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:

- **Inferior:**

  Pubic bone and iliac crest:

  Level of L4.

- **Umbilicus:**

  Level of IV disc L3-L4

Abdominal Quadrants

Formed by two intersecting lines:

Vertical & Horizontal

Intersect at umbilicus.

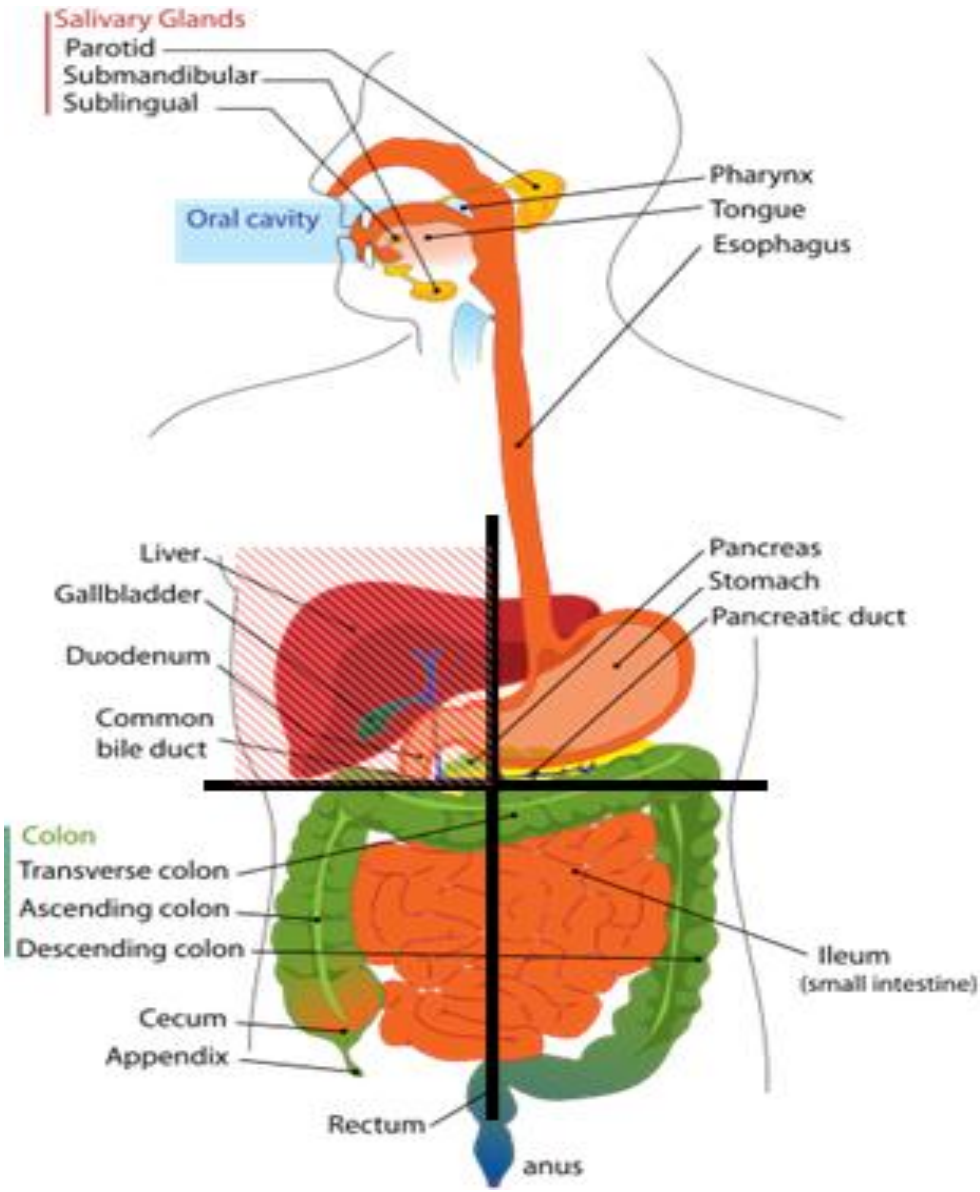
Quadrants:

Upper left.

Upper right.

Lower left.

Lower right



Abdominal Regions

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 pupis

2- Horizontal Planes:

-**Subcostal plane**

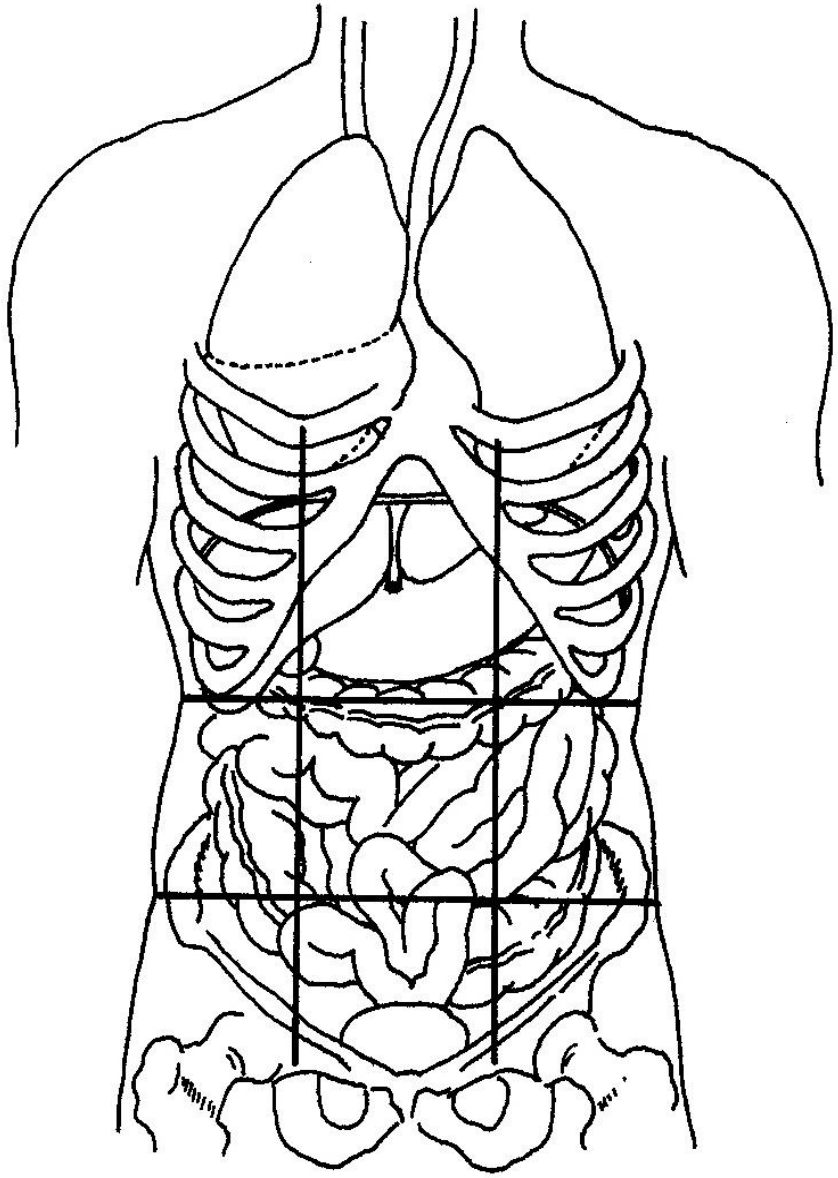
- at level of L3 vertebra

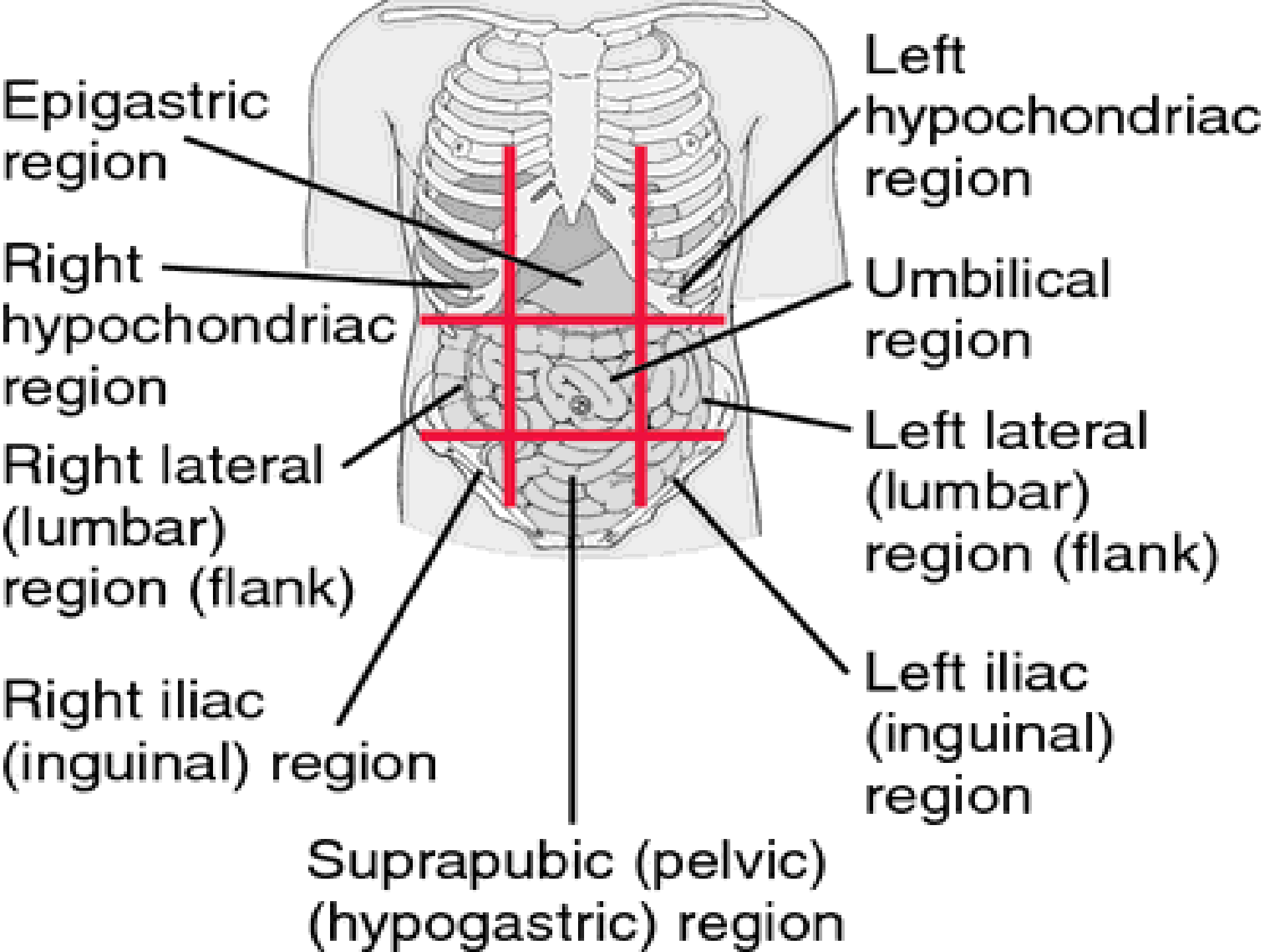
-Joins the lower end of costal cartilage on each side

-**Intertubercular plane:**

-- At the level of L5 vertebra

- Through tubercles of iliac crests.




Epigastric region
Left hypochondriac region
Right hypochondriac region
Umbilical region
Left lateral (lumbar) region (flank)
Right lateral (lumbar) region (flank)
Right iliac (inguinal) region
Left iliac (inguinal) region
Suprapubic (pelvic) (hypogastric) region

Abdominal wall divided into:-

- Anterior abdominal wall

- Posterior abdominal wall

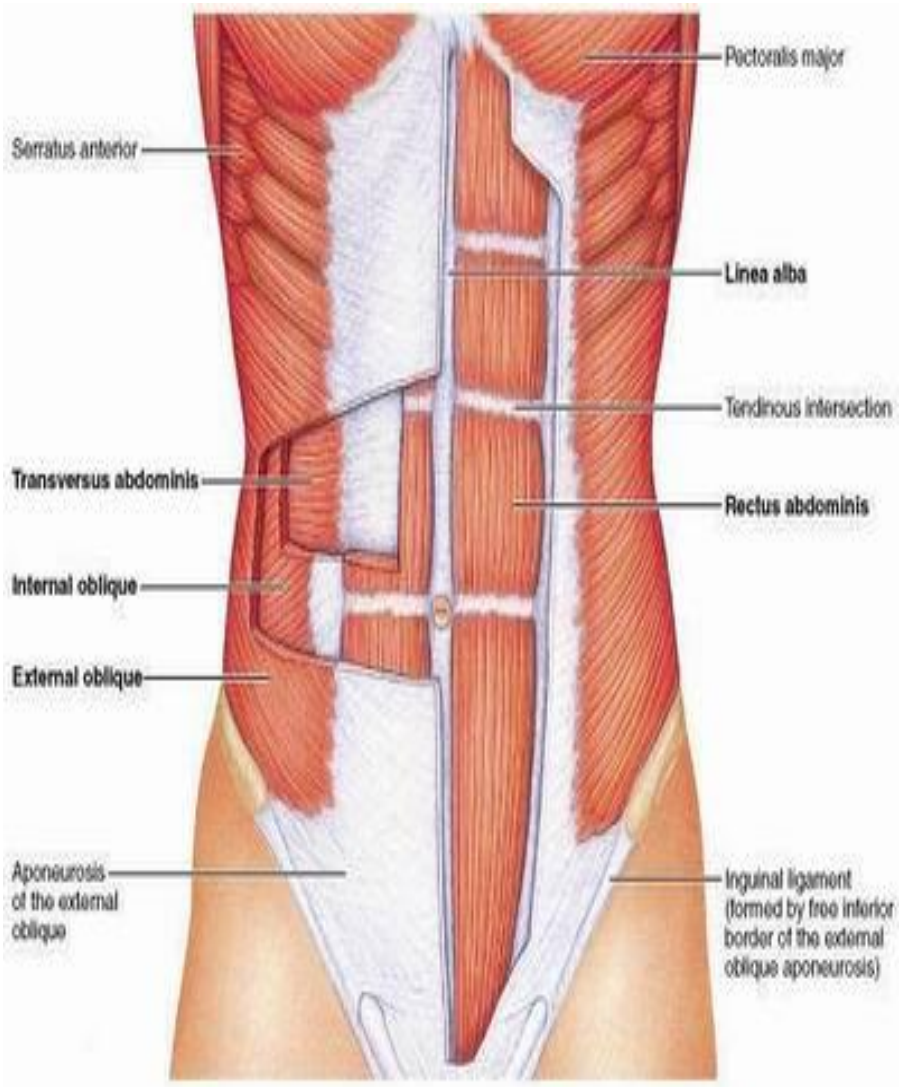
What are the Layers of Anterior Abdominal Wall

- ✓ **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.

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

- ✓ **Muscular layer**
  - External oblique muscle
  - Internal oblique muscle
  - Transverse abdominal muscle
  - Rectus abdominis

- ✓ Transversalis fascia
- ✓ Extraperitoneal fascia
- ✓ Parietal Peritoneum



Superficial Fascia

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

- **Attachment of scarpa's fascia= membranous fascia**

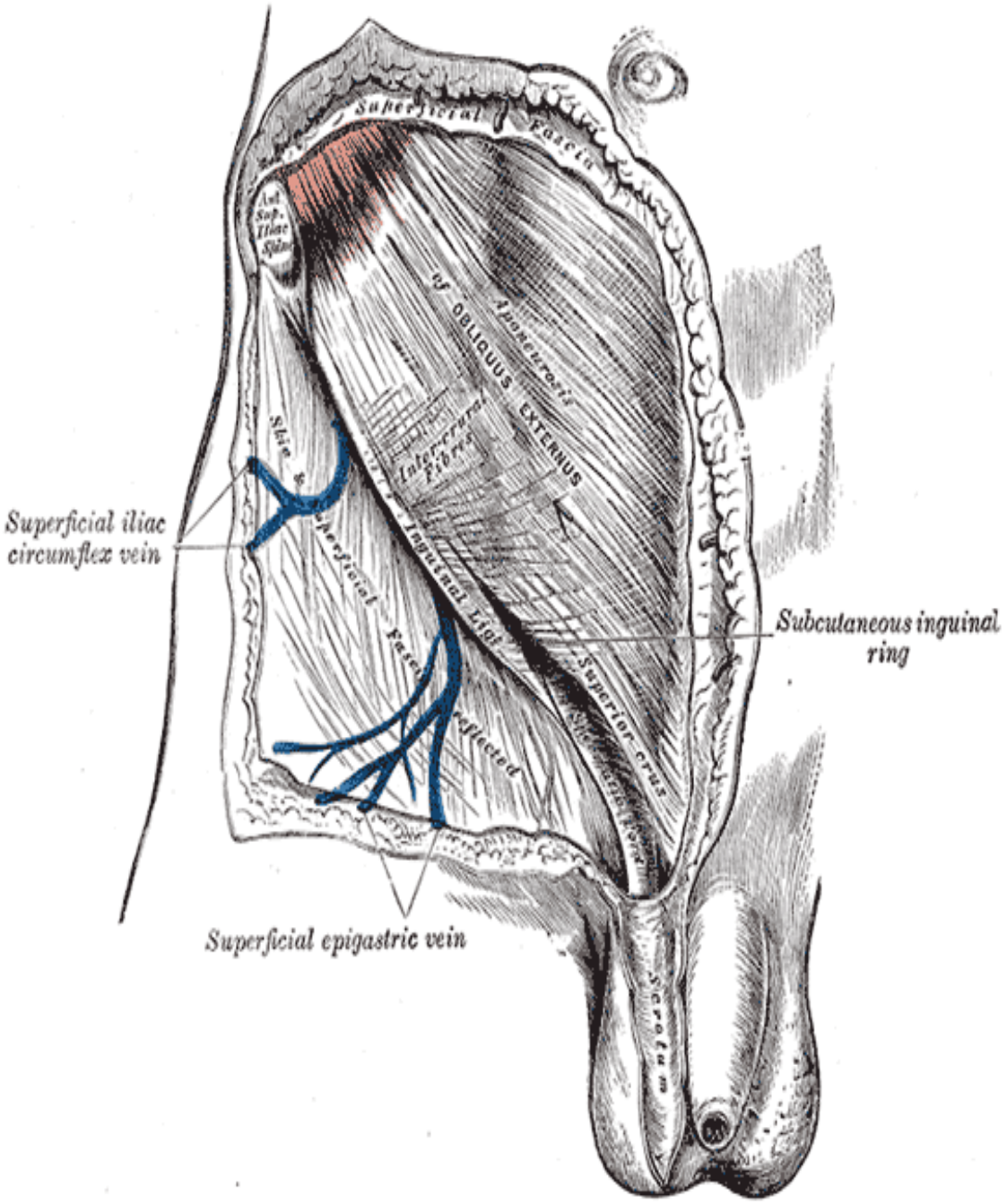
  INF: Fascia lata

  Sides: Pubic arch

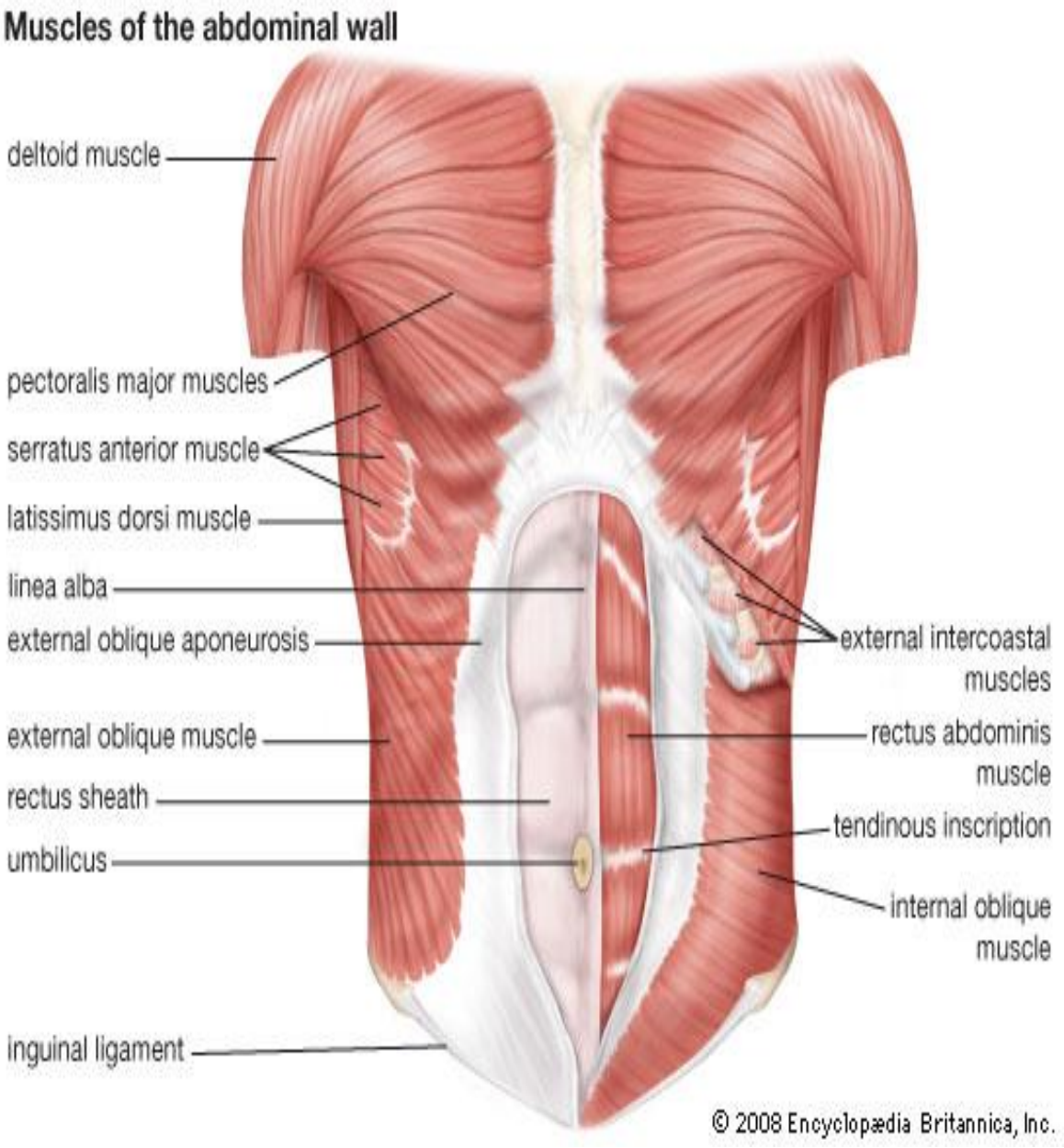
  Post: Perineal body

– Membranous layer in scrotum referred to as colle's fascia

– Rupture of penile urethra lead to extravasations of urine into(scrotum, perineum, penis &abdomen)



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



External oblique muscle

-Broad

-Thin

✓ **Direction:**

Downward forward medially

✓ **Origin**

outer surface of lower 8 ribs.

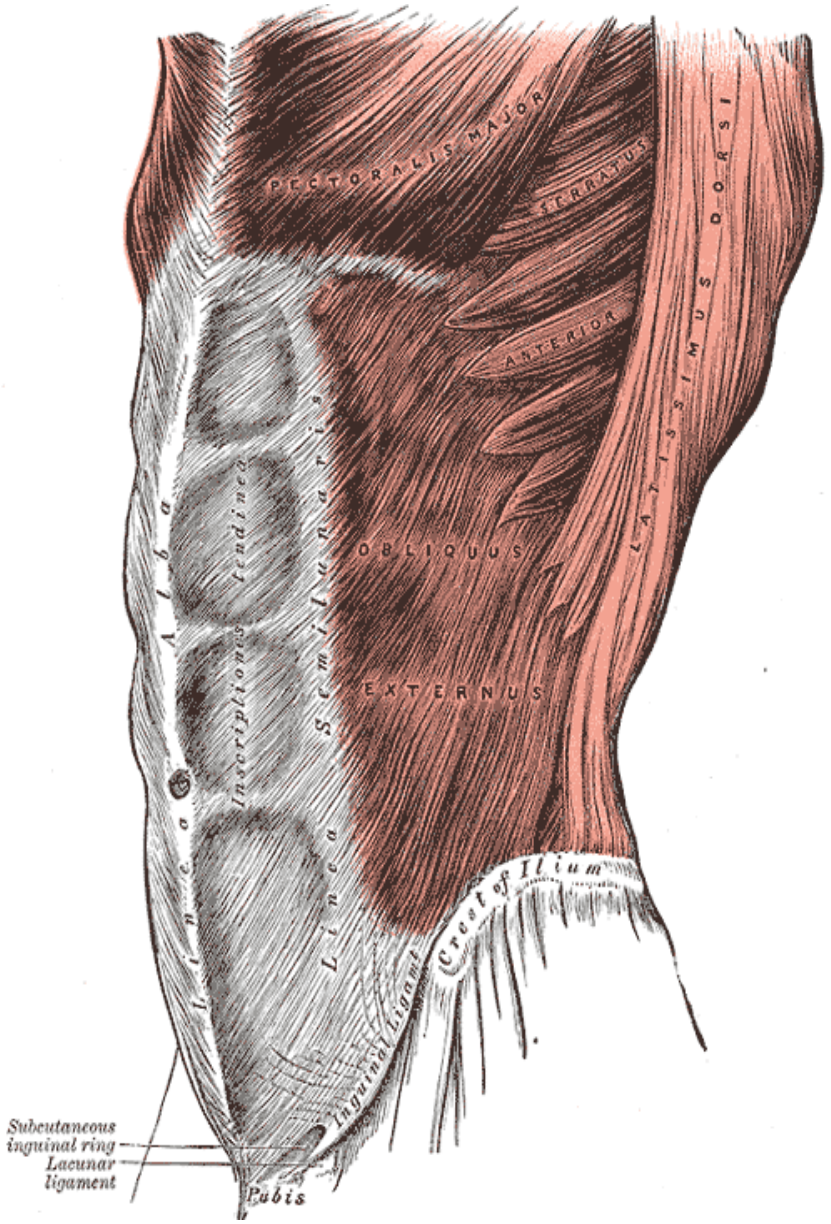
✓ **Insertion**

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

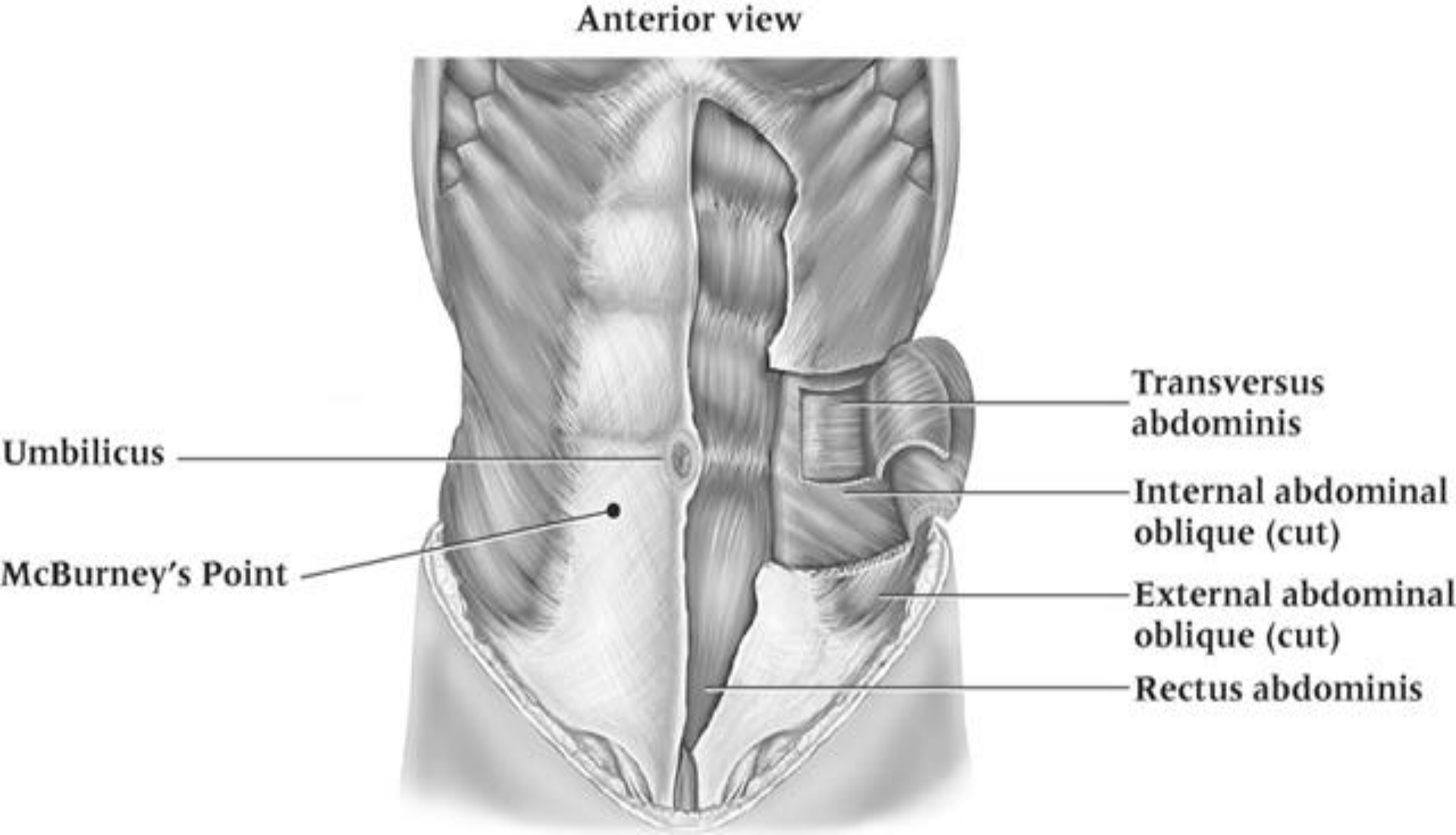
✓ **Nerve Supply**

1- Lower 6th thoracic nerves

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



Muscles of the anterior abdominal wall



✓Aponeurosis of external oblique muscle

Superficial inguinal ring.

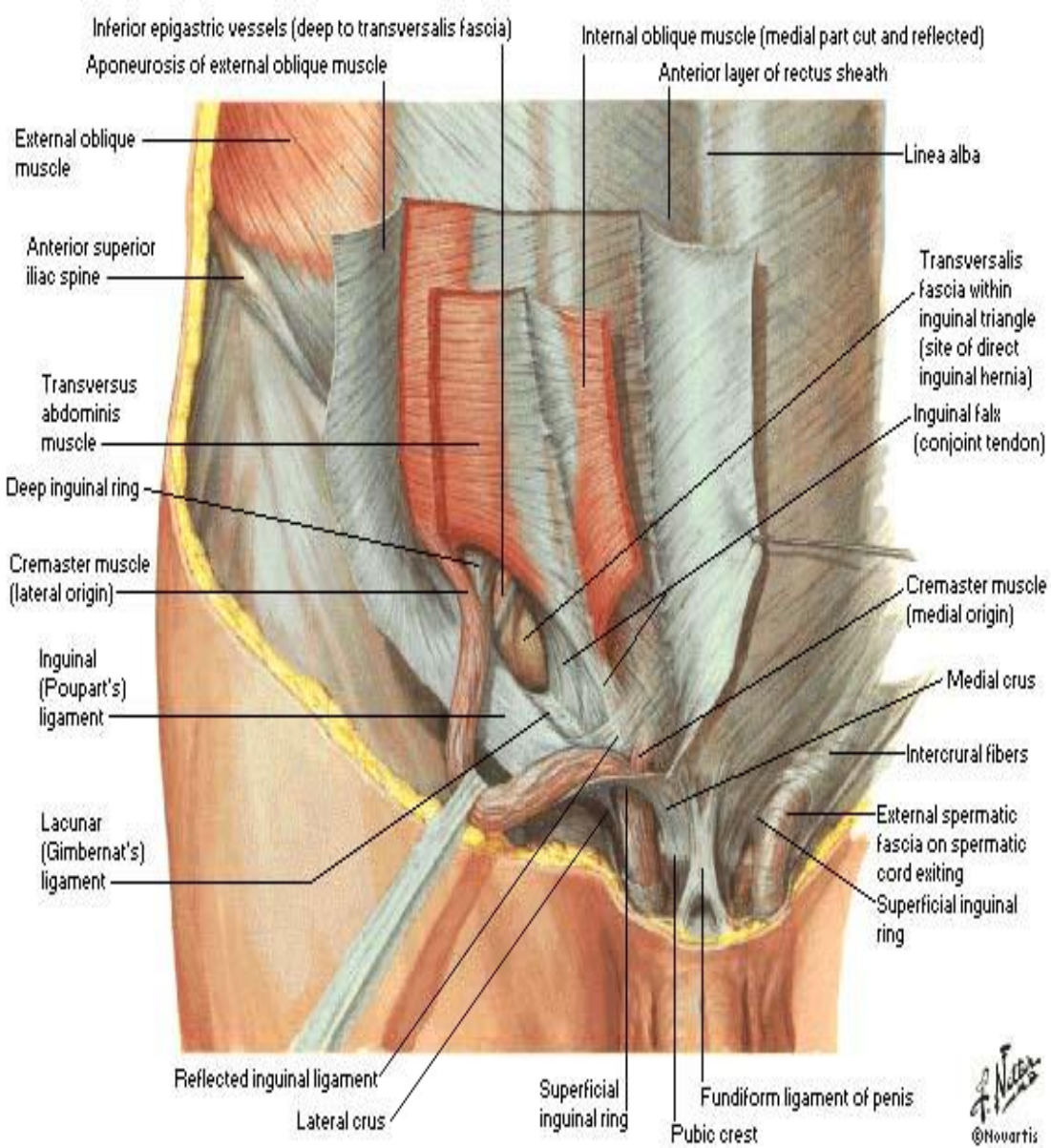
Inguinal ligament

Lacunar ligament

Pectineal ligament

Boundaries of inguinal canal

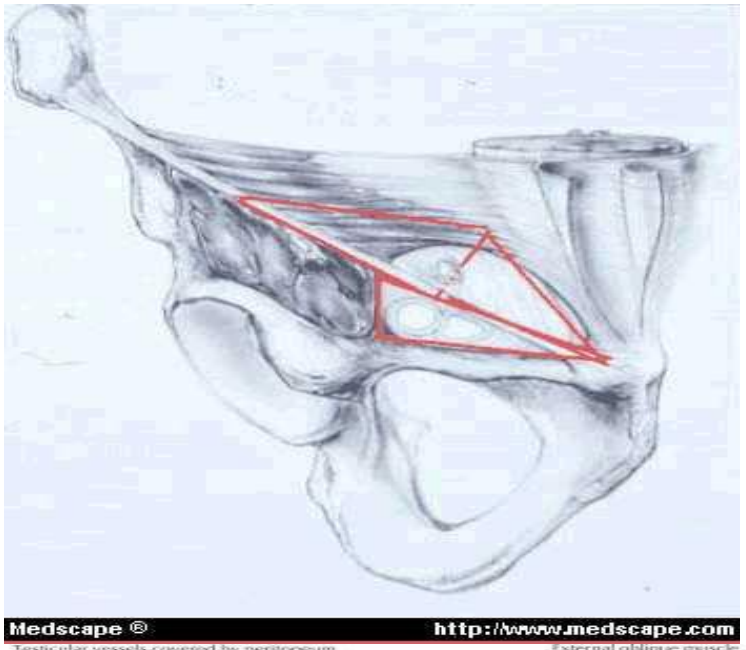
Formation of rectus sheath (

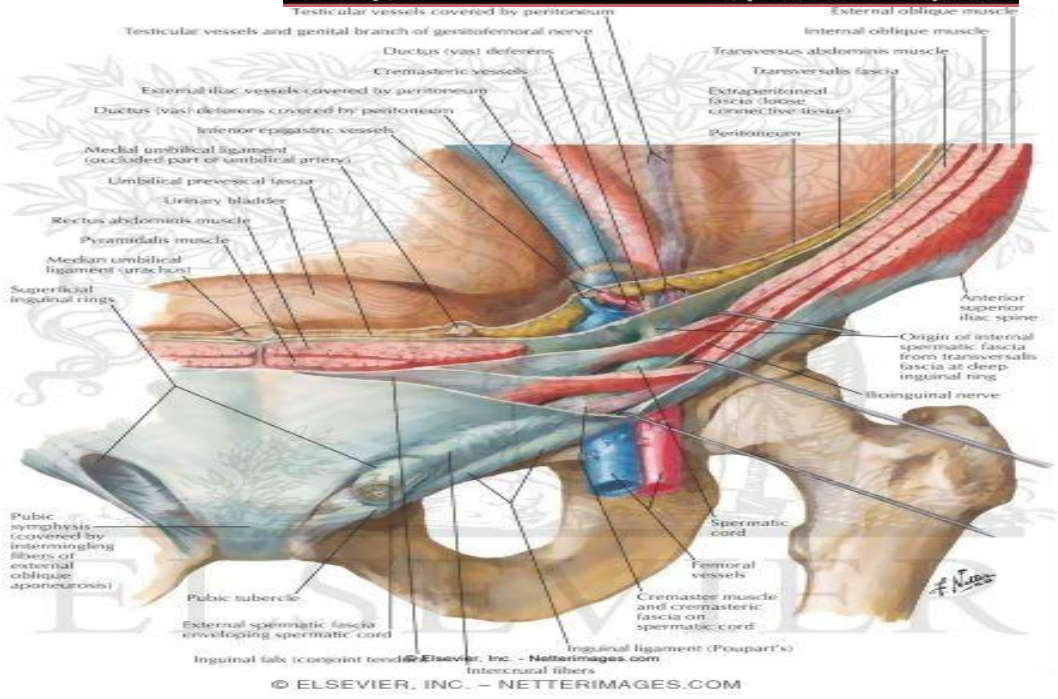


Inguinal ligament

1- folded back ward the lower border of aponeurosis of external muscle on it self

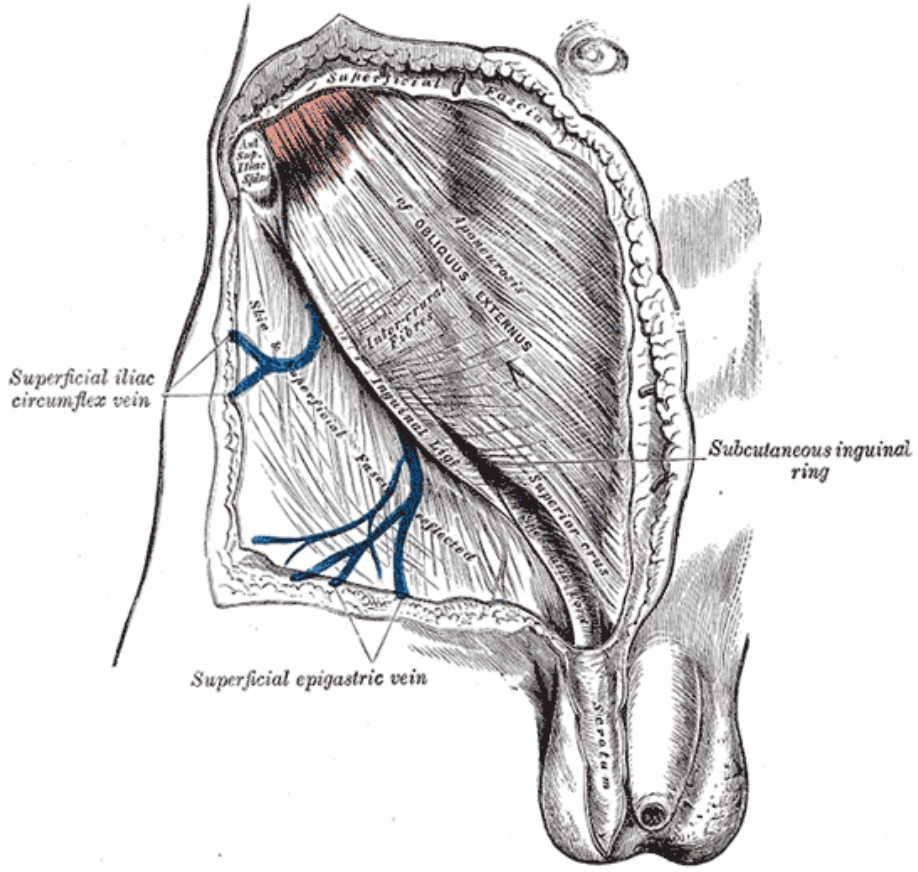
2- between ant.sup.iliac spine and the pupic tubercle

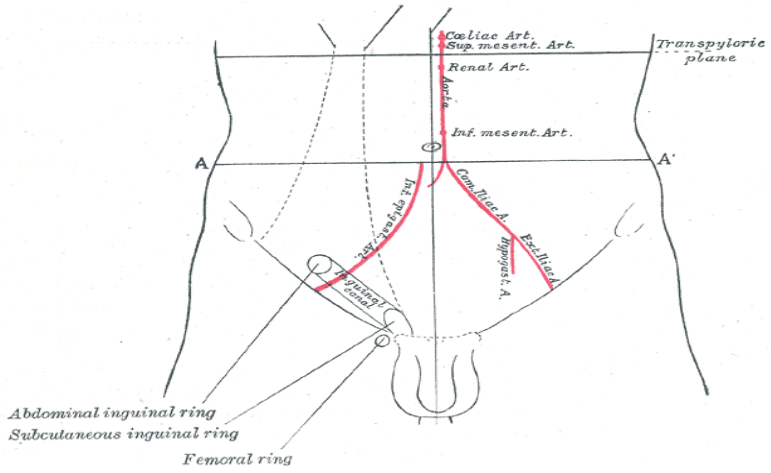


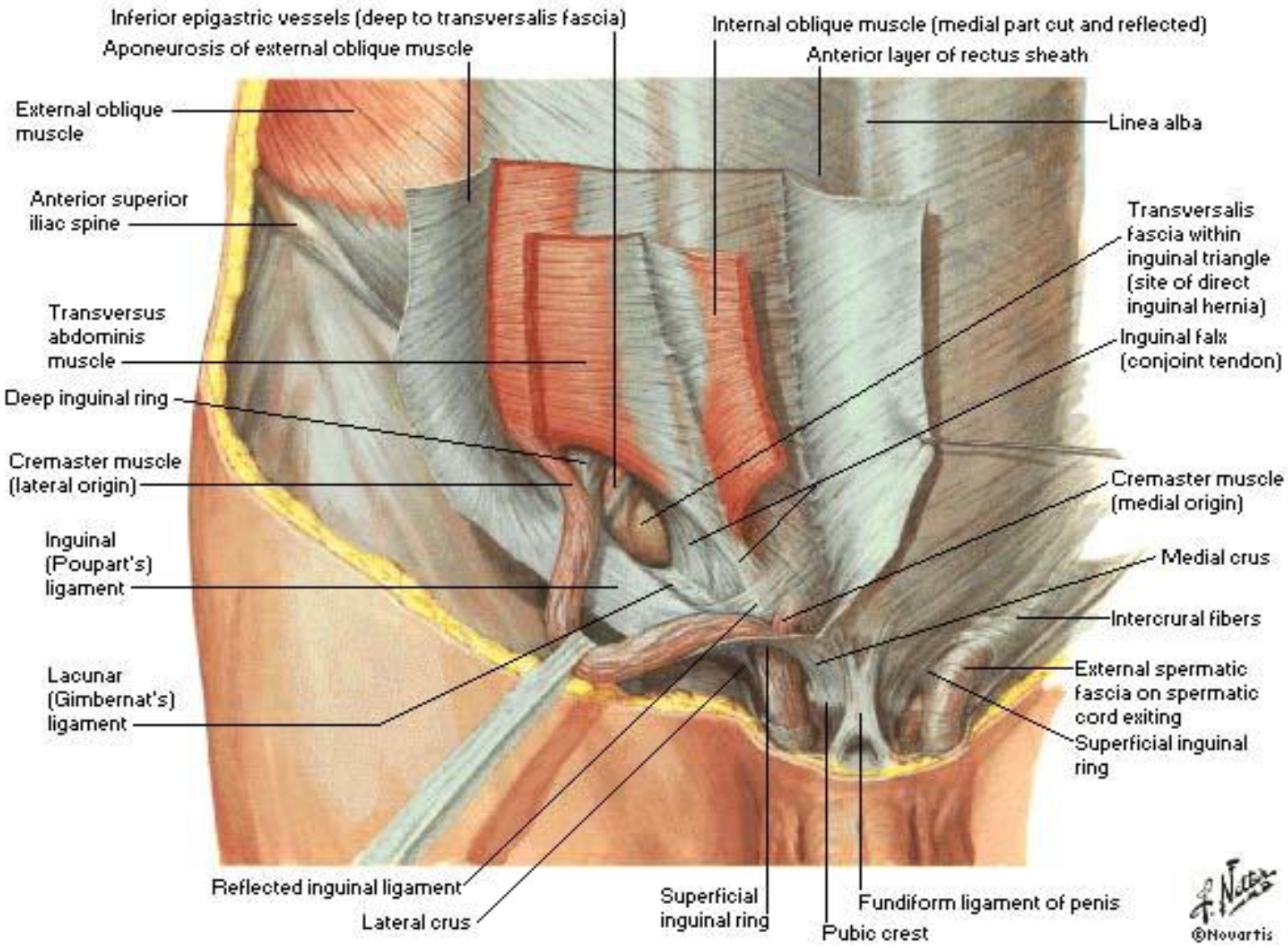


Superficial inguinal ring.

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





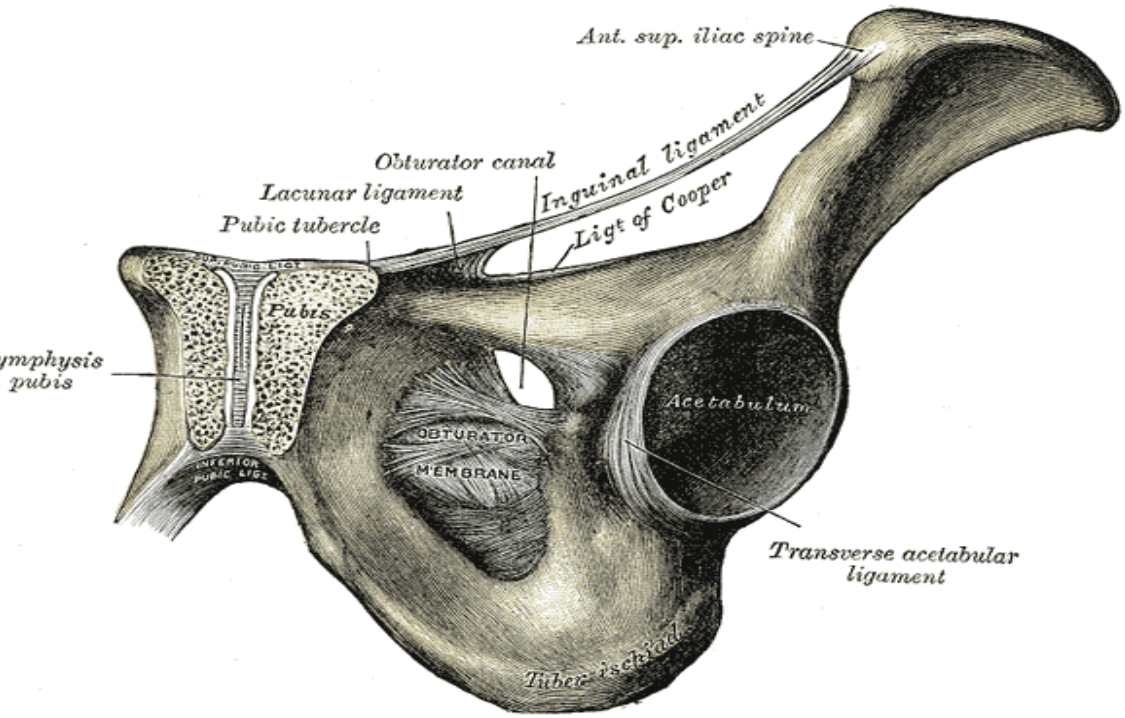

Inferior epigastric vessels (deep to transversalis fascia)
Aponeurosis of external oblique muscle
Internal oblique muscle (medial part cut and reflected)
Anterior layer of rectus sheath
External oblique muscle
Linea alba
Anterior superior iliac spine
Transversalis fascia within inguinal triangle (site of direct inguinal hernia)
Transversus abdominis muscle
Inguinal falx (conjoint tendon)
Deep inguinal ring
Cremaster muscle (lateral origin)
Cremaster muscle (medial origin)
Inguinal (Poupart's) ligament
Medial crus
Intercrural fibers
Lacunar (Gimbernat's) ligament
External spermatic fascia on spermatic cord exiting
Superficial inguinal ring
Reflected inguinal ligament
Lateral crus
Superficial inguinal ring
Pubic crest
Fundiform ligament of penis
©Novartis

Lacunar ligament

1- extension of aponeurosis of external muscle backward and upward to the pectineal line

2- on the superior ramus of the pupis

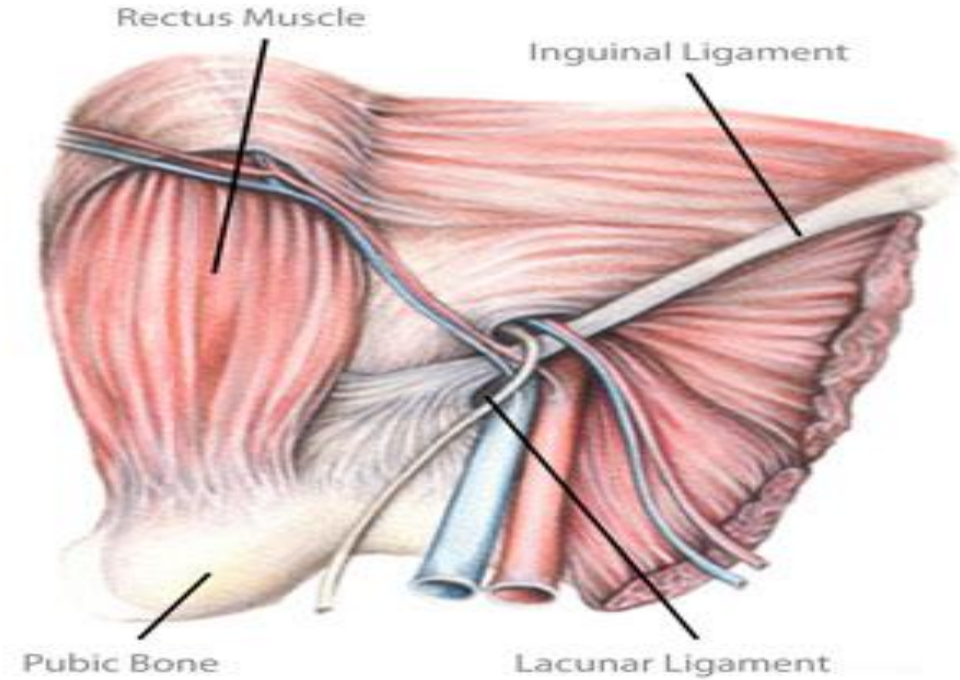
3- its sharp, free crecentric edge forms the medial margin of the femoral ring



Pectineal ligament

1- Continuation of the lacunar ligment at pectineal line

2- Continuation with a thickeing of the periosteum



Internal Oblique

✓ Direction:

upward forward medially

✓ Origin

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

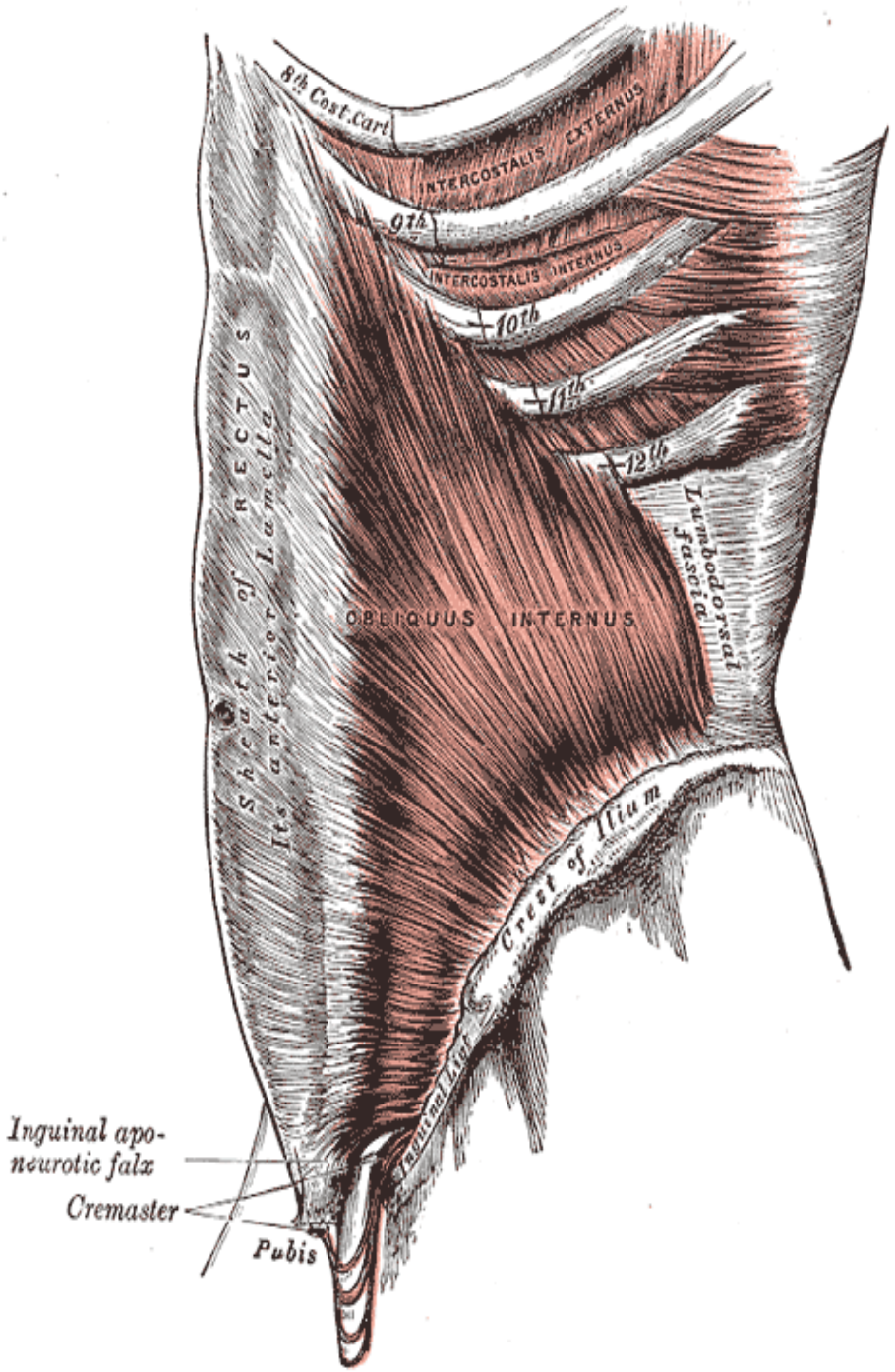
✓ Insertion

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

–

✓ Nerve Supply

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



Internal oblique muscle……..cont

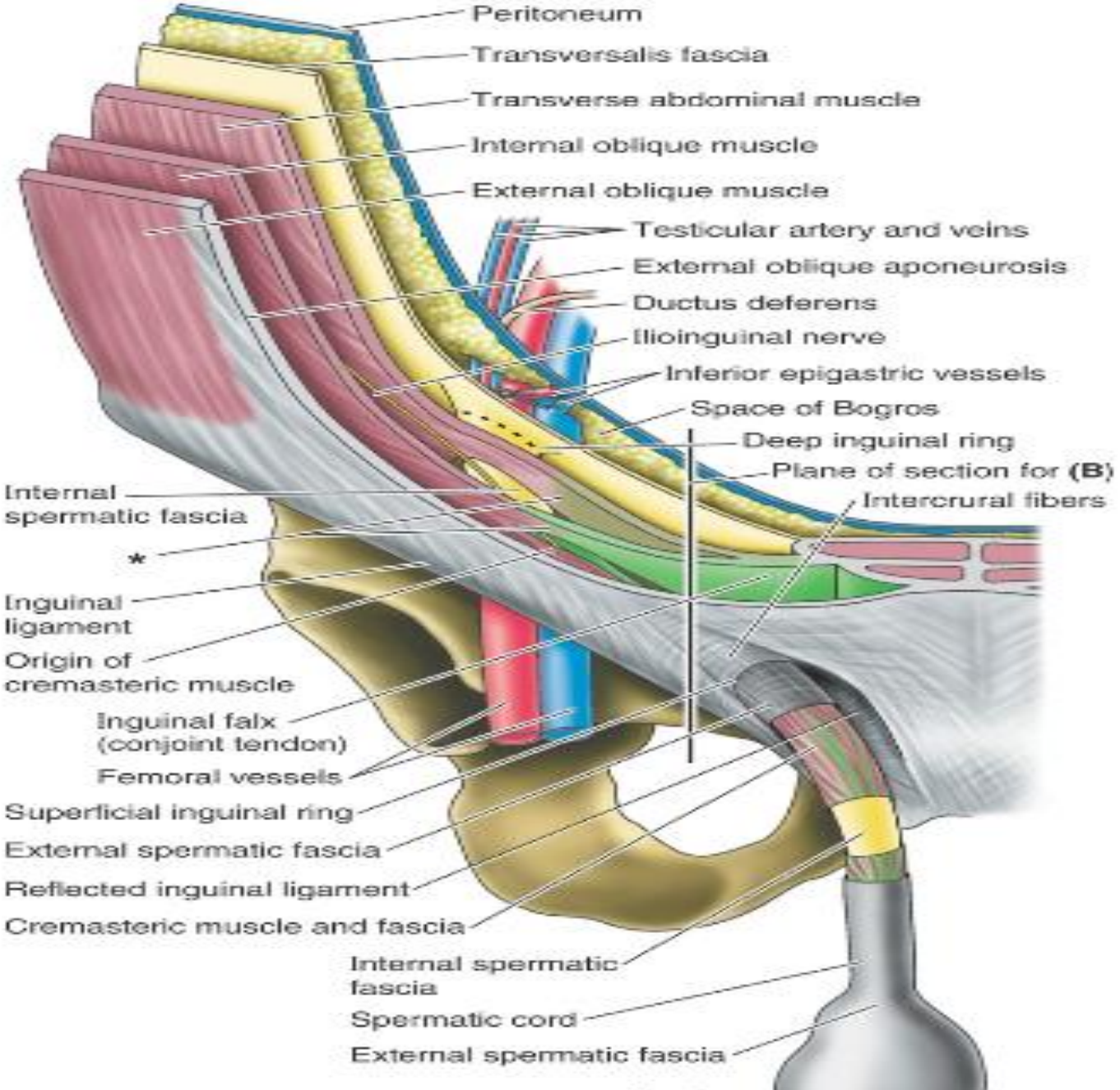
Conjoint tendon

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

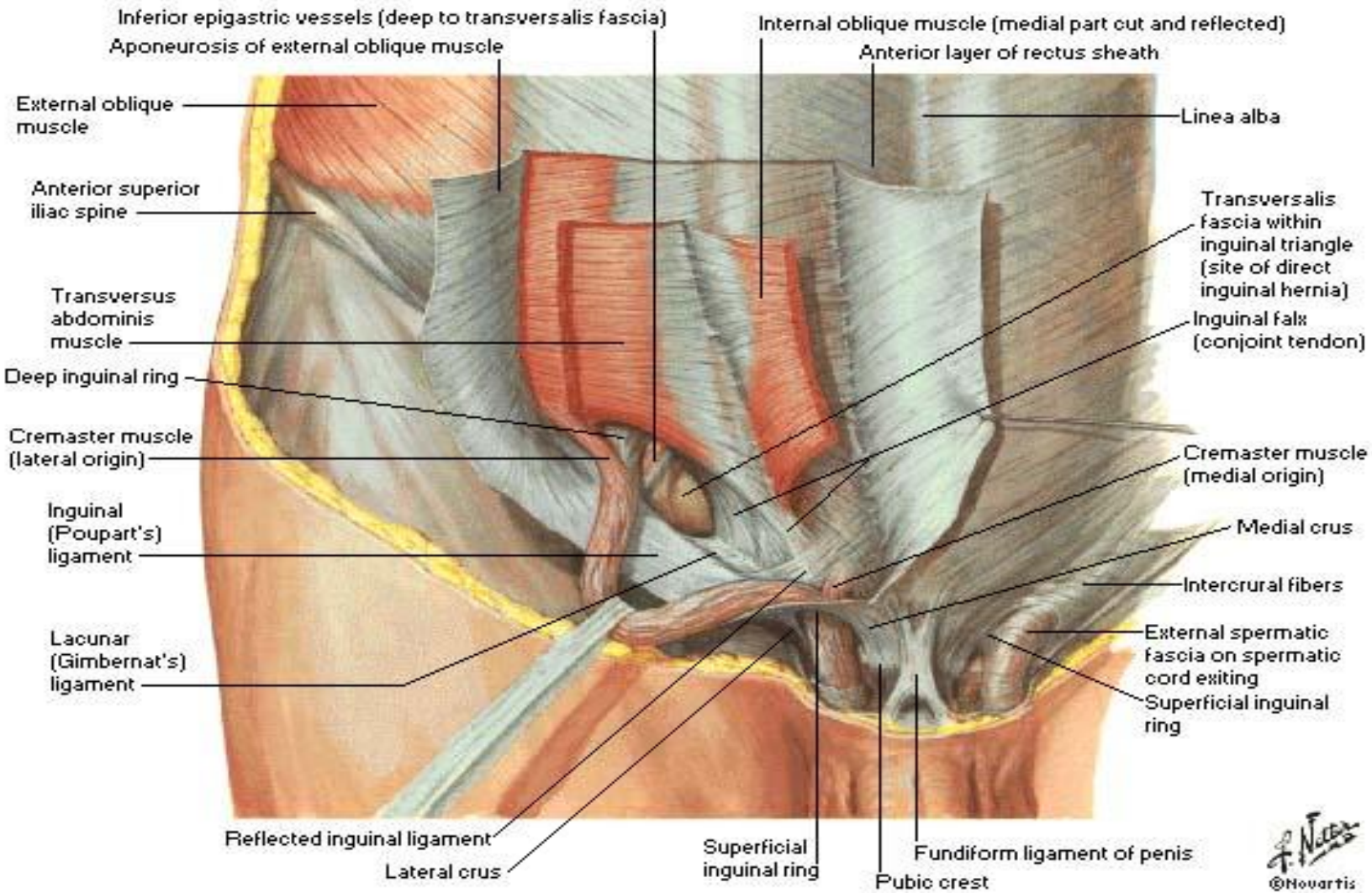
Cremastric fascia

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**


Peritoneum
Transversalis fascia
Transverse abdominal muscle
Internal oblique muscle
External oblique muscle
Testicular artery and veins
External oblique aponeurosis
Ductus deferens
Ilioinguinal nerve
Inferior epigastric vessels
Space of Bogros
Deep inguinal ring
Plane of section for (B)
Intercrural fibers
Internal spermatic fascia
*
Inguinal ligament
Origin of cremasteric muscle
Inguinal falx (conjoint tendon)
Femoral vessels
Superficial inguinal ring
External spermatic fascia
Reflected inguinal ligament
Cremasteric muscle and fascia
Internal spermatic fascia
Spermatic cord
External spermatic fascia

Conjoint tendon & Cremastric 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.

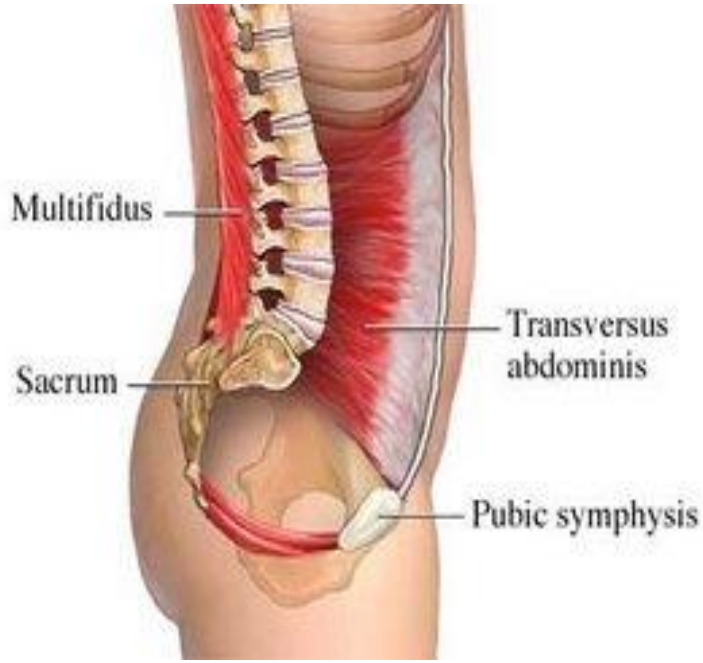
✓ **Insertion**

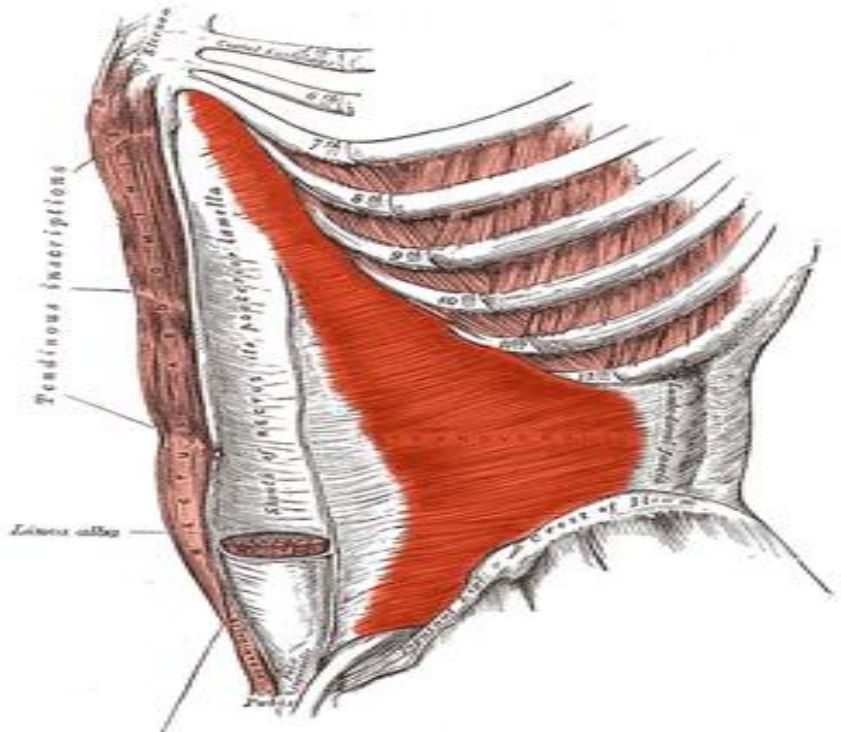
Xiphoid process, Linea alba, symphysis pubis.

✓ 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**

Symphsis pubis, pubic crest

✓ **Insertion**

$5^{th,}$ 6^{th} and 7^{th} costal cartilage & xiphoid process.

✓ **Nerve Supply**

Lower 6^{th} thoracic nerves

Rectus abdominis muscle……cont

- Linea semilunaris
- Tendinous intersection:

Lines & Land marks of the Anterior Abdominal Wall

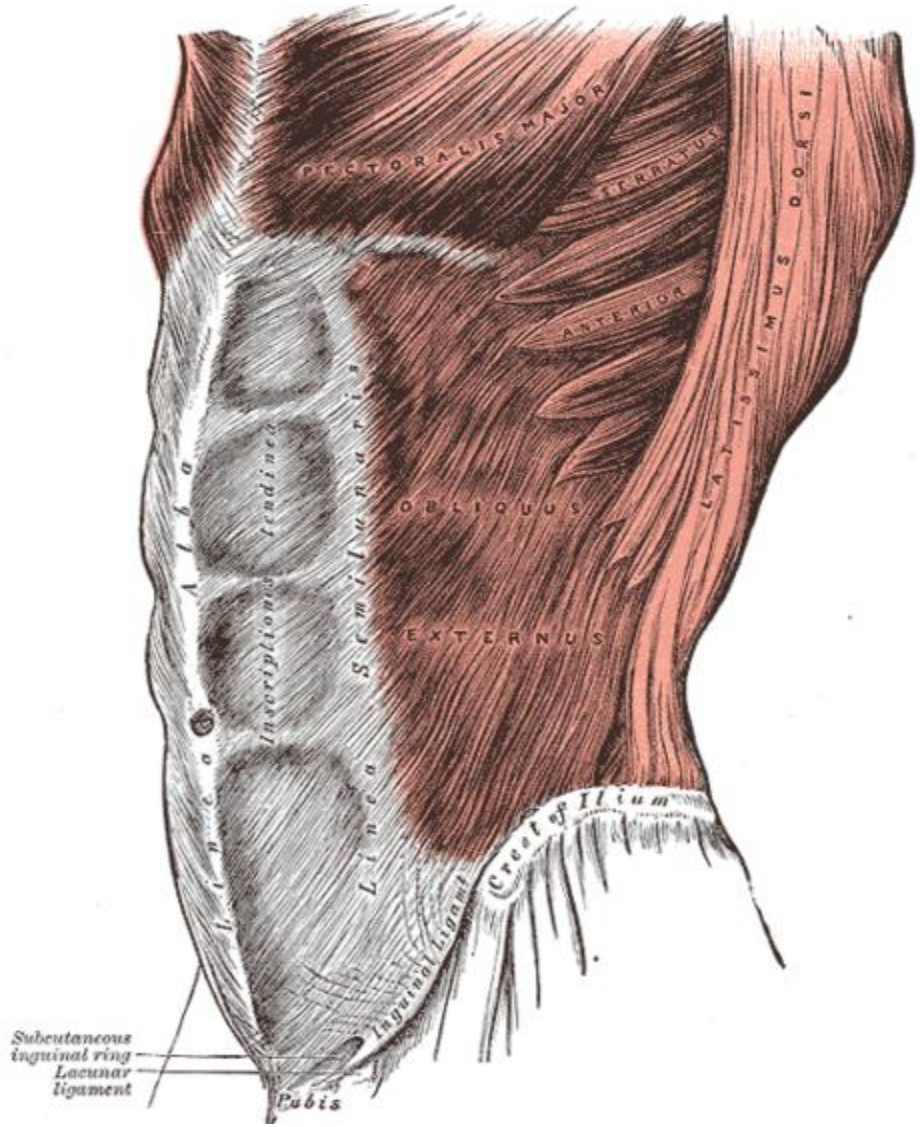
Linea alba:

- Located along the midline.

-Between the xiphoid process & symphysis pupis

- Formed by the fusion of aponeurosises 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 pupic tubercle



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 pupis

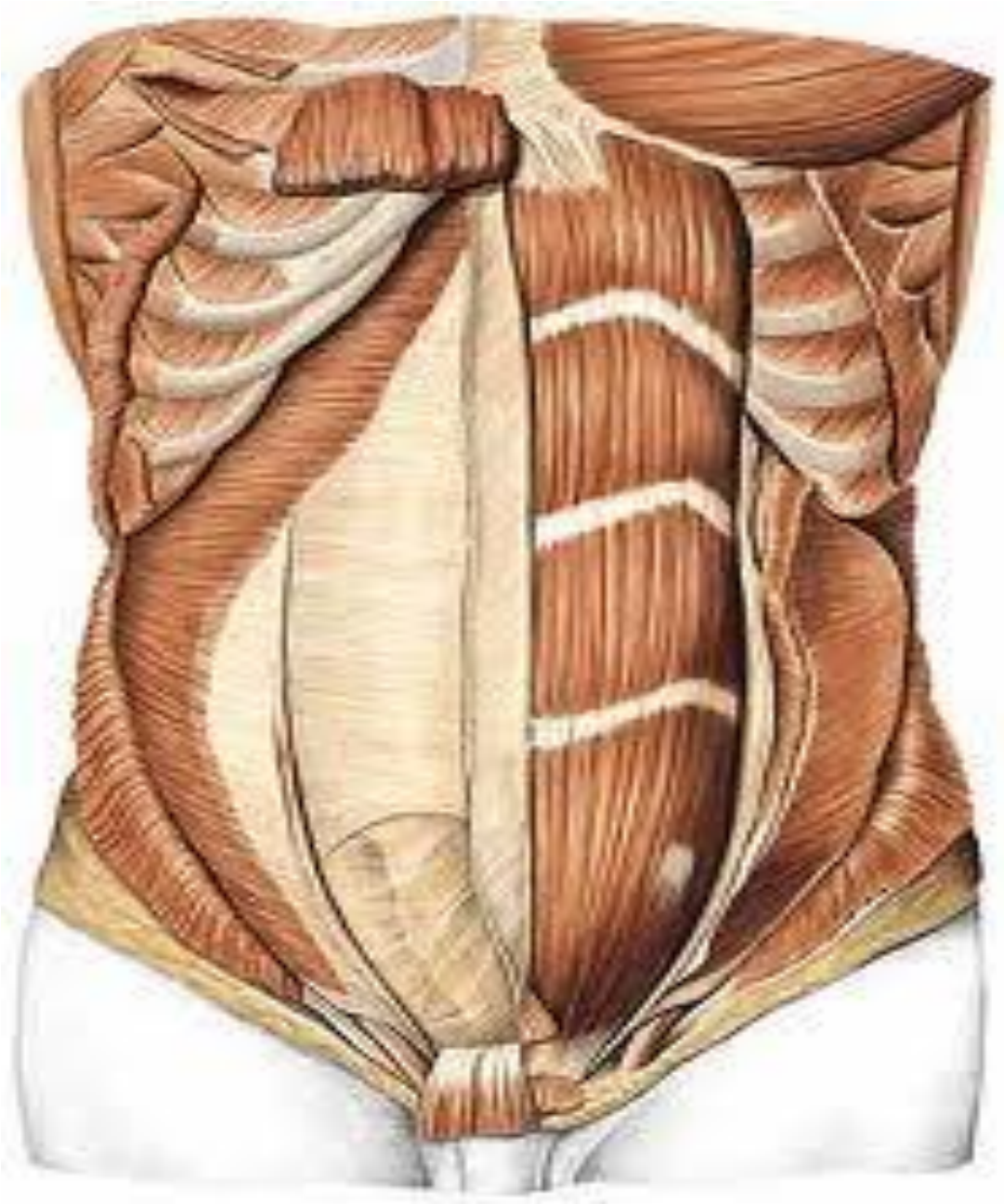
Insertion:

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.
- **Contents**
  - Rectus abdominis muscle
  - Pyramidalis muscle (if present)
  - The anterior rami of the lower six thoracic nerves
  - The superior and inferior epigastric vessels
  - Lymphatic vessels.

Rectus sheath…….cont

- Description the rectus sheath is considered at three levels.

1- Above the costal margin

2- Between the costal margin and *the level of the anterior superior iliac spine*

3- *Between the level of the anteriorsuperior iliac spine and* the anterior wall of the pubis.

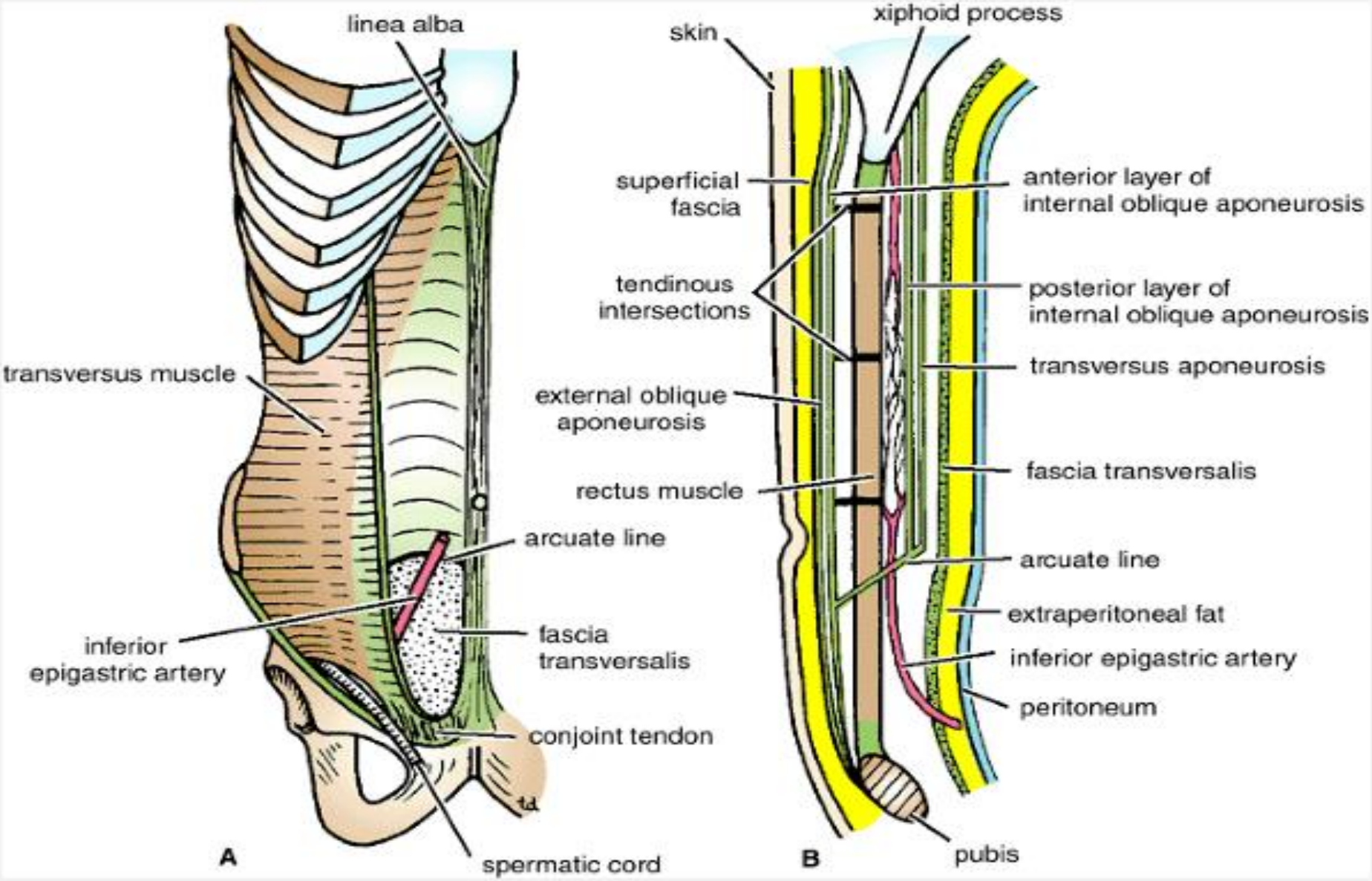
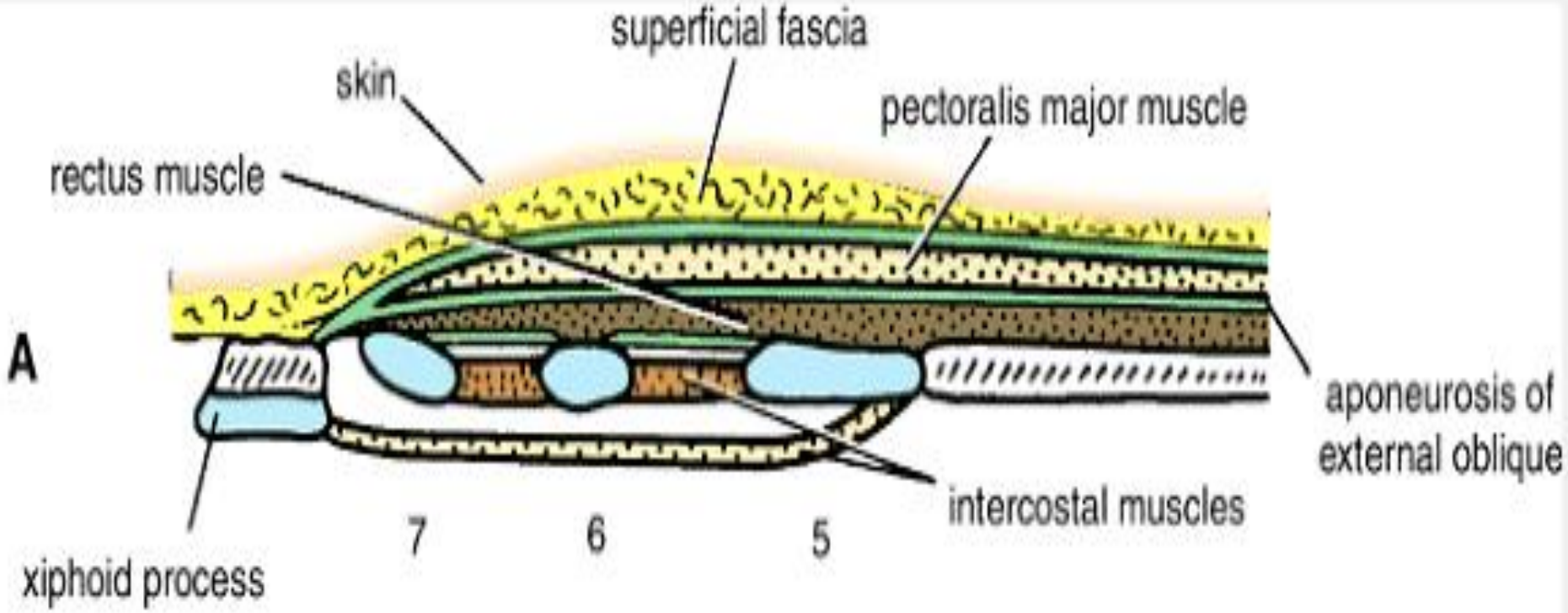


Figure 4-10 Rectus sheath in anterior view **(A)** and in sagittal section **(B)**. Note the arrangement of the aponeuroses forming the rectus sheath.

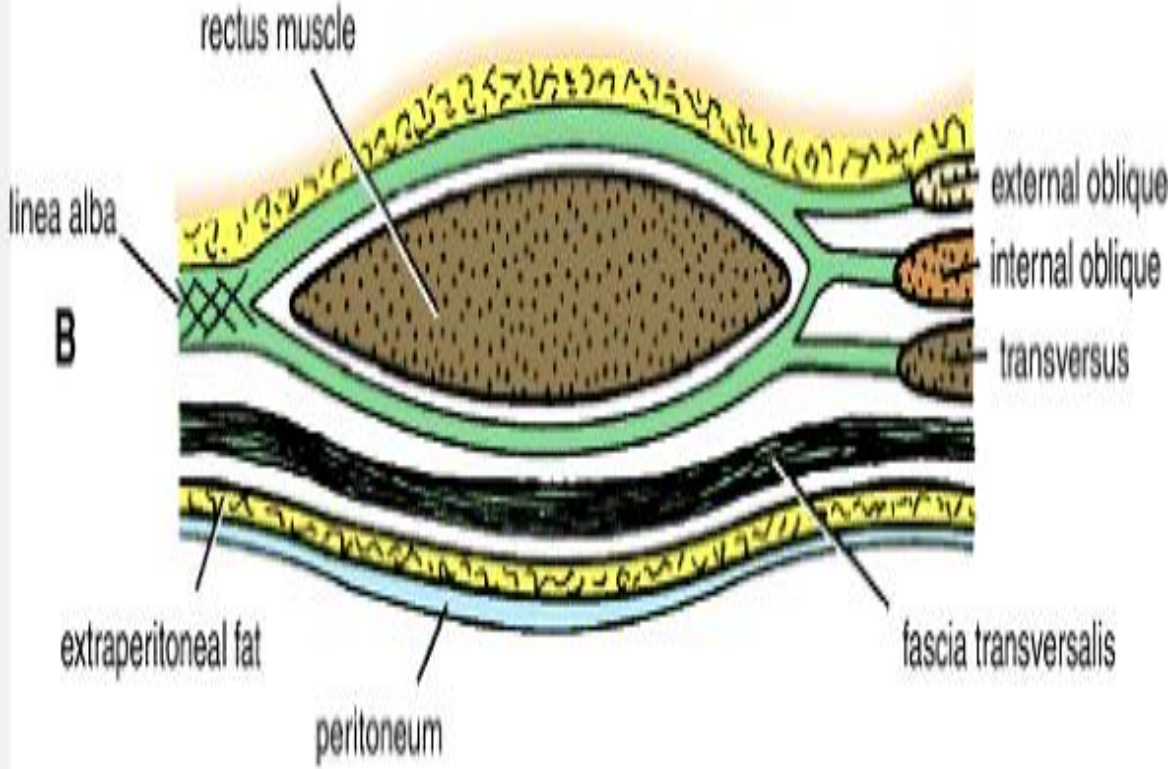


***ABOVE THE COSTAL MARGIN*,**

- ANTERIOR WALL # APONEUROSIS OF THE EXTERNAL OBLIQUE.
- POSTERIOR WALL # THORACIC WALL THAT IS, THE FIFTH, SIXTH, AND SEVENTH COSTAL CARTILAGES AND THE INTERCOSTAL SPACES.

Between the costal margin* and *the level of the anterior superior iliac spine

- 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.



Between the level of the anterosuperior iliac 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.

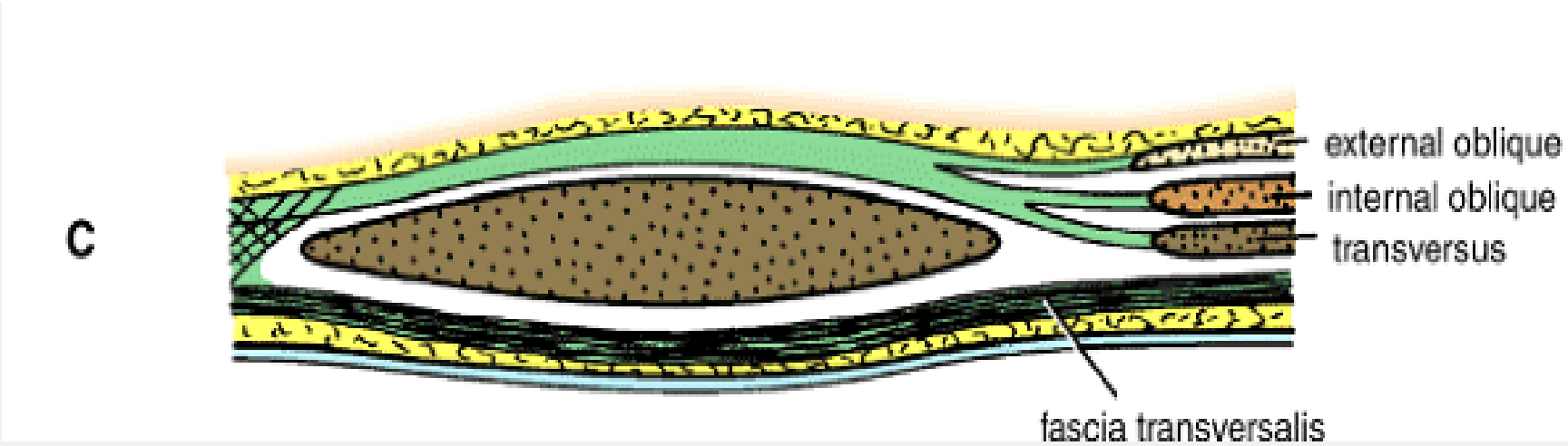


Figure 4-13 Transverse sections of the rectus sheath seen at three levels. **A**. Above the costal margin. **B**. Between the costal margin and the level of the anterior superior iliac spine. **C**. Below the level of the anterior superior iliac spine and above the pubis.

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.

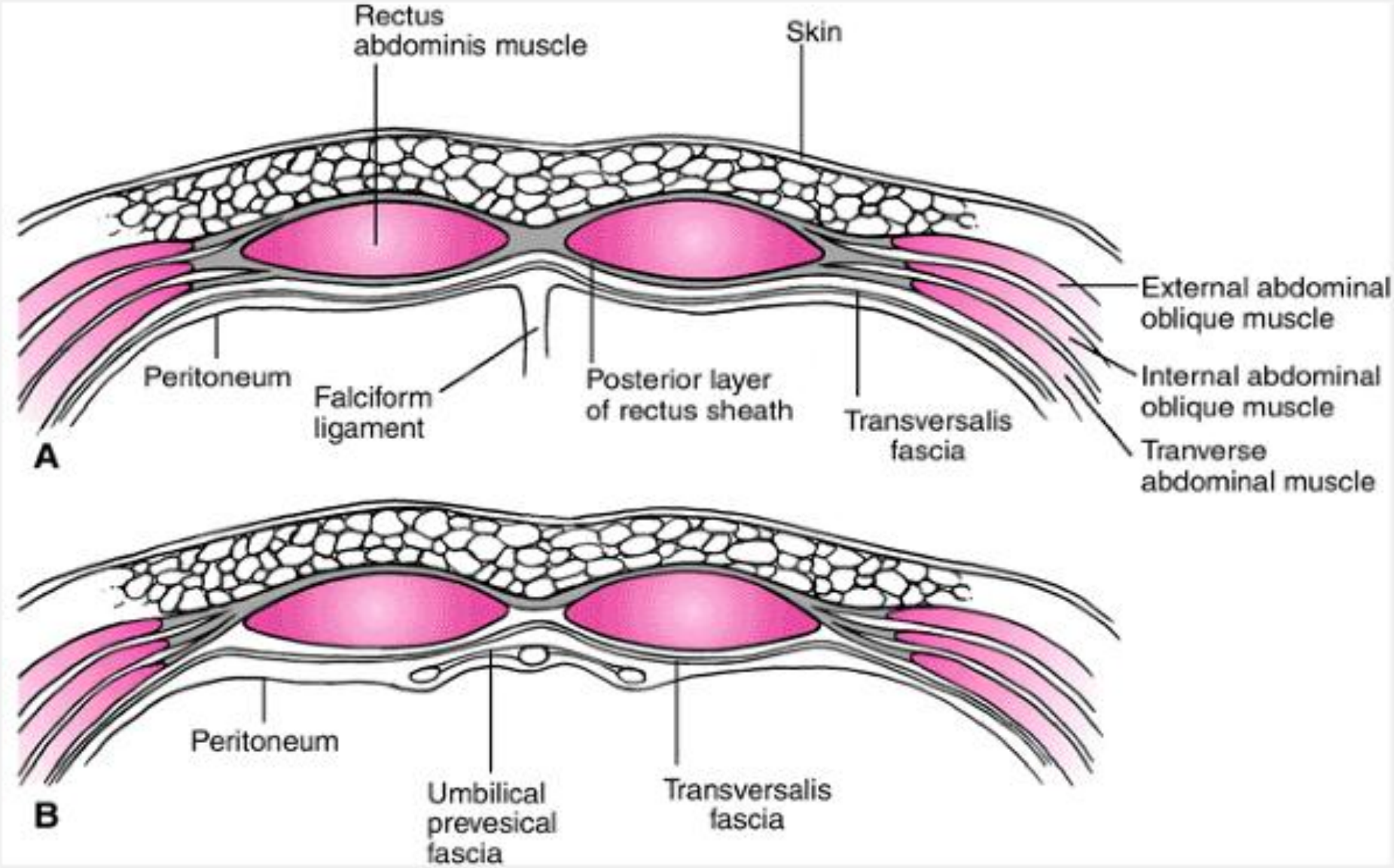


Figure 5-2 Arrangement of the rectus sheath above the umbilicus (upper) and below the arcuate line (lower).

Others fascia in the ant. abd.ominal wall

❖ Transversalis fascia

- a thin layer of fascia 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.

❖ Parietal peritoneum

✓ It is a thin serous membrane

✓ Continuous below with the parietal peritoneum lining the pelvis.

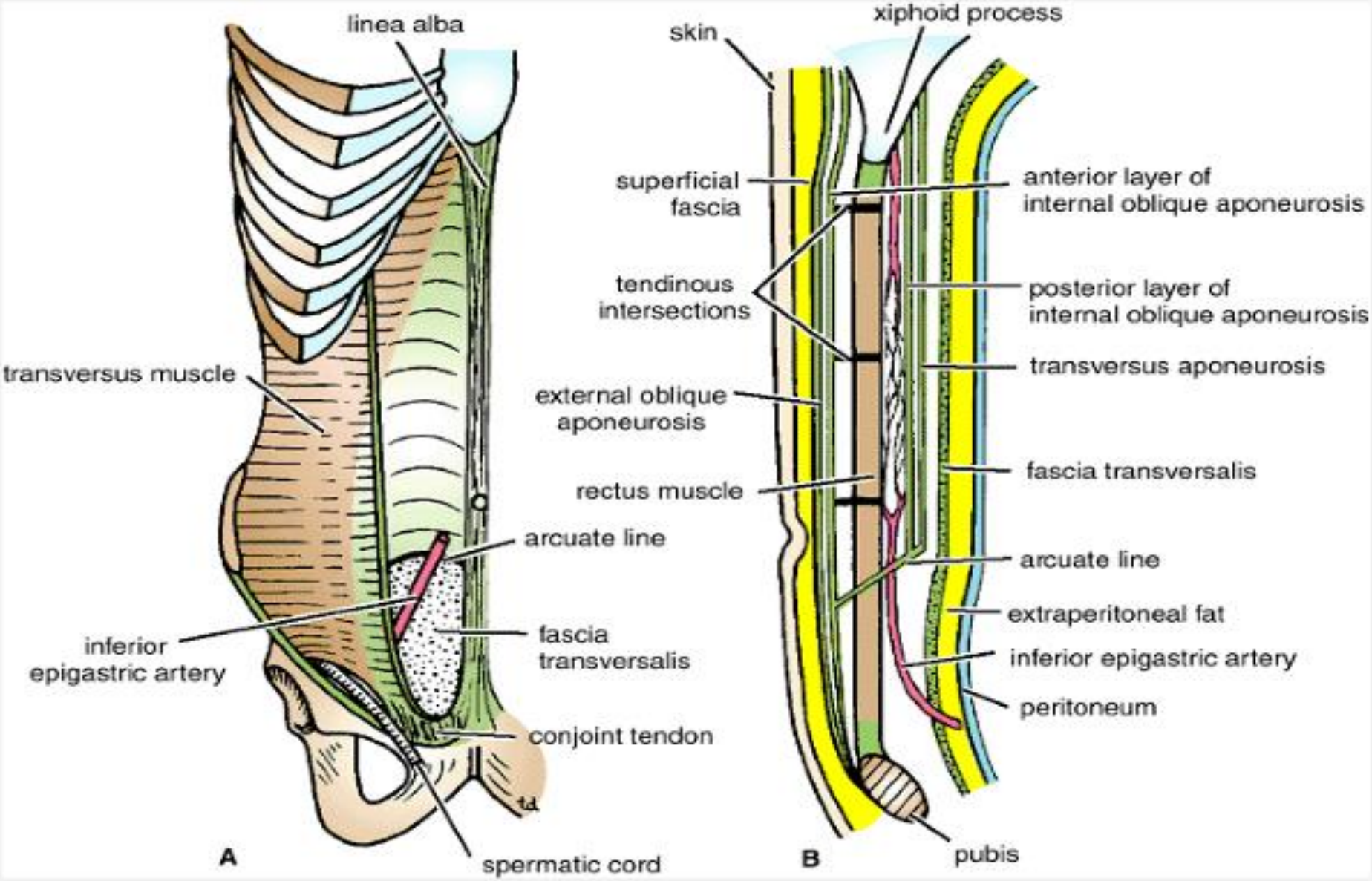
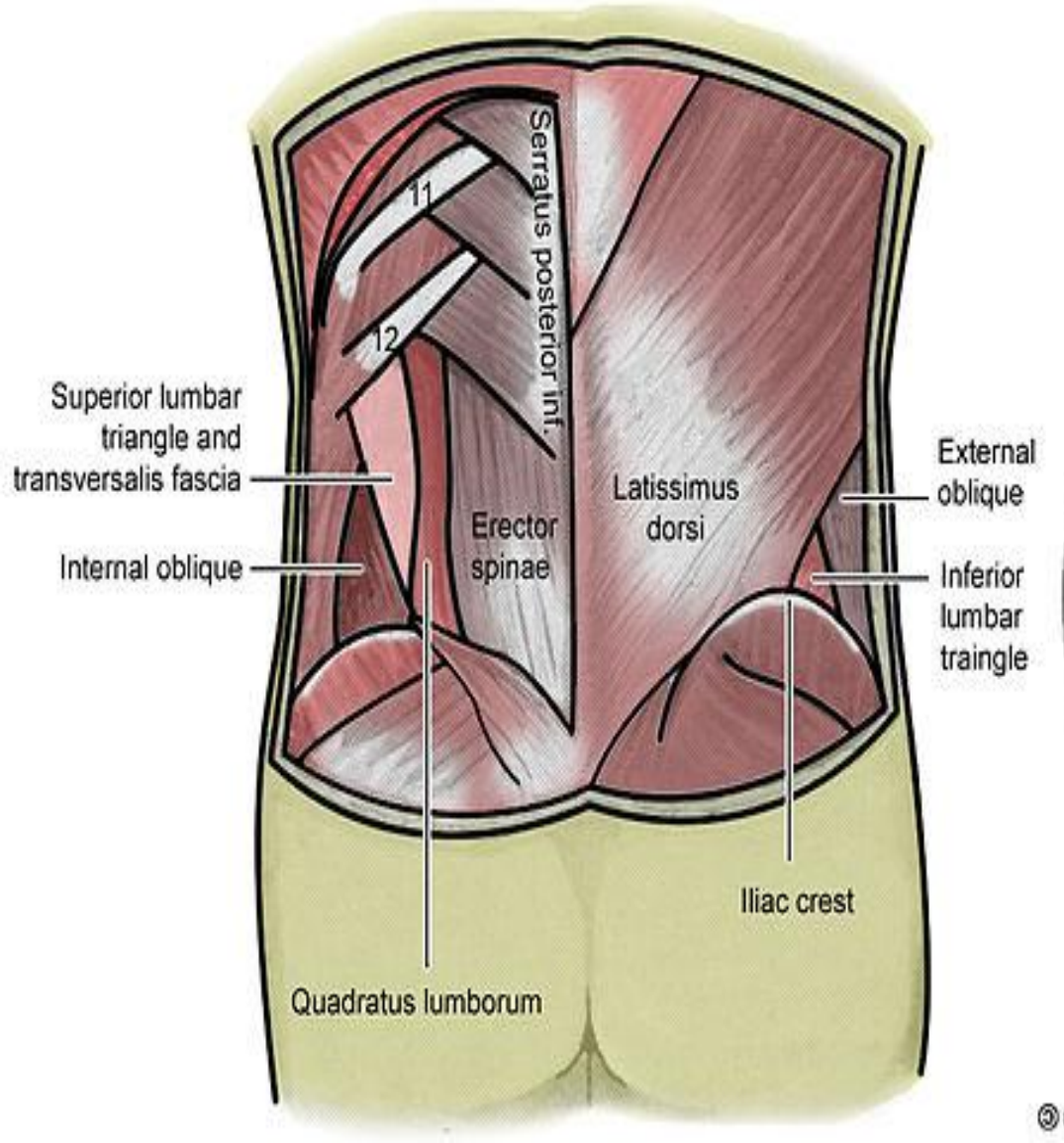
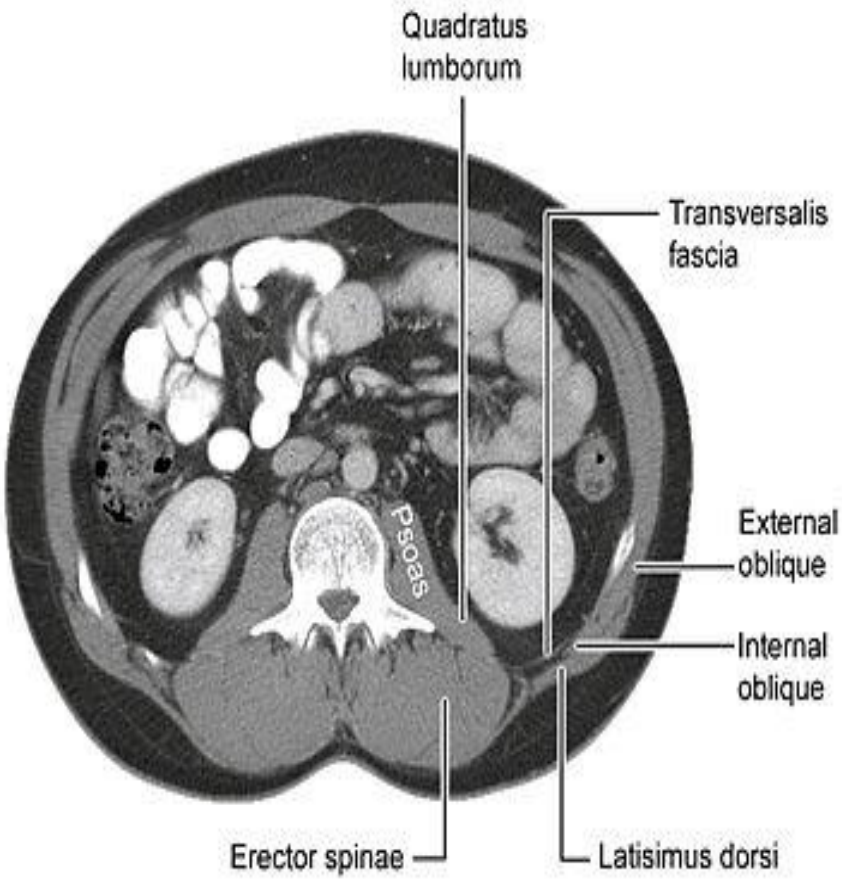


Figure 4-10 Rectus sheath in anterior view **(A)** and in sagittal section **(B)**. Note the arrangement of the aponeuroses forming the rectus sheath.

Lumbar triangle





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.

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

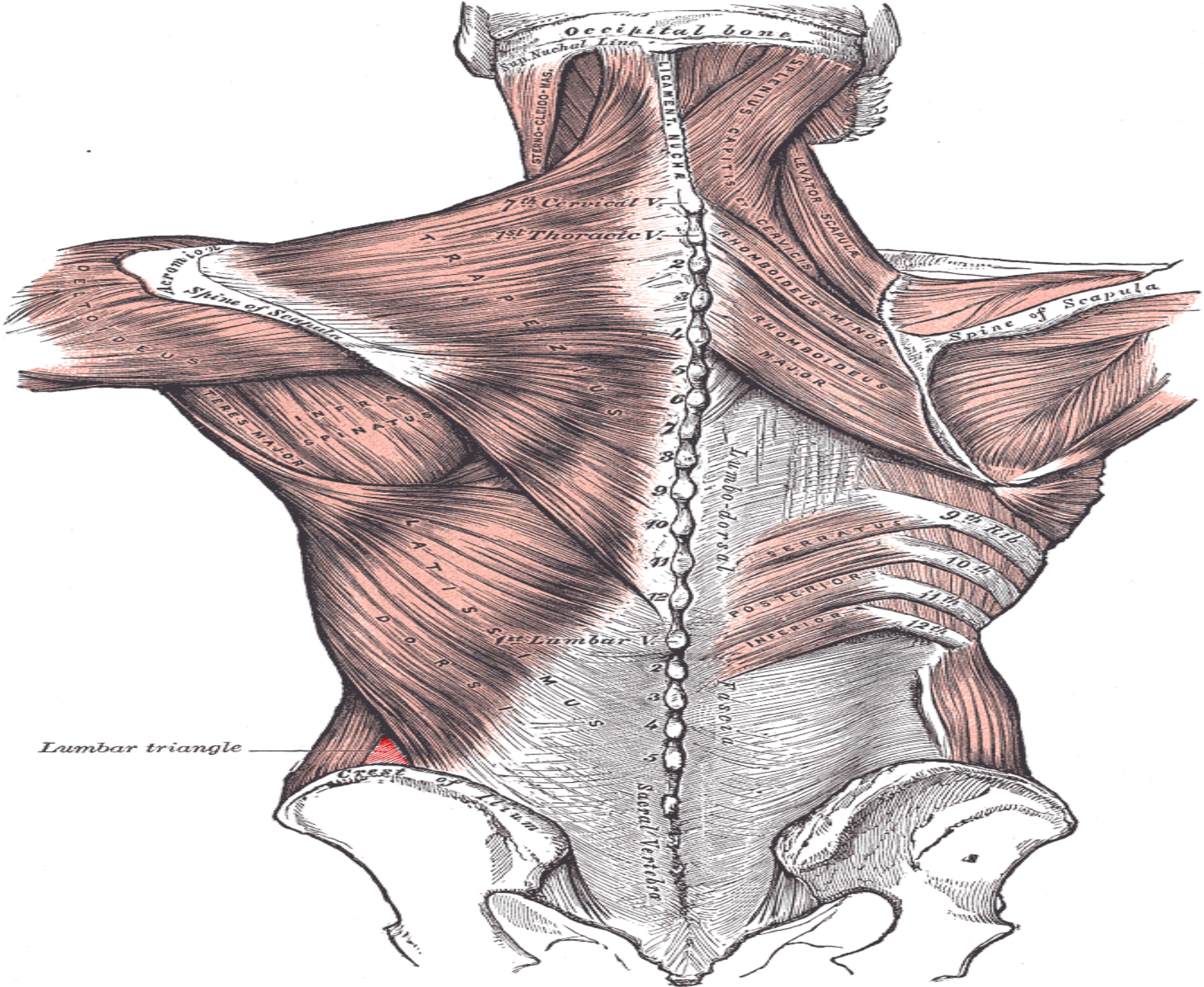
Medially: by the quadratus lumborum muscle

laterally :by the internal abdominal oblique muscle

Superiorly: by the 12th rib.

The floor : transversalis fascia

Roof: is the external abdominal oblique muscle


Occipital bone
Sup. Nuchal Line
STERNO-CLEIDO-MAST.
LIGAMENT. NUCHÆ
SPLENIUS CAPITIS ET CERVICIS
LEVATOR SCAPULÆ
7th Cervical V.
1st Thoracic V.
TRAPEZIUS
RHOMBOIDEUS MINOR
RHOMBOIDEUS MAJOR
Acromion
Spine of Scapula
DELTOIDEUS
TERES MAJOR
LATISSIMUS DORSI
Sup. Lumbar V.
Lumbo-dorsal Fascia
SERRATUS POSTERIOR INFERIOR
9th Rib
10th
11th
12th
Lumbar triangle
Crest of Ilium
Sacral Vertebræ

Action of the Ant. Abdominal muscle

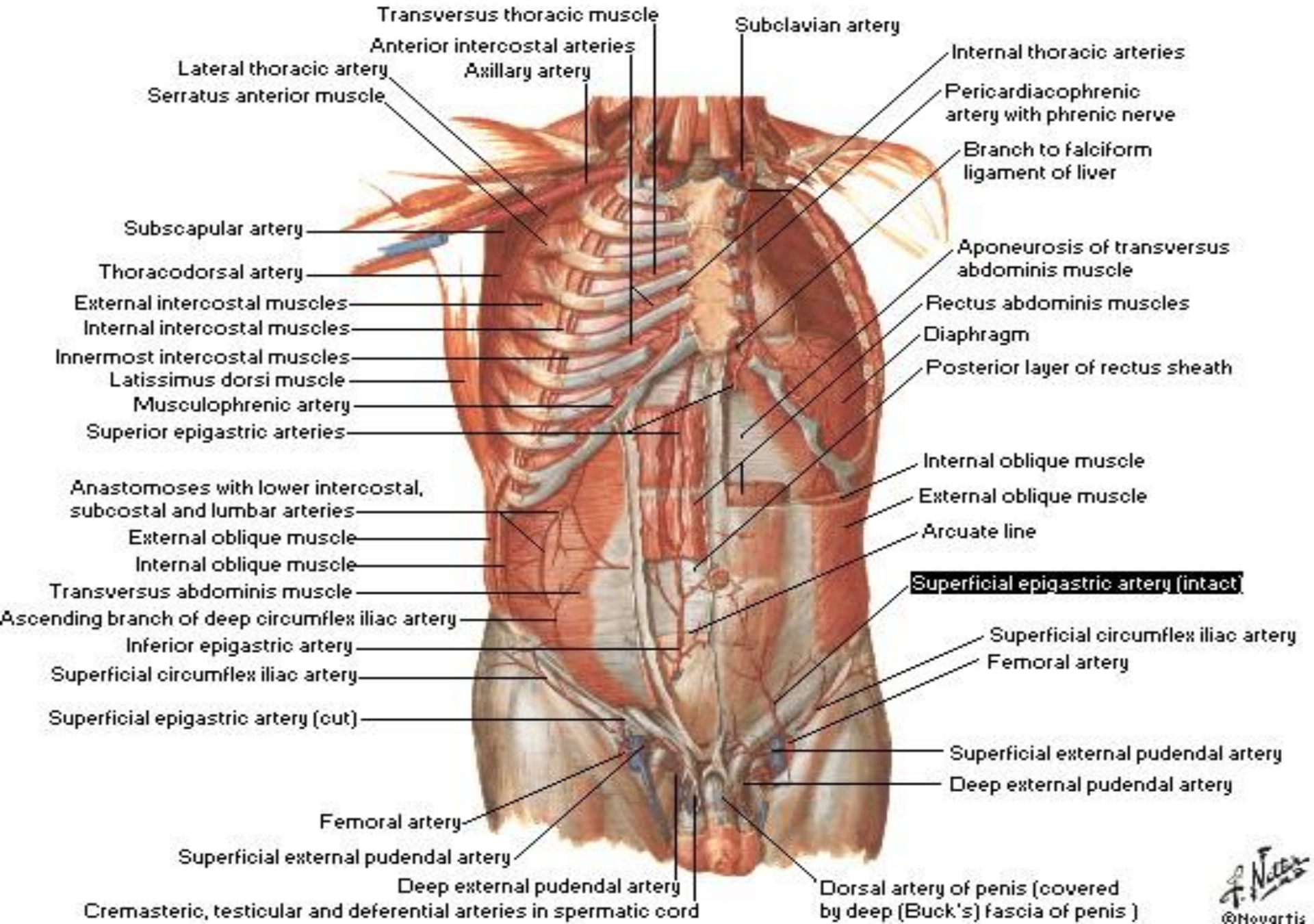
- Deep expiration
- Increase the intra abdominal pressure in
  - Vomiting
  - Cough
  - Defecation
  - Labour
- Protect viscera
- keep viscera in position
- Rectus abdominis → bends trunk forward

Blood supply of the ant. Abdominal wall

Arteries

- Sup. Epigastric artery
- Inf. Epigastric artery
- Intercostal arteries
- Lumbar arteries
- Deep circumflex artery

Arteries of Anterior Abdominal Wall



Blood supply……cont

Veins

1- Above the umbilicus

- Lat. Thoracic. vein.→ Axillary vein

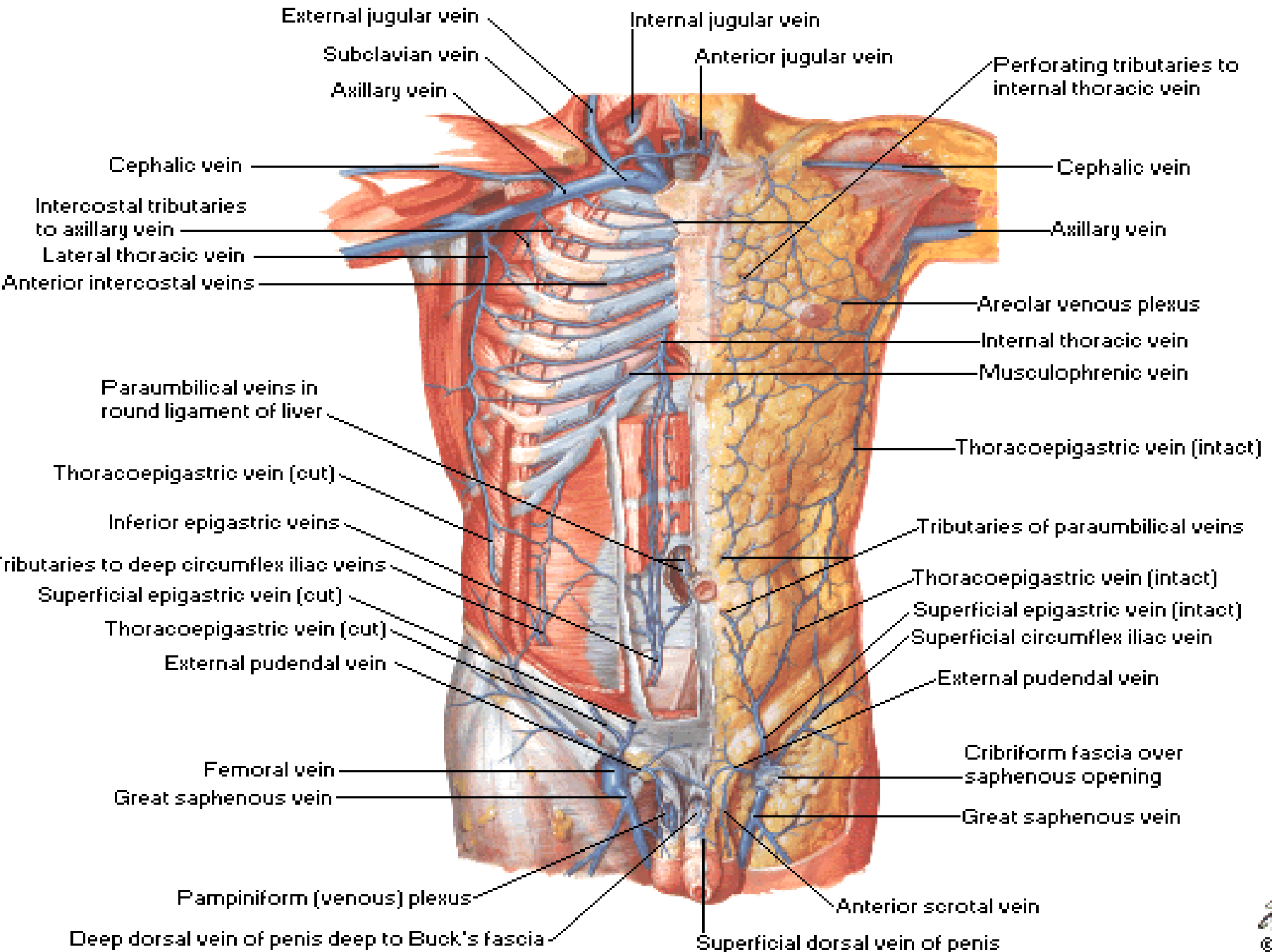
2- Below the umbilicus

- Inf. Epigastric → Femoral vein

3- Paraumbilica veins

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

Veins of Anterior Abdominal Wall



Nerve supply of the ant. Abdominal wall

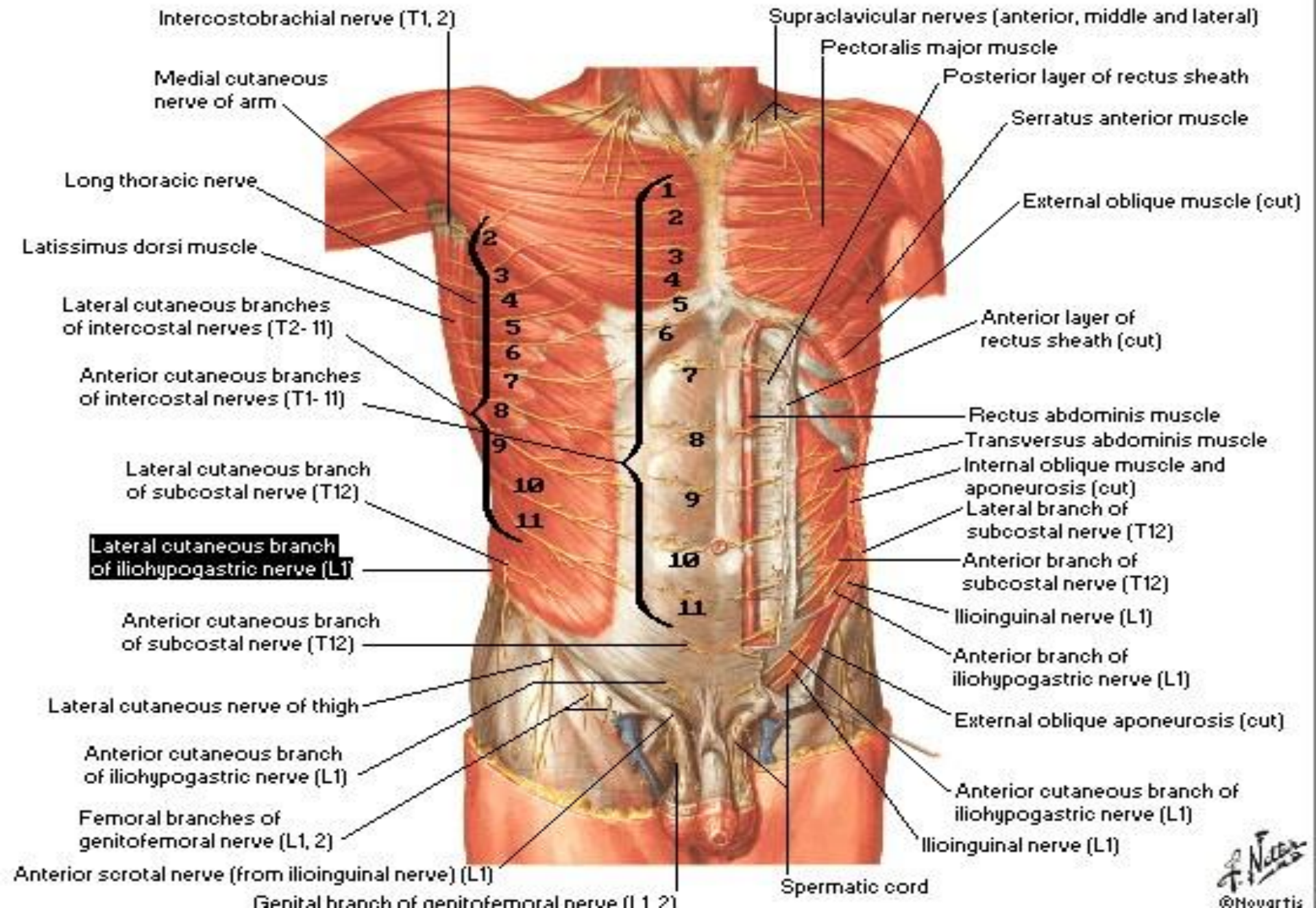
- **Thoracoabdominal nerve**: Lower 6th thoracic nerves & 12th subcostal nerve

- **Dermatomes** (Anterior, lateral cutaneous nerve terminal branches of Thoracoabdominal nerve
  - T7 to skin superior to umbilicus below xiphoid process
  - T10 to skin surrounding umbilicus
  - L1 to skin inferior to umbilicus above sym.pubis

- **LI 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

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 mad In the direction of the line of cleavage in the skin so that the hairline scare 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 incsion
- Midline incision
- Transrectus incision
- Transverse incision
- Muscle splitting
- Abdominothoracic incision