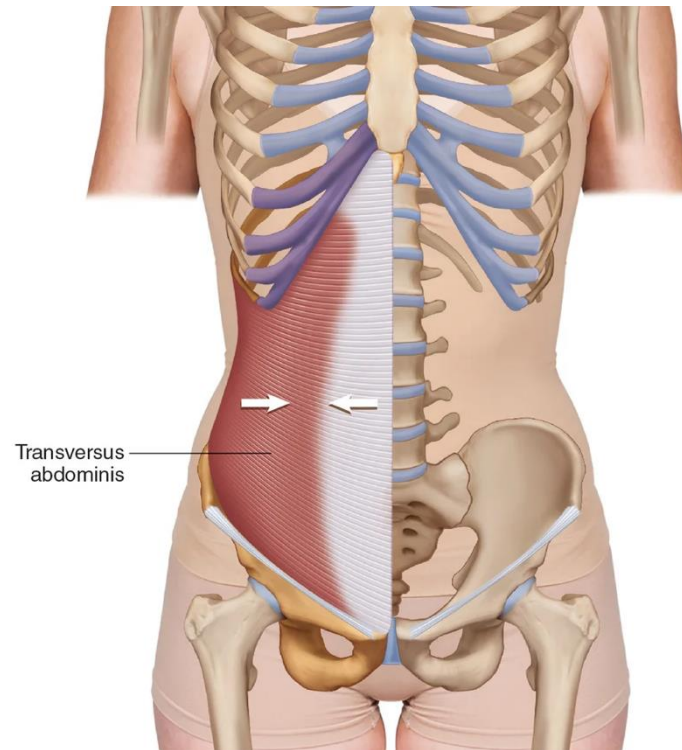
9- Transversus Abdominis Muscle

Fiber Direction	Origin	Insertion	Nerve Supply
Transversely forward Under internal oblique	Inner surface of lower 6 costal cartilages, lumbar fascia, iliac crest inguinal ligament	Xiphoid process, linea alba, symphysis pubis	Lower 6 thoracic nerves, L1 (iliohypogastric & ilioinguinal nerves)

Assist in the formation of:

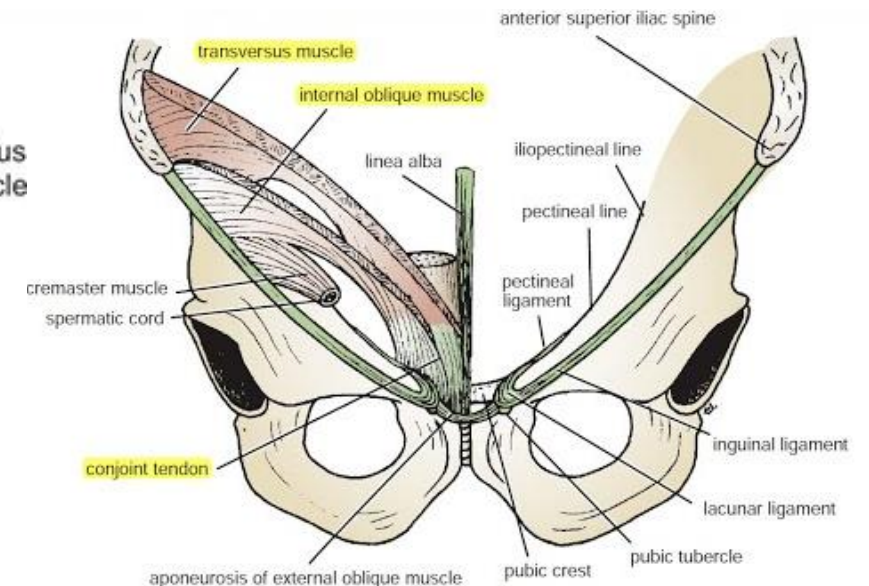
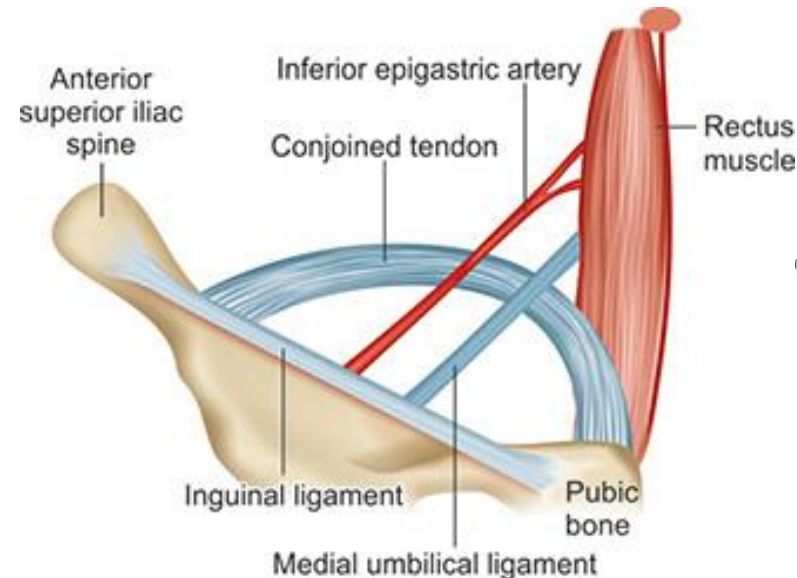
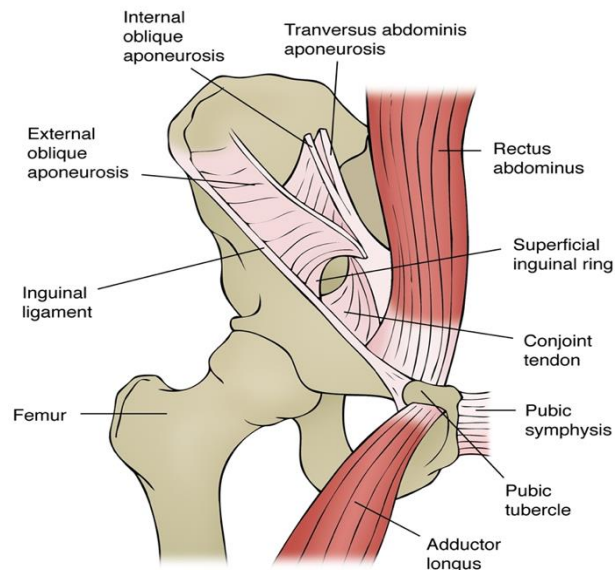
- **Conjoint tendon**
- **Rectus sheath**

– to be explained-



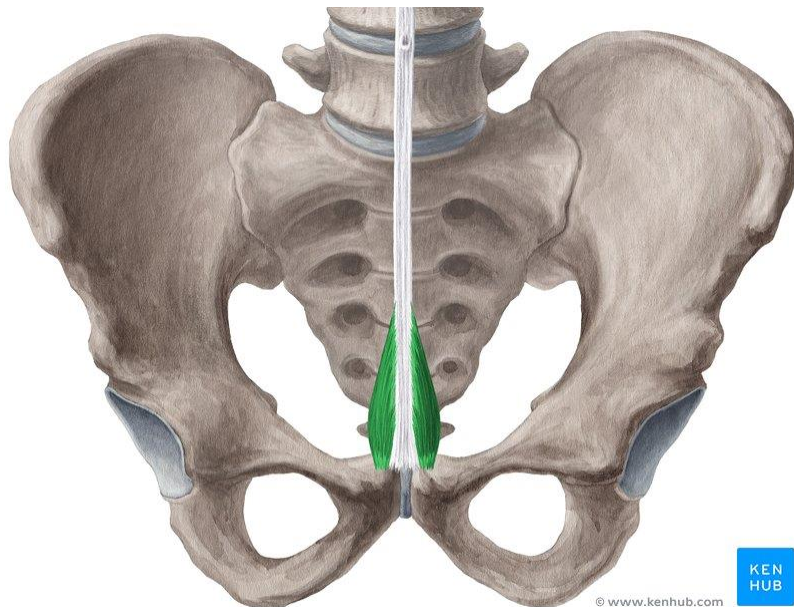
10- Conjoint Tendon

- The **lowest tendinous fibers** of the **internal oblique** join with the **transversus abdominis** muscle. → Together, they form the **conjoint tendon**.
- This tendon attaches medially to the **Linea alba** inferiorly to the **pubic bone** & Has a **lateral free border**.
- It **supports the posterior wall of the inguinal canal**, making it clinically important, especially in **hernia repairs ☺ (herniorrhaphy)**, because it's a tough and reliable structure thus, provides support in the repair process.

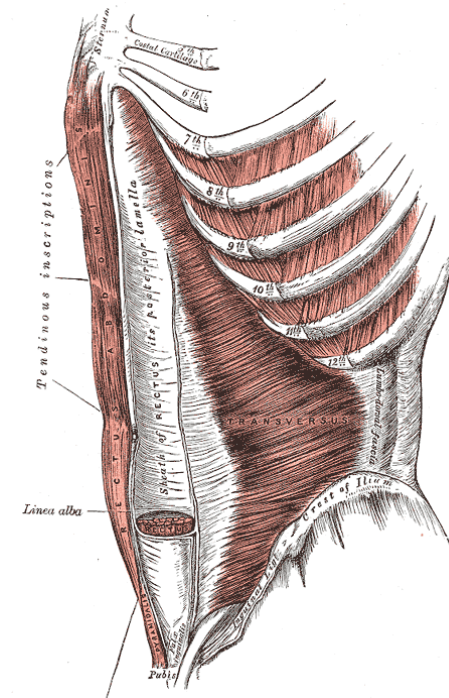


11- Pyramidalis muscle

Fiber Direction	Origin	Insertion	Nerve Supply	Action
Vertically	Anterior surface of the pubis	-Linea alba -It lies in front of the lower part of the rectus abdominis muscle, inside the rectus sheath.	12th subcostal nerve	pulls the Linea alba downward



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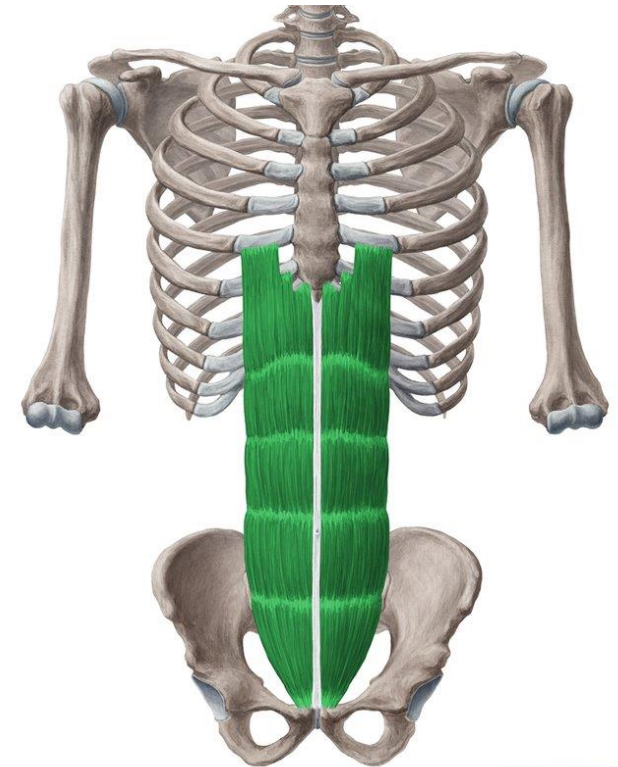
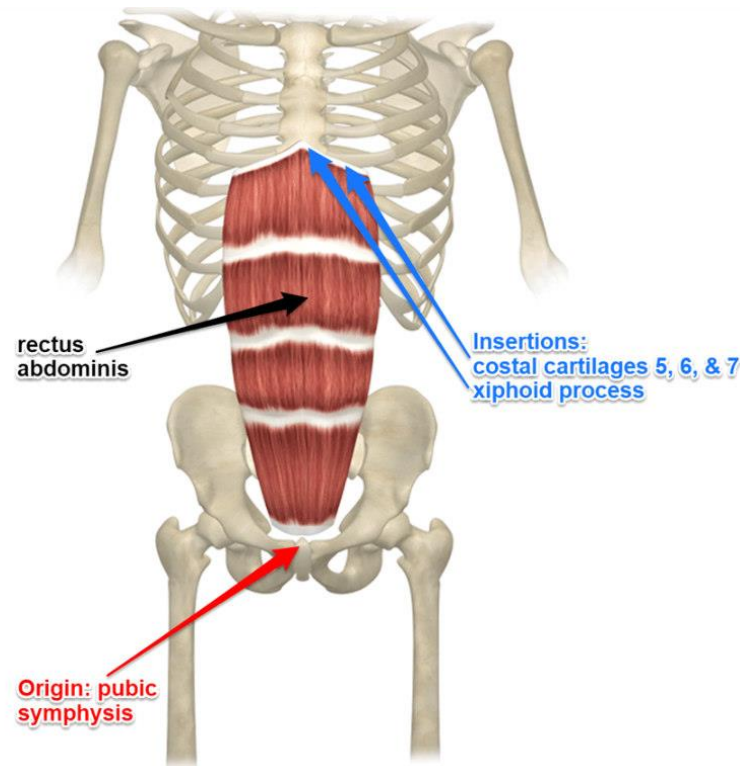


12- Rectus Abdominis Muscle

Fiber Direction	Origin	Insertion	Nerve Supply
(long strap muscle) Extends along the whole length of the anterior abdominal wall	Pubic crest, symphysis pubis	5th, 6th, and 7th costal cartilages, xiphoid process	Lower 6 thoracic nerves (T7–T12)

Associated Structures:

- **Linea alba,**
- **Linea semilunaris,**
- **Tendinous intersections,**
- **Rectus sheath**



13- Lines & Landmarks

Rectus sheath

splits into anterior and posterior walls to surround the rectus abdominis muscle

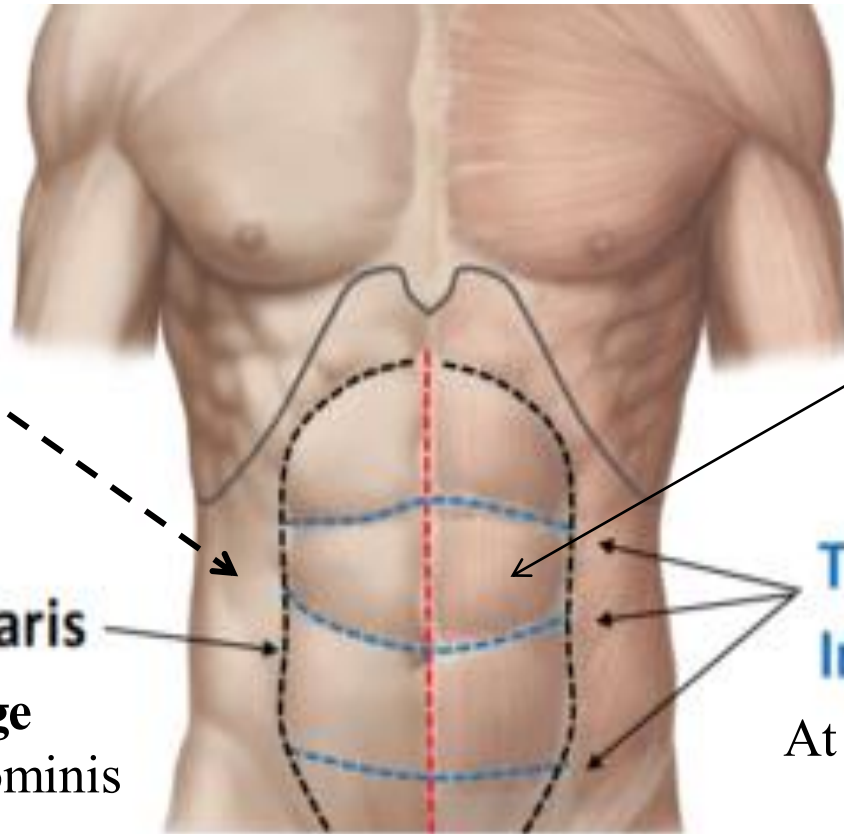
Linea Semilunaris

At the **lateral edge** of the rectus abdominis

Linea Alba

Linea Alba

- Along the midline, from xiphoid process to symphysis pubis
 - Formed by: Fusion of aponeuroses of external oblique, internal oblique, and transversus abdominis
- Common site for 😊 **midline incisions**, Minimal bleeding (fibrous, avascular tissue) But Poor healing.



yielding **square M. segments**: originates from the embryonic myotomes, where the rectus abdominis initially develops in segments separated by fibrous tissue.

Transverse Intersections

At the **anterior wall**

3 / or 4 bands:

1. At: xiphoid process
2. Midway
3. At: umbilicus

14- Rectus sheath

Aspect	Description
Type	Long fibrous sheath
Formation	Formed mainly by the aponeuroses of the three lateral abdominal muscles: <ul style="list-style-type: none">▪ External oblique▪ Internal oblique▪ Transversus abdominis
Location	Found on both sides of the linea alba
Lateral Boundary	Linea semilunaris (marks the lateral edge of rectus abdominis)

15- Rectus sheath Contents

Structure	Notes
1. Rectus abdominis	Main muscle enclosed
2. Pyramidalis muscle	If present (absent in ~20% of people)
3. Anterior rami of lower 6 thoracic (intercostal) nerves	Course: <ul style="list-style-type: none">▪ Originate in thorax▪ Travel between transversus abdominis & internal oblique▪ Enter rectus sheath laterally to Supply rectus abdominis▪ End as anterior cutaneous branches
4. Superior epigastric vessels	Branch of internal thoracic artery
5. Inferior epigastric vessels	Branch of external iliac artery
6. Lymphatic vessels	Drain structures within sheath

16- Rectus sheath Levels

Level	Anterior Wall	Posterior Wall
1. Above the Costal Margin (at the xiphoid and costal cartilage)	Skin → Superficial fascia → Deep fascia → Pectoralis muscle → Aponeurosis of external oblique	Xiphoid process, thoracic wall (5th, 6th, and 7th costal cartilages and intercostal spaces), intercostal muscles
2. Between Costal Margin and ASIS (Above and Below Umbilicus)	Skin → Superficial fascia → Aponeurosis of external oblique → Anterior layer of internal oblique	Posterior layer of internal oblique → Transversus abdominis → Transversalis fascia → Extraperitoneal fat → Parietal peritoneum
3. Below Anterior Superior Iliac Spine (ASIS) to Pubis	Skin → Superficial fascia → Aponeuroses of all three muscles	No muscle aponeurosis; Rectus abdominis lies directly on transversalis fascia → Extraperitoneal fat → Parietal peritoneum

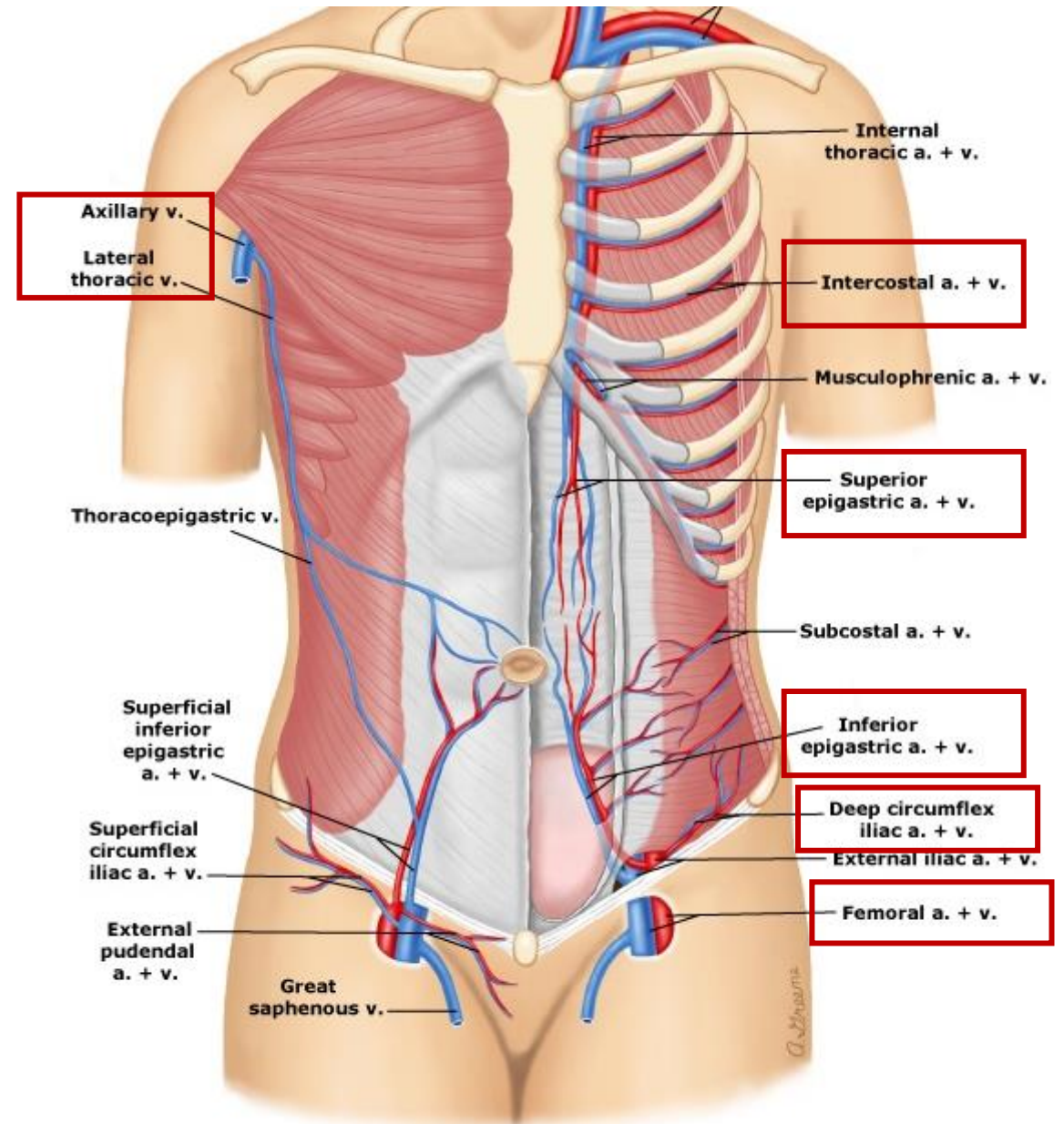
17- Blood Supply of the Anterior Abdominal Wall

Arteries

1. Superior epigastric artery
2. Inferior epigastric artery
3. Intercostal arteries
Run along the nerves from the thorax
4. Lumbar arteries
From the abdominal aorta
5. Deep circumflex iliac artery

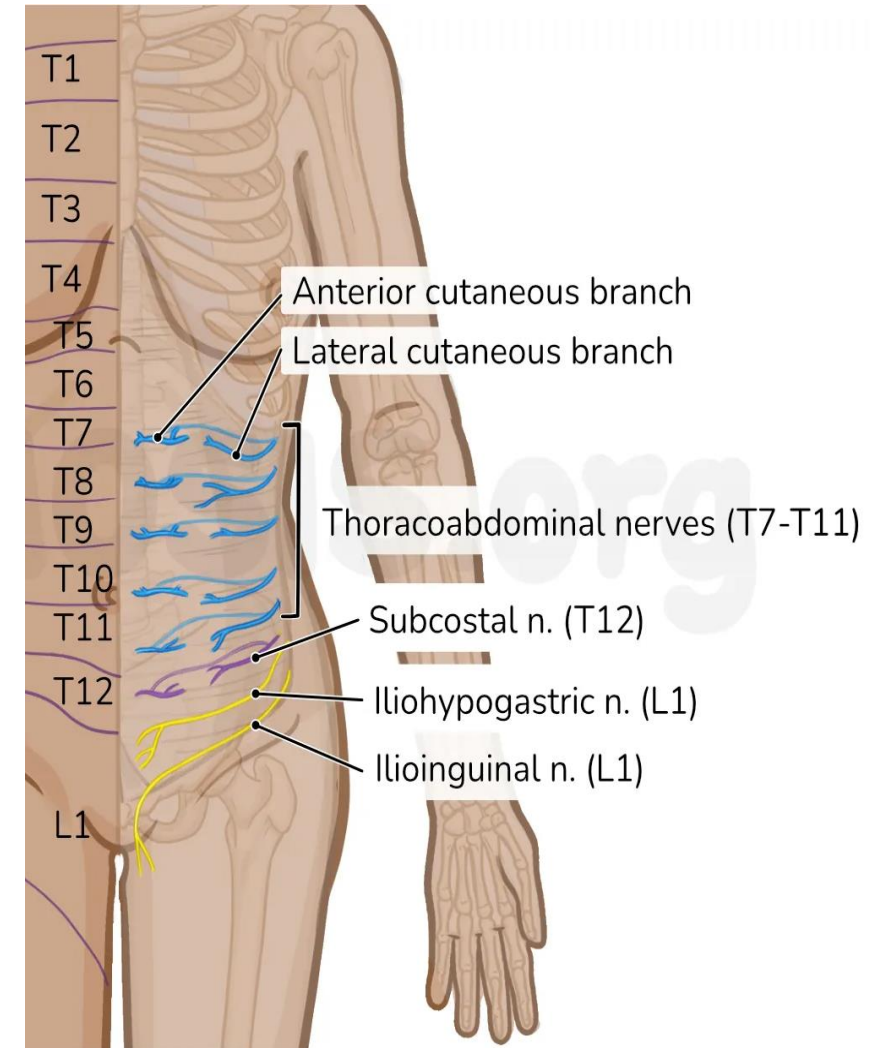
Veins

1. Above the umbilicus:
 - Lateral thoracic vein → Axillary vein
2. Below the umbilicus:
 - Inferior epigastric vein → Femoral vein
3. Paraumbilical veins:
 - Drain via ligamentum teres → Portal vein
 - Porto-systemic anastomosis



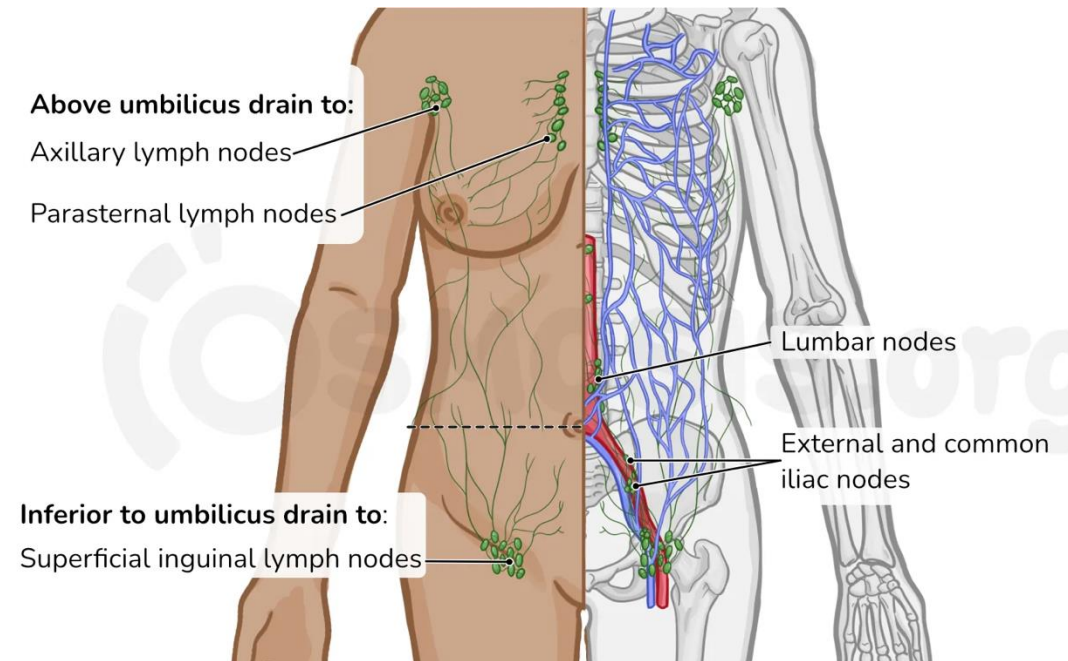
18- Nerve Supply of the Anterior Abdominal Wall:

- **Thoracoabdominal nerve**
→ Formed by **lower 6 thoracic nerves & 12th subcostal nerve**
- **Dermatomes** (via anterior & lateral cutaneous branches of thoracoabdominal nerves):
 - **T7** → Skin **superior to umbilicus**, below xiphoid process
 - **T10** → Skin **surrounding the umbilicus**
 - **L1** → Skin **inferior to umbilicus**, above symphysis pubis
- **L1 nerve** → Supplies **lower abdomen and scrotum**
 - **Iliohypogastric nerve**
 - **Ilioinguinal nerve**



19- lymphatics & Actions

- **Lymphatic Drainage of the Anterior Abdominal Wall**
 - Above the umbilicus → Anterior axillary lymph nodes
 - Below the umbilicus → Superficial inguinal lymph nodes
 - Above the iliac crest → Posterior axillary lymph nodes (*subscapular L.N*)
 - Below the iliac crest → Superficial inguinal lymph nodes
- **Action of the Anterior Abdominal Muscles**
 - Deep expiration
 - Increase intra-abdominal pressure in:
 - Vomiting
 - Cough
 - Defecation
 - Labour
 - Protect viscera
 - Keep viscera in position
 - Rectus abdominis → bends trunk forward



20- Clinical Notes!

■ **Abdominal Stab Wounds**

•The **structures pierced** by a stab wound depend on the **location**:

- **Lateral to rectus sheath**
- **Anterior to rectus sheath**
- **In the midline (Linea alba)**

■ **Surgical Incision through the Anterior Abdominal Wall**

Factors Controlling Incision:

- 1.Position and direction of nerves
- 2.Direction of muscle fibers
- 3.Arrangement of aponeurosis forming the rectus sheath

•The **direction of the incision** should follow the **line of cleavage** in the skin

→ results in a **hairline scar**

■ **Incision Through the Rectus Sheath**

•Widely used

•Rectus abdominis muscle and its nerve supply are preserved

•During closure:

- Anterior and posterior walls of the rectus sheath are sutured separately
- The rectus muscle is returned to position between the suture lines