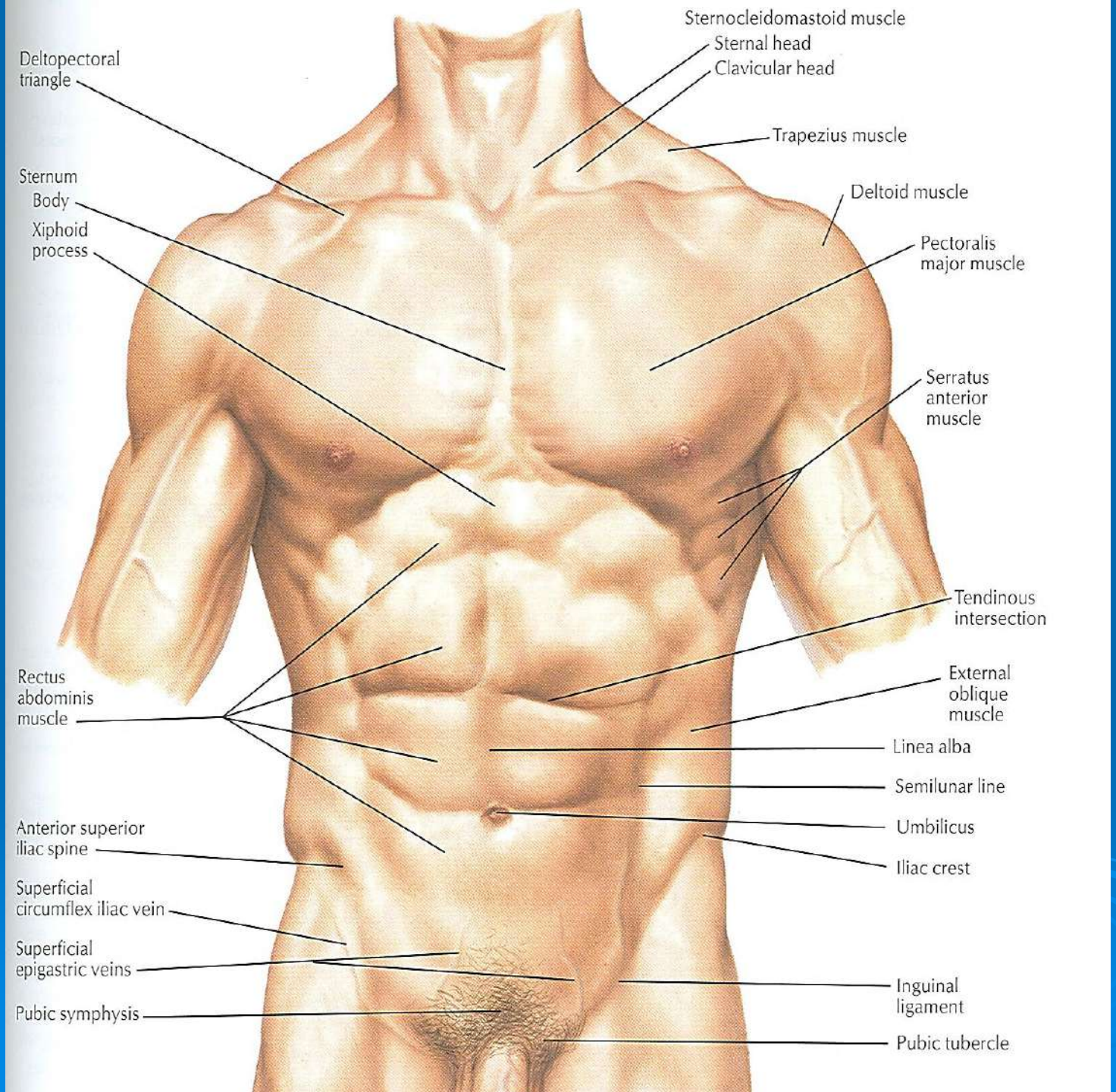
# ABDOMINAL WALL
# &
# RECTUS SHEATH

# Learning Objectives

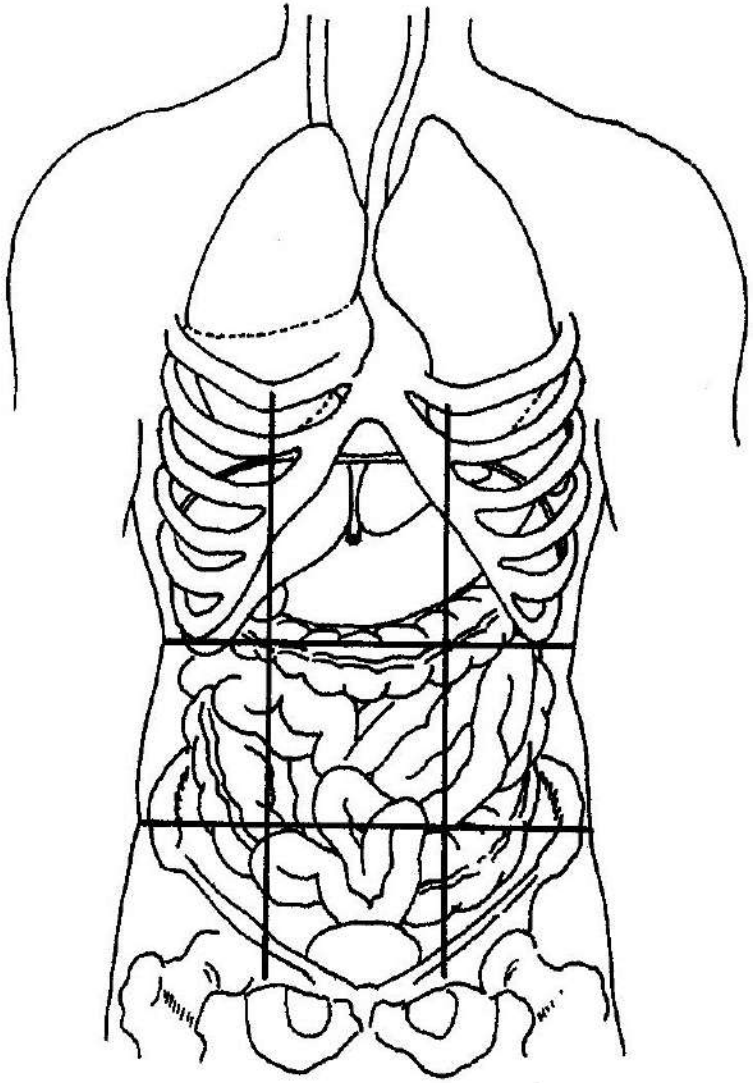
- Describe the anatomy, innervation and functions of the muscles of the anterior, lateral and posterior abdominal walls.
- Discuss their functional relations their roles in posture, ventilation and voiding of abdominal/pelvic/thoracic contents.

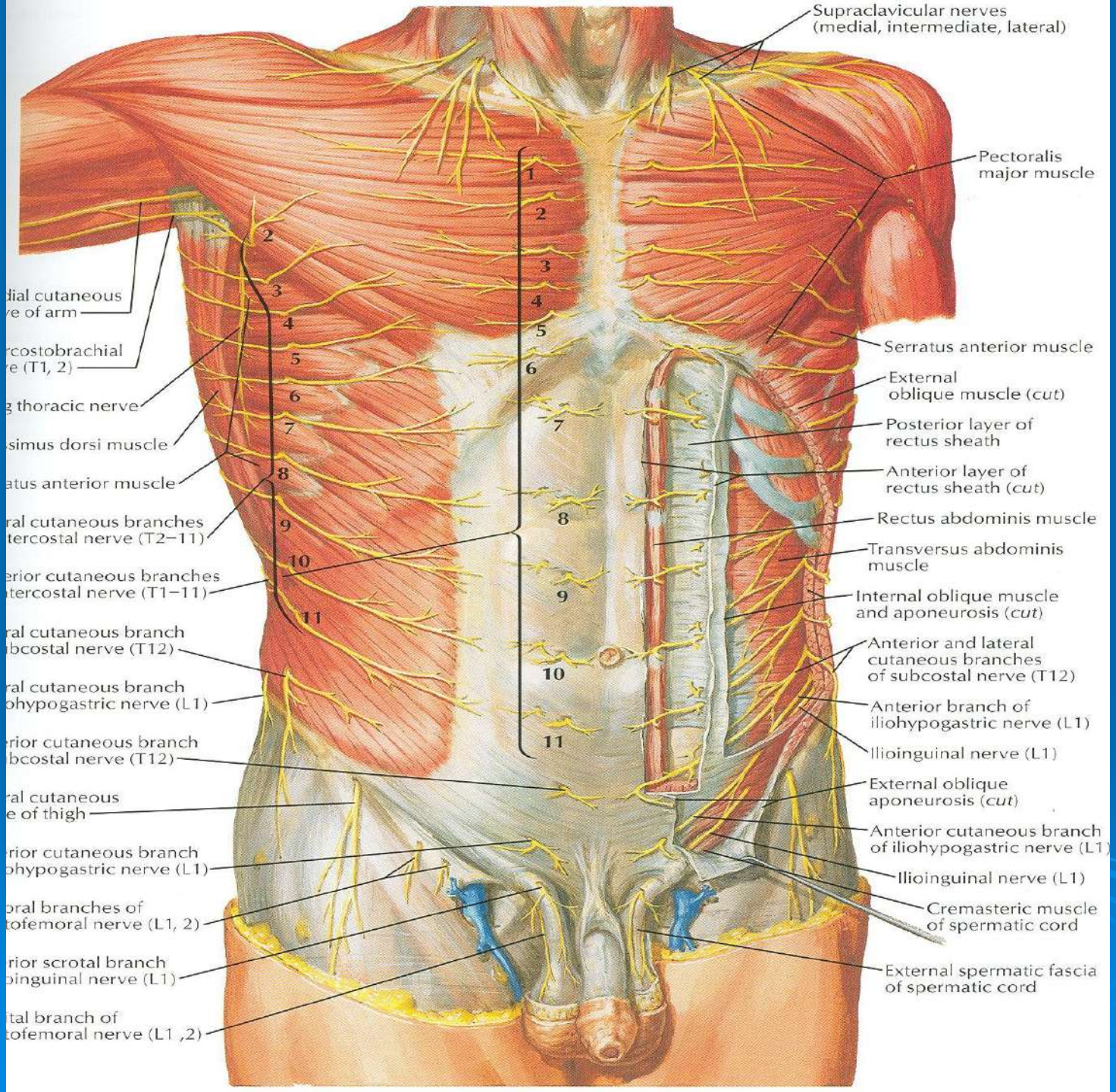

Sternocleidomastoid muscle
Sternal head
Clavicular head
Deltopectoral triangle
Trapezius muscle
Sternum
Body
Xiphoid process
Deltoid muscle
Pectoralis major muscle
Serratus anterior muscle
Tendinous intersection
Rectus abdominis muscle
External oblique muscle
Linea alba
Semilunar line
Umbilicus
Anterior superior iliac spine
Iliac crest
Superficial circumflex iliac vein
Superficial epigastric veins
Inguinal ligament
Pubic symphysis
Pubic tubercle

# Abdominal Quadrants

- Formed by two intersecting lines:
  - Intersect at umbilicus.
- Quadrants:
  - Upper left.
  - Upper right.
  - Lower left.
  - Lower right.

# Abdominal Quadrants




Supraclavicular nerves (medial, intermediate, lateral)
Pectoralis major muscle
Serratus anterior muscle
External oblique muscle (cut)
Posterior layer of rectus sheath
Anterior layer of rectus sheath (cut)
Rectus abdominis muscle
Transversus abdominis muscle
Internal oblique muscle and aponeurosis (cut)
Anterior and lateral cutaneous branches of subcostal nerve (T12)
Anterior branch of iliohypogastric nerve (L1)
Ilioinguinal nerve (L1)
External oblique aponeurosis (cut)
Anterior cutaneous branch of iliohypogastric nerve (L1)
Ilioinguinal nerve (L1)
Cremasteric muscle of spermatic cord
External spermatic fascia of spermatic cord
dial cutaneous ve of arm
rcostobrachial ve (T1, 2)
g thoracic nerve
simus dorsi muscle
atus anterior muscle
ral cutaneous branches tercostal nerve (T2–11)
erior cutaneous branches tercostal nerve (T1–11)
ral cutaneous branch bcostal nerve (T12)
ral cutaneous branch ohypogastric nerve (L1)
erior cutaneous branch bcostal nerve (T12)
ral cutaneous e of thigh
erior cutaneous branch ohypogastric nerve (L1)
oral branches of tofemoral nerve (L1, 2)
erior scrotal branch oinguinal nerve (L1)
tal branch of tofemoral nerve (L1 ,2)
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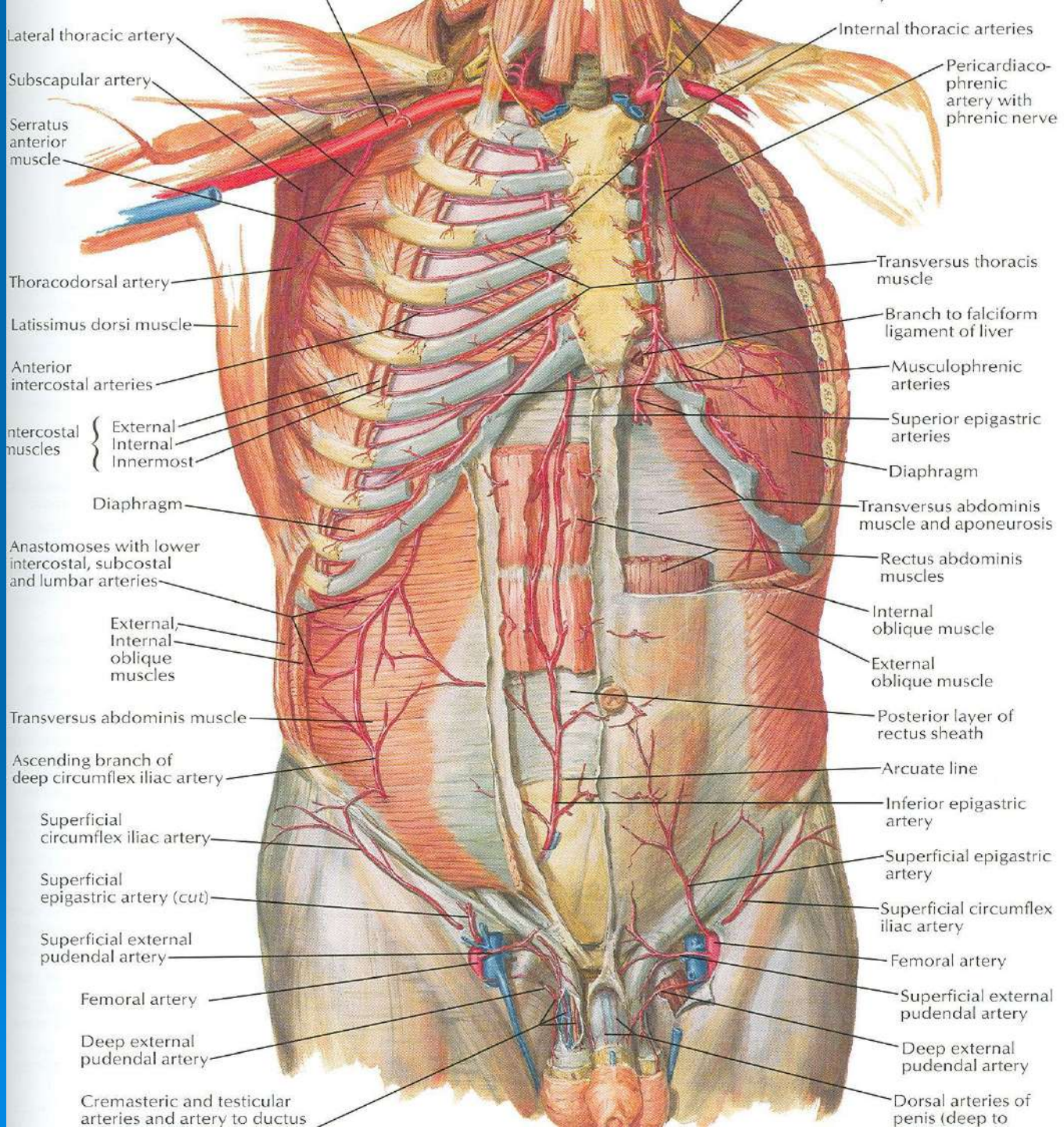
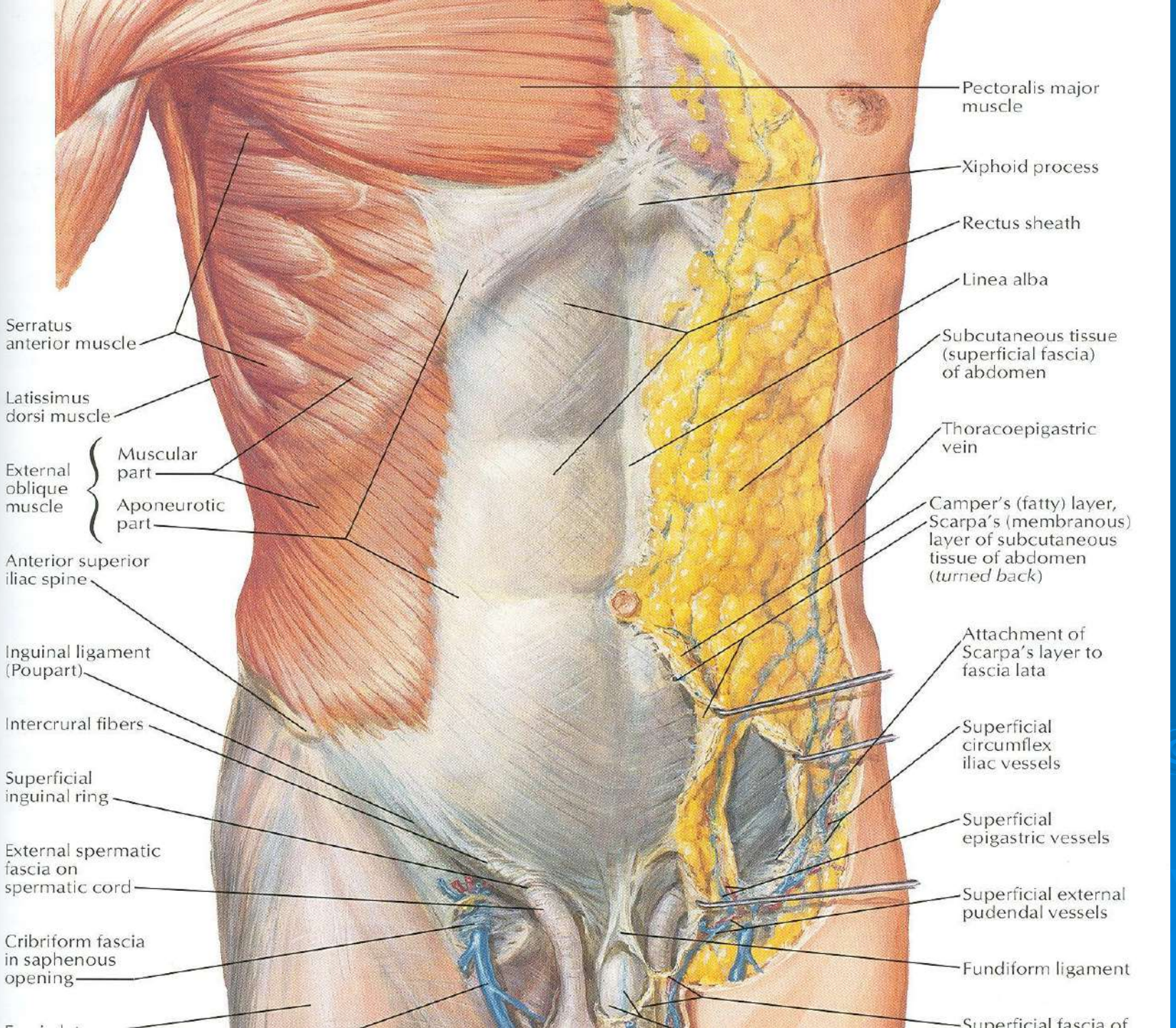
# Blood Supply

- Skin near the midline is supplied by branches of the superior epigastric artery (br. of int. thoracic artery) and the inferior epigastric artery ( br. of external iliac artery)
- Skin of the flanks is supplied by branches from the intercostal, lumbar, and deep circumflex arteries


Lateral thoracic artery
Subscapular artery
Serratus anterior muscle
Thoracodorsal artery
Latissimus dorsi muscle
Anterior intercostal arteries
Intercostal muscles
External
Internal
Innermost
Diaphragm
Anastomoses with lower intercostal, subcostal and lumbar arteries
External, Internal oblique muscles
Transversus abdominis muscle
Ascending branch of deep circumflex iliac artery
Superficial circumflex iliac artery
Superficial epigastric artery (cut)
Superficial external pudendal artery
Femoral artery
Deep external pudendal artery
Cremasteric and testicular arteries and artery to ductus
Internal thoracic arteries
Pericardiacophrenic artery with phrenic nerve
Transversus thoracis muscle
Branch to falciform ligament of liver
Musculophrenic arteries
Superior epigastric arteries
Diaphragm
Transversus abdominis muscle and aponeurosis
Rectus abdominis muscles
Internal oblique muscle
External oblique muscle
Posterior layer of rectus sheath
Arcuate line
Inferior epigastric artery
Superficial epigastric artery
Superficial circumflex iliac artery
Femoral artery
Superficial external pudendal artery
Deep external pudendal artery
Dorsal arteries of penis (deep to

# Superficial Fascia

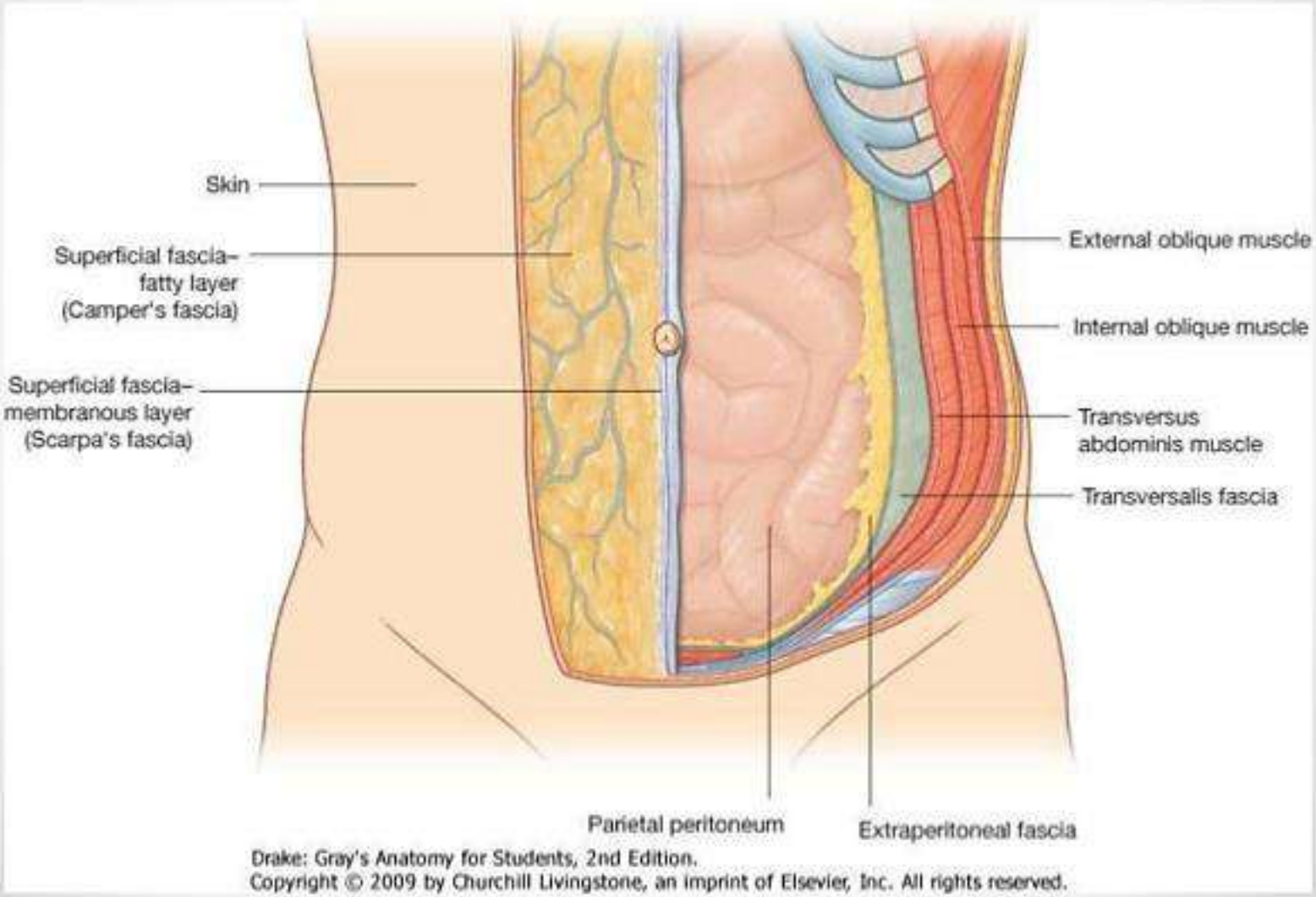
- Fatty layer or fascia of camper is continuous with the superficial fat over the rest of the body and may be extremely thick in obese patients
- The membranous layer or scarpa's fascia is thin and fades out laterally and above
- Becomes continuous with the superficial fascia of the back and the thorax


Pectoralis major muscle
Xiphoid process
Rectus sheath
Linea alba
Serratus anterior muscle
Subcutaneous tissue (superficial fascia) of abdomen
Latissimus dorsi muscle
Thoracoepigastric vein
External oblique muscle
Muscular part
Aponeurotic part
Camper's (fatty) layer, Scarpa's (membranous) layer of subcutaneous tissue of abdomen (turned back)
Anterior superior iliac spine
Attachment of Scarpa's layer to fascia lata
Inguinal ligament (Poupart)
Intercrural fibers
Superficial circumflex iliac vessels
Superficial inguinal ring
Superficial epigastric vessels
External spermatic fascia on spermatic cord
Superficial external pudendal vessels
Cribriform fascia in saphenous opening
Fundiform ligament

# Superficial Fascia

- Inferiorly the membranous layer passes onto the front of the thigh, where it fuses with the deep fascia
- In the midline inferiorly forms a tubular sheath for the penis or clitoris
- Below in the perineum, enters the wall of the scrotum or labia majora
- From there it passes to be attached on each side to the margins of pubic arch, here it is called Colle's fascia

# Layers of Anterior Abdominal Wall



# Superficial Fascia

- Posteriorly it fuses with the perineal body and the margin of the perineal membrane
- The fatty layer is represented as a smooth muscle in the scrotum, the dartos muscle
- The membranous layer persists as a separate layer

# Deep Fascia

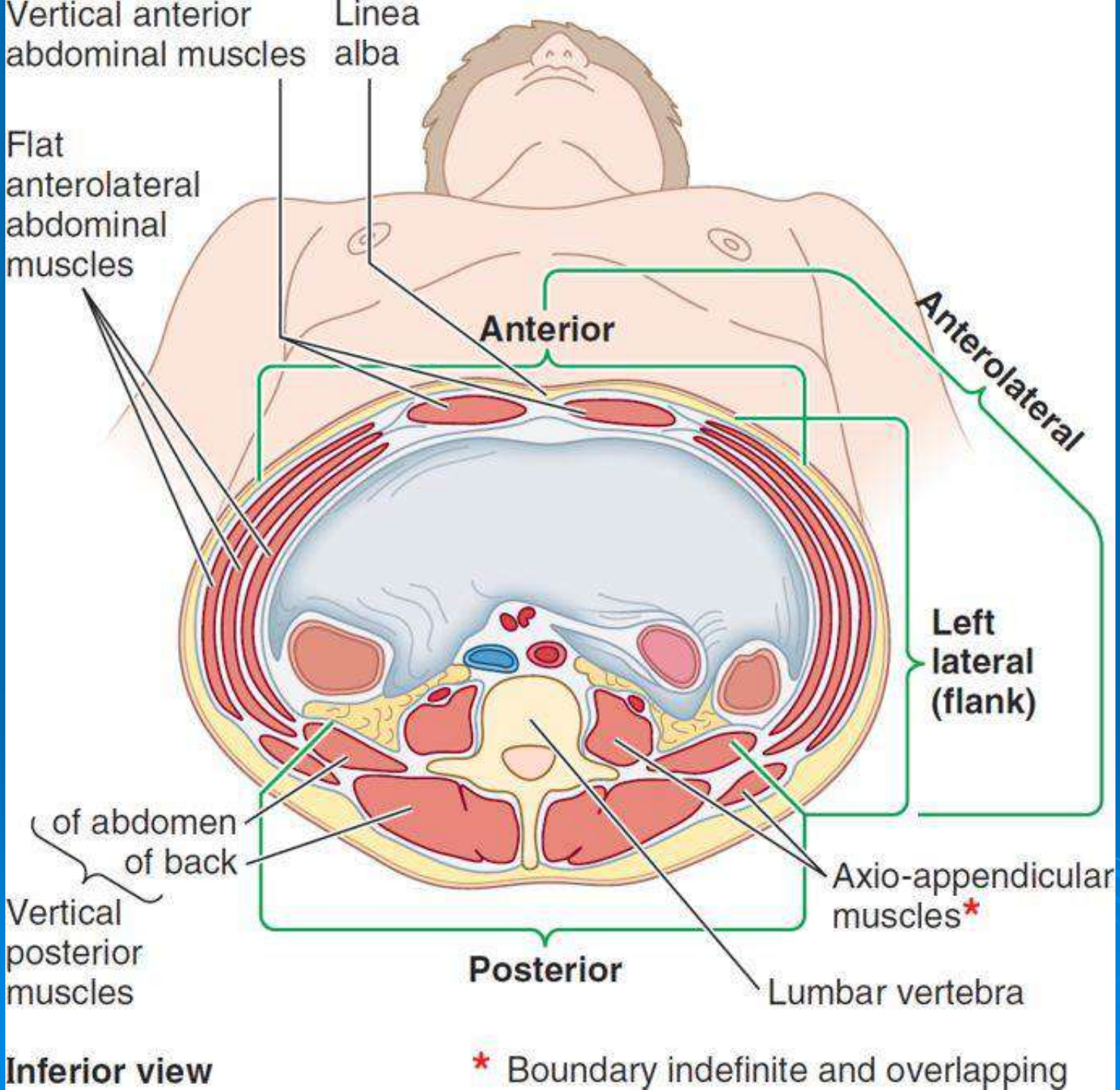
- Deep fascia in the anterior abdominal wall is merely a thin layer of connective tissue covering the muscles
- It lies immediately deep to the membranous layer of the superficial fascia

# Muscles

- Consists of Three broad thin sheets that are aponeurotic in front
- From exterior to interior they are:
- External oblique, internal oblique, and transverse
- A wide vertical muscle, the rectus abdominis
- They lie on either side of the midline anteriorly

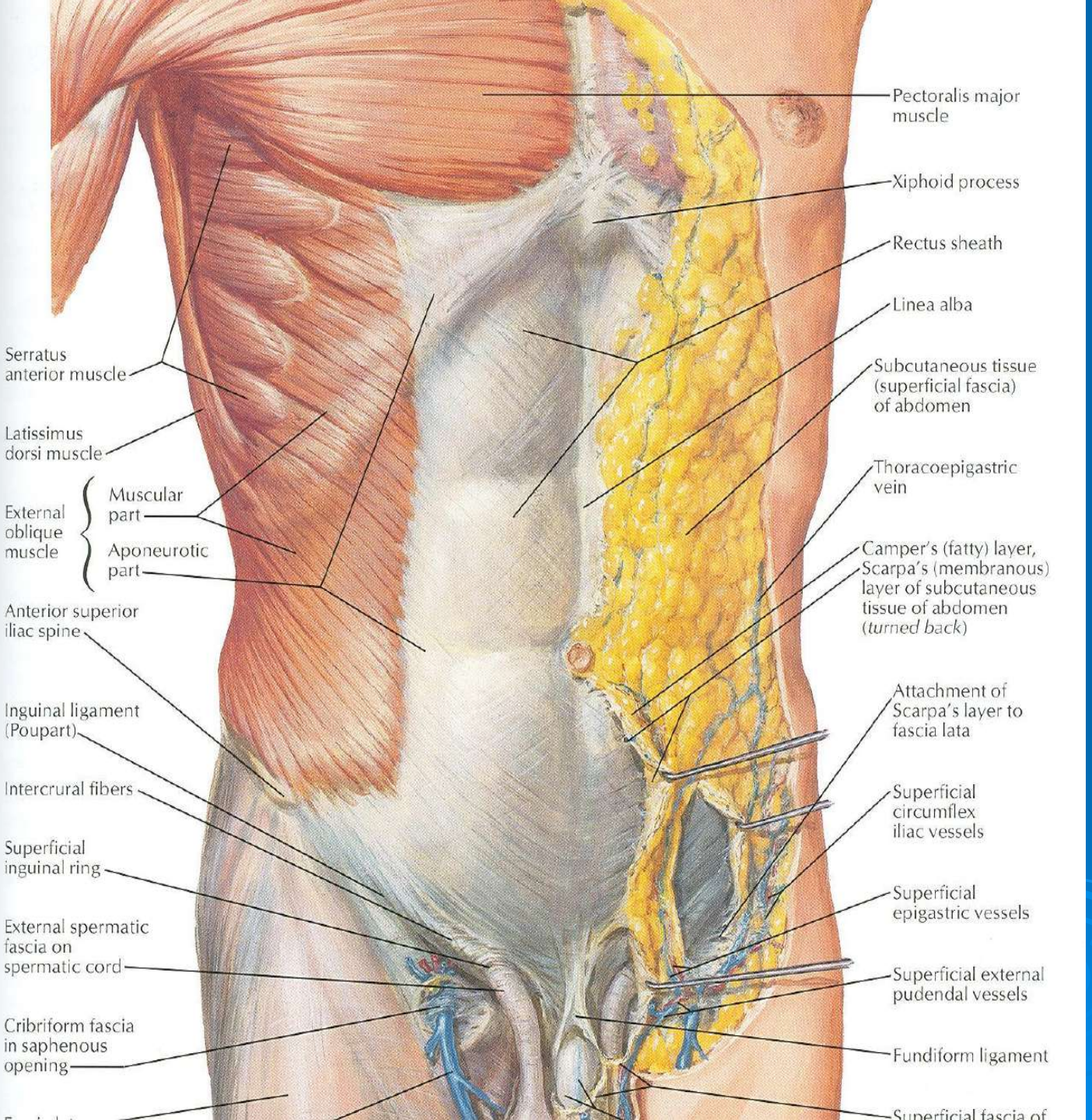
# Muscles

- As the aponeurosis of three sheets pass forward, they enclose the rectus abdominis to form the rectus sheath
- The cremaster muscle which is derived from the lower fibers of internal oblique, passes inferiorly as a covering of the spermatic cord and enters scrotum


Vertical anterior abdominal muscles
Linea alba
Flat anterolateral abdominal muscles
Anterior
Anterolateral
Left lateral (flank)
of abdomen
of back
Vertical posterior muscles
Axio-appendicular muscles*
Posterior
Lumbar vertebra
Inferior view
* Boundary indefinite and overlapping

# External Oblique Muscle

- Is a broad, thin, muscular sheet
- Origin: Lower 8 ribs
- Insertion: Xiphoid process, linea alba, pubic tubercle, iliac crest
- Nerve Supply: Lower 6 thoracic nerves, iliohypogastric & ilioinguinal nerves
- Action: Supports abdominal contents, assist in forced expiration, micturition, defecation, parturition, vomiting


Pectoralis major muscle
Xiphoid process
Rectus sheath
Linea alba
Serratus anterior muscle
Subcutaneous tissue (superficial fascia) of abdomen
Latissimus dorsi muscle
Thoracoepigastric vein
External oblique muscle
Muscular part
Aponeurotic part
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Attachment of Scarpa's layer to fascia lata
Inguinal ligament (Poupart)
Intercrural fibers
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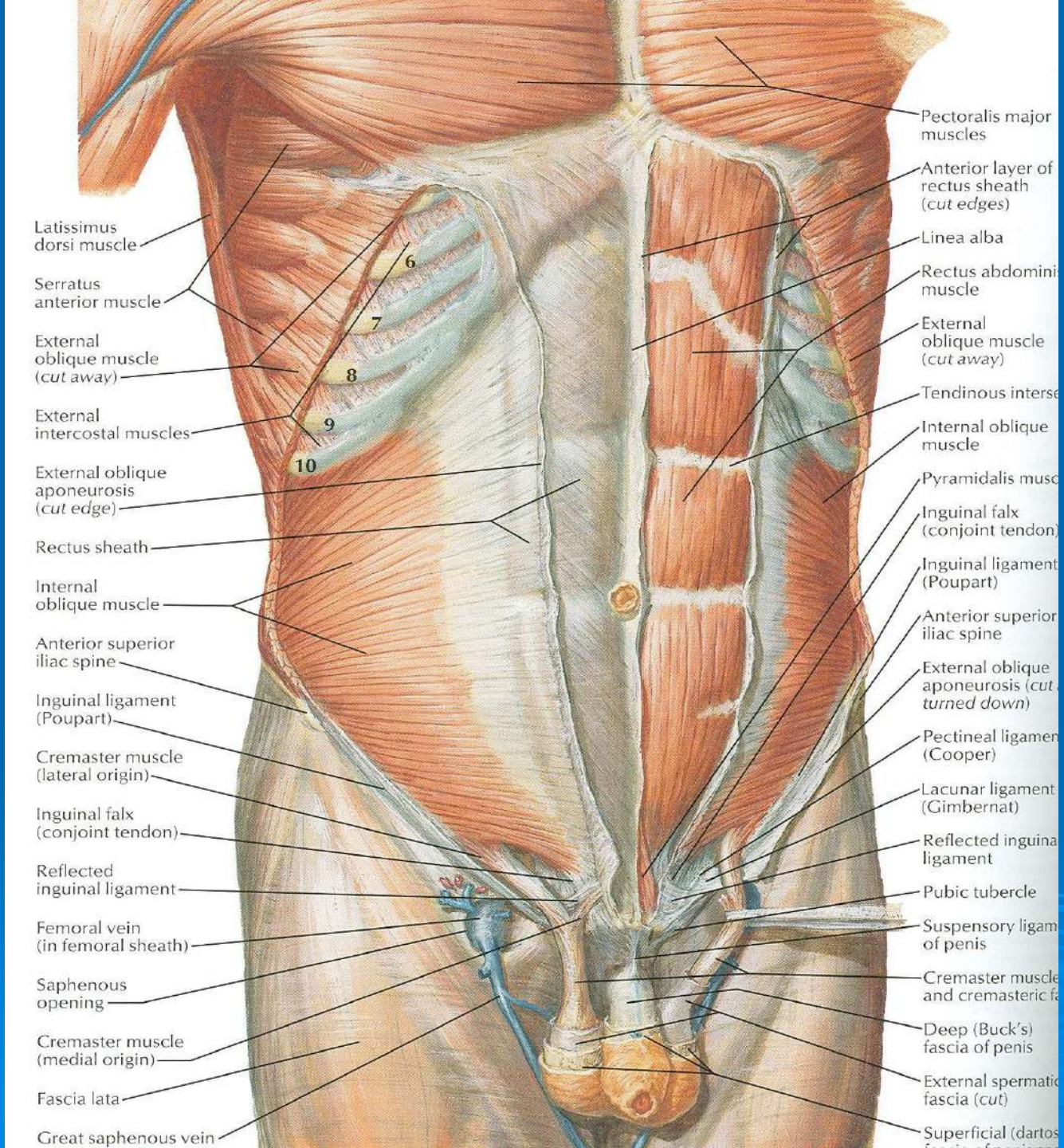
Superficial inguinal ring
Superficial epigastric vessels
External spermatic fascia on spermatic cord
Superficial external pudendal vessels
Cribriform fascia in saphenous opening
Fundiform ligament

# External Oblique Muscle

- A triangular shaped defect in the external oblique aponeurosis lies immediately above and medial to the pubic tubercle, known as superficial inguinal ring
- Between the anterosuperior iliac spine and the pubic tubercle, the lower border of the aponeurosis is folded backward on itself, forming the inguinal ligament

# Internal Oblique Muscle

- Origin: Lumbar fascia, iliac crest, lateral two-thirds of inguinal ligament
- Insertion: Lower three ribs and costal cartilages, xiphoid process, linea alba, symphysis pubis
- Nerve Supply: Lower six thoracic nerves, iliohypogastric & ilioinguinal nerves
- Action: Supports abdominal contents, assist in forced expiration, micturition, defecation, parturition, vomiting


Pectoralis major muscles
Anterior layer of rectus sheath (cut edges)
Linea alba
Rectus abdomini muscle
External oblique muscle (cut away)
Tendinous interse
Internal oblique muscle
Pyramidalis musc
Inguinal falx (conjoint tendon)
Inguinal ligament (Poupart)
Anterior superior iliac spine
External oblique aponeurosis (cut turned down)
Pectineal ligamen (Cooper)
Lacunar ligament (Gimbernat)
Reflected inguina ligament
Pubic tubercle
Suspensory ligam of penis
Cremaster muscle and cremasteric fa
Deep (Buck's) fascia of penis
External spermati fascia (cut)
Superficial (dartos
Latissimus dorsi muscle
Serratus anterior muscle
External oblique muscle (cut away)
External intercostal muscles
External oblique aponeurosis (cut edge)
Rectus sheath
Internal oblique muscle
Anterior superior iliac spine
Inguinal ligament (Poupart)
Cremaster muscle (lateral origin)
Inguinal falx (conjoint tendon)
Reflected inguinal ligament
Femoral vein (in femoral sheath)
Saphenous opening
Cremaster muscle (medial origin)
Fascia lata
Great saphenous vein
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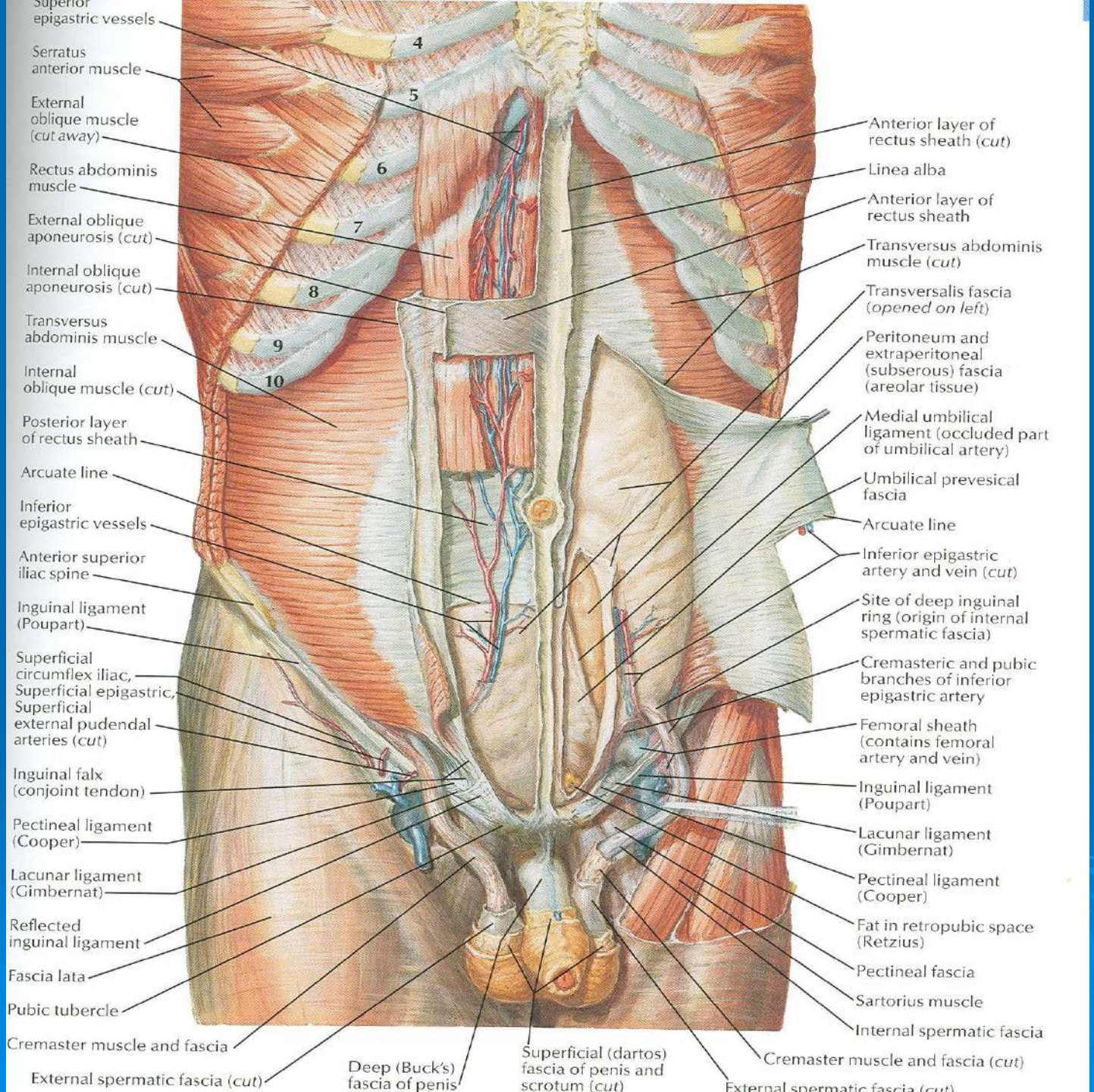
# Transversus Abdominis

- Origin: Lower six costal cartilages, lumbar fascia, iliac crest, lateral third of inguinal ligament
- Insertion: Xiphoid process, linea alba, symphysis pubis
- Nerve Supply: Lower six thoracic nerves, iliohypogastric & ilioinguinal nerves
- Action: Compresses abdominal contents


Superior epigastric vessels
Serratus anterior muscle
External oblique muscle (cut away)
Rectus abdominis muscle
External oblique aponeurosis (cut)
Internal oblique aponeurosis (cut)
Transversus abdominis muscle
Internal oblique muscle (cut)
Posterior layer of rectus sheath
Arcuate line
Inferior epigastric vessels
Anterior superior iliac spine
Inguinal ligament (Poupart)
Superficial circumflex iliac, Superficial epigastric, Superficial external pudendal arteries (cut)
Inguinal falx (conjoint tendon)
Pectineal ligament (Cooper)
Lacunar ligament (Gimbernat)
Reflected inguinal ligament
Fascia lata
Pubic tubercle
Cremaster muscle and fascia
External spermatic fascia (cut)
Deep (Buck's) fascia of penis
Superficial (dartos) fascia of penis and scrotum (cut)
4
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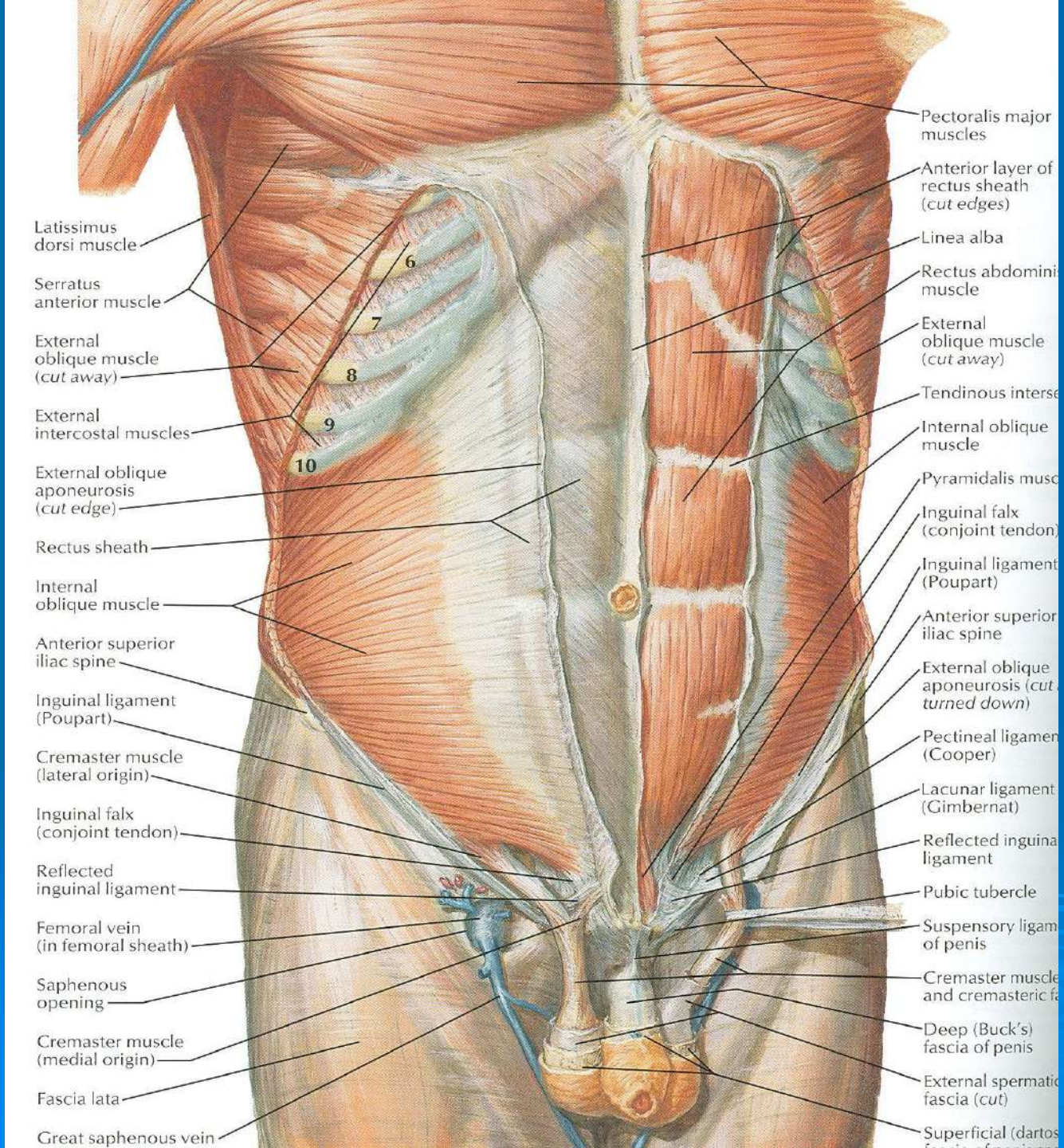
Anterior layer of rectus sheath (cut)
Linea alba
Anterior layer of rectus sheath
Transversus abdominis muscle (cut)
Transversalis fascia (opened on left)
Peritoneum and extraperitoneal (subserous) fascia (areolar tissue)
Medial umbilical ligament (occluded part of umbilical artery)
Umbilical prevesical fascia
Arcuate line
Inferior epigastric artery and vein (cut)
Site of deep inguinal ring (origin of internal spermatic fascia)
Cremasteric and pubic branches of inferior epigastric artery
Femoral sheath (contains femoral artery and vein)
Inguinal ligament (Poupart)
Lacunar ligament (Gimbernat)
Pectineal ligament (Cooper)
Fat in retropubic space (Retzius)
Pectineal fascia
Sartorius muscle
Internal spermatic fascia
Cremaster muscle and fascia (cut)
External spermatic fascia (cut)

# Rectus Abdominis

- Origin: Symphysis pubis and pubic crest
- Insertion: 5th, 6th and 7th costal cartilages and xiphoid process
- Nerve Supply: Lower six thoracic nerves
- Action: Compresses abdominal contents, flexes vertebral column, accessory muscle of expiration


Pectoralis major muscles
Anterior layer of rectus sheath (cut edges)
Linea alba
Rectus abdomini muscle
External oblique muscle (cut away)
Tendinous interse
Internal oblique muscle
Pyramidalis musc
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Inguinal ligament (Poupart)
Anterior superior iliac spine
External oblique aponeurosis (cut turned down)
Pectineal ligamen (Cooper)
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Reflected inguina ligament
Pubic tubercle
Suspensory ligam of penis
Cremaster muscle and cremasteric fa
Deep (Buck's) fascia of penis
External spermati fascia (cut)
Superficial (dartos
Latissimus dorsi muscle
Serratus anterior muscle
External oblique muscle (cut away)
External intercostal muscles
External oblique aponeurosis (cut edge)
Rectus sheath
Internal oblique muscle
Anterior superior iliac spine
Inguinal ligament (Poupart)
Cremaster muscle (lateral origin)
Inguinal falx (conjoint tendon)
Reflected inguinal ligament
Femoral vein (in femoral sheath)
Saphenous opening
Cremaster muscle (medial origin)
Fascia lata
Great saphenous vein
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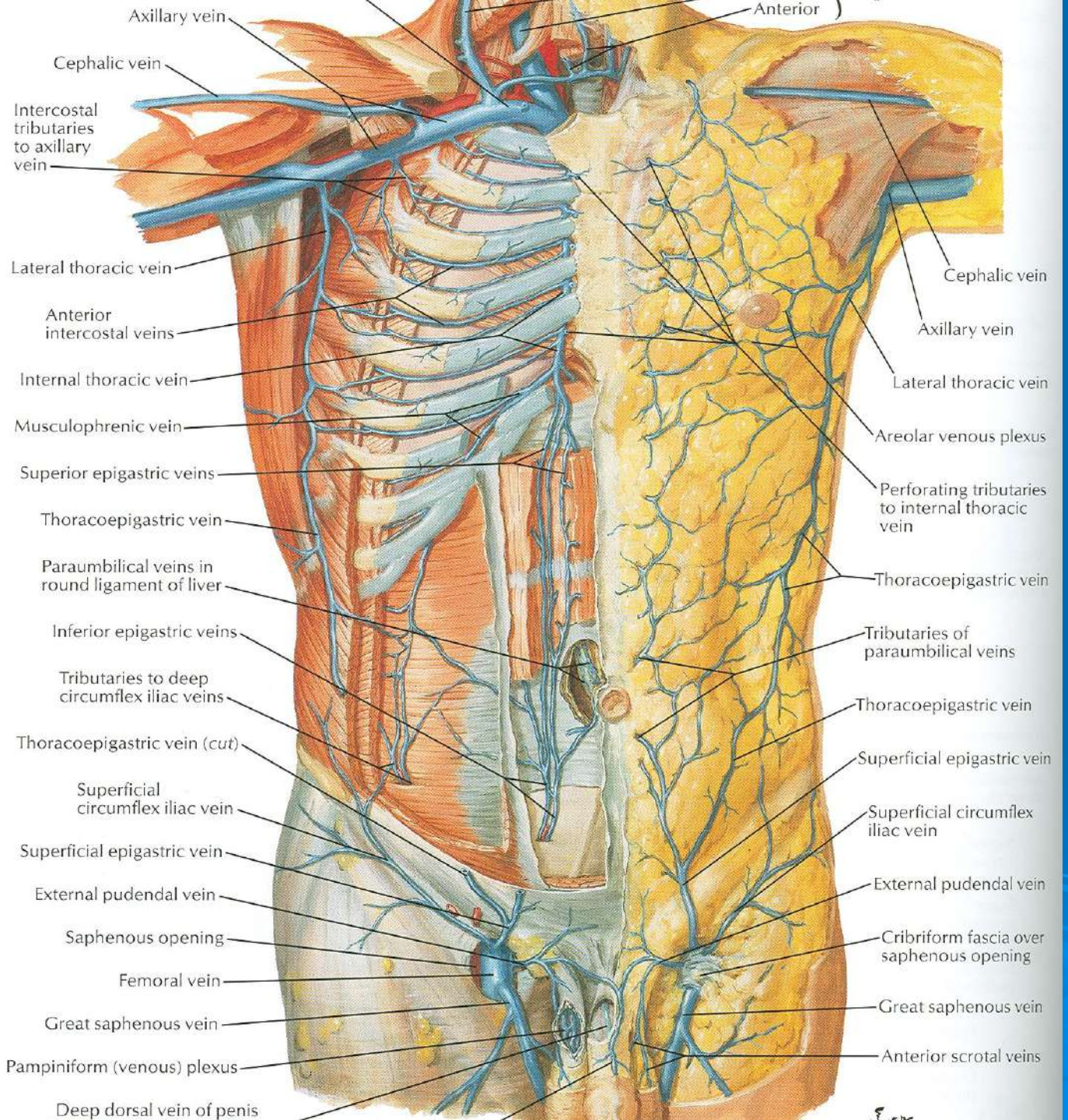
# Lymph Drainage

- Lymph drainage of the skin of the anterior abdominal wall above the umbilicus is upward to the anterior axillary (pectoral group of nodes)
- Below the level of umbilicus drains downward and laterally to the superficial inguinal nodes
- Swelling in the groin is may be due to enlarged superficial inguinal node

# Venous Drainage

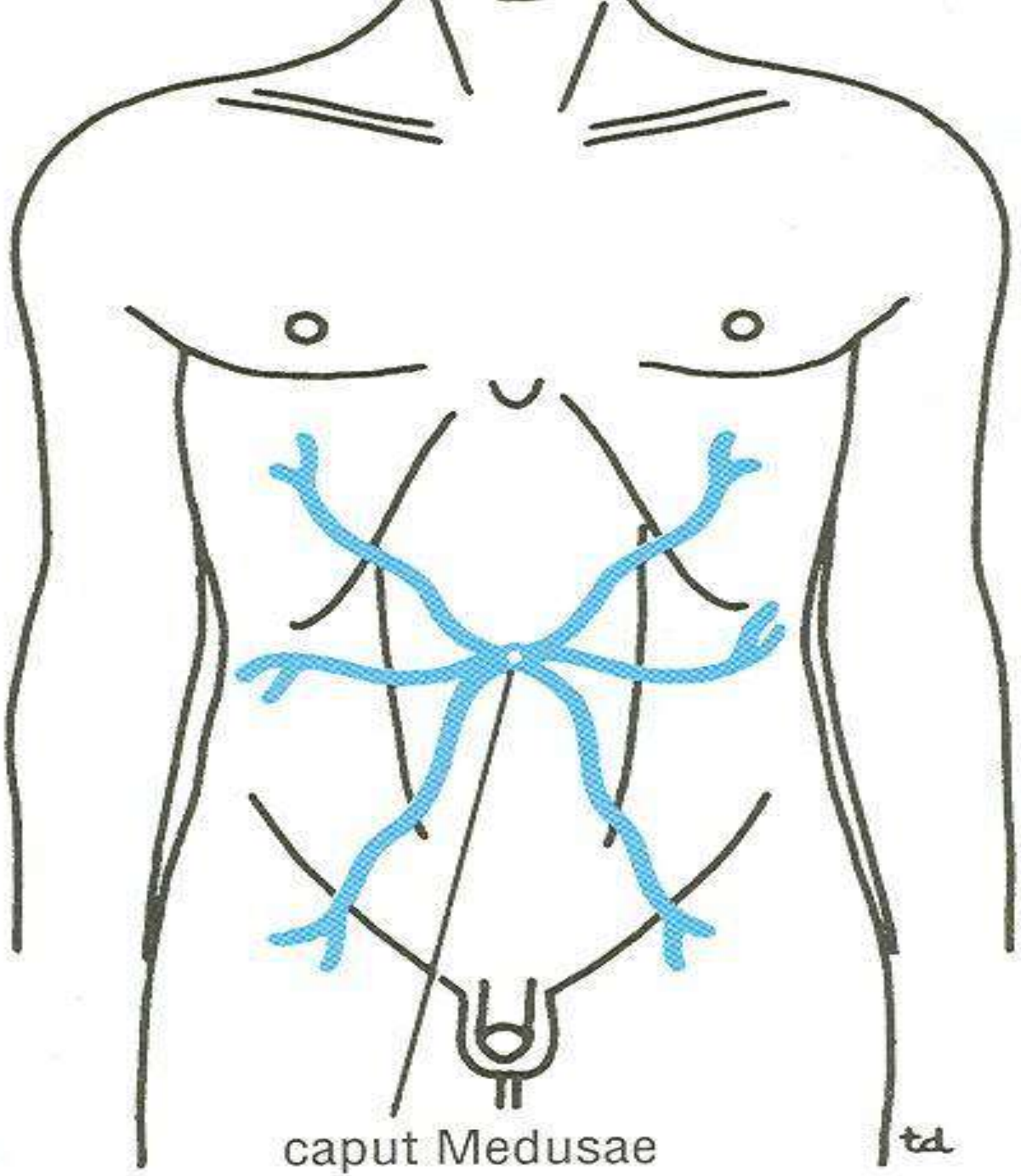
- Venous blood is collected into a network of veins that radiate from the umbilicus
- The network is drained above into the axillary vein via the lateral thoracic vein
- Below into the femoral vein via the superficial epigastric and the great saphenous veins
- Few small veins, the paraumbilical veins form a clinically important portal-system venous anastomosis


Axillary vein
Cephalic vein
Intercostal tributaries to axillary vein
Lateral thoracic vein
Anterior intercostal veins
Internal thoracic vein
Musculophrenic vein
Superior epigastric veins
Thoracoepigastric vein
Paraumbilical veins in round ligament of liver
Inferior epigastric veins
Tributaries to deep circumflex iliac veins
Thoracoepigastric vein (cut)
Superficial circumflex iliac vein
Superficial epigastric vein
External pudendal vein
Saphenous opening
Femoral vein
Great saphenous vein
Pampiniform (venous) plexus
Deep dorsal vein of penis
Anterior
Cephalic vein
Axillary vein
Lateral thoracic vein
Areolar venous plexus
Perforating tributaries to internal thoracic vein
Thoracoepigastric vein
Tributaries of paraumbilical veins
Thoracoepigastric vein
Superficial epigastric vein
Superficial circumflex iliac vein
External pudendal vein
Cribriform fascia over saphenous opening
Great saphenous vein
Anterior scrotal veins

# Caput Medusae

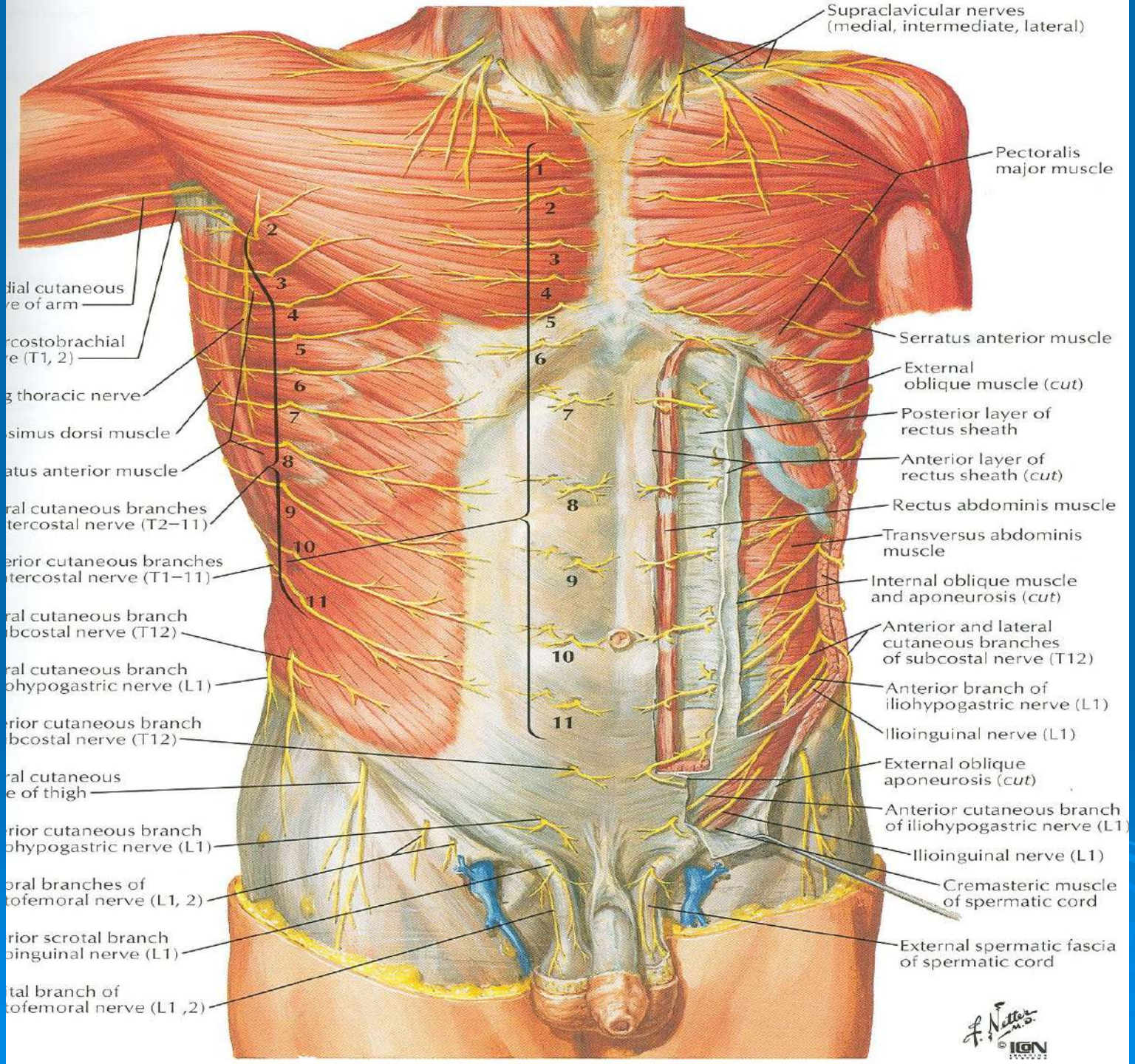
- The superficial veins around the umbilicus and the paraumbilical veins connecting them to the portal vein may become grossly distended in case of portal vein obstruction

- The distended subcutaneous veins radiate out from the umbilicus, producing in severe cases the clinical picture called Caput Medusae


caput Medusae

# Nerves

- Nerves of the anterior abdominal wall supply the skin, muscles and the parietal peritoneum
- They are derived from the anterior rami of lower six thoracic and the first lumbar nerves
- Inflammation of parietal peritoneum causes pain in the overlying skin and also a reflex increase in tone of the abdominal musculature in the same area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Rectus abdominis muscle
Transversus abdominis muscle
Internal oblique muscle and aponeurosis (cut)
Anterior and lateral cutaneous branches of subcostal nerve (T12)
Anterior branch of iliohypogastric nerve (L1)
Ilioinguinal nerve (L1)
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oral branches of
tofemoral nerve (L1, 2)
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tofemoral nerve (L1 ,2)
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# Rectus Sheath

- Is a long fibrous sheath
- Encloses the rectus abdominis and pyramidalis muscle (if present)
- Contains the anterior rami of lower six thoracic nerves and the superior and inferior epigastric vessels and lymph vessels
- Formed mainly by aponeurosis of three lateral abdominal muscles

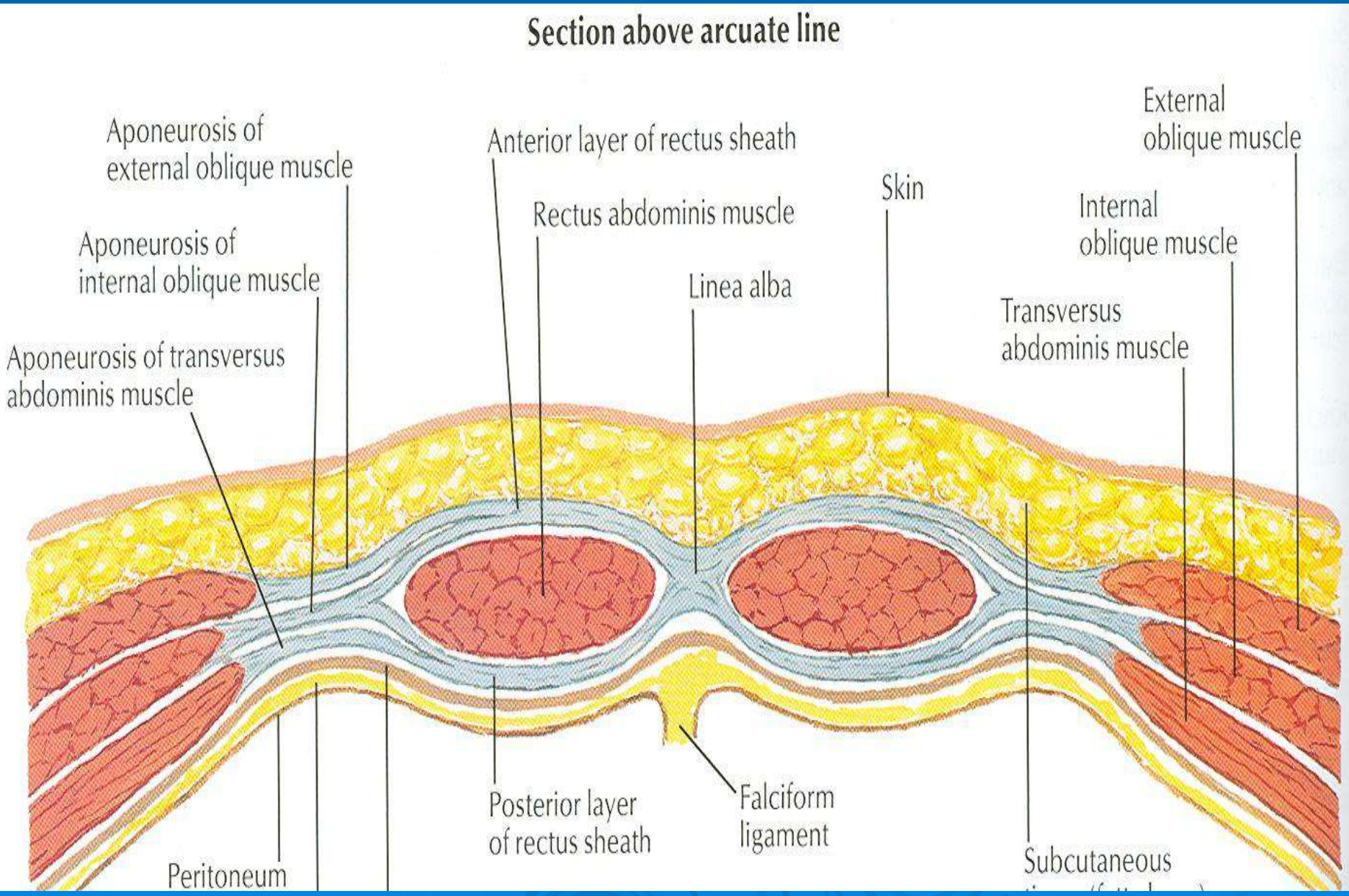
# Rectus Sheath

For description it is considered at three levels:

- Above the costal margin the anterior wall is formed by the aponeurosis of the external oblique and posterior wall is formed by the thoracic wall
- That is the $5^{th}$ , $6^{th}$ and $7^{th}$ costal cartilages and the intercostal spaces

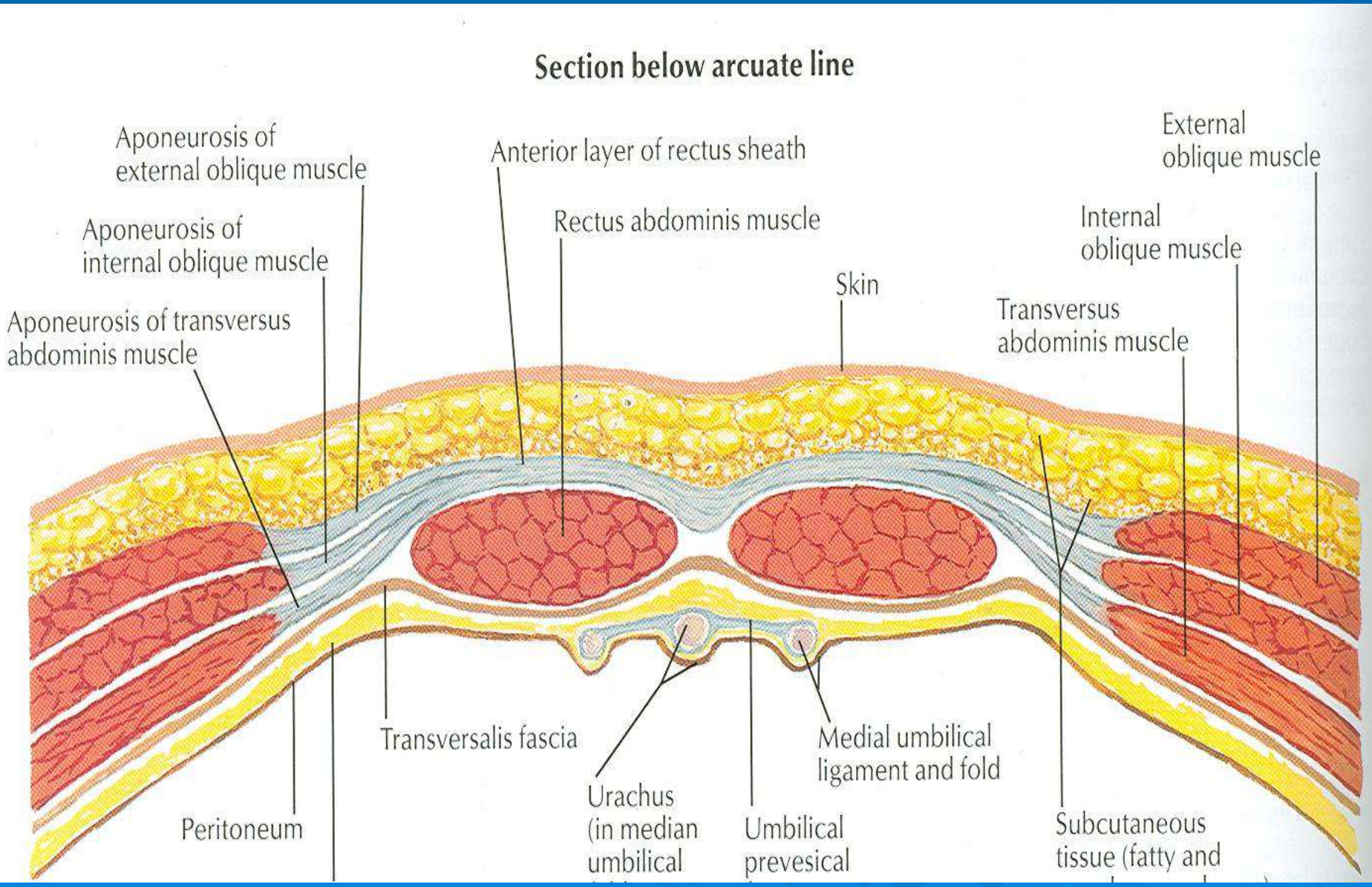
# Rectus Sheath

- Between the costal margin and the level of the anterosuperior 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
- Transversus aponeurosis is directed behind the muscle


Section above arcuate line
Aponeurosis of external oblique muscle
Aponeurosis of internal oblique muscle
Aponeurosis of transversus abdominis muscle
Anterior layer of rectus sheath
Rectus abdominis muscle
Linea alba
Skin
External oblique muscle
Internal oblique muscle
Transversus abdominis muscle
Peritoneum
Posterior layer of rectus sheath
Falciform ligament
Subcutaneous

# Rectus Sheath

- Between the level of the anterosuperior iliac spine and the pubis, the aponeurosis of all three muscles form the anterior wall
- The posterior wall is absent
- The rectus muscle lies in contact with the fascia transversalis


Section below arcuate line
Aponeurosis of external oblique muscle
Aponeurosis of internal oblique muscle
Aponeurosis of transversus abdominis muscle
Anterior layer of rectus sheath
Rectus abdominis muscle
Skin
External oblique muscle
Internal oblique muscle
Transversus abdominis muscle
Transversalis fascia
Medial umbilical ligament and fold
Urachus (in median umbilical
Umbilical prevesical
Peritoneum
Subcutaneous tissue (fatty and

# Rectus Sheath

- 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 Alba

- The rectus sheath is separated from its fellow on the opposite side by a fibrous band called the linea alba
- Extends from the xiphoid process to the symphysis pubis

# Next Lecture