



GI

Anatomy

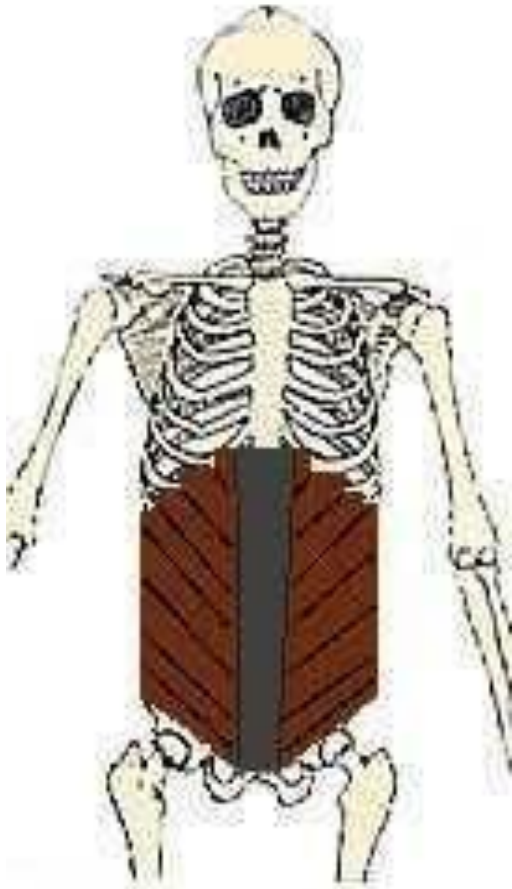
LEC no. 5



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COLOR CODE :

Black : The text in the original slides

Red : What doctor mentioned during lecture which wasn't present in the slides

Blue : Additional information

Underlined or highlighted paragraphs are what doctor focused on (very important) .

Abdominal wall

Borders of the Abdomen

- Abdomen is the region of the trunk that lies between the diaphragm above and the inlet of the pelvis below
- Borders

Superior:

Costal cartilages 7-12.

Xiphoid process:

Why from 7-12?

Because 7 is connected to sternum, 8 connected to 7, 9 connected to 8 till the tenth, But (11, 12) are in the posterior aspect and called the floating ribs.

That's mean the ribs in relation to the anterior are till the tenth.

In the midline and there is coastal cartilage on the lateral side right to left

• Inferior:

Pubic bone and iliac crest:

Level of L4.

• Umbilicus:

In the umbilical region

Level of IV disc L3-L4

In the days of the past, they were dividing the Abdomin into four quadrants, but this division is not accurate.

Abdominal Quadrants

Formed by two intersecting lines:

Vertical & Horizontal

Intersect at umbilicus.

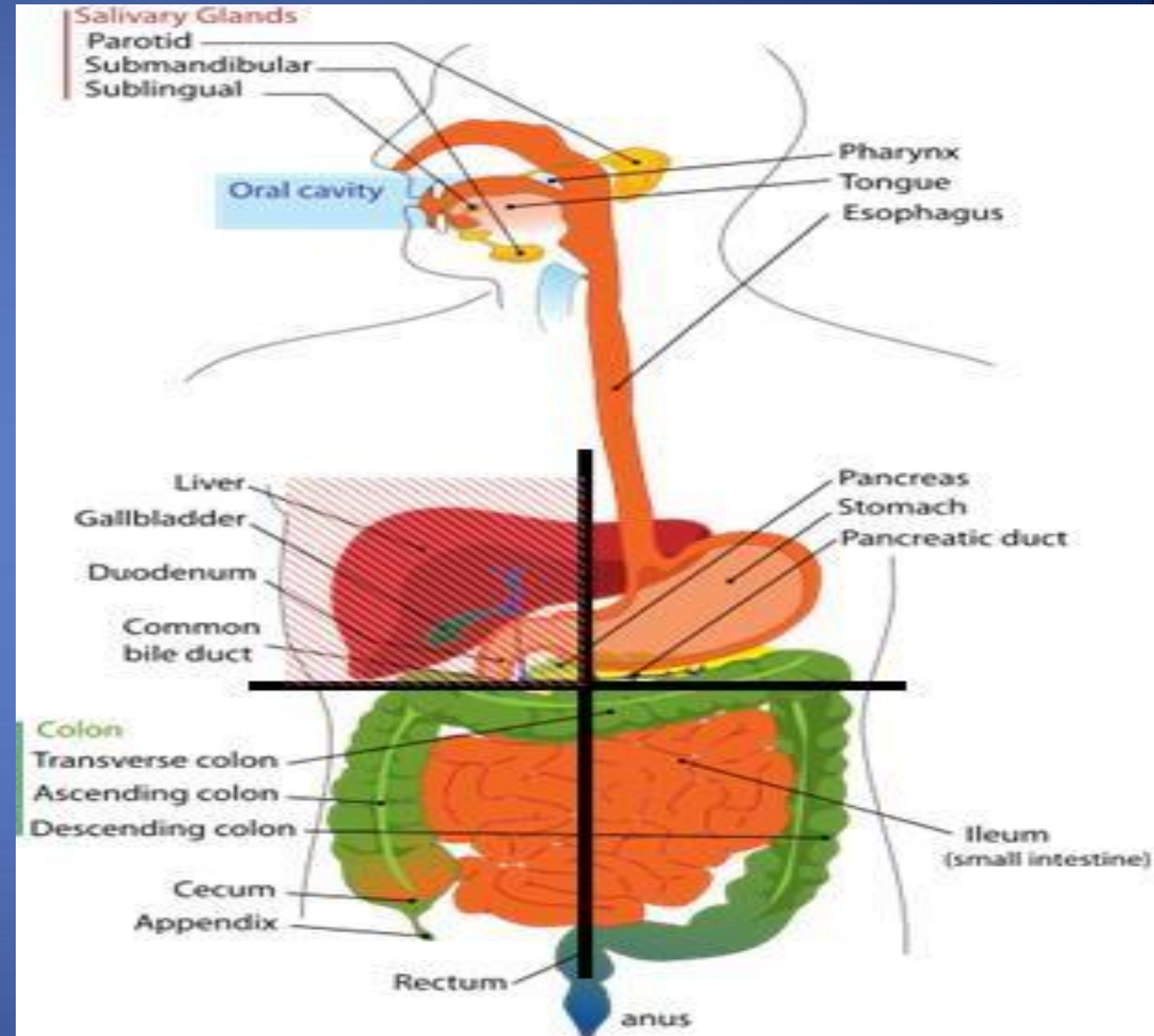
Quadrants:

Upper left.

Upper right.

Lower left.

Lower right



Abdominal Regions

How we divided them??
by two horizontal lines
and by two vertical lines

Divided into 9 regions by two pairs of planes:

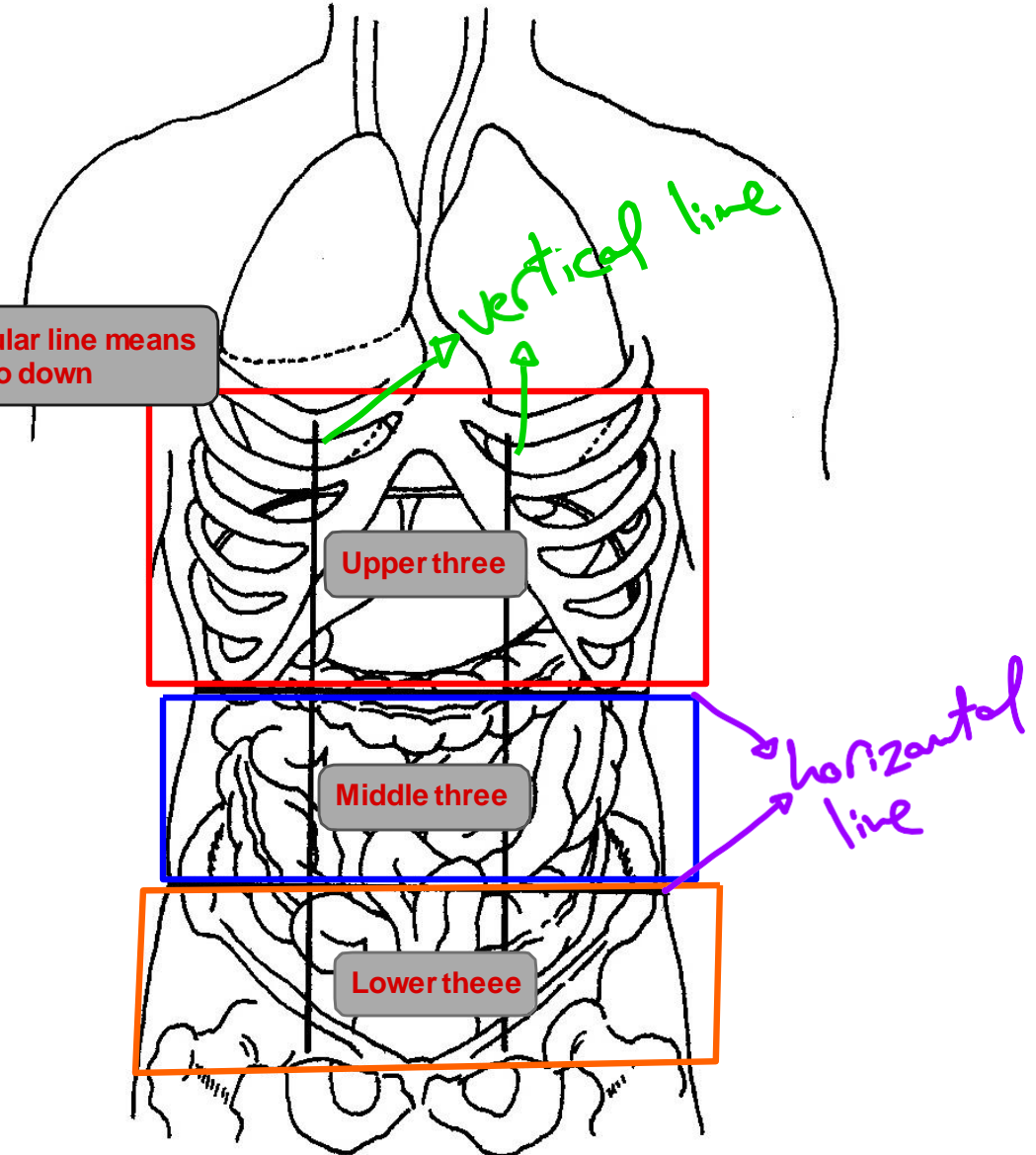
1- Vertical Planes:

- Left and right lateral planes
- Midclavicular planes
- passes through the midpoint between the ant. sup. iliac spine and symphysis pubis

The Vertical we call them midclavicular line means from the middle of the clavicle we go down

2- Horizontal Planes:

- Subcostal plane
- at level of L3 vertebra
- Joins the lower end of costal cartilage on each side
- Intertubercular plane:
- At the level of L5 vertebra
- Through tubercles of iliac crests.



Very important to know the location of the organs

Epigastric region

Left hypochondriac region

We find spleen here

liver and here gallbladder

Right hypochondriac region

Umbilical region
small intestine

Here there is the right kidney+ascending colon

Right lateral (lumbar) region (flank)

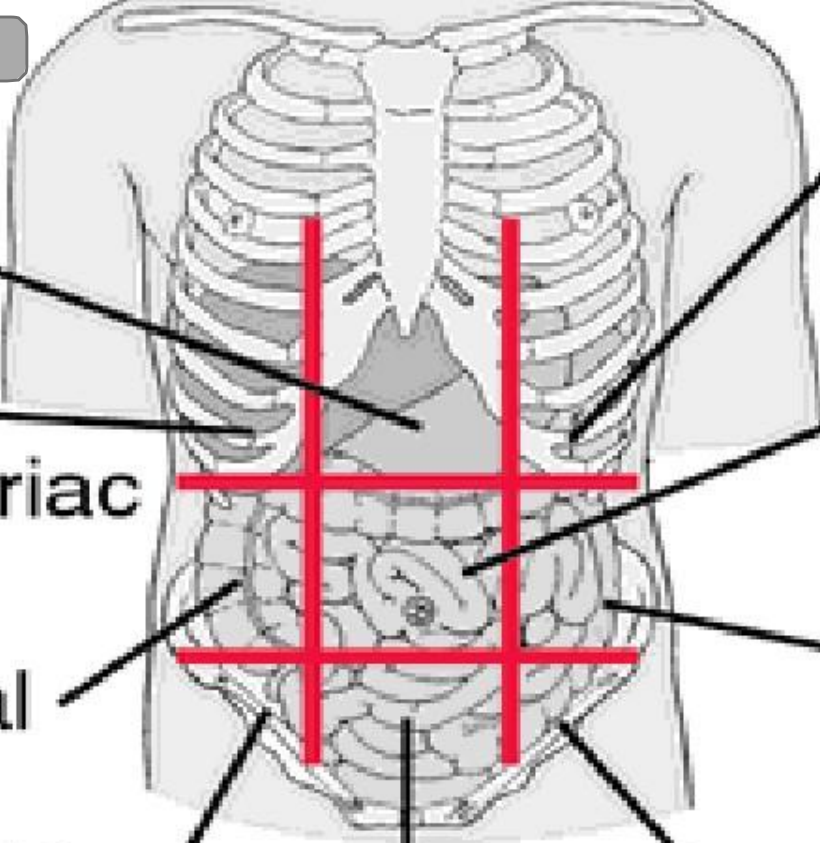
Left lateral (lumbar) region (flank)
left kidney+ descending colon

Right iliac (inguinal) region

Left iliac (inguinal) region

Urinary bladder is here

Suprapubic (pelvic) (hypogastric) region



Abdominal wall divided into:-



Anterior abdominal wall



Posterior abdominal wall

Inside it we find kidney ,abdominal aorta,inferior vena cava

It cover all the anterior abdominal wall

What are the Layers of Anterior Abdominal Wall

V2: it is important to know the order of the layers.

- ✓ Skin
- ✓ Superficial Fascia
 - Above the umbilicus one layer
 - Below the umbilicus two layers
 - Camper's fascia- fatty superficial layer.
 - Scarp's fascia- deep membranous layer.

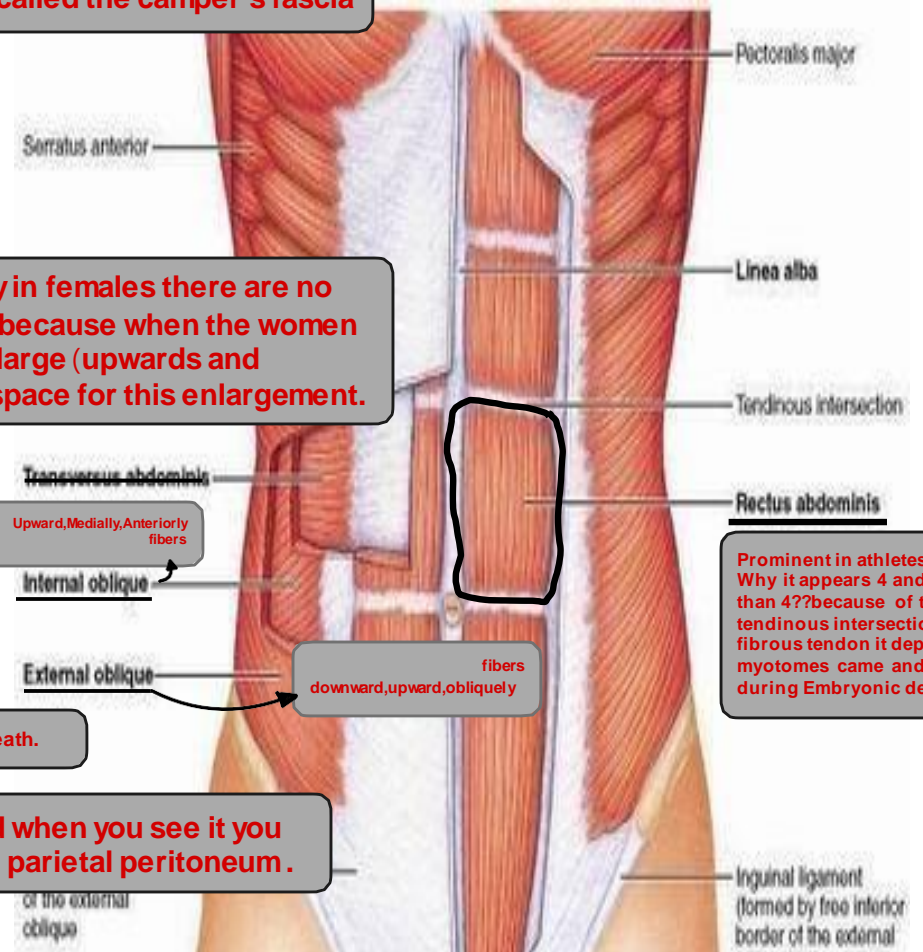
A fat layer called the camper's fascia

- ✓ Deep fascia:
 - Thin layer of C.T covering the muscle may absent

Like the abdomen especially in females there are no deep fascia or it's very thin, because when the women get pregnant and uterus enlarge (upwards and anteriorly) we should give space for this enlargement.

✓ 4 Muscular layer

- External oblique muscle External abdominus
- Internal oblique muscle Internal abdominal
- Transverse abdominal muscle
- Rectus abdominis



Prominent in athletes Why it appears 4 and sometimes more than 4?? because of the presence of tendinous intersection and as it's a fibrous tendon it depends on how many myotomes came and made the muscle during Embryonic development.

- ✓ Transversalis fascia It Participate in composition of femoral sheath.

- ✓ Extraperitoneal fascia Above the peritoneal and when you see it you now that the next layer is parietal peritoneum.

- ✓ Parietal Peritoneum It's the last layer and unless you opened it you can't reach the underlying organs.

allah created this fibres to be like a net, and that's why the anterior abdominal muscles are very strong and able to protect the abdominal viscera.

Superficial Fascia

- Camper's fascia - fatty layer = dartos muscle in male
- Scarpa's fascia - membranous layer.

Important

- Attachment of Scarpa's fascia = membranous fascia

INF: Fascia lata

1 cm below lingual ligament in lower limb

Sides: Pubic arch

Post: Perineal body

- Membranous layer in scrotum referred to as colle' sfascia
- Rupture of penile urethra lead to extravasations of urine into (scrotum, perineum, penis & abdomen)

Its extension in the scrotum called dartous muscle.

Superficial iliac circumflex vein

Subcutaneous inguinal ring

Superficial epigastric vein

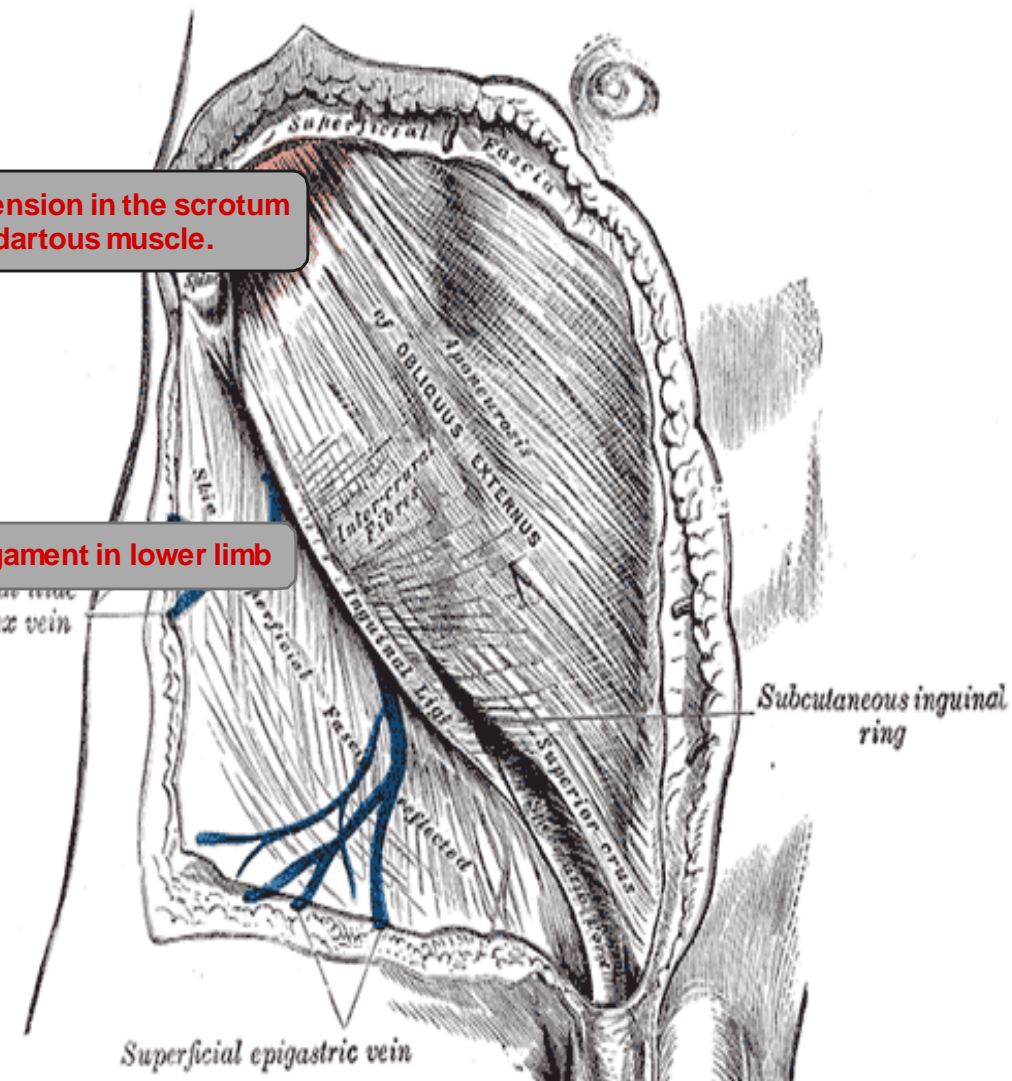
Important

If a patient had a rupture in the urethra and extravasation of the urine (the urine is out from urethra) where will it go?

It enters the membranous layer and don't get out of it and kept surrounded by it

The question is: Will it go up or down the umbilical?

It will go down but it won't go to lower limb because it's connected to fascia lata, and in the pelvis it reach till the perineal body and around the pubic arch.



✓ Muscles

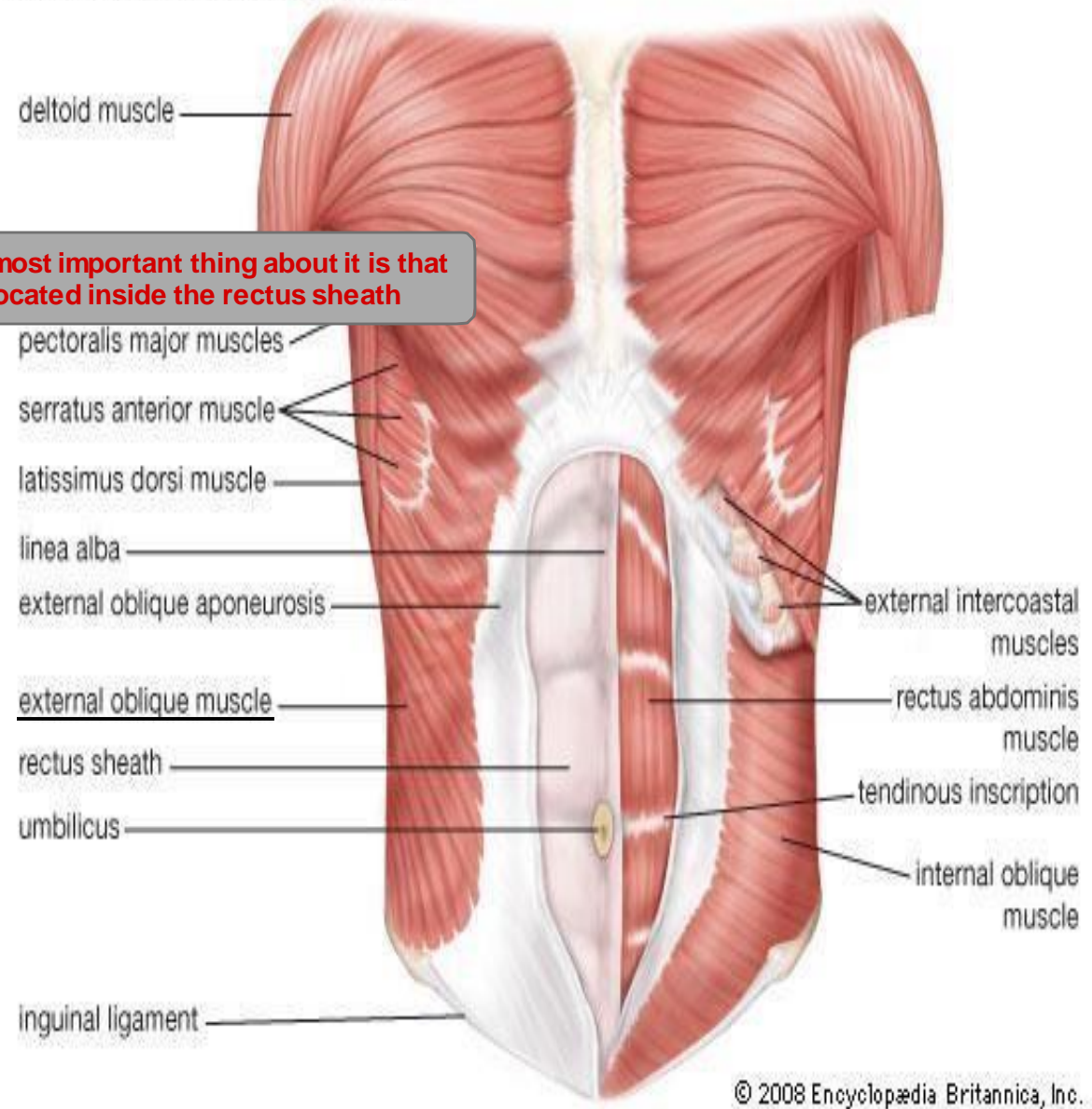
- Rectus abdominis
- External oblique muscle
- Internal oblique muscle
- Transverse abdominal muscle

Insertion is important here

The important thing here is that the internal oblique fibrous with the transverse make conjoint tendon and this is an important tendon in the hernia

The most important thing about it is that it is located inside the rectus sheath

Muscles of the abdominal wall



External oblique muscle

-Broad

-Thin

✓ **Direction:**

Downward forward medially

✓ **Origin**

outer surface of lower 8 ribs.

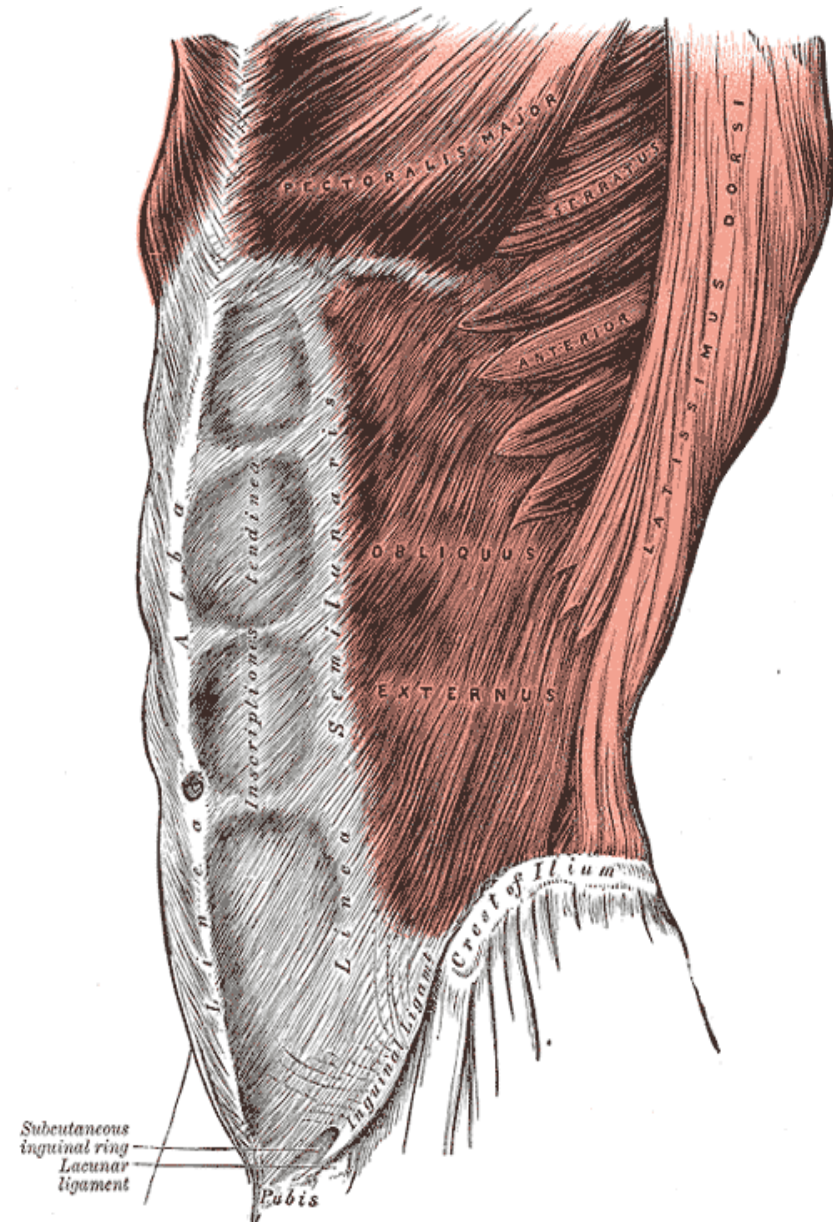
✓ **Insertion**

Xiphoid process, Linea alba,
pubic crest, pubic tubercle,
iliac crest(ant. Half).

✓ **Nerve Supply**

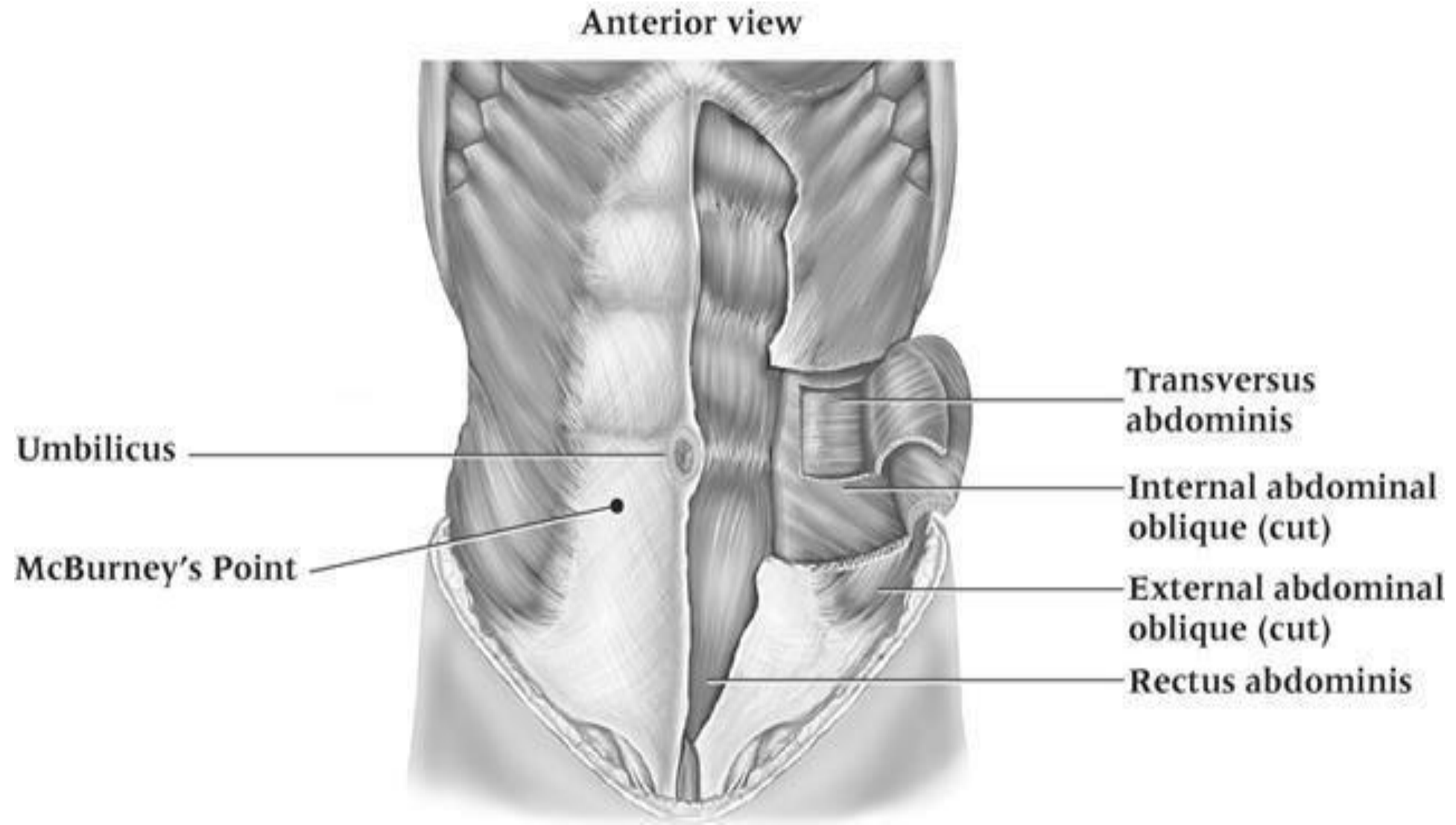
1- Lower 6th thoracic nerves

2- L1(iliohypogastric n., ilioinguinal n.)



Lower 6 thoracic nerves come from the thorax and go to the abdomen and give nerve motor supply to the abdominal muscle, also they have sensory nerve for the skin of the abdomen. They reach the abdominal wall between the transverse and internal oblique muscles, so they give all abdominal muscles with L1 nerve except the rectus abdominis; it only takes nerve from the lower 6 thoracic nerves.

Muscles of the anterior abdominal wall



✓ Aponeurosis of external oblique muscle

What does it do??

The spermatic cord passes through the inguinal canal. This Ring was made by Aponeurosis of ext. oblique and in the form of right, left cruses

Superficial inguinal ring.

Inguinal ligament Important

Lacunar ligament Make the medial boundary of femoral ring

Pectineal ligament Attach to pubic ramus (iliopectinel line)

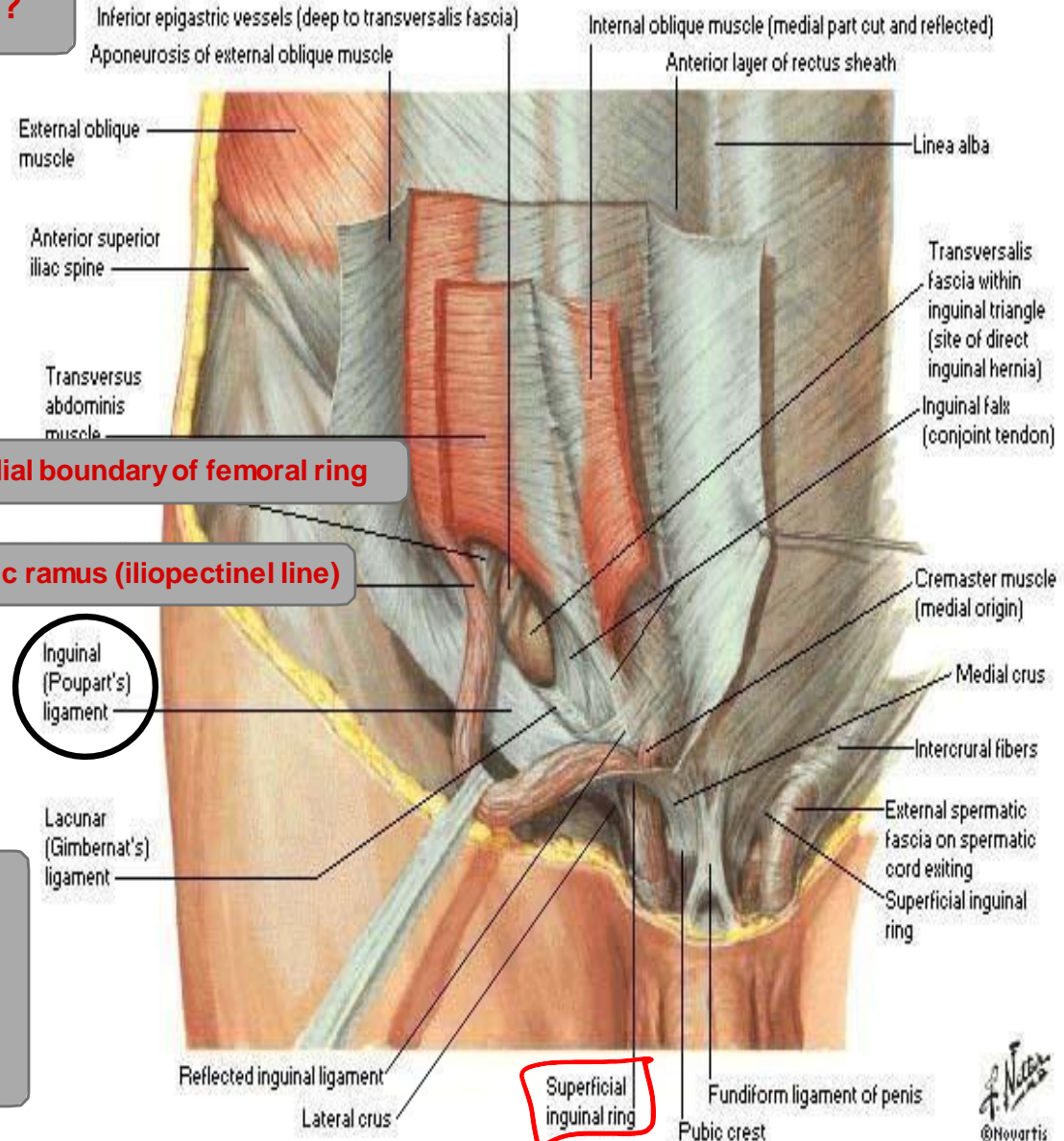
Boundaries of inguinal canal

Formation of rectus sheath (

Those make the rectus sheath:
Aponeurosis of ext. oblique + internal + transvers especially the internal one.

Inside the rectus we have rectus abdominus muscle

Have anterior, posterior, wall

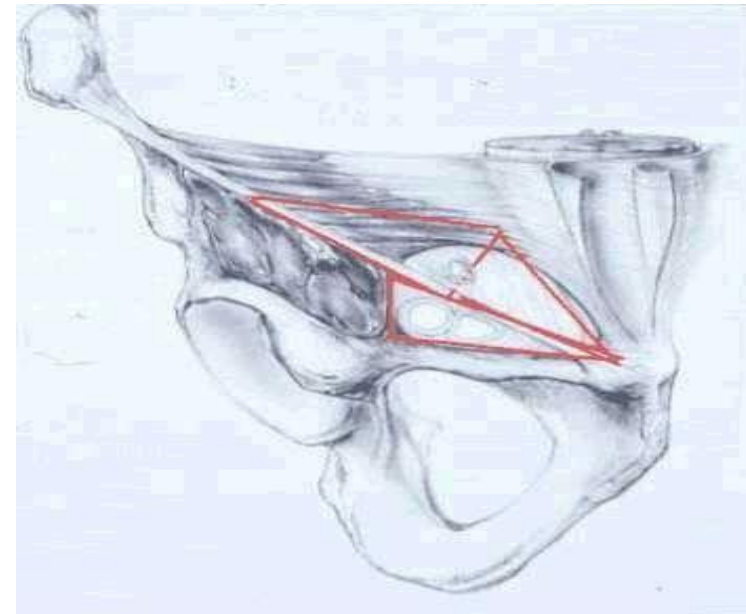


Inguinal ligament

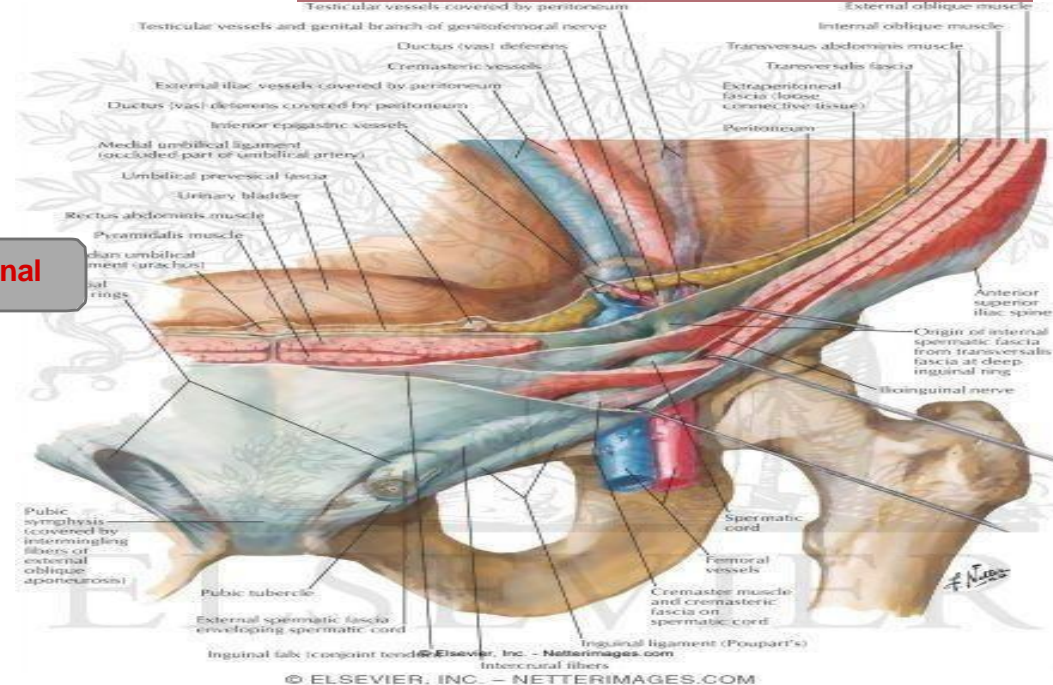
- 1 folded back ward the lower border of aponeurosis of external muscle on it self
- 2 between ant.sup.ilic spine and the pupic tubercle

It is present in males and females but in males it is clearer inguinal canal

Round ligament of female uterus passes from inguinal canal



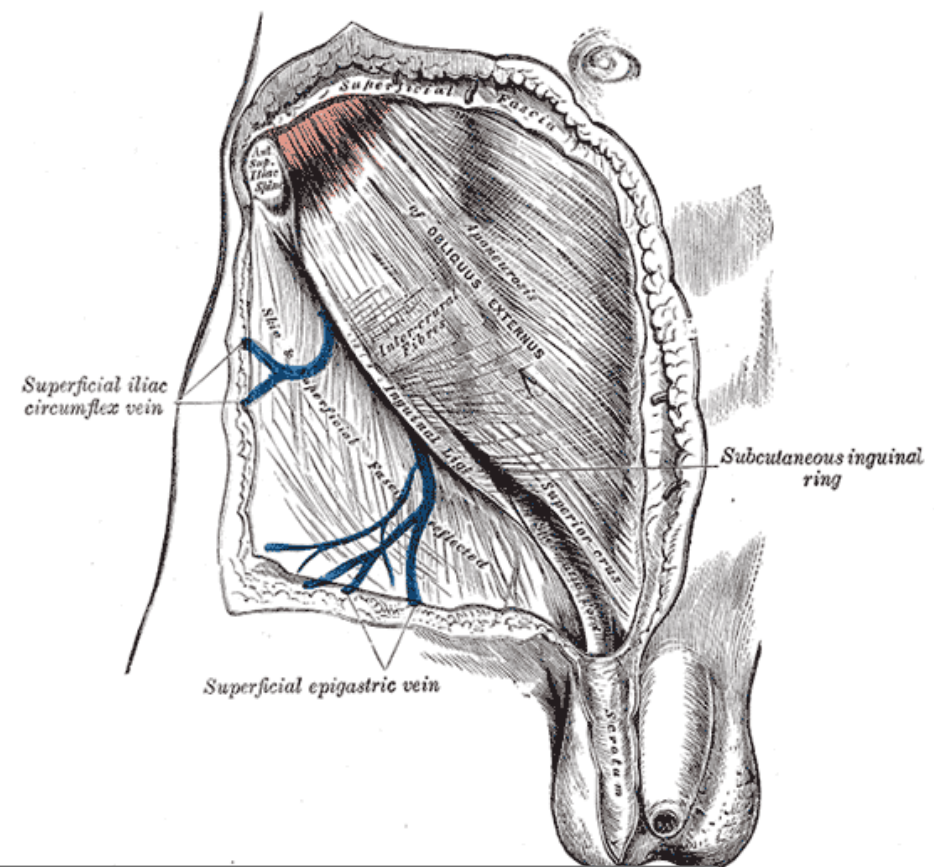
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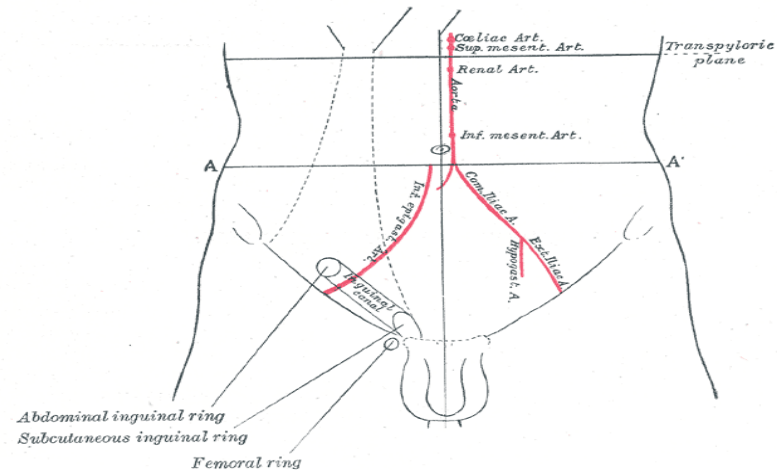
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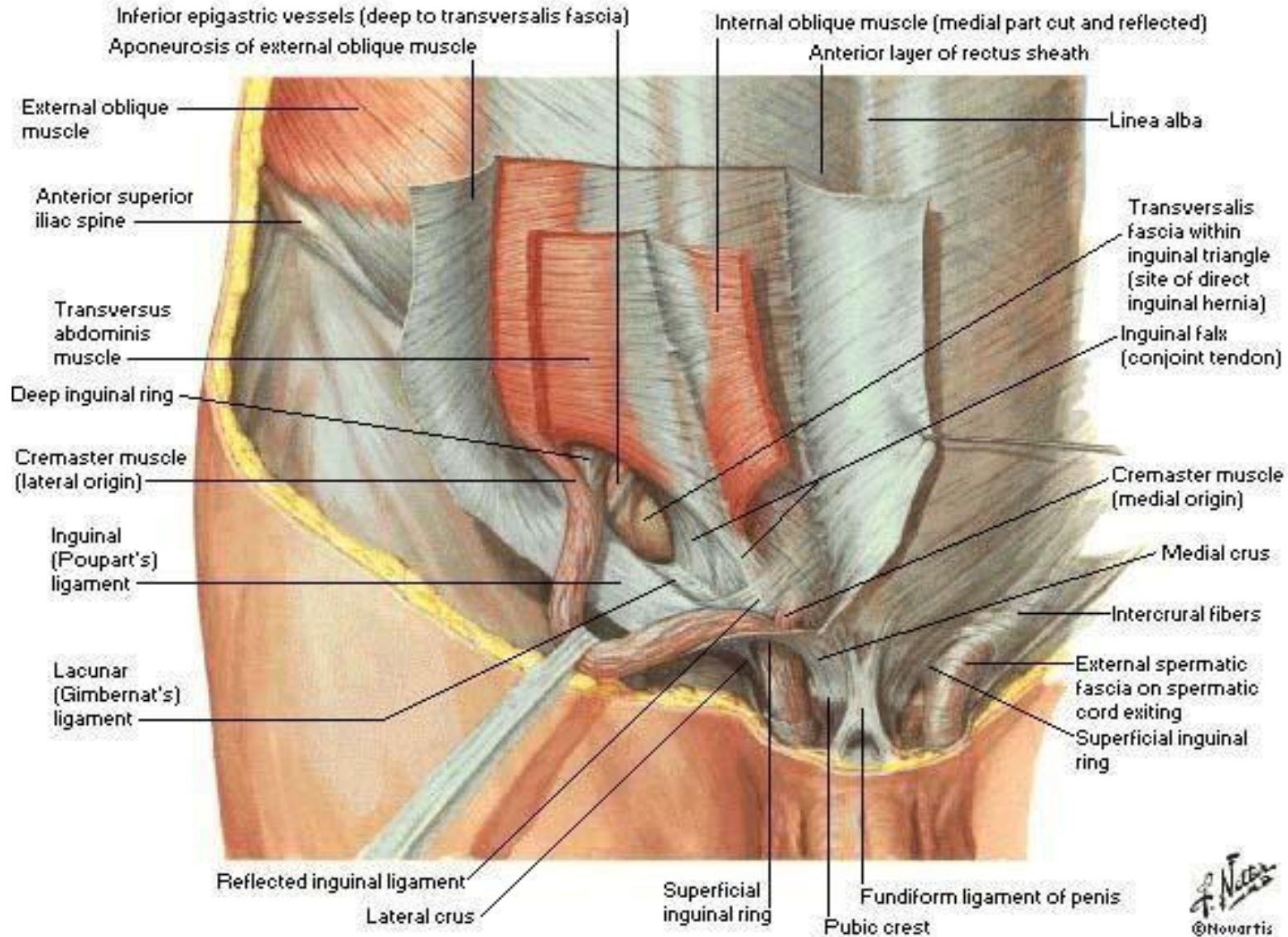
Superficial inguinal ring.

- 1- triangular shape
- 2- Defect in external oblique aponeurosis
- 3- lies immediately above and medial to the pubic tubercle
- 4- Opening for passing the spermatic cord or ligament of uterus



.It is present in males and females, but in males it is more clear

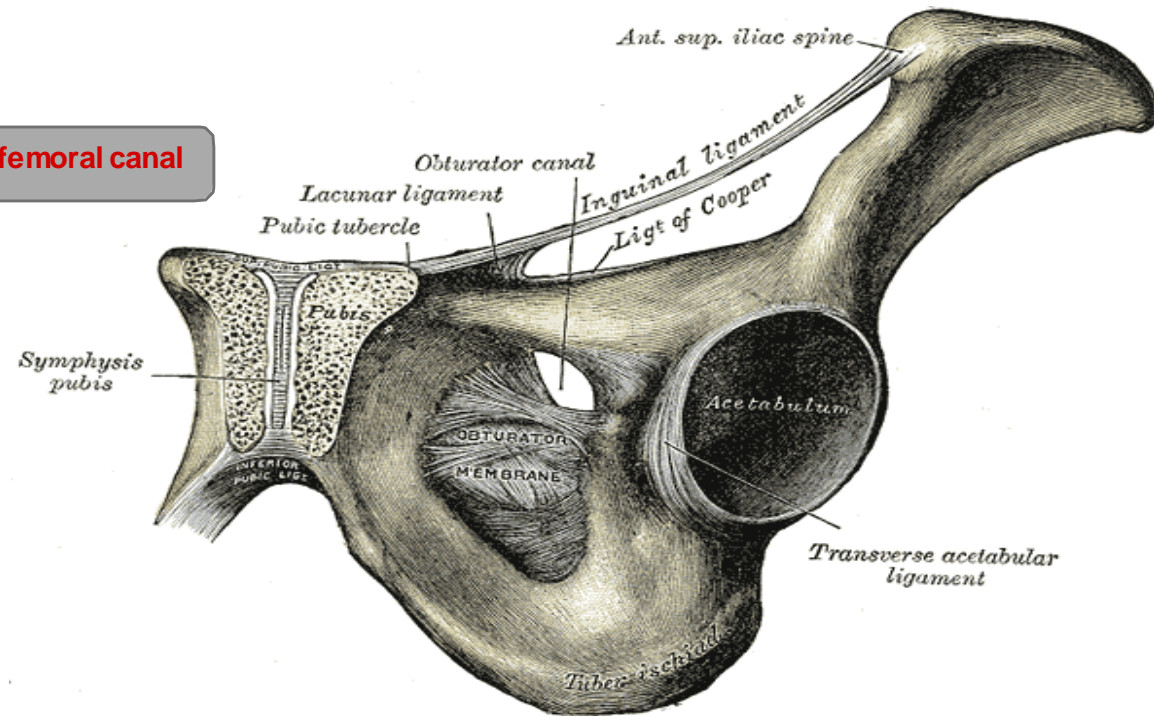




Lacunar ligament

Medial to femoral canal

- 1 extension of aponeurosis of external muscle backward and upward to the pectineal line
- 2 on the superior ramus of the pubis
- 3 its sharp, free crecentric edge forms the medial margin of the femoral ring

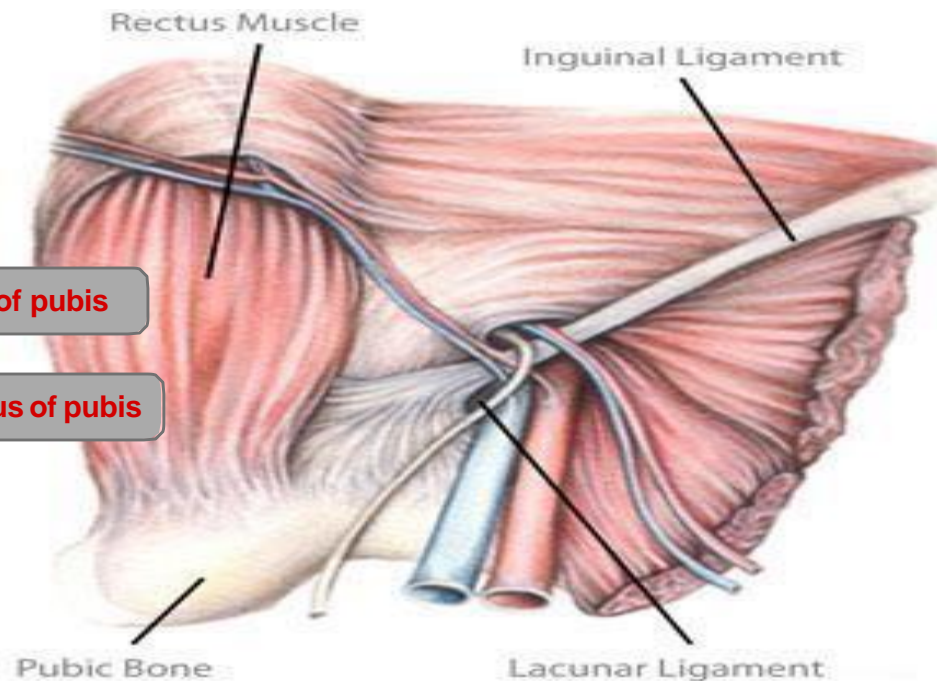


Pectineal ligament

- 1 Continuation of the lacunar ligament at pectineal line
- 2 Continuation with a thickening of the periosteum

On the ramus of pubis

Of vamus of pubis



Expected question:-

In the external oblique aponeurosis, in the abdomen, there are anatomical structures like what? Like a superficial inguinal ring, inguinal ligament, lacunar ligament, rectus sheath, inguinal canal, pectineal ligament

Internal Oblique

✓ **Direction:**

upward forward medially

✓ **Origin**

Lumbar Fascia, Ant 2/3 iliac crest, lateral two thirds of inguinal ligament.

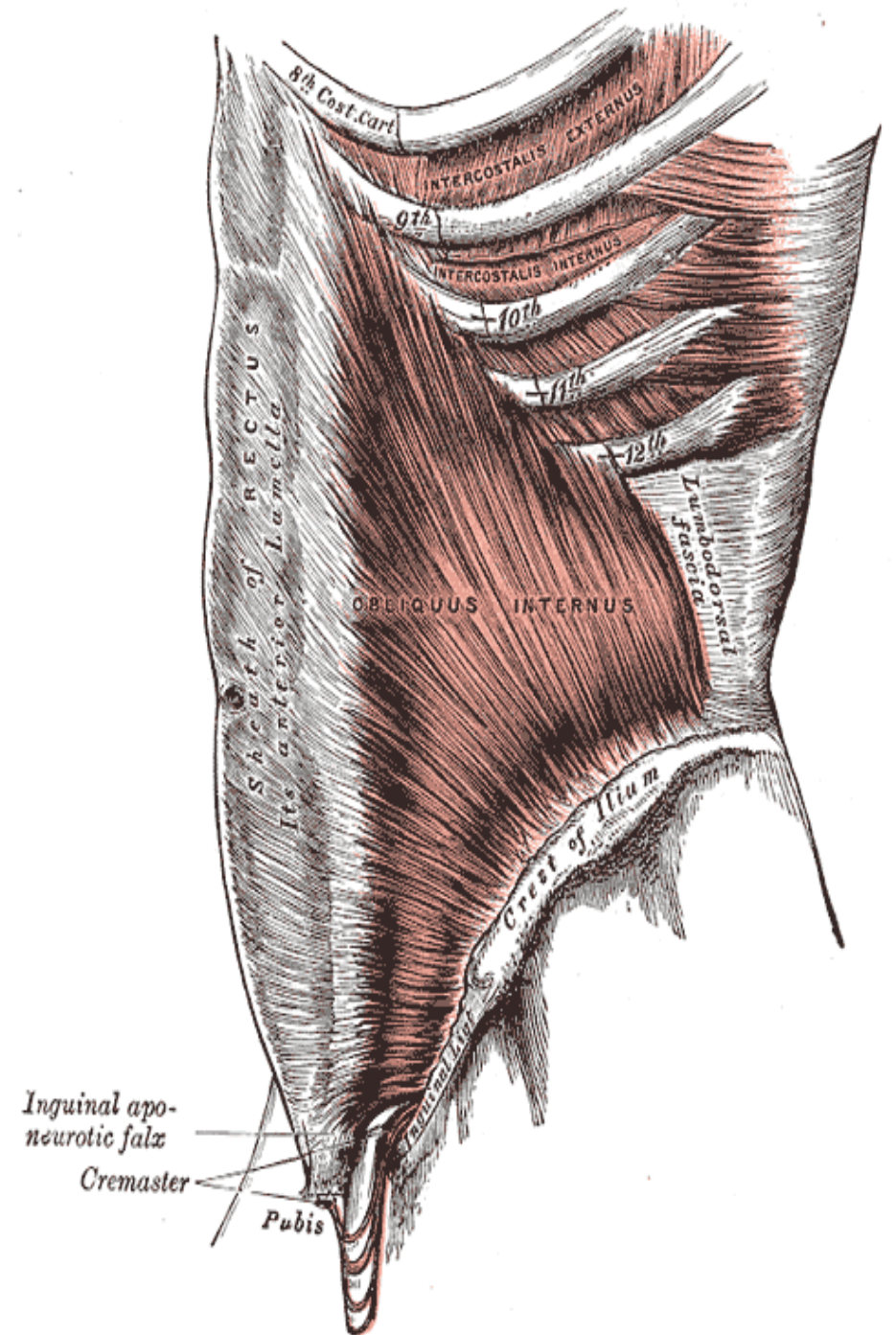
✓ **Insertion**

- Lower three ribs & costal cartilage, Xiphoid process, Linea alba, symphysis pubis.

-

✓ **Nerve Supply**

Lower 6th thoracic nerves, iliohypogastric n & ilioinguinal n → L1.



Internal oblique muscle.....cont

- **Conjoint tendon**

- The lowest tendinous fibers of internal oblique which joint with + transversus abdominis

- Attach medially to linea alba

- Support the inguinal canal (superficial inguinal ring)

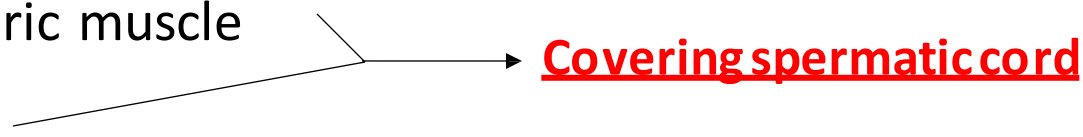
- Has lateral free border

- **Cremastric fascia**

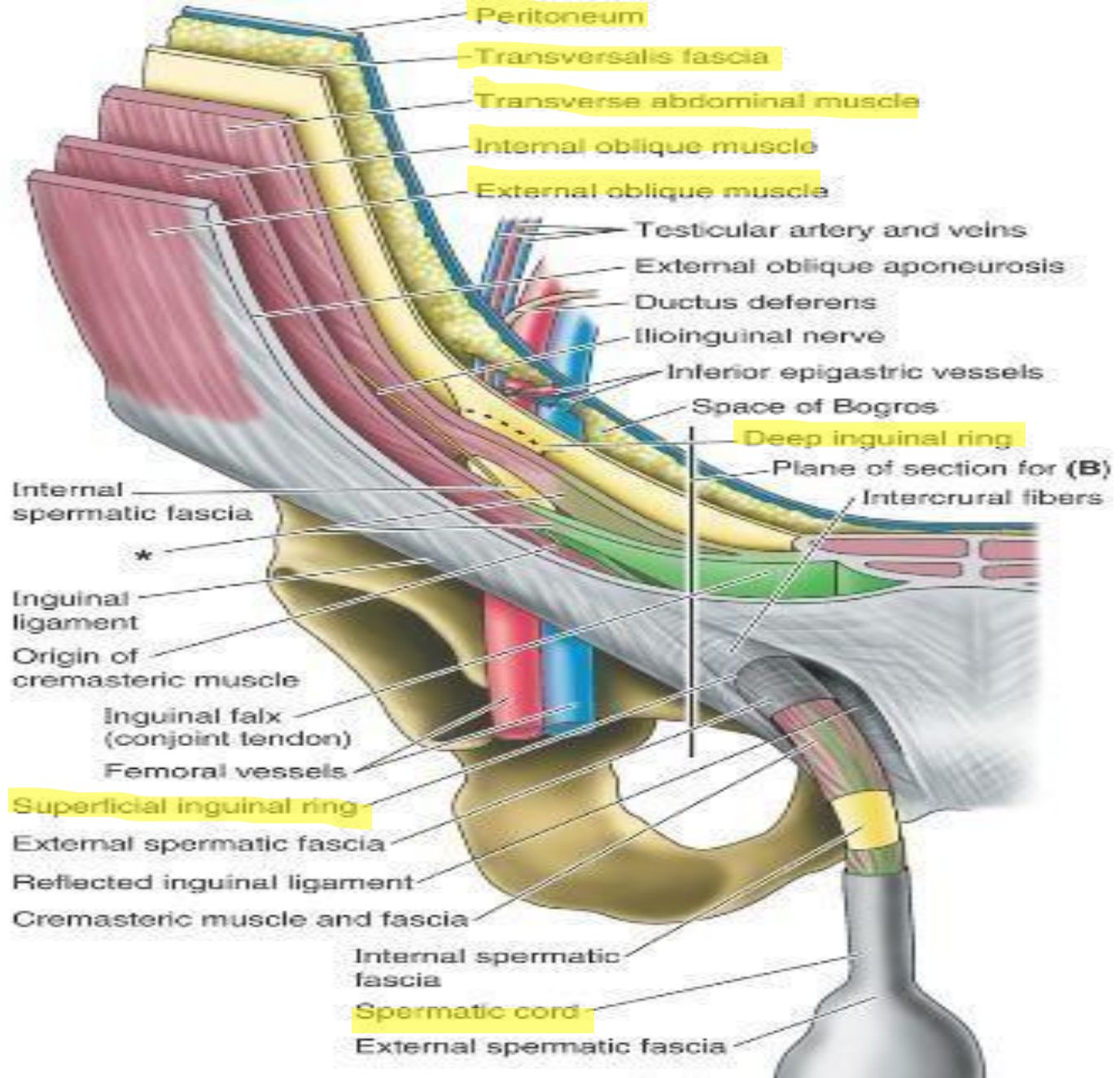
- **Internal oblique** has free lower border arches over the **spermatic cord** or **ligament of uterus**

- Cremastric muscle

- Fascia

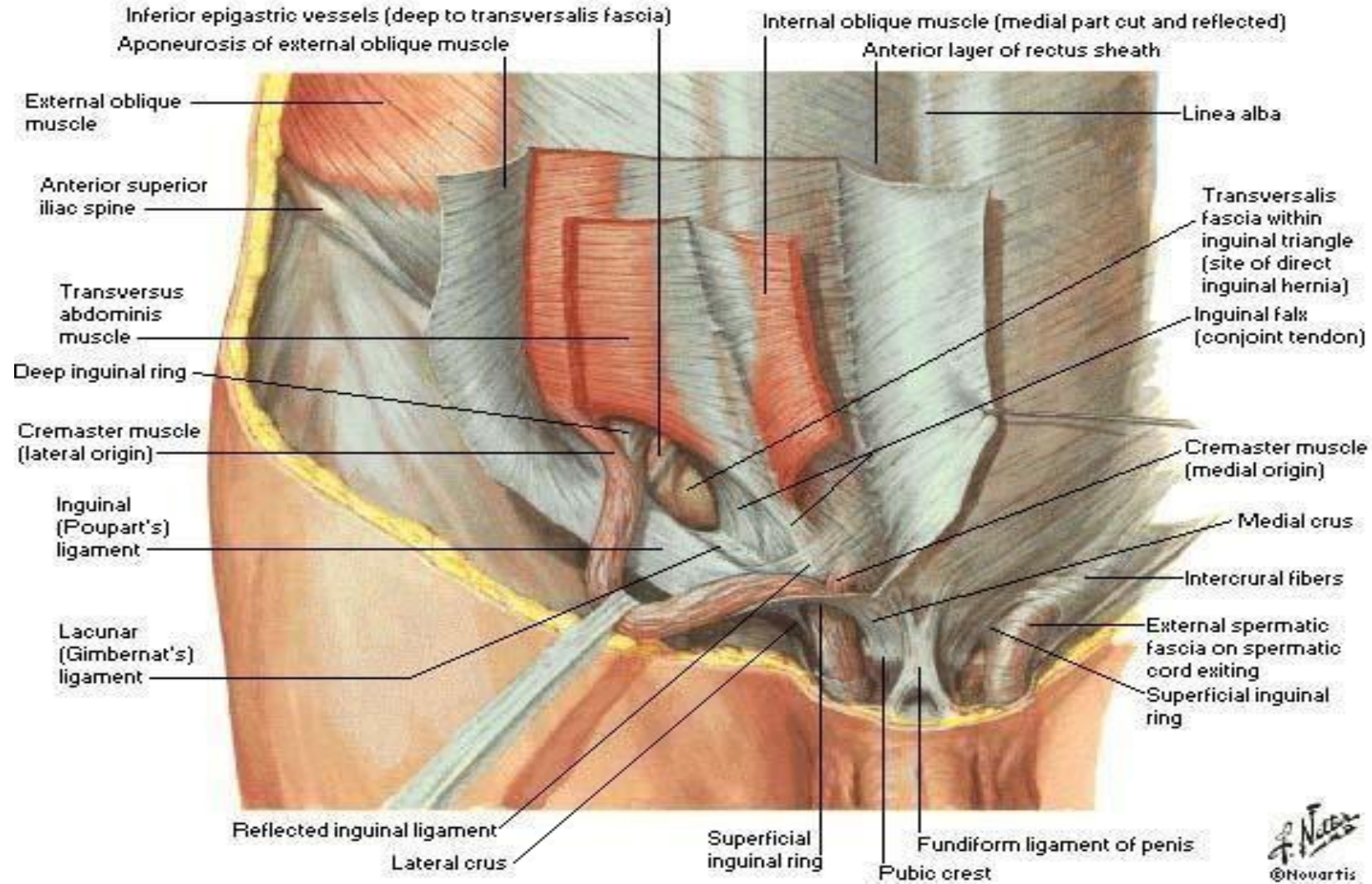


- Int. abd.muscle assist in the formation of the **Roof of the inguinal canal**



Deep inguinal ring has a relation with femoral artery, we can find its surface anatomy by sensing the palpation of femoral artery and going up 2 cm or 1 cm above inguinal ligament.

Conjoint tendon & Cremasteric fascia



❖ Transversus Abdominis

Direction

- Its fibers run horizontally forward under the internal oblique

✓ Origin

- Inner surface of lower six costal cartilage, lumbar fascia, anterior two thirds of iliac crest, lateral third of inguinal ligament.

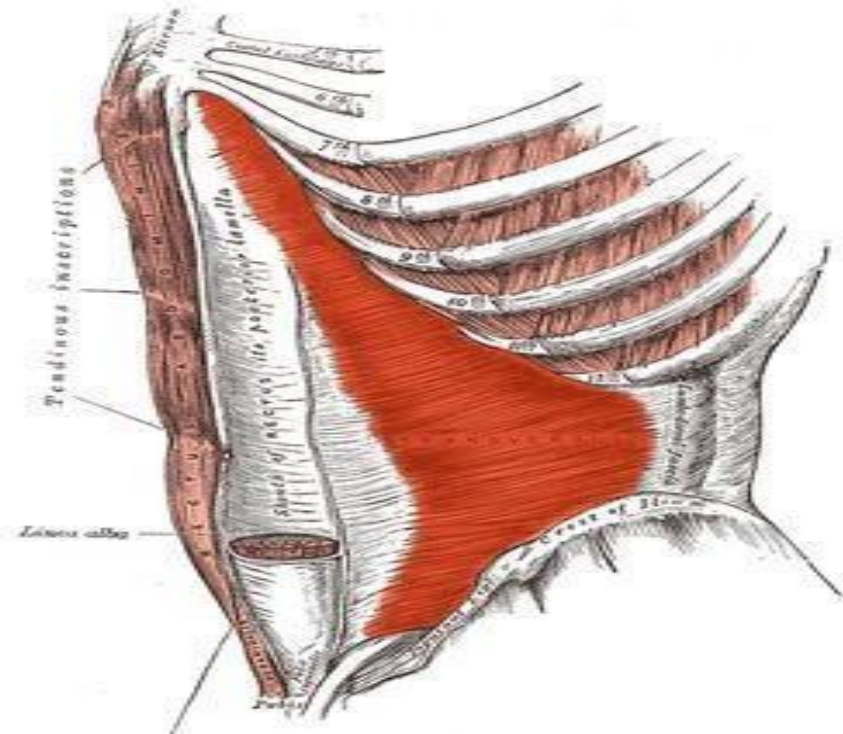
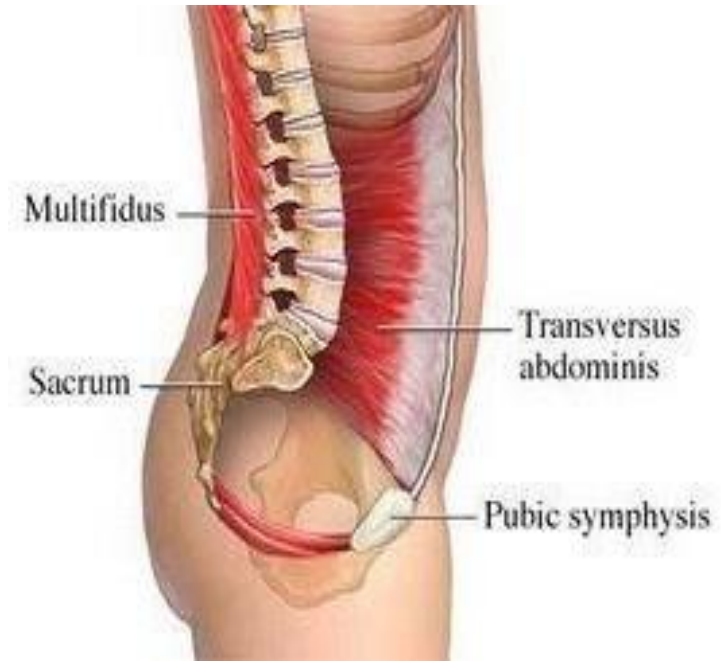
✓ Insertion

Xiphoid process, Linea alba, symphysis pubis.

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

✓ Nerve Supply

Lower six thoracic nerves, L1 (iliohypogastric n.& ilioinguinal n.)



Transversus Abdominis.....cont

Assist in the formation of

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

RECTUS ABDOMINIS

- Long strap muscle
- Extends along the whole length of the anterior abdominal wall
- In the rectus sheath

✓ Origin

Symphysis pubis, pubic crest

✓ Insertion

5th, 6th and 7th costal cartilage & xiphoid process.

Nerve Supply

Lower 6th thoracic nerves Not L1 because it is not situated in rectus sheath



Tendinous intersections, separate the muscles into sections.

Rectus abdominis muscle.....cont

- **Linea semilunaris:** it is the lateral edge of rectus abdominis
- **Tendinous intersection:**

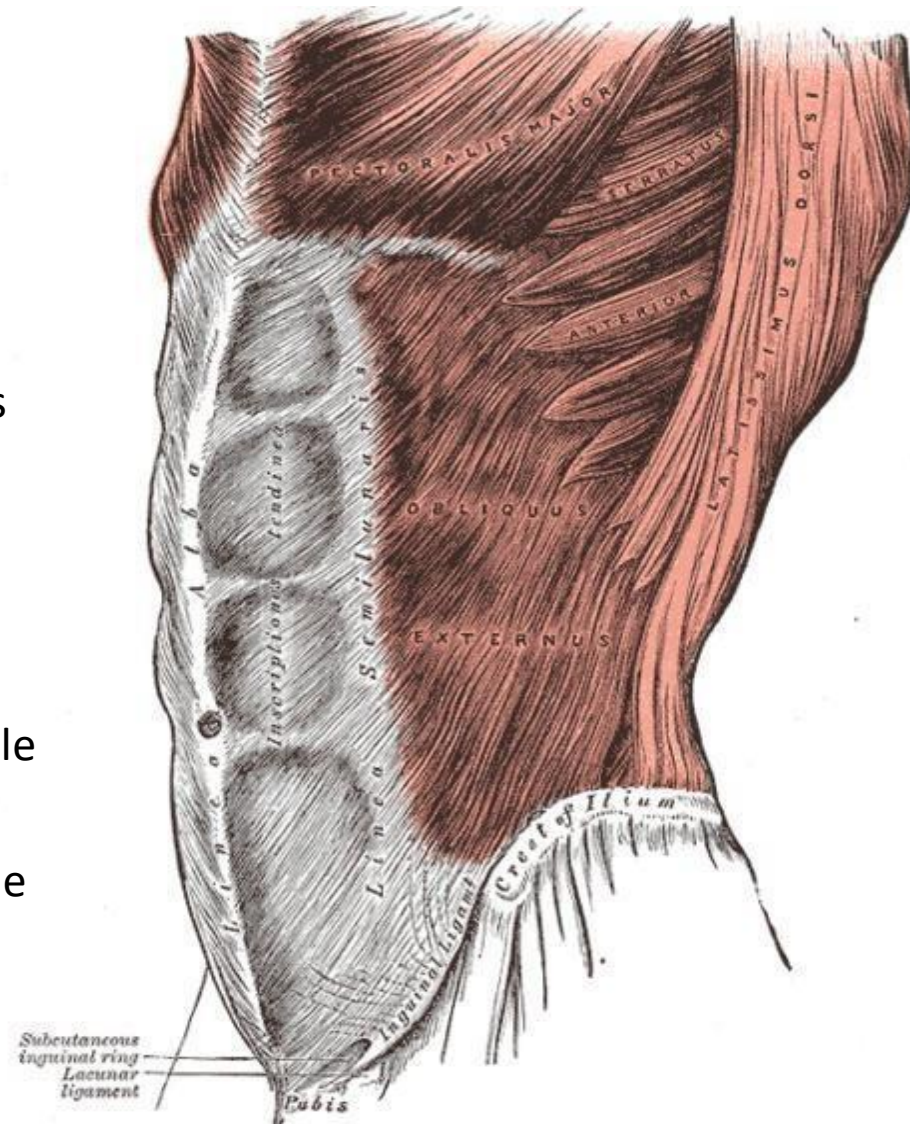
Lines & Land marks of the Anterior Abdominal Wall

Linea alba:

- Located along the midline.
- Between the xiphoid process & symphysis pubis
- Formed by the fusion of aponeuroses of three abdominal wall (Ex.In, Tran. Abd. muscle)

Linea semilunaris

- Lateral margins of rectus abd. muscle
- Can be palpated
- Extend from 9th c.c to pubic tubercle



Clinical importance: we can make midline incision, giving high space incision without causing a lot of bleeding. But the disadvantage is that it needs longer time to heal.

Tendinous intersection: = Linea
transverses

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



Pyramidalis muscle

Origin

Ant. Surface of the pubis

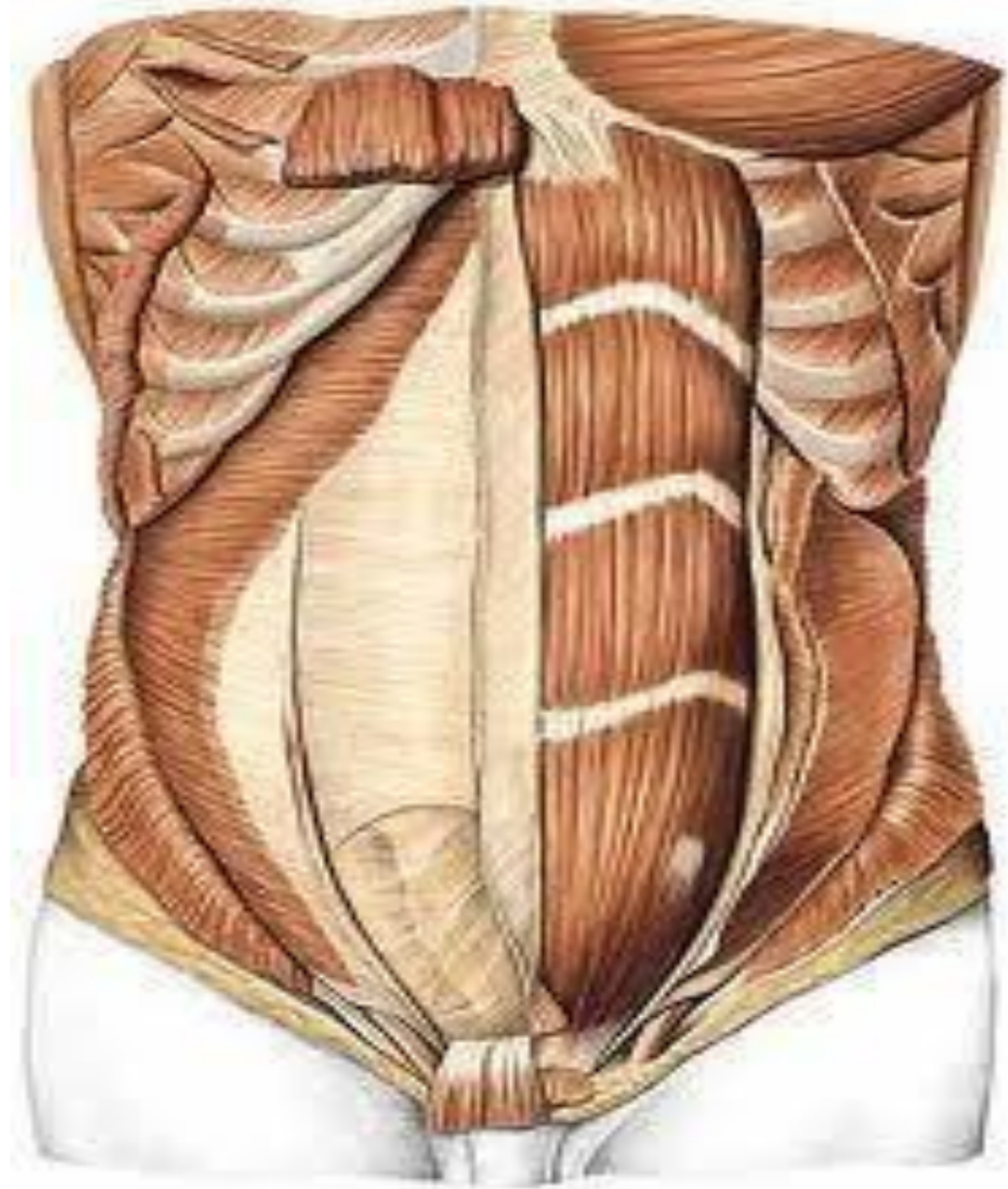
Insertion:

Linea alba

-It lies in front of the lower part of the rectus abdominis muscle

-Nerve supply

12th subcostal nerve



Rectus sheath

Rectus sheath.....cont

- The rectus sheath is a **long fibrous sheath**
- Formed mainly by **the aponeuroses** of **the three lateral abdominal muscles**. (external, internal & transversus)
- **Contents**
 - Rectus abdominis muscle
 - Pyramidalis muscle (if present)
 - The anterior rami of the lower six thoracic nerves (NO L1)
 - The superior (from internal thoracic artery of sub clavicular) and inferior epigastric vessels (from external iliac artery)
 - Lymphatic vessels.

Rectus sheath.....cont

- Description the rectus sheath is considered at three levels.

1 *Above the costal margin (above xiphoid process)*

2 *Between the costal margin and the level of the anterior superior iliac spine (above and below umbilicus)*

3 *Between the level of the anterosuperior iliac spine and the pubis the anterior wall (at level of pelvis)*

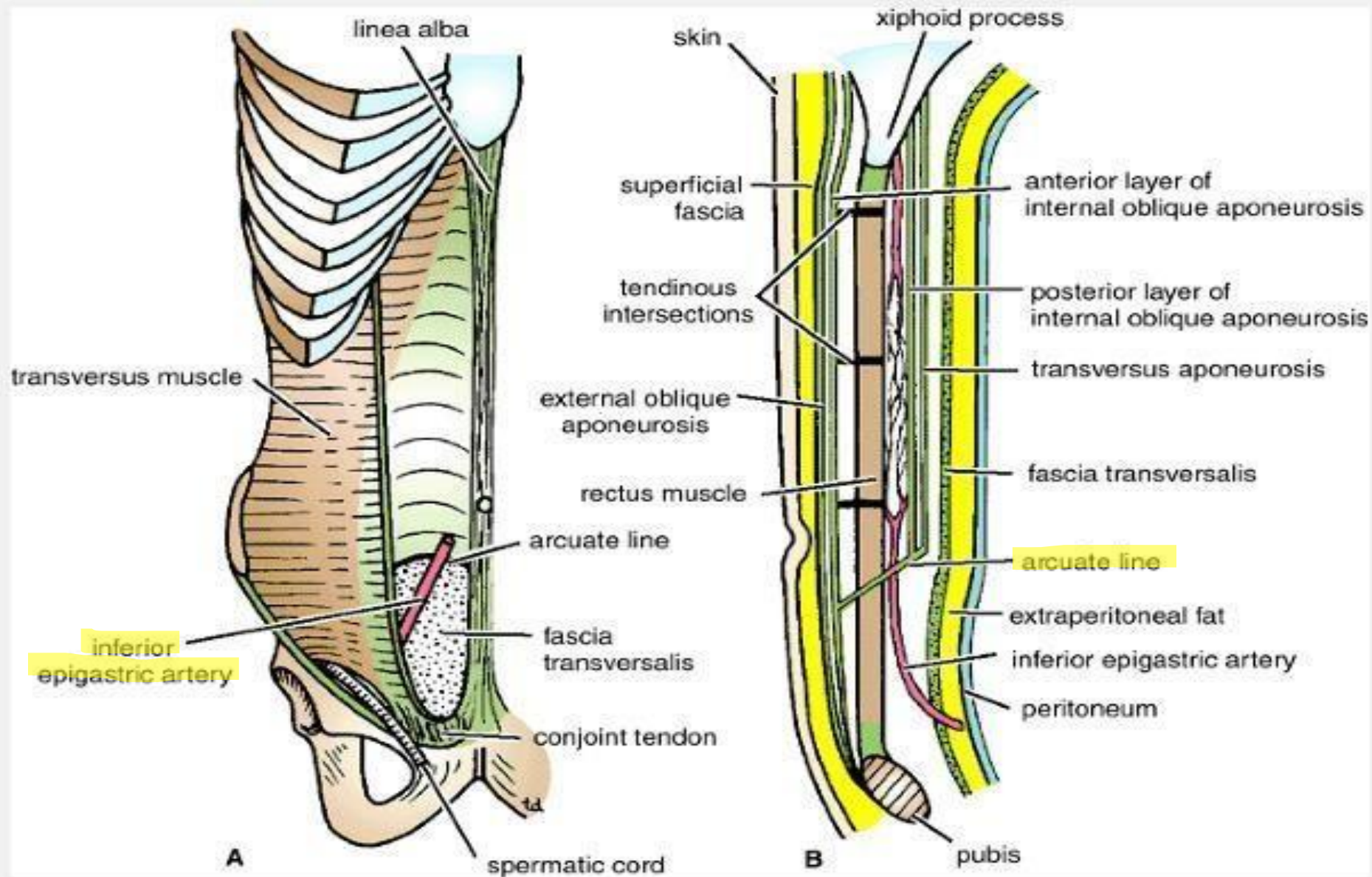
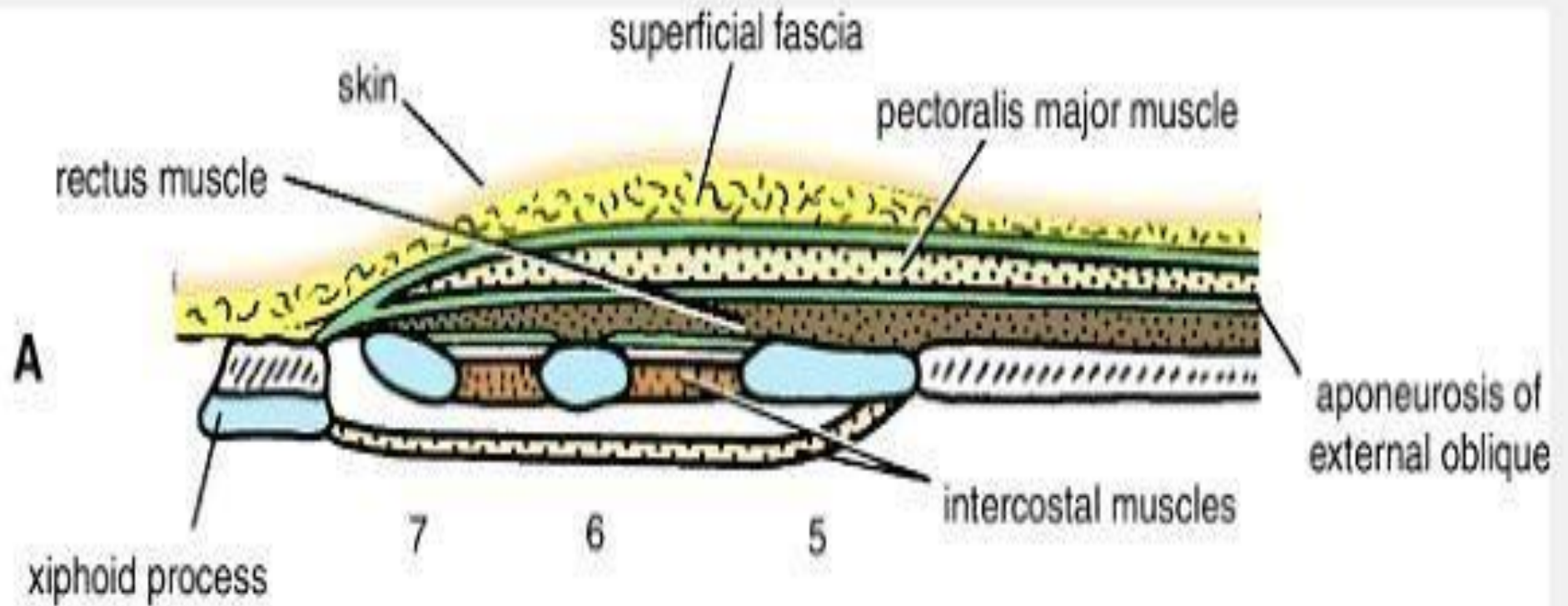


Figure 4-10 Rectus sheath in anterior view (A) and in sagittal section (B). Note the arrangement of the aponeuroses forming the rectus sheath.

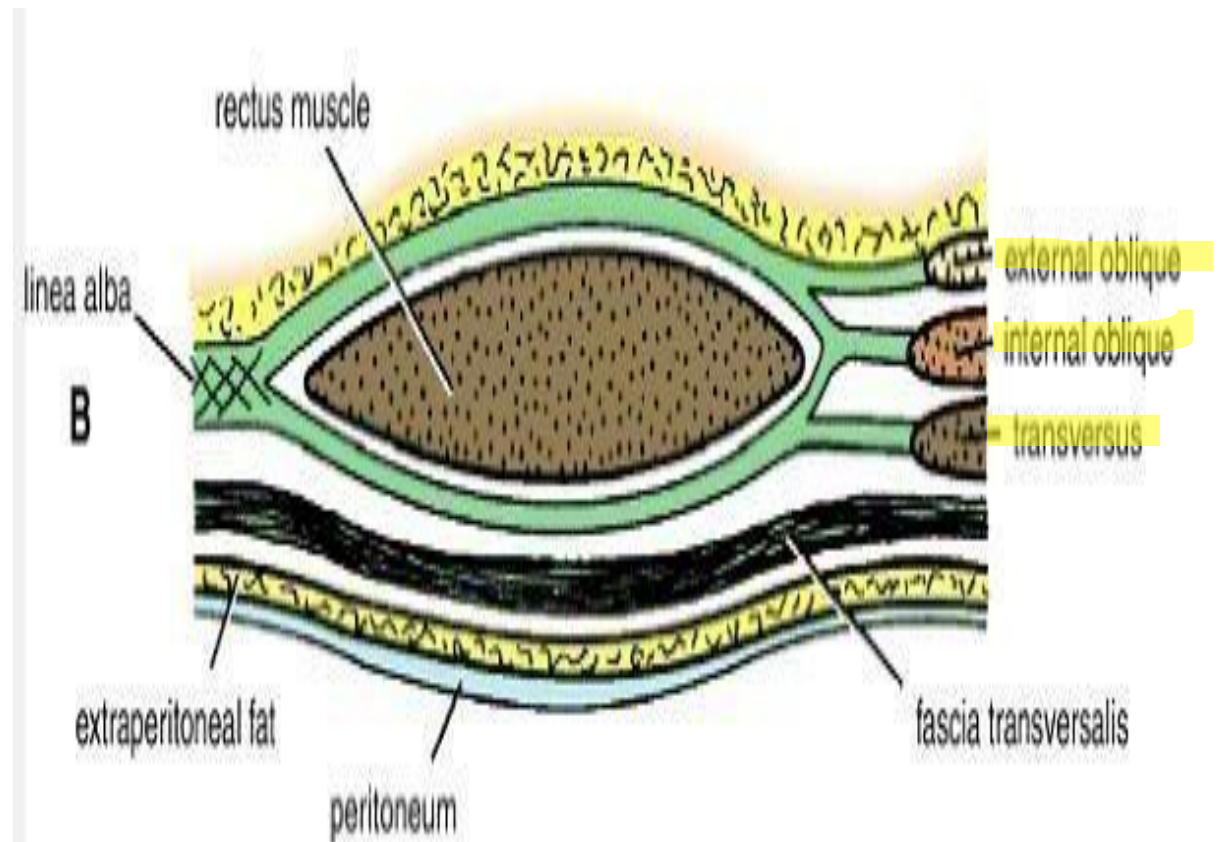


ABOVE THE COSTAL MARGIN,

- **ANTERIOR WALL #:** **APONEUROSIS OF THE EXTERNAL OBLIQUE.**
- **POSTERIOR WALL #:** **THORACIC WALL** THAT IS, THE FIFTH, SIXTH, AND SEVENTH COSTAL CARTILAGES AND THE INTERCOSTAL SPACES. (there is no internal oblique nor transversus)

Between the costal margin and the level of the anterior superior iliac spine (above and below umbilicus)

- The aponeurosis of the internal oblique **splits** to enclose the rectus muscle
- the external oblique aponeurosis is directed in **front** of the muscle
- the transversus aponeurosis is directed **behind** the muscle.



Anterior wall	posterior wall
Skin, superficial fascia, external oblique aponeurosis, 1 layer of internal oblique	1 layer of internal oblique, transversus abdominus, transversalis fascia, extra peritoneal fat & peritoneum

Between the level of the anterosuperioriliac spine and the pubis
the anterior wall: the aponeurosis of **all three muscles form**.
The posterior wall is absent, and the rectus muscle lies in contact with the **fascia transversalis**.

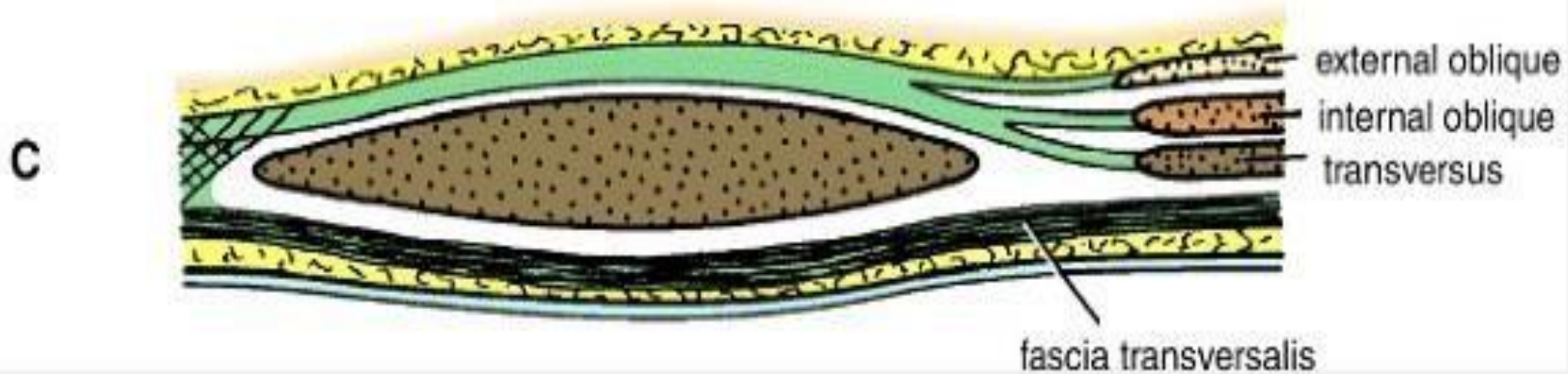


Figure 4-13 Transverse sections of the rectus sheath seen at three levels. **A.** Above the costal margin. **B.** Between the costal margin and the level of the anterior superior iliac spine. **C.** Below the level of the anterior superior iliac spine and above the pubis.

Rectus sheath.....cont

- The posterior wall of the rectus sheath is not attached to the rectus abdominis muscle. The anterior wall is firmly attached to it by the muscle's tendinous intersections
- **Linea semicircularis** (arcuate line)
- Is a crescent-shaped line marking the inferior limit of the posterior layer of the rectus sheath just below the level of the iliac crest.
- **Meaning: below superior iliac spine, the posterior wall of rectus sheath will be fascia transversalis only.**

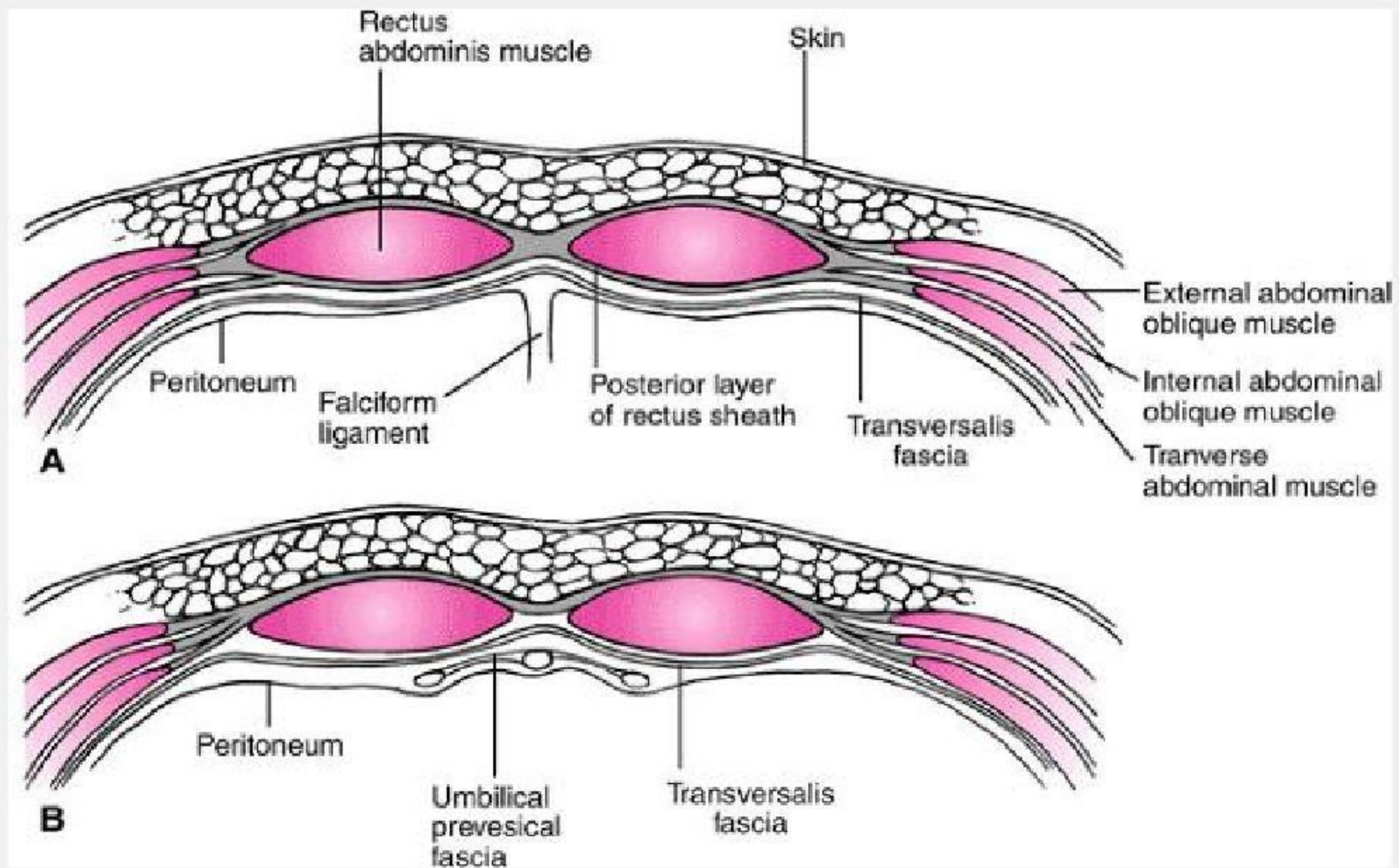


Figure 5-2 Arrangement of the rectus sheath above the umbilicus (upper) and below the arcuate line (lower).

Others fascia in the ant. abd.ominal wall

❖ **Transversalis fascia**

- a thin layer of fascia **deep** that lines the **Transversus Abdominis muscle**
- continue to diaphragm , iliac muscle & pelvis fascia
- contribute to femoral sheath

❖ **Extraperitoneal Fascia**

- ✓ The thin layer of C.T and adipose tissue between the peritoneum and fascia transversalis.
- ✓ It is located before the parietal peritoneum.

❖ **Parietal peritoneum**

- ✓ It is a thin serous membrane
- ✓ Continuous below with the parietal peritoneum lining the pelvis.

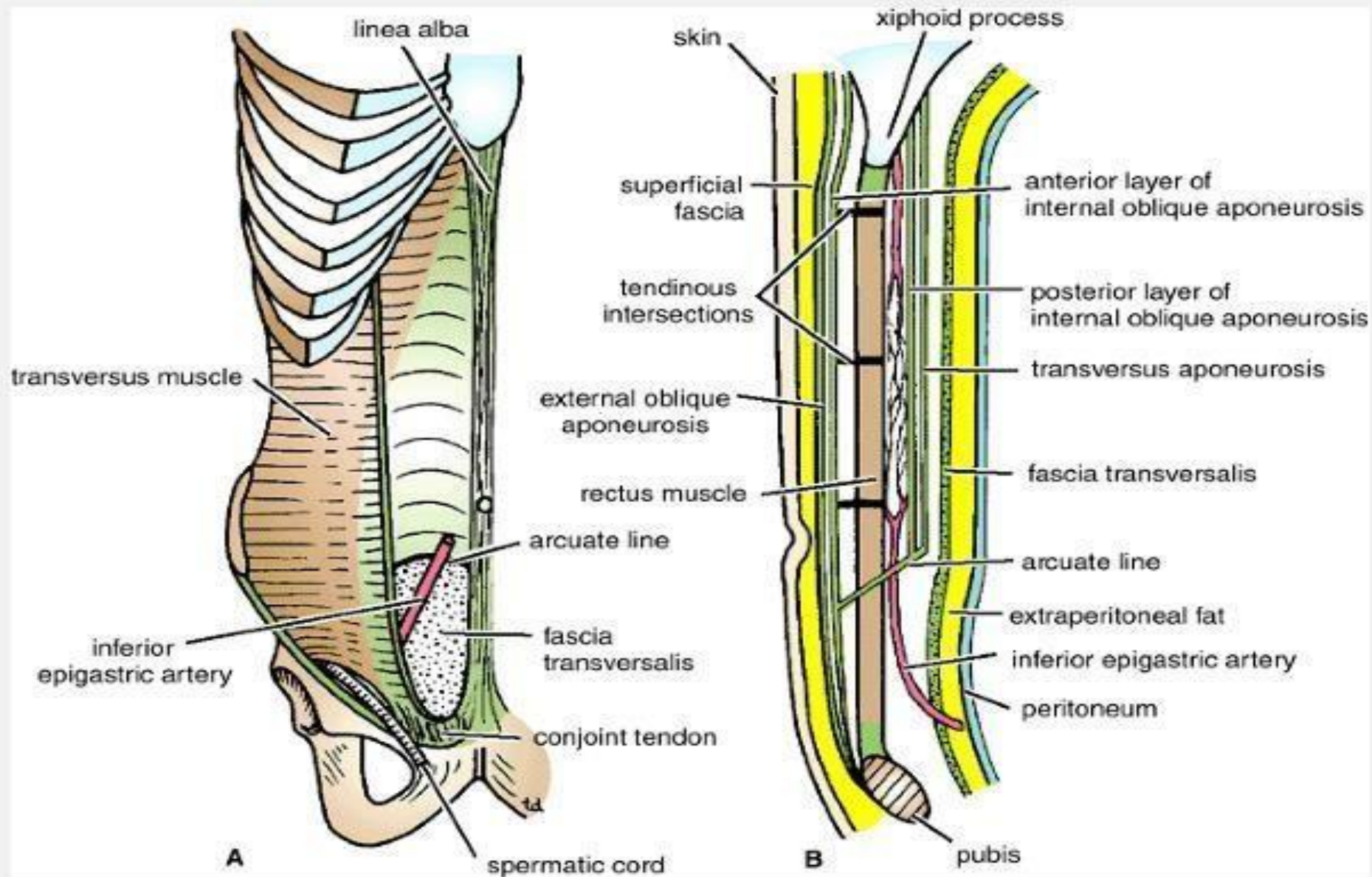
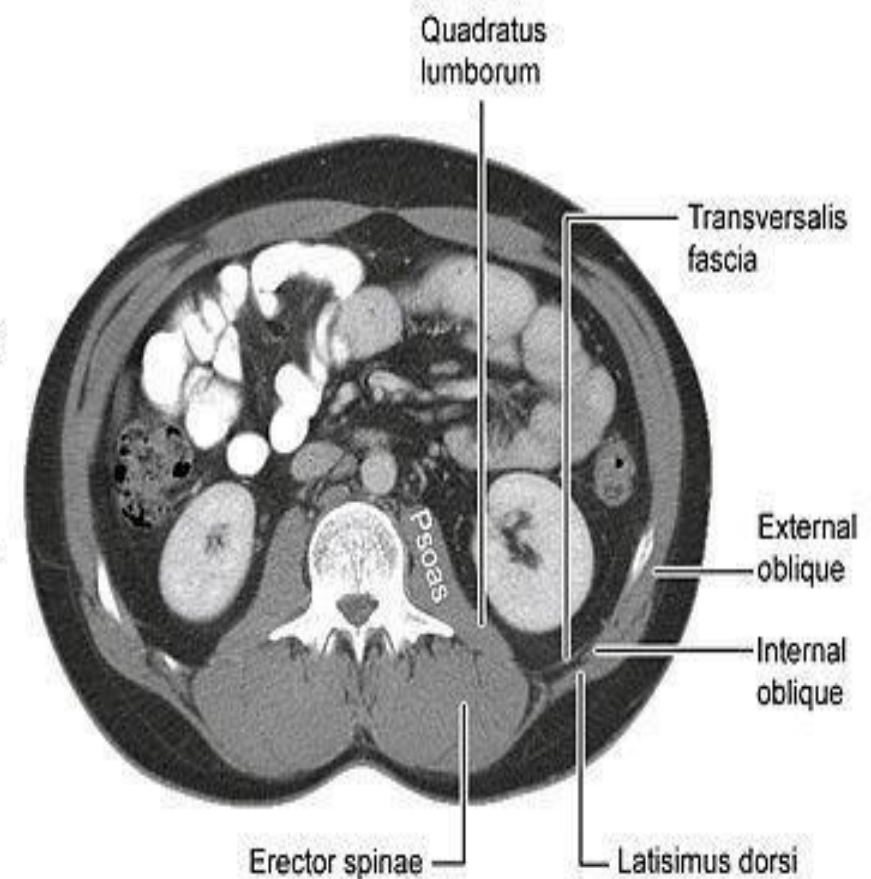
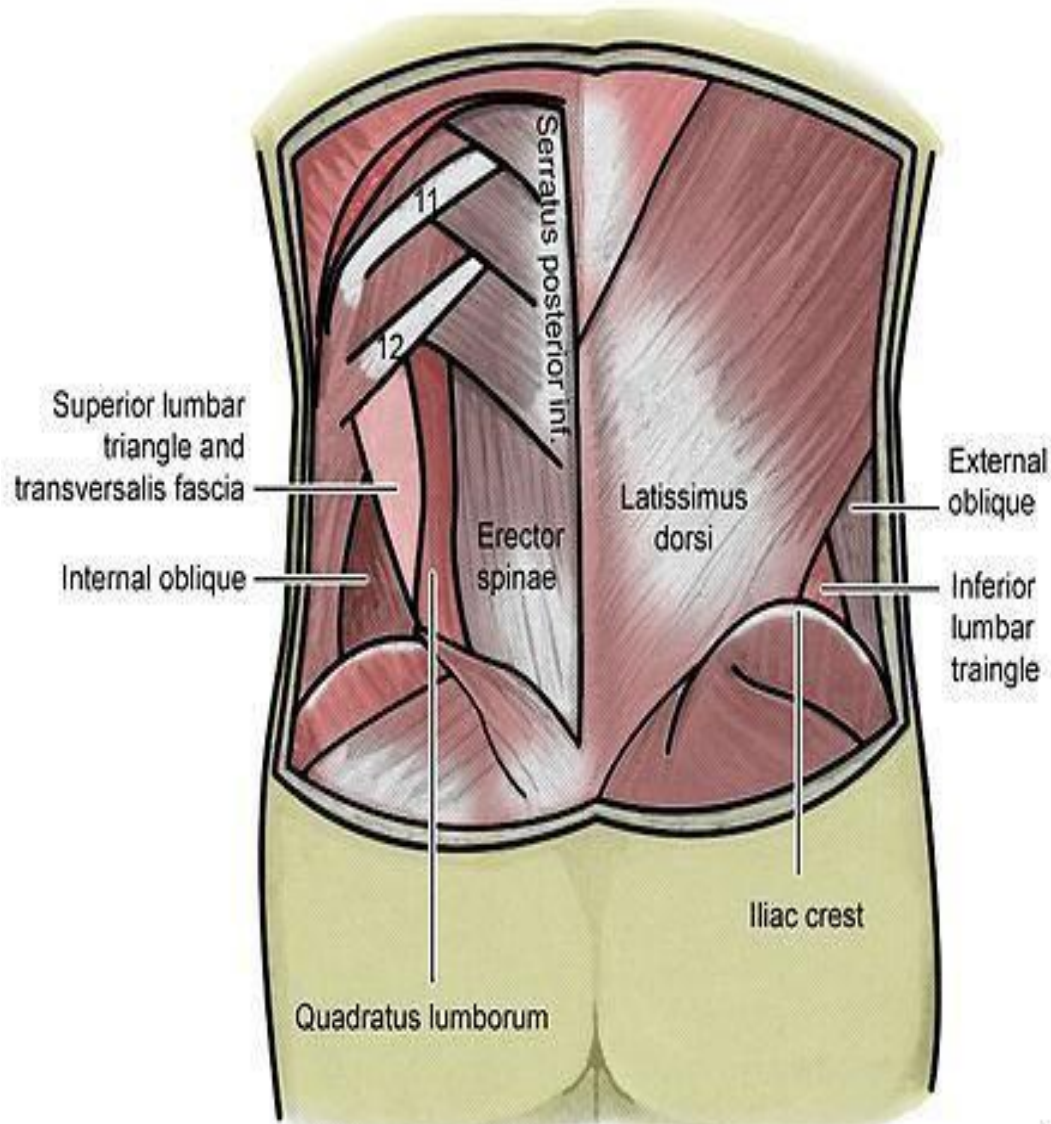


Figure 4-10 Rectus sheath in anterior view (A) and in sagittal section (B). Note the arrangement of the aponeuroses forming the rectus sheath.

NOT REQUIRED !!!

Lumbar triangle



NOT REQUIRED !!!

lumbar triangle

- 1- the inferior lumbar (Petit) triangle, which lies superficially
 - 2- the superior lumbar (Grynfeltt) triangle, which is deep and superior to the inferior triangle.
- Of the two, the superior triangle is the more consistently found in cadavers, and is more commonly the site of herniation
 - however, the inferior lumbar triangle is often simply called the lumbar triangle, perhaps owing to its more superficial location and ease in demonstration.

NOT REQUIRED !!!

Lumber triangle(petitis)

- The inferior lumbar (Petit) triangle is formed
 - **Medially** by the latissimus dorsi muscle
 - **laterally** by the external abdominal oblique muscle
 - **Inferiorly** by the iliac crest
 - **The floor** internal abdominal oblique muscle.
- The fact that herniation occasionally occur here is of clinical importance.

Superior lumbar (Grynfeltt-Lesshaft) triangle

NOT REQUIRED !!!

Medially: by the quadratus lumborum muscle

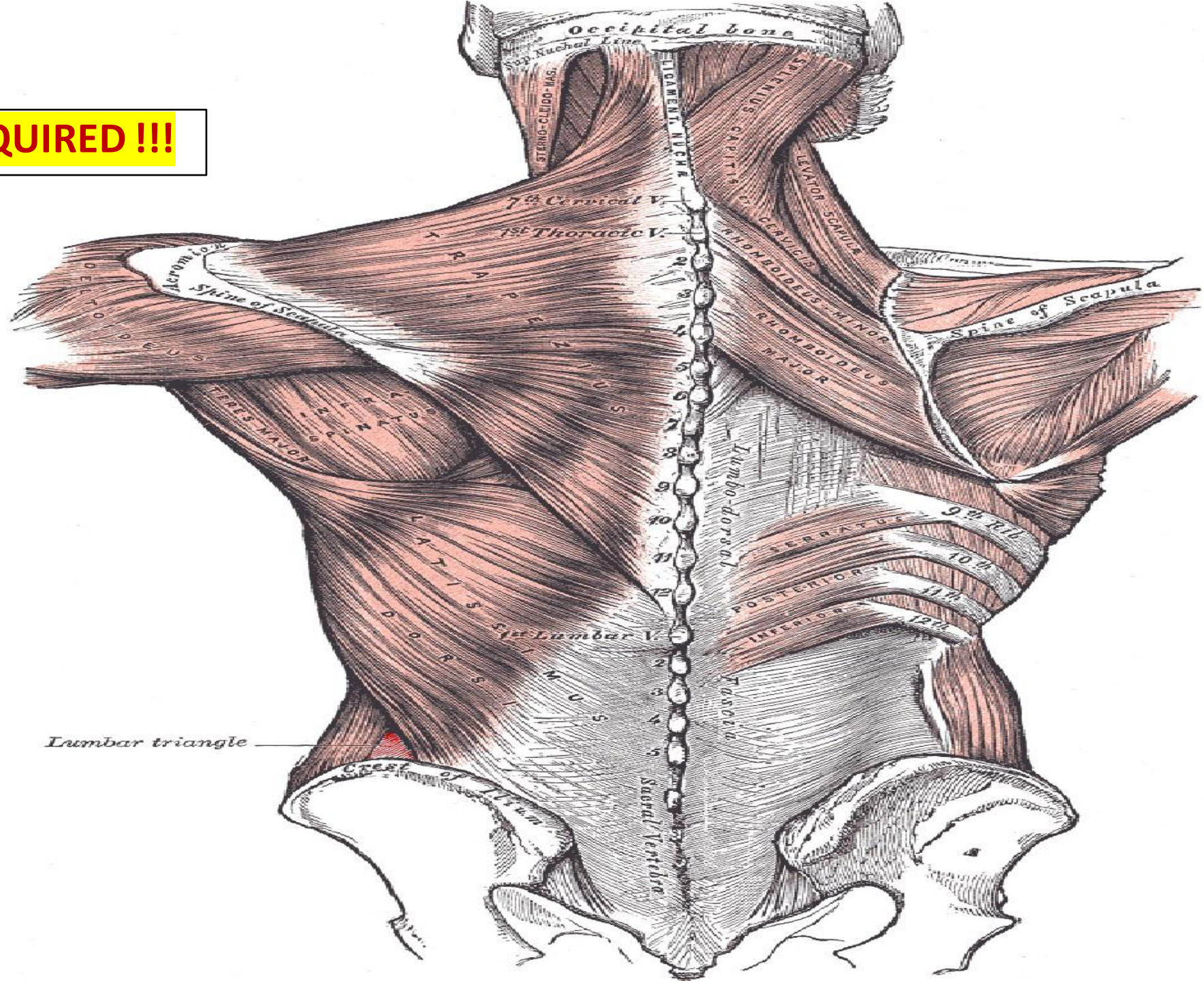
laterally :by the internal abdominal oblique muscle

Superiorly: by the 12th rib.

The floor : transversalis fascia

Roof: is the external abdominal oblique muscle

NOT REQUIRED !!!



Action of the Ant. Abdominal muscle

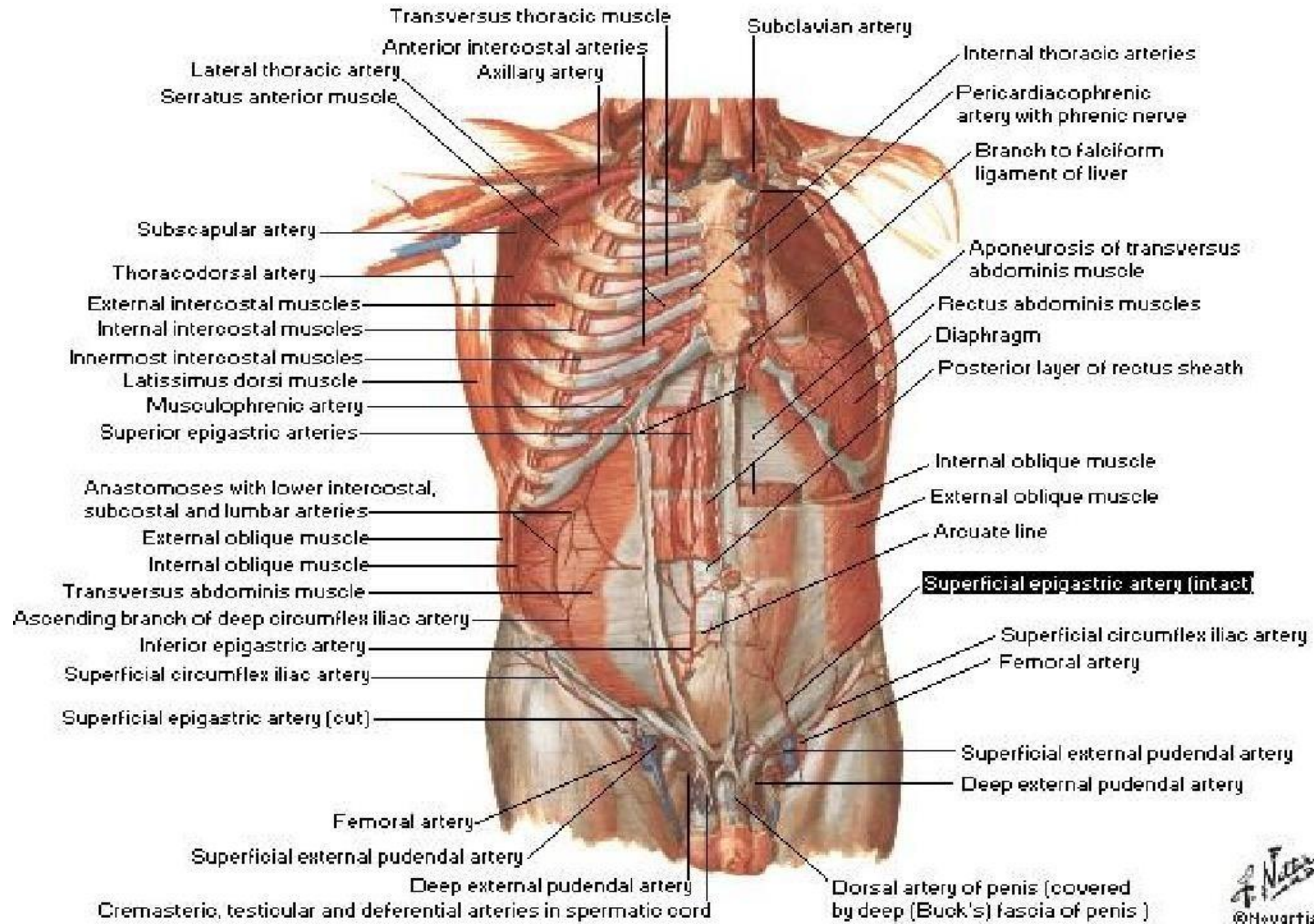
- Deep expiration
- Increase the intra abdominal pressure in
 - Vomiting
 - Cough
 - Defecation
 - Labour
- Protect viscera
- keep viscera in position
- Rectus abdominis → bends trunk forward

Blood supply of the ant. Abdominal wall

Arteries

- Sup. Epigastric artery
 - Inf. Epigastric artery
- Content of rectus sheath
- Intercostal arteries
 - Lumbar arteries
- From the Abdominal aorta 4 on the right & left of abdomen
- Deep circumflex artery
- From external iliac artery
-

Arteries of Anterior Abdominal Wall



Blood supply.....cont

Veins

1- Above the umbilicus

- Lateral. Thoracic. vein. → **Axillary** vein

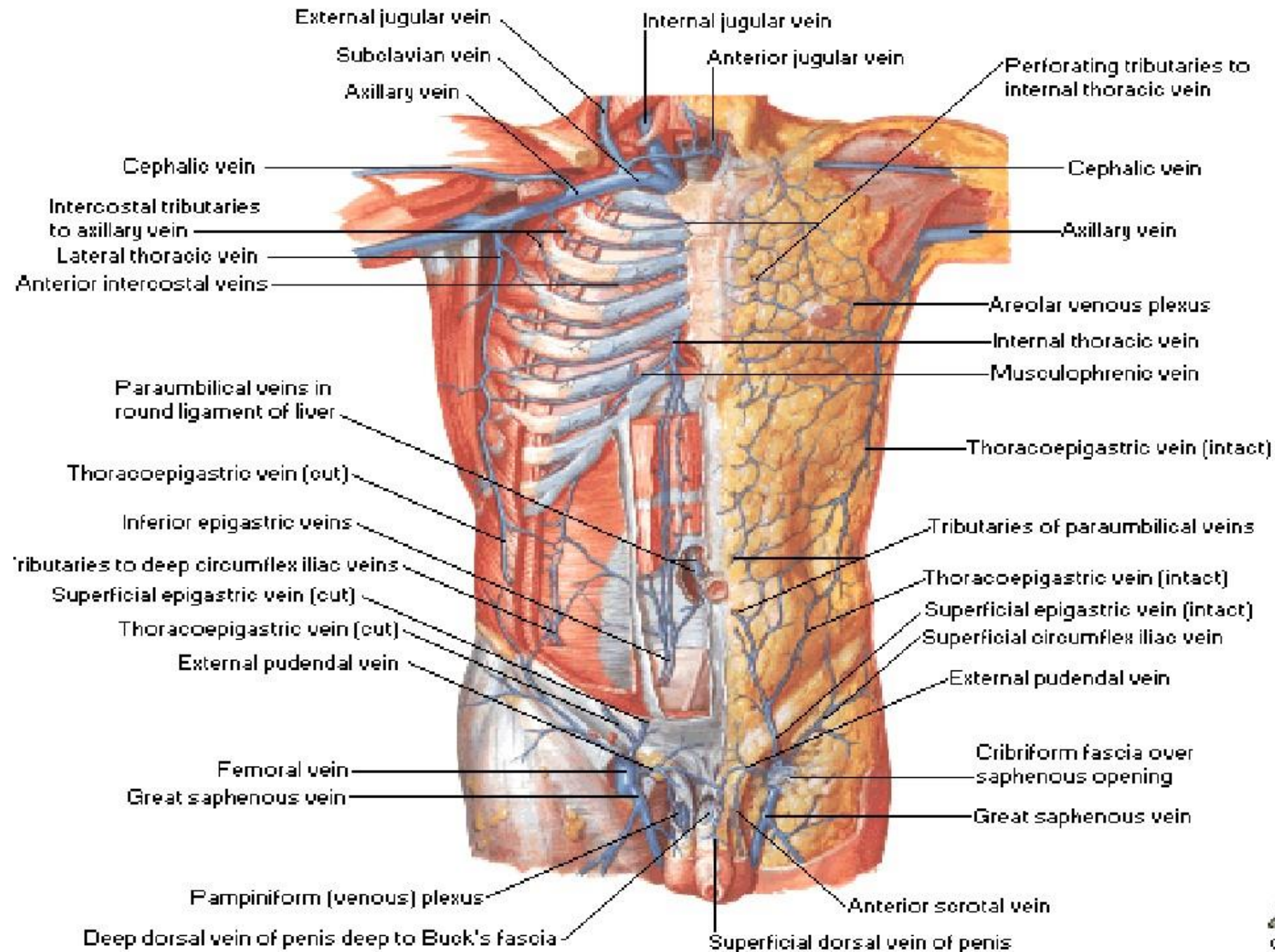
2- Below the umbilicus

- Inferior. Epigastric → **Femoral** vein

3- Paraumbilical veins

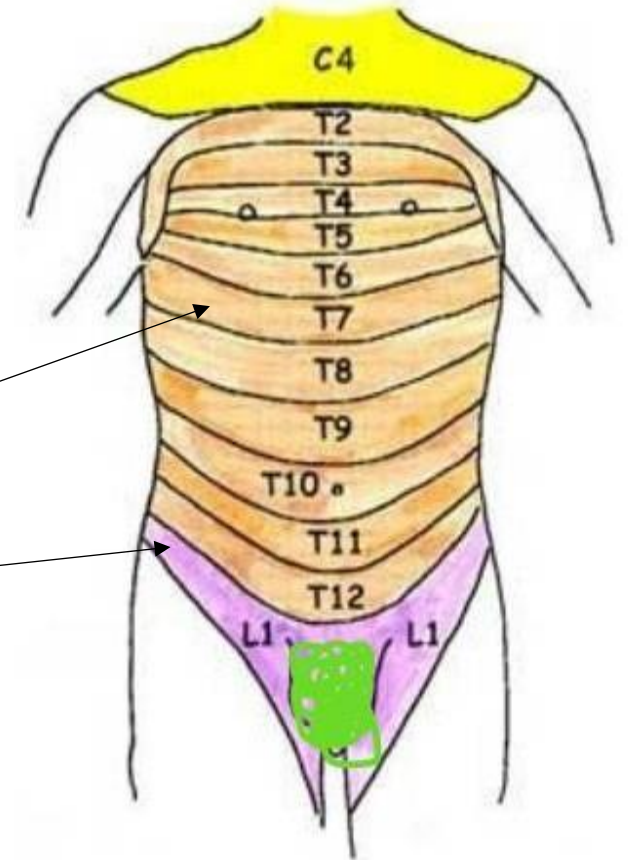
- Ligamentum teres → **portal** vein(Porto- systemic anastomosis)

Veins of Anterior Abdominal Wall

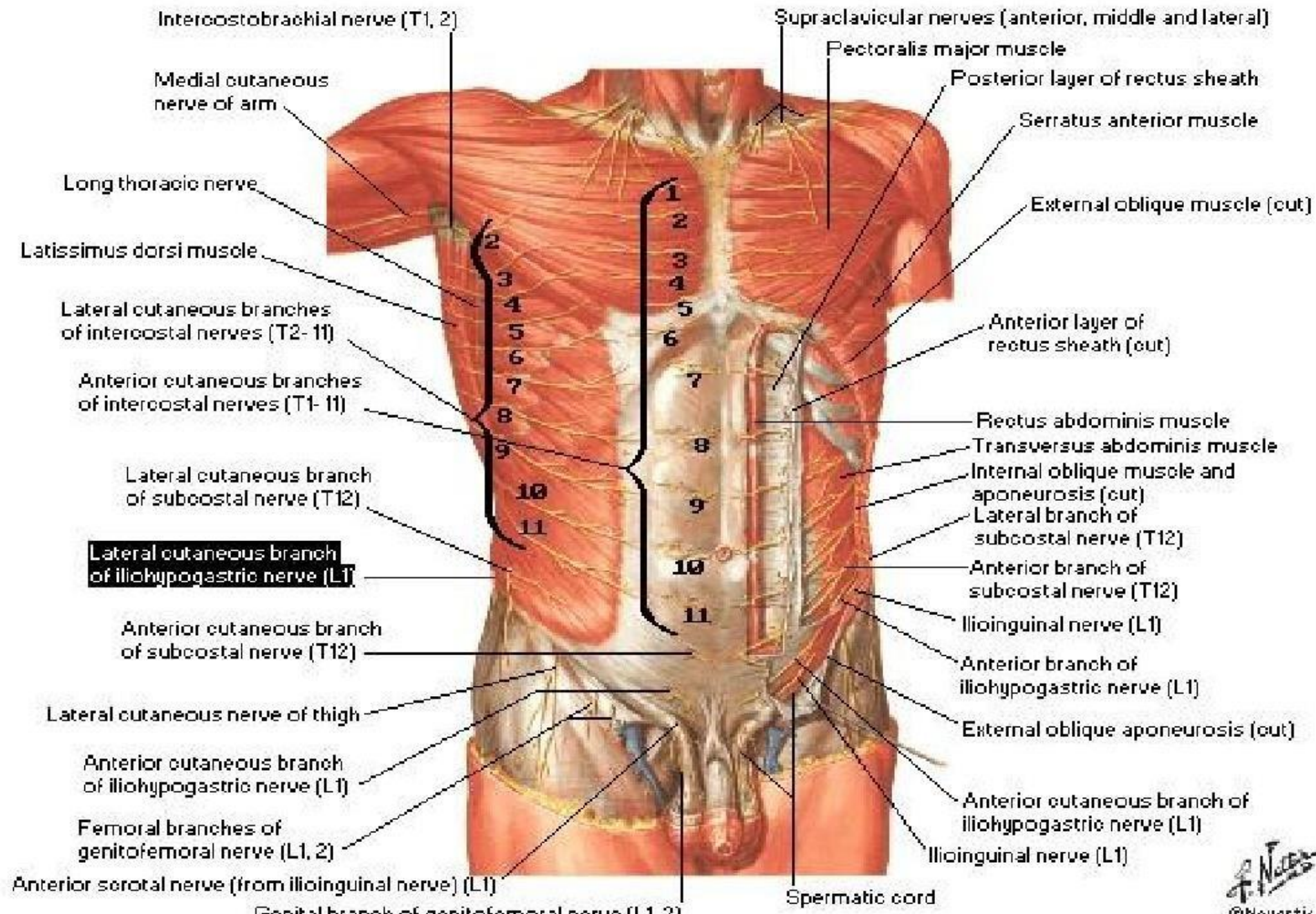


Nerve supply of the ant. Abdominal wall

- **Thoracoabdominal nerve:** Lower 6th thoracic nerves & 12th subcostal nerve
- **Dermatomes** (Anterior, lateral cutaneous nerve terminal branches of Thoracoabdominal nerve)
 - **Dermatomes are nerves that innervate the skin.**
 - T7 to skin superior to umbilicus below xiphoid process
 - T10 to skin surrounding umbilicus
 - L1 to skin inferior to umbilicus above sym. pubis
- **L1 nerve**
 - Iliohypogastric nerve
 - Ilioinguinal nerve



Nerves of Anterior Abdominal Wall



Lymphatic drainage of ant. Abdominal wall

- Above the umbilicus → Ant. **axillary** L.N
- Below the umbilicus → Sup. **Inguinal** L.N

- Above the iliac crest → Post. **axillary** L.N
- Below the iliac crest → Sup. **inguinal** L.N

TIP to memorize:
ABAS umbilicus

TIP to memorize:
ABOVE ---> Axillary
BELOW ---> Inguinal

Clinical notes

Abdominal stab wounds

Surgical incision

Abdominal stab wounds

- Lateral to rectus sheath
- Ant. To rectus sheath
- In the midline= Linea alba
- Structures in the various layers through which an abdominal **stab wound** depend on the anatomical location

Surgical incision

- The length and direction of surgical incision through the ant. Abdominal wall to expose the underlying viscera are largely controlled by
 - 1 position & direction of nerves
 - 2 direction of muscle fibers
 - 3- arrangement of the apponeurosis forming the rectus sheath
- The incision should be made in the direction of the line of cleavage in the skin so that the hairline scar is produced

Incision through the rectus sheath

- Widely used
- The rectus abdominis muscle and its nerve supply are kept intact
- On closure the ant & post wall of the sheath are sutured separately and the rectus muscle back into position between the suture lines

Common types of incisions

- Paramedian incision
- Pararectus incision
- **Midline incision**
- Transrectus incision
- Transverse incision
- Muscle splitting
- Abdominothoracic incision



Finished <3

V2: note in slide 8