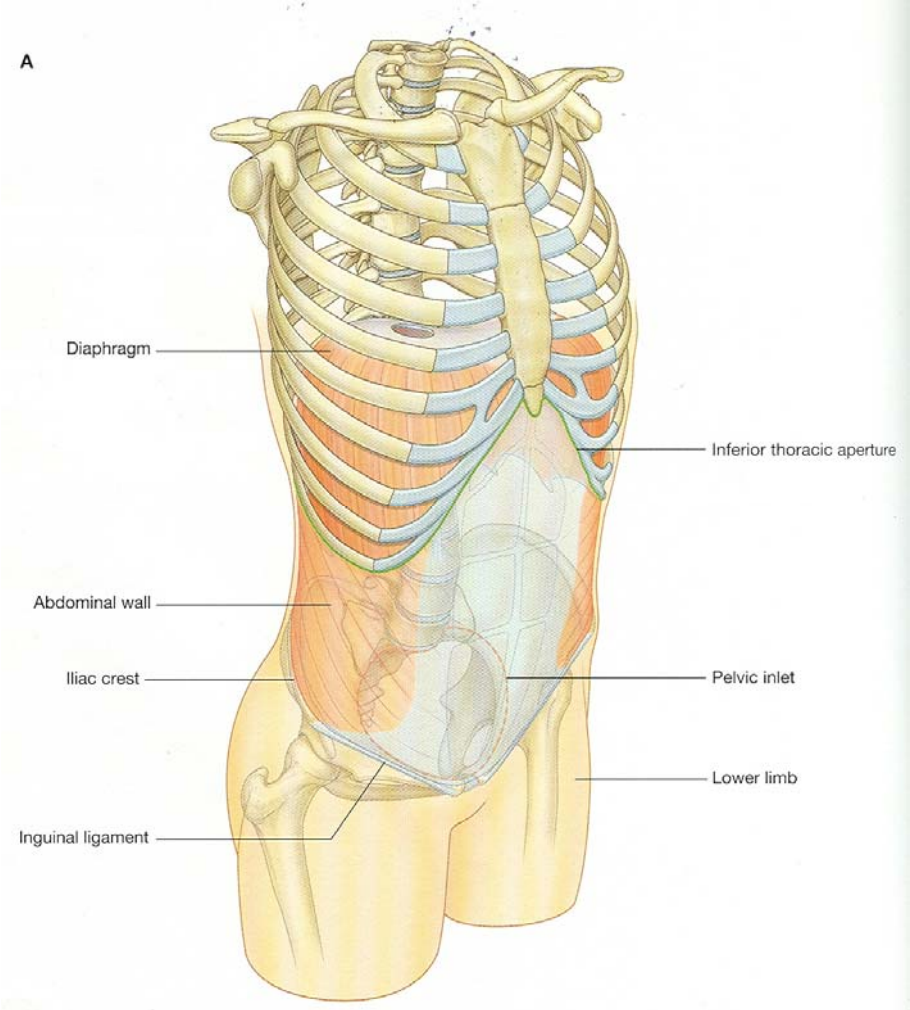
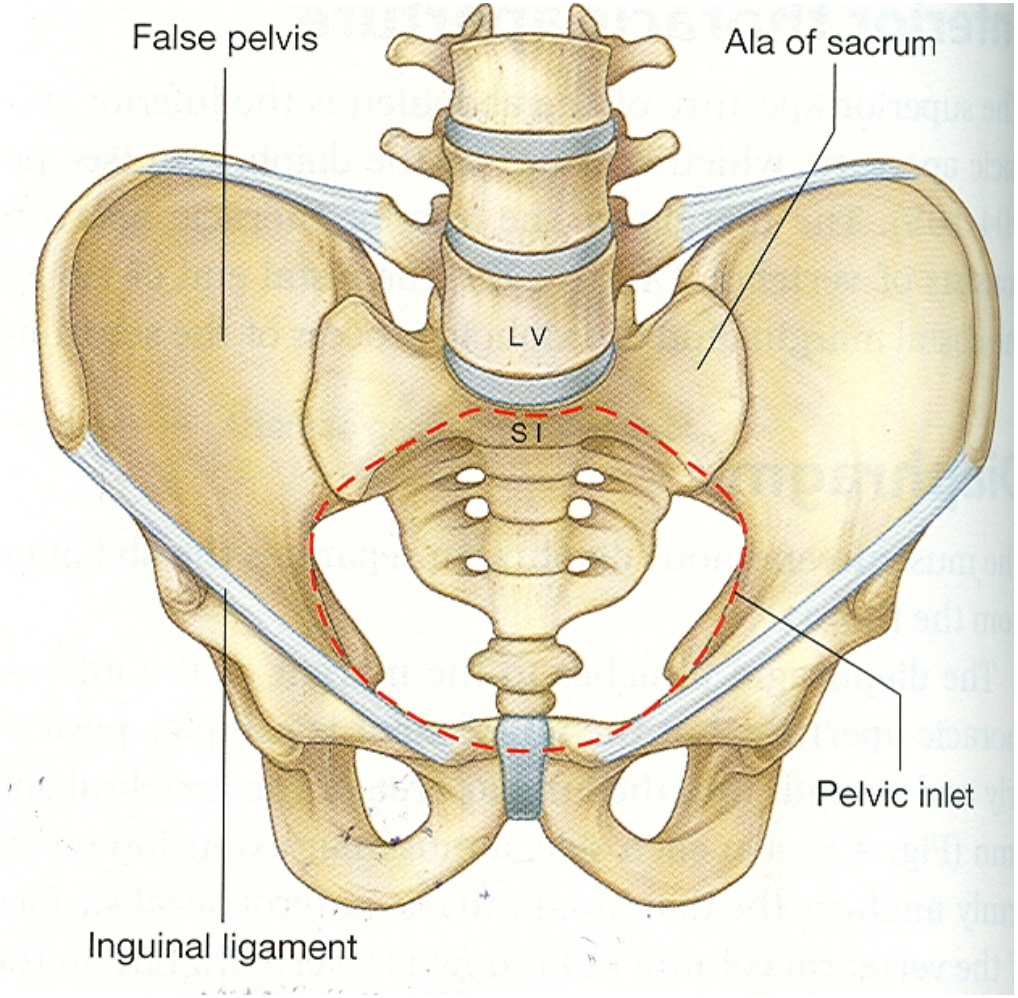
Introduction to abdomen

Cylindrical chamber extending from diaphragm to the base of the pelvis, comprising of abdomen proper & the lesser pelvis



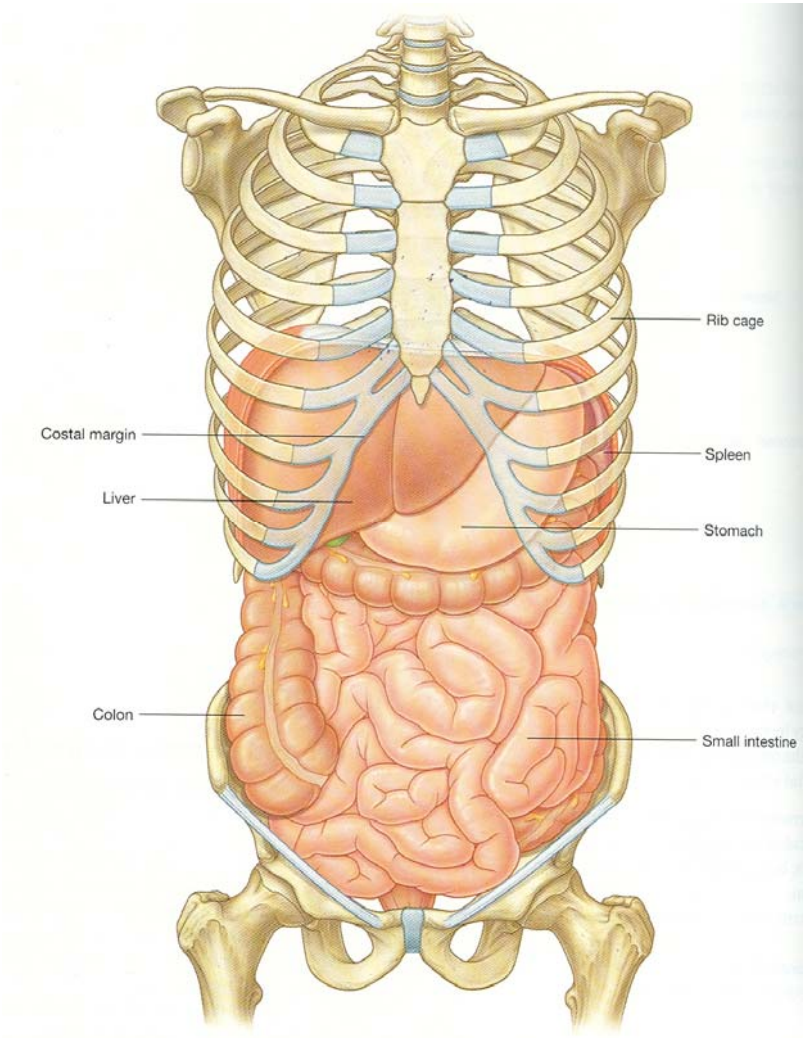
- Abdomen proper & lesser pelvis communicate with each other at the plane of inlet into lesser pelvis (upper border of pubic symphysis,pubic crests, arcuate line of innominate bones,sacral promontary)



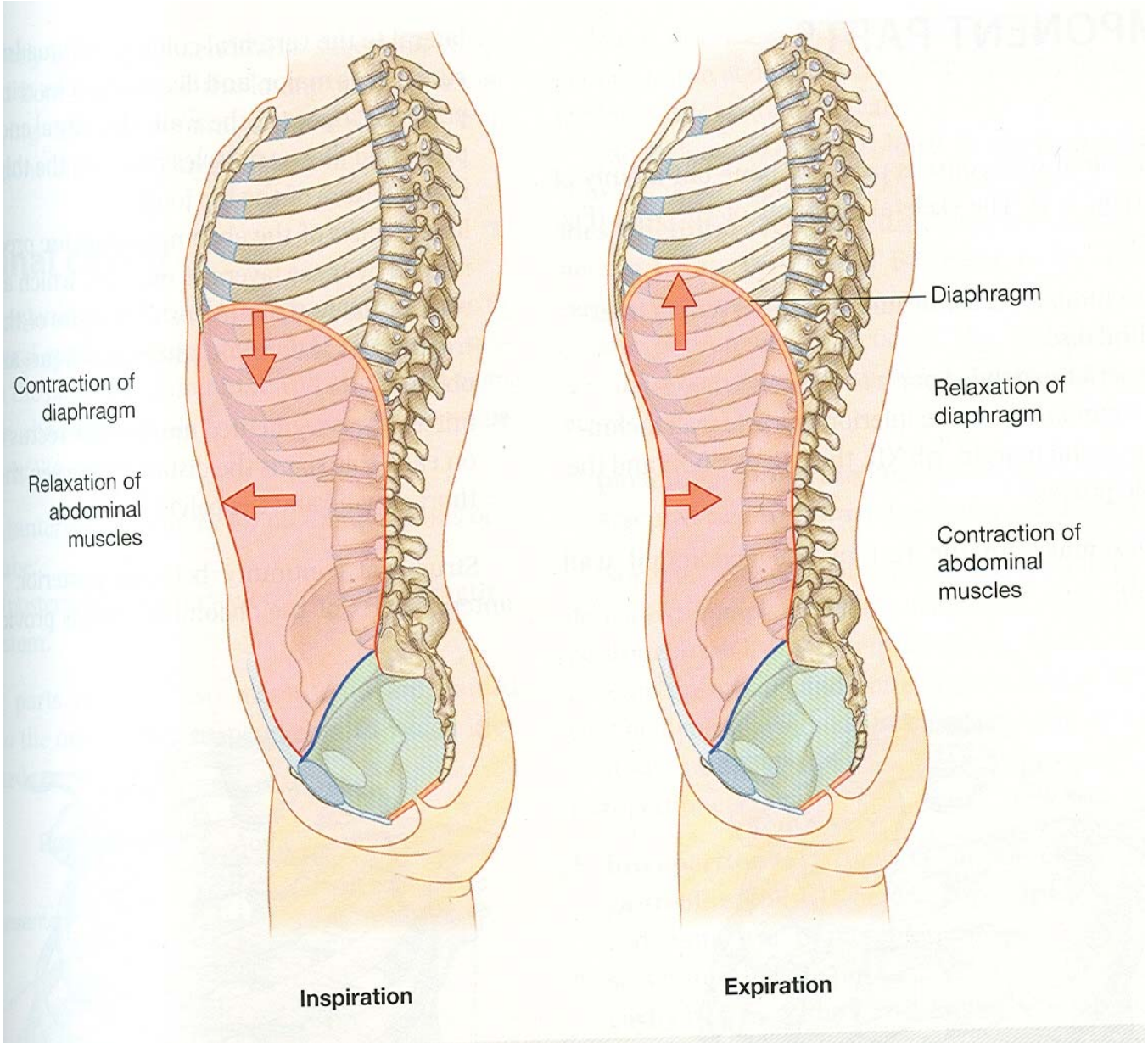
- Contents of Abdomen proper:- Most of the digestive tube, Liver, pancreas, spleen, kidneys, ureters (in part), supra renal gland & various blood &lymph vessels lymph nodes &nerves
- Contents of lesser pelvis:- Terminal parts of ureters, urinary bladders, the sigmoid colon, rectum some coils of ileum, internal genitalia, blood & lymph vesels, lymph nodes & nerves

Functions

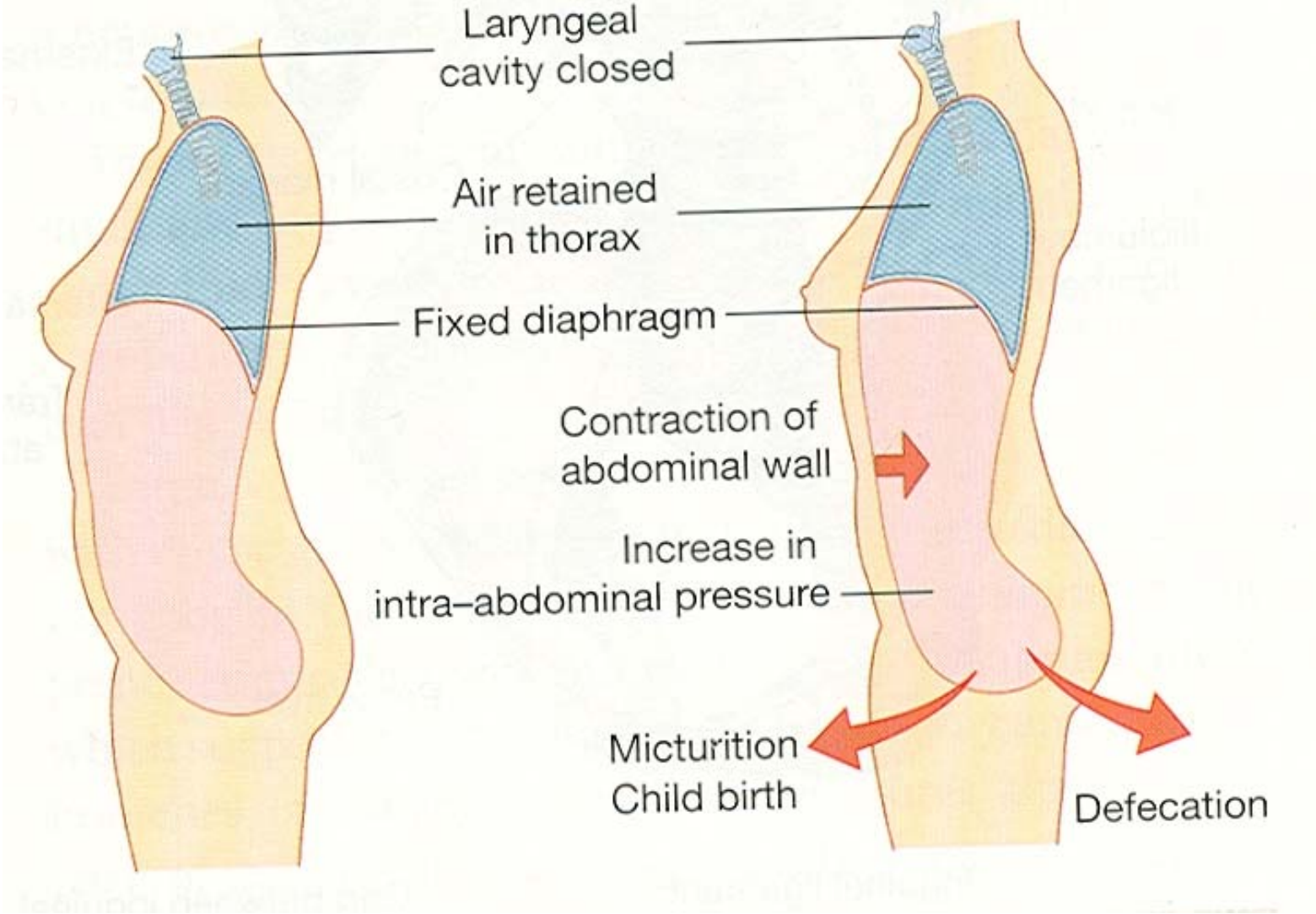
- Houses & protects major viscera



Assists in breathing



Changes in the intra abdominal pressure



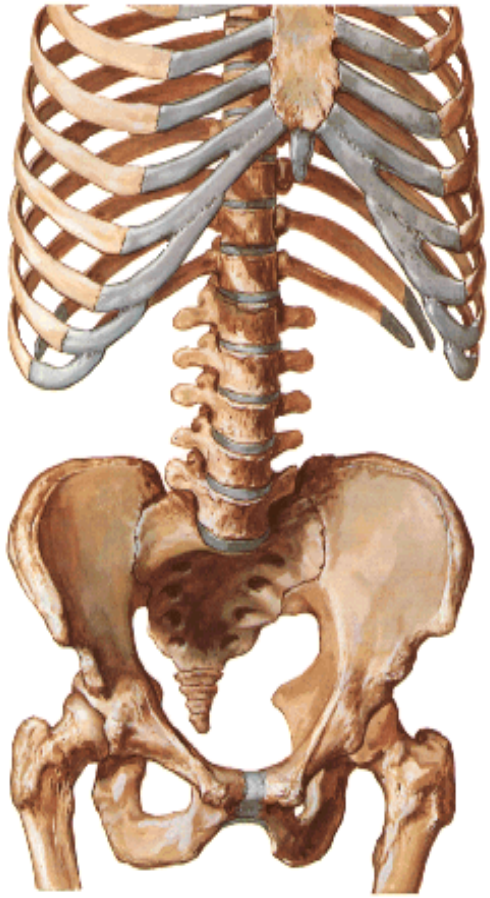
Component parts

- Wall-

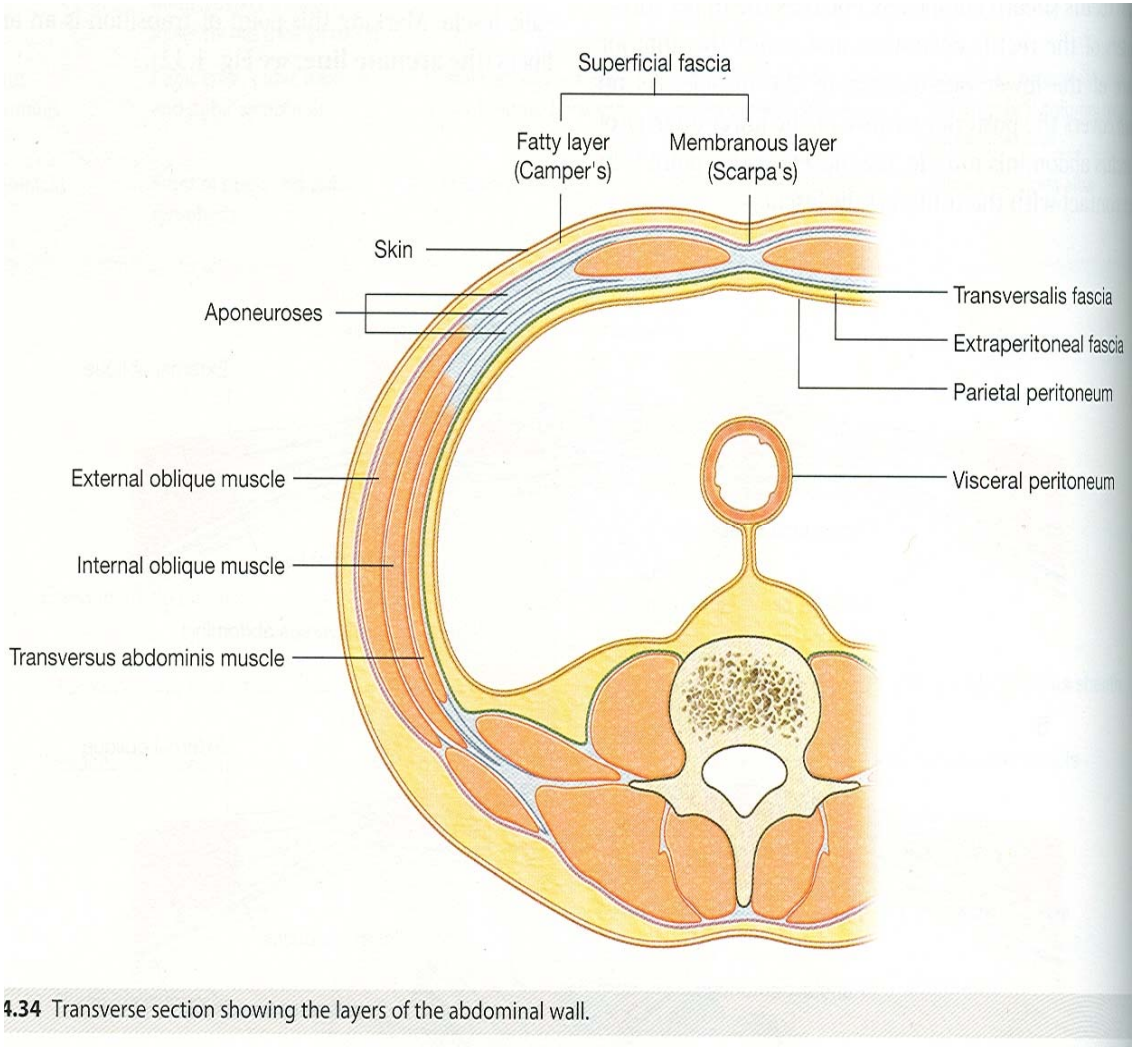
  Skeletal elements

  Muscles

Bony Framework of Abdomen

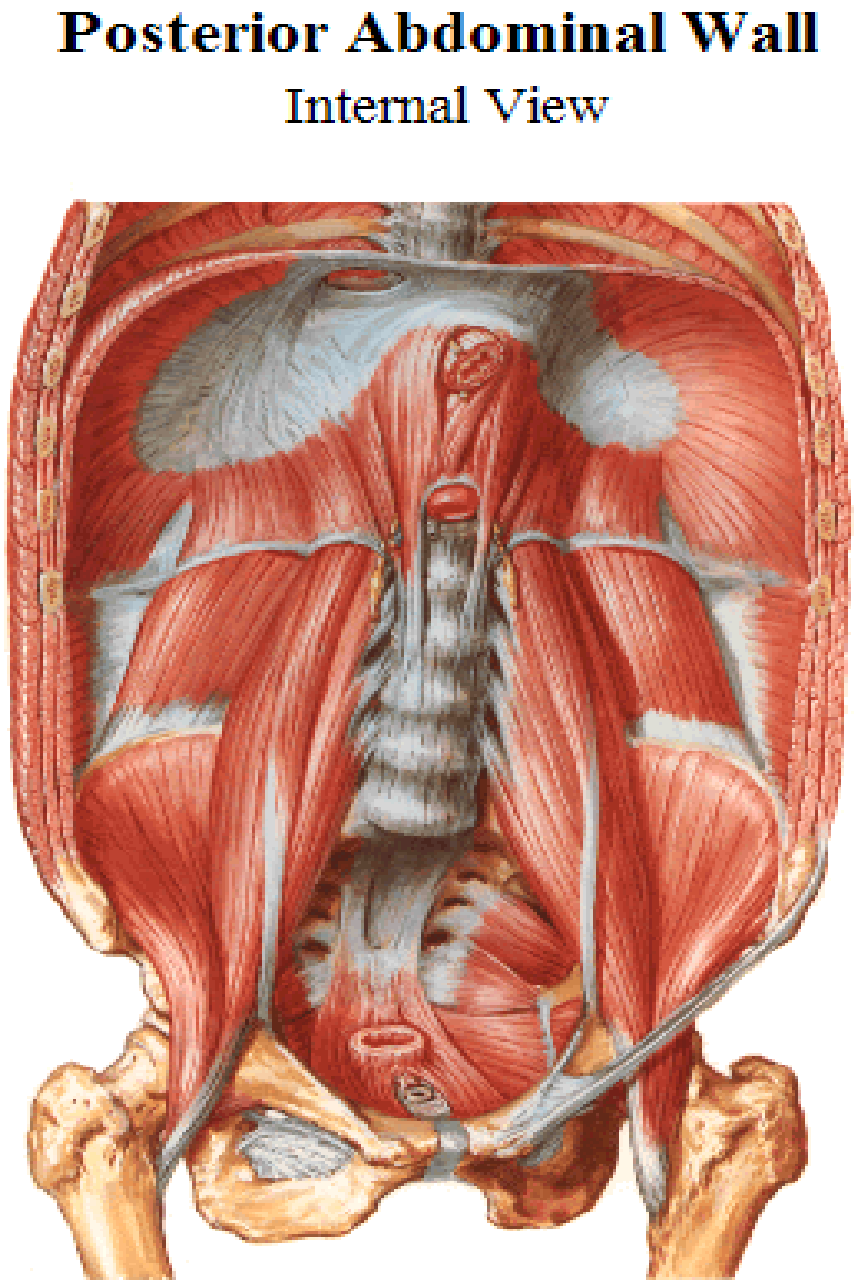


- Muscles:-
- Anteriorly a segmented muscle Rectus abdominis
- Anterolateraly External oblique, internal oblique & trasversus abdominis

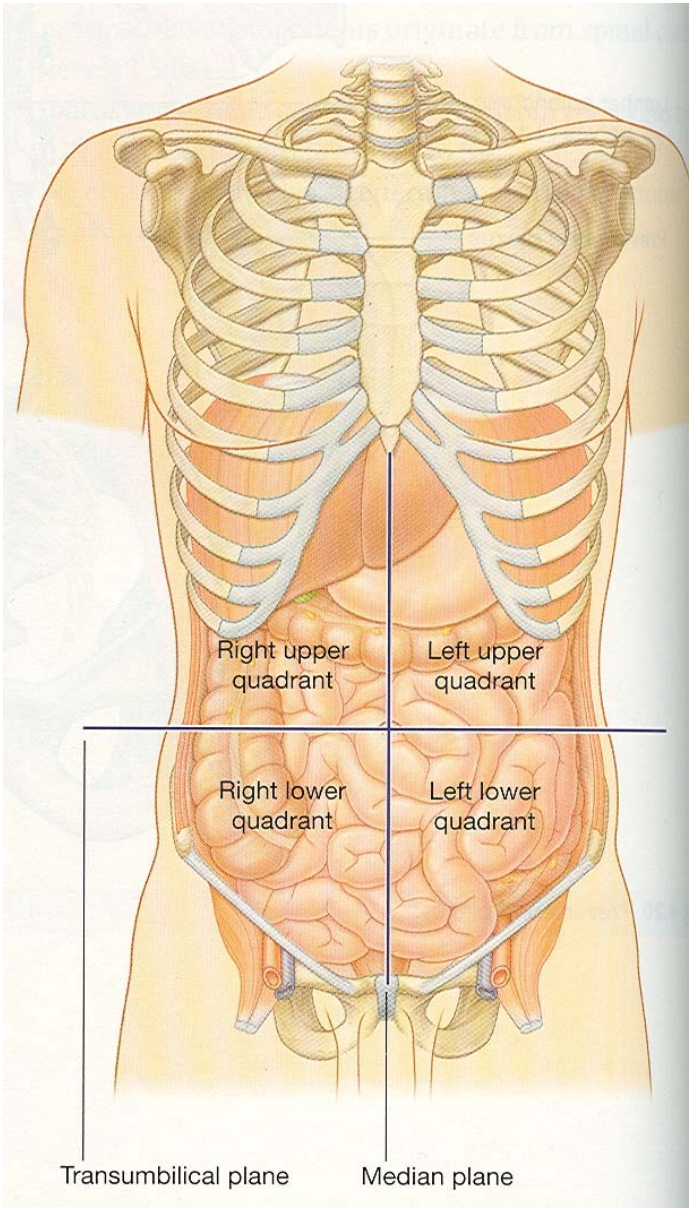


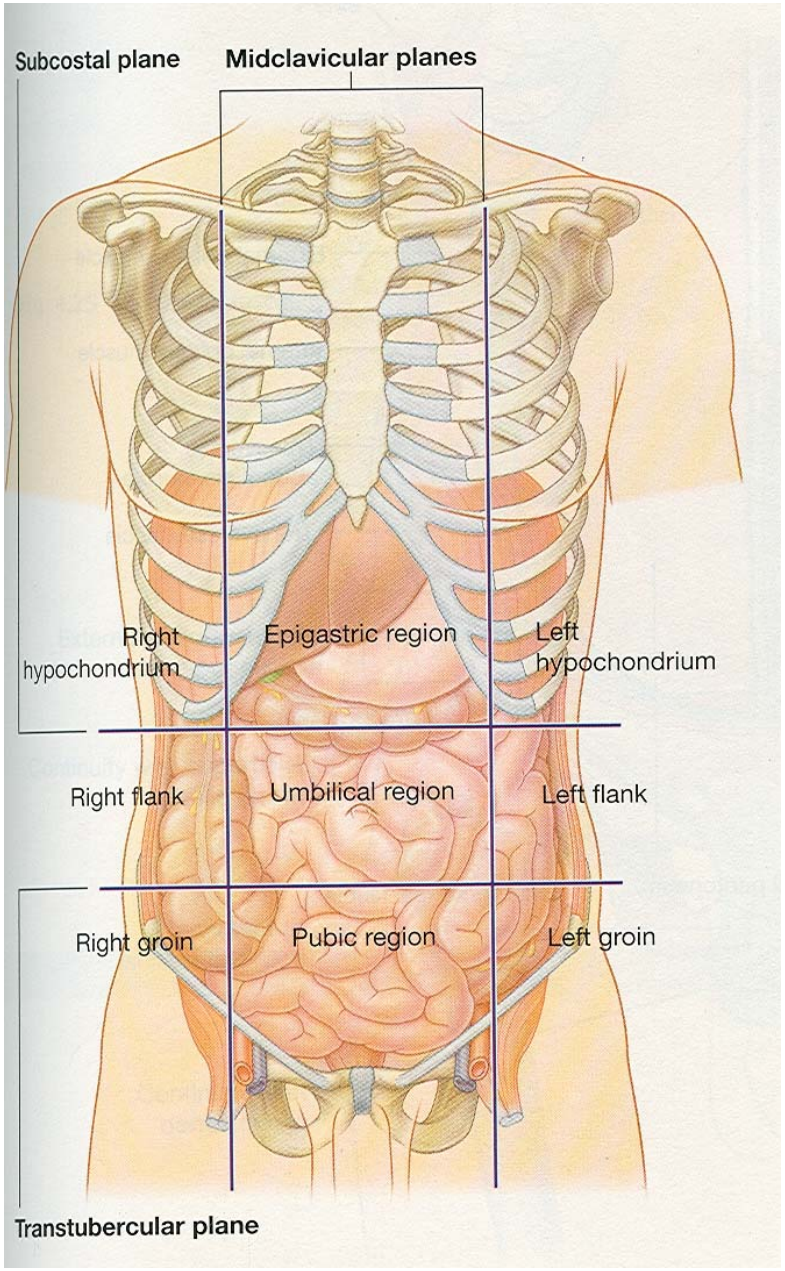
4.34 Transverse section showing the layers of the abdominal wall.

- Posteriorly- Quadratus lumborum, psoas major & iliacus

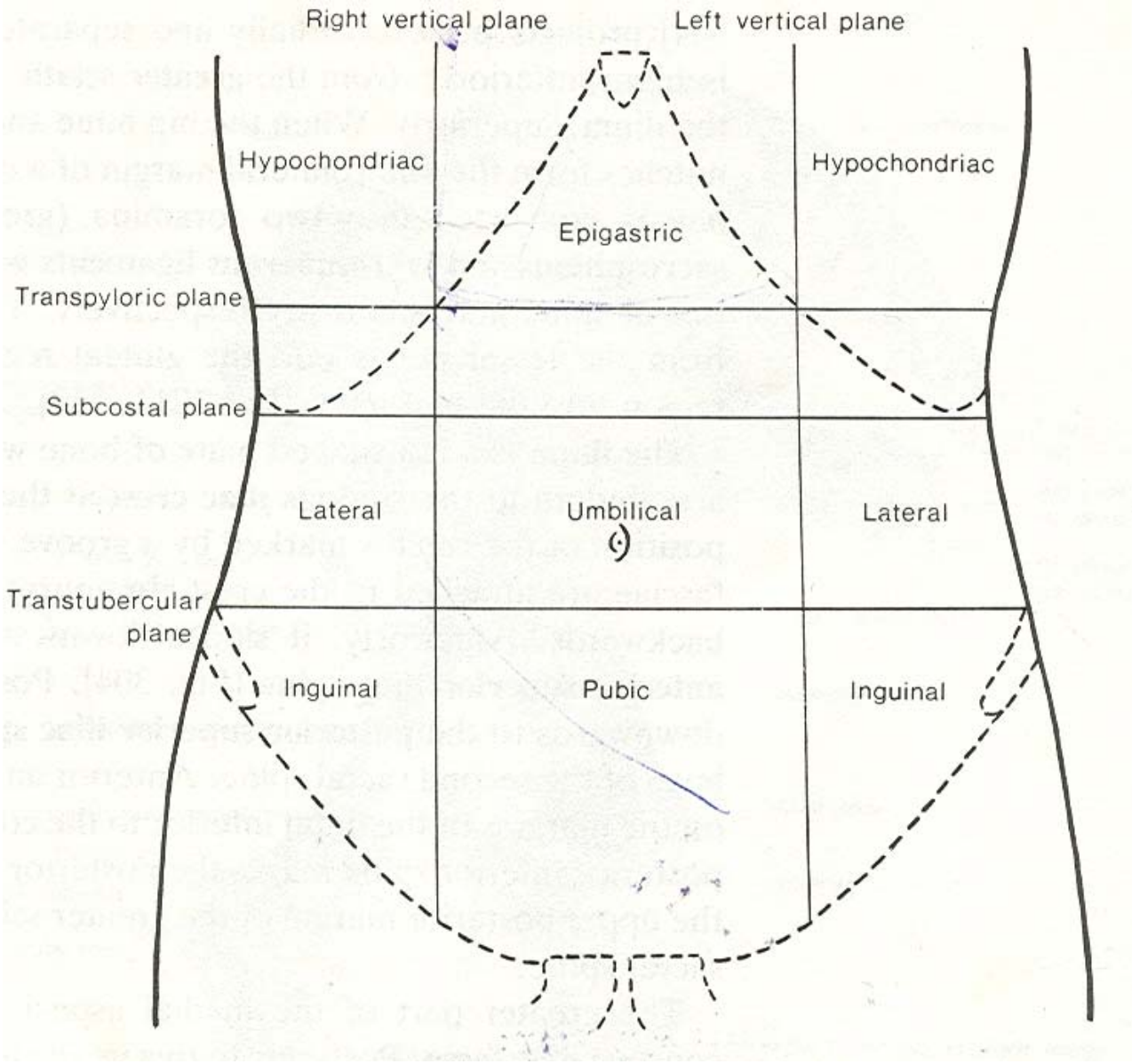


Abdominal regions





Regions on anterior abdominal wall



- Transpyloric plane- midway between suprasternal notch & symphysis pubis, cuts the tip of ninth costal cartilage, vertebral level L_1 lower border
- Trans tubercular plane- Passes from 5^{TH} Lumber vertebra near its upper border

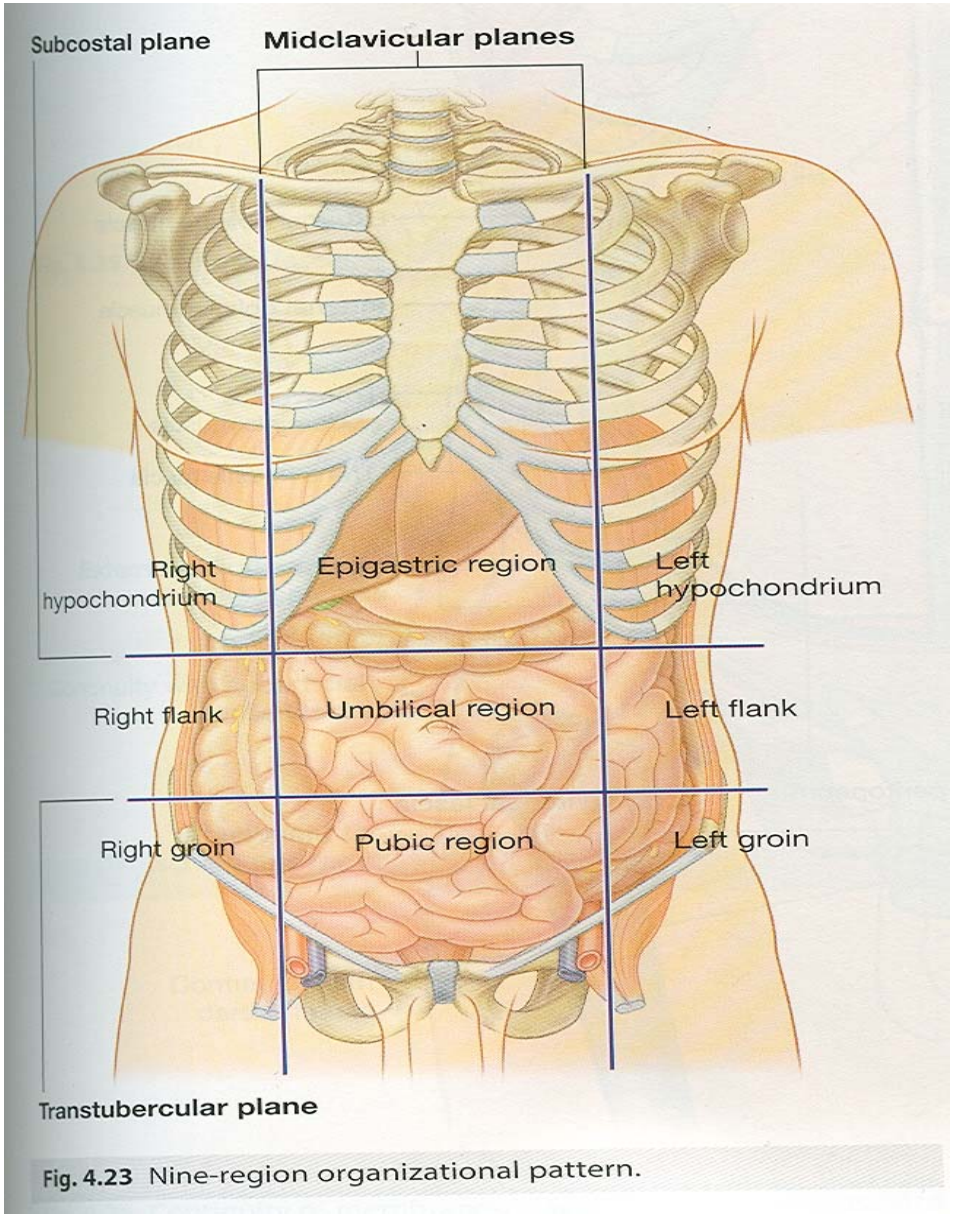
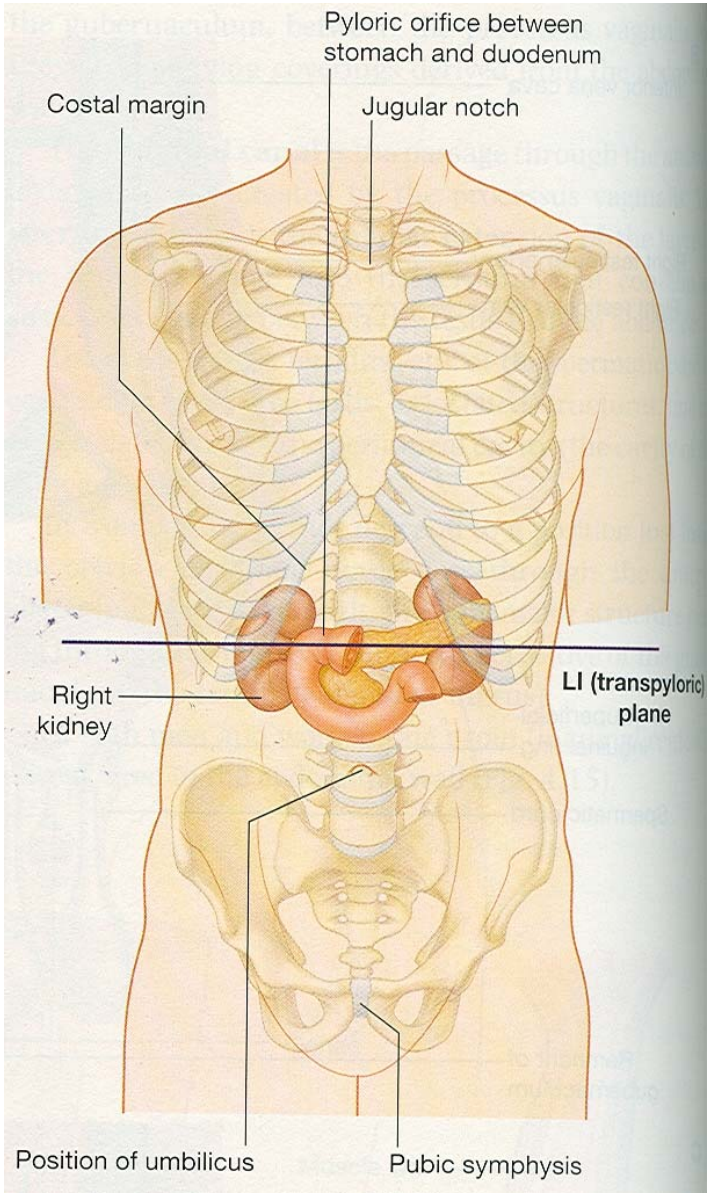


Fig. 4.23 Nine-region organizational pattern.

Transpyloric plane



Some other lines and planes

- Subcostal plane- Lower margin of rib cage, passes thru upper border of L_3
- Supracristal plane- joins the highest point of iliac crest, passes thru body of $L5^{th}$

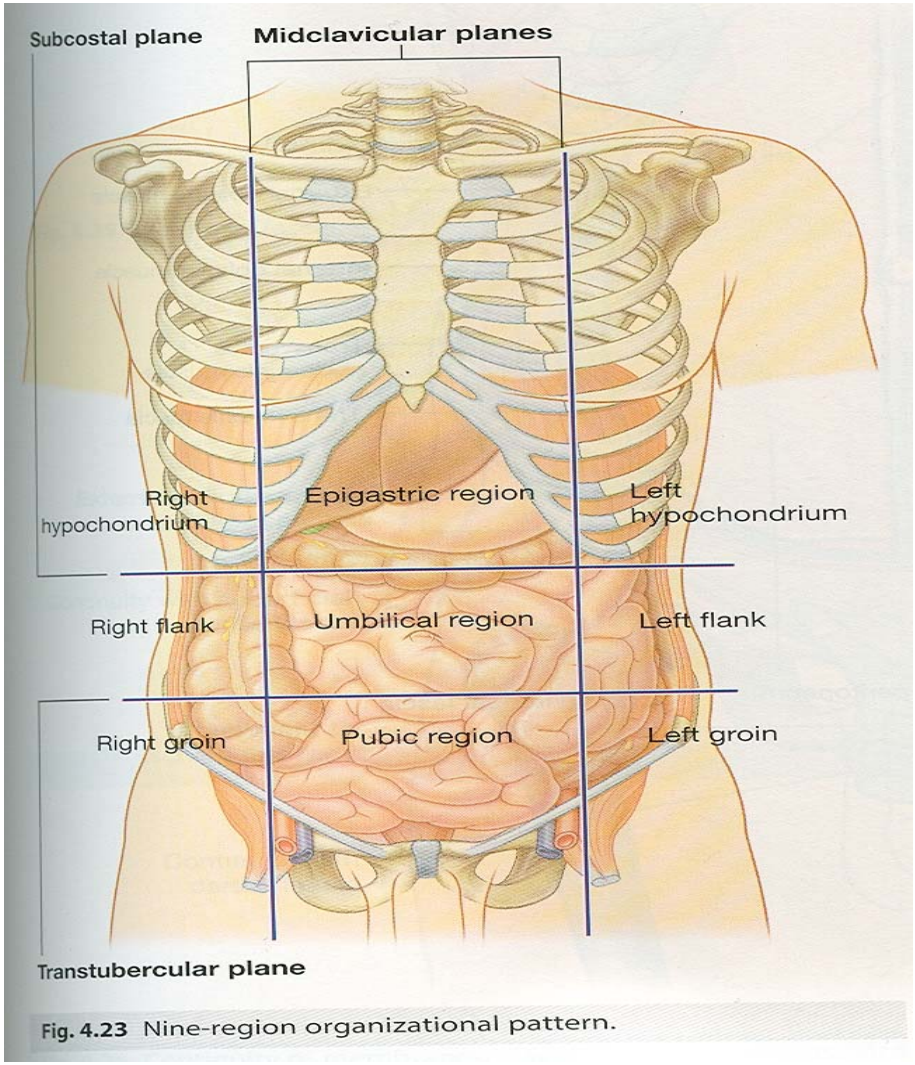


Fig. 4.23 Nine-region organizational pattern.

Vertical planes

- Midline
- Midclavicular line: passes thru the midpoint of the clavicle, crosses the costal margin just lateral to the tip of ninth costal cartilage & passes thru a point midway between the anterior superior iliac spine & the pubic symphysis

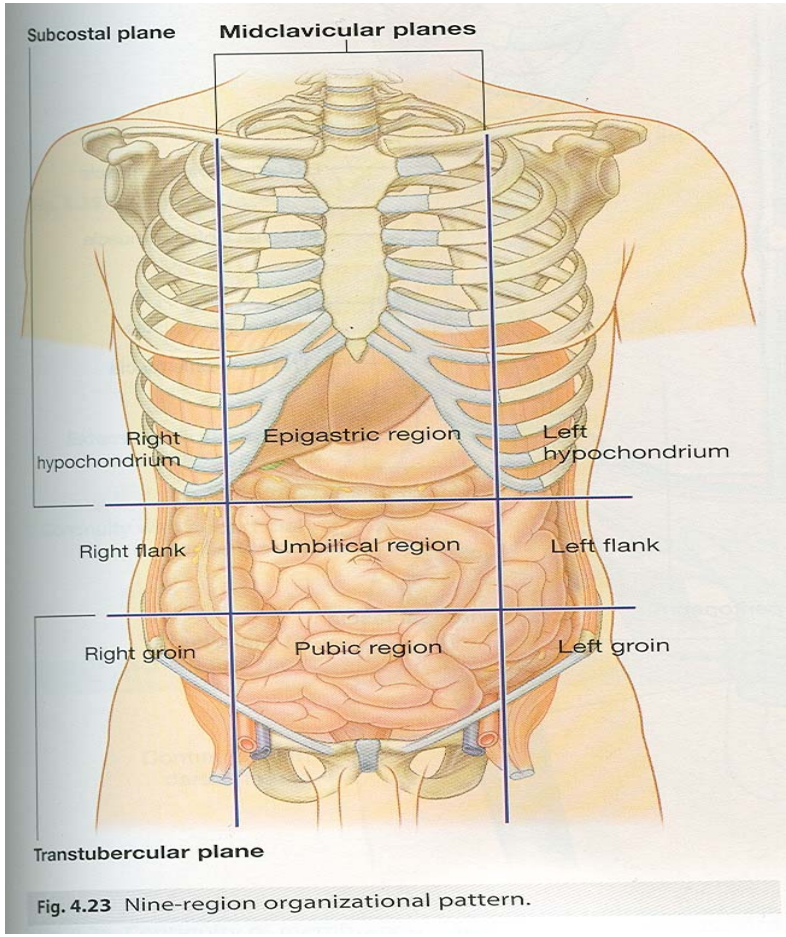


Fig. 4.23 Nine-region organizational pattern.

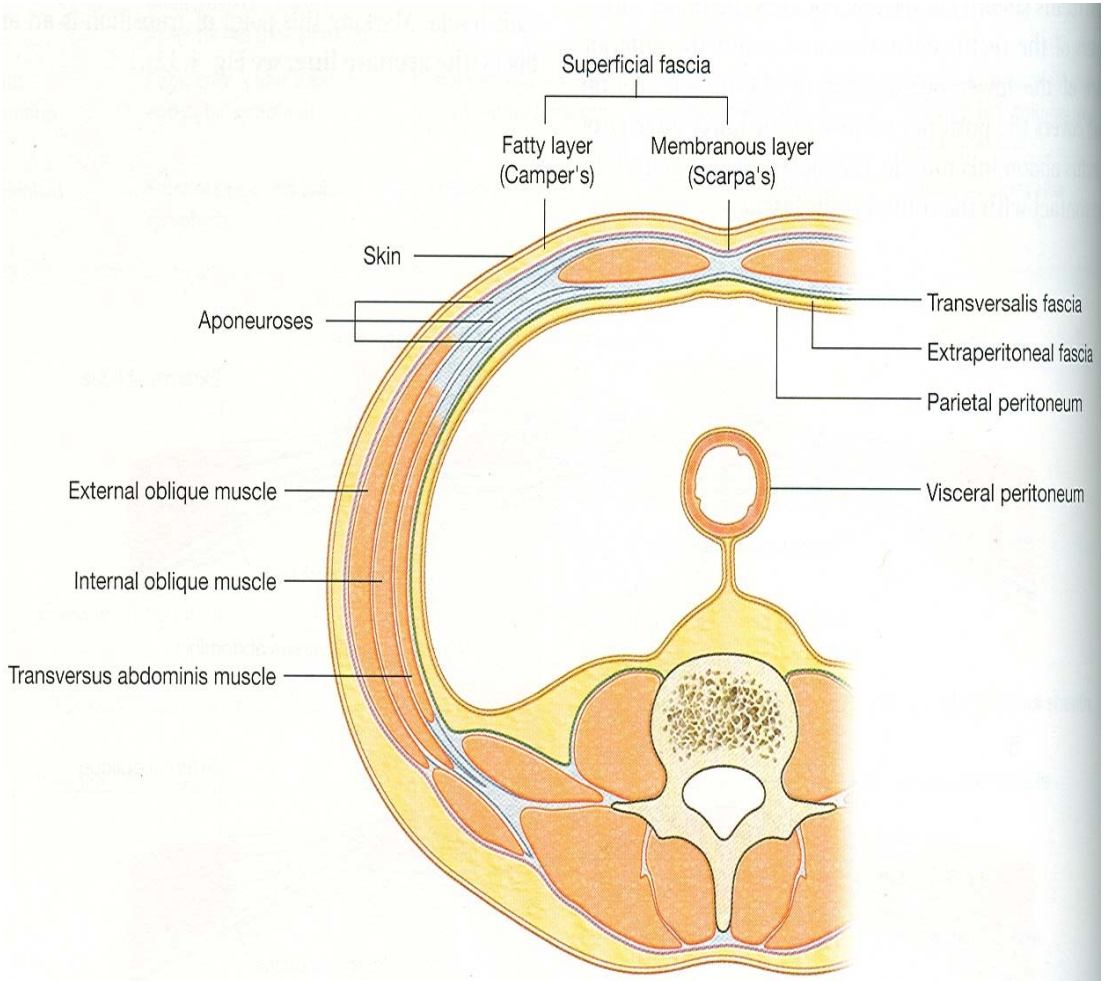
Abdominal cavity

- Cavity is lined by Peritoneum-
  - Parietal peritoneum
  - Visceral peritoneum

  Abdominal viscera can be
  - Intraperitoneal structures
  - Retroperitoneal structures

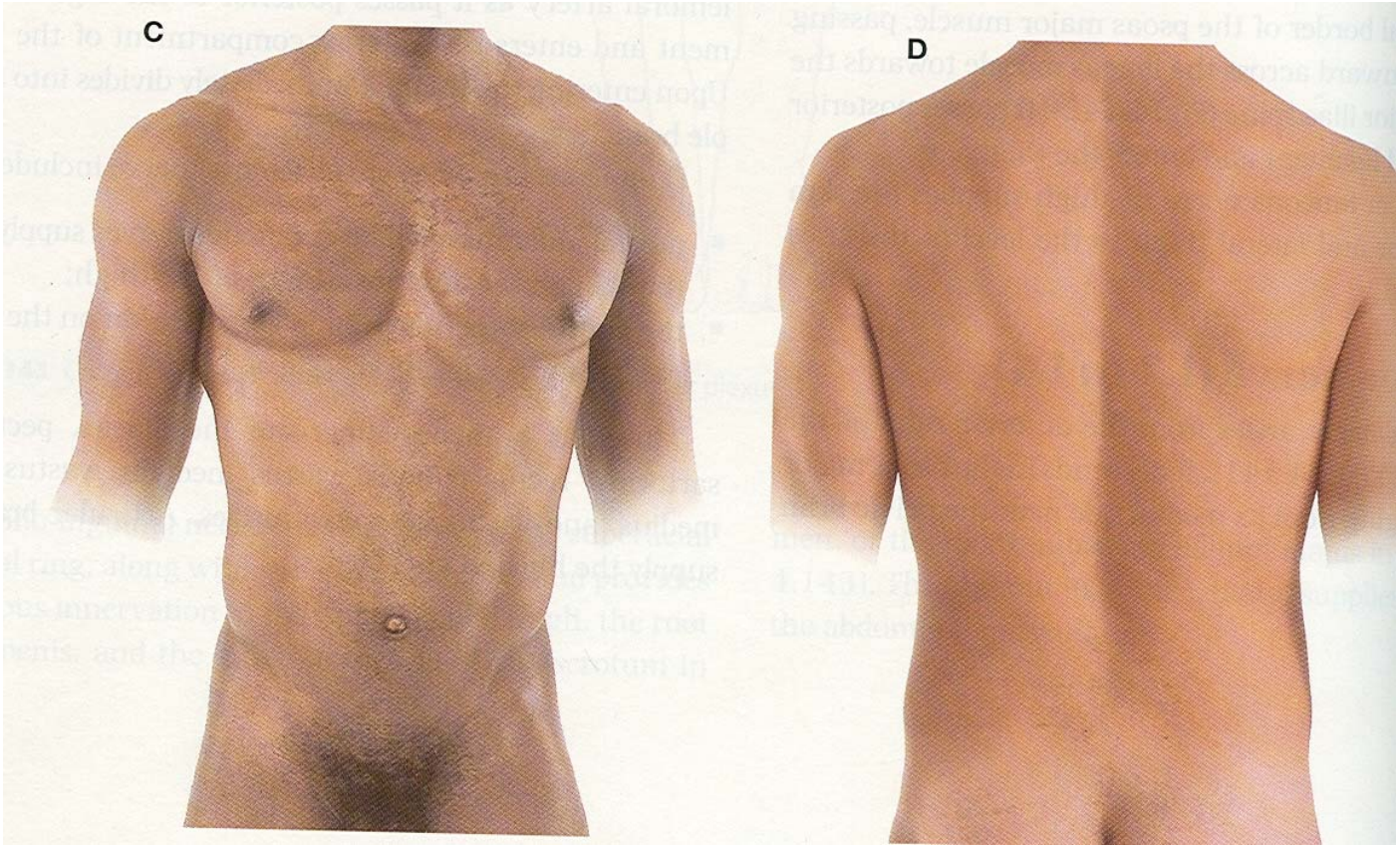
Anterior abdominal wall

- Includes both the front and side of the wall
- Made up of the skin, superficial fascia, muscles , fascia transversalis, extra peritoneal connective tissue & parietal layer of peritoneum



4.34 Transverse section showing the layers of the abdominal wall.

- Skin- highly strechable, show following feature
- A midline verticle furrow
- Umbilicus
- Linea semilunaris
- Three transverse furrows



Umbilicus

- Normal scar
- Normally lies at the junction between the third & fourth vertebra
- Supplied by T10 segment
- Marks the water shed line of the body
- Important site of portocaval anastomosis
- Meeting point of four folds in embryo
- Meeting point of three systems

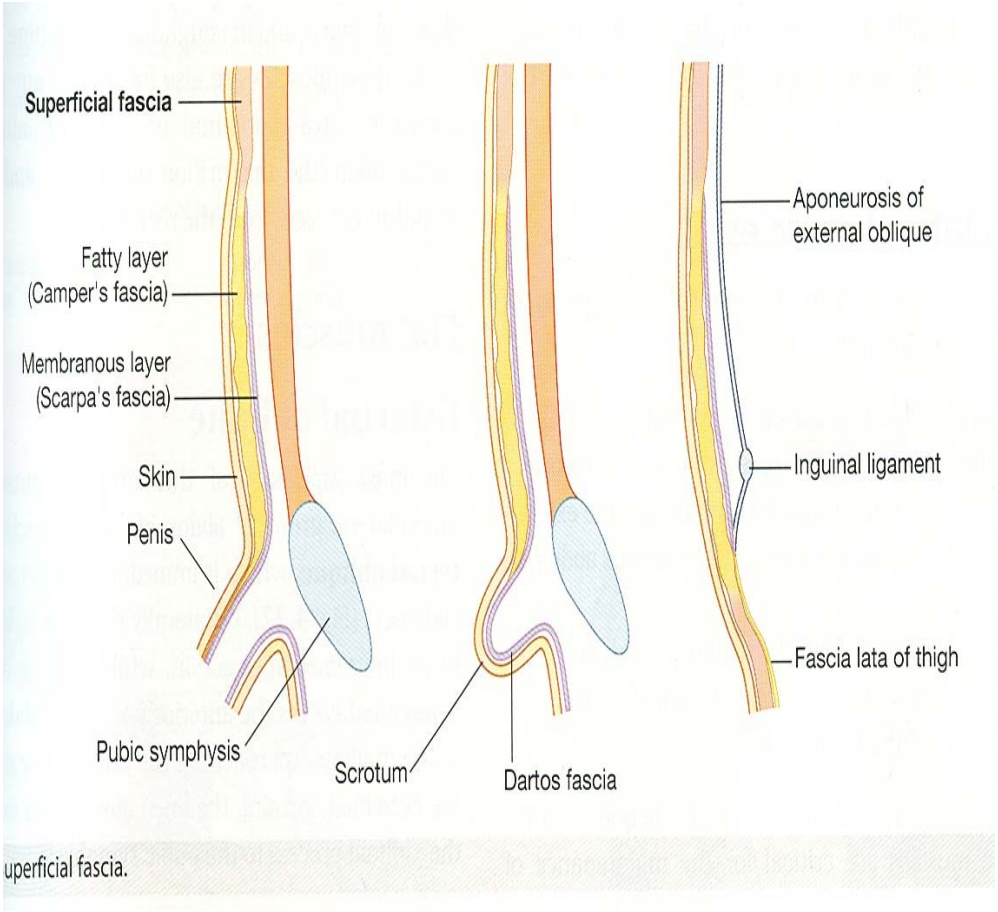
Superficial fascia

- A layer of fatty connective tissue
- Single layer up to umbilicus
- Below umbilicus splits in to

  superficial fatty layer

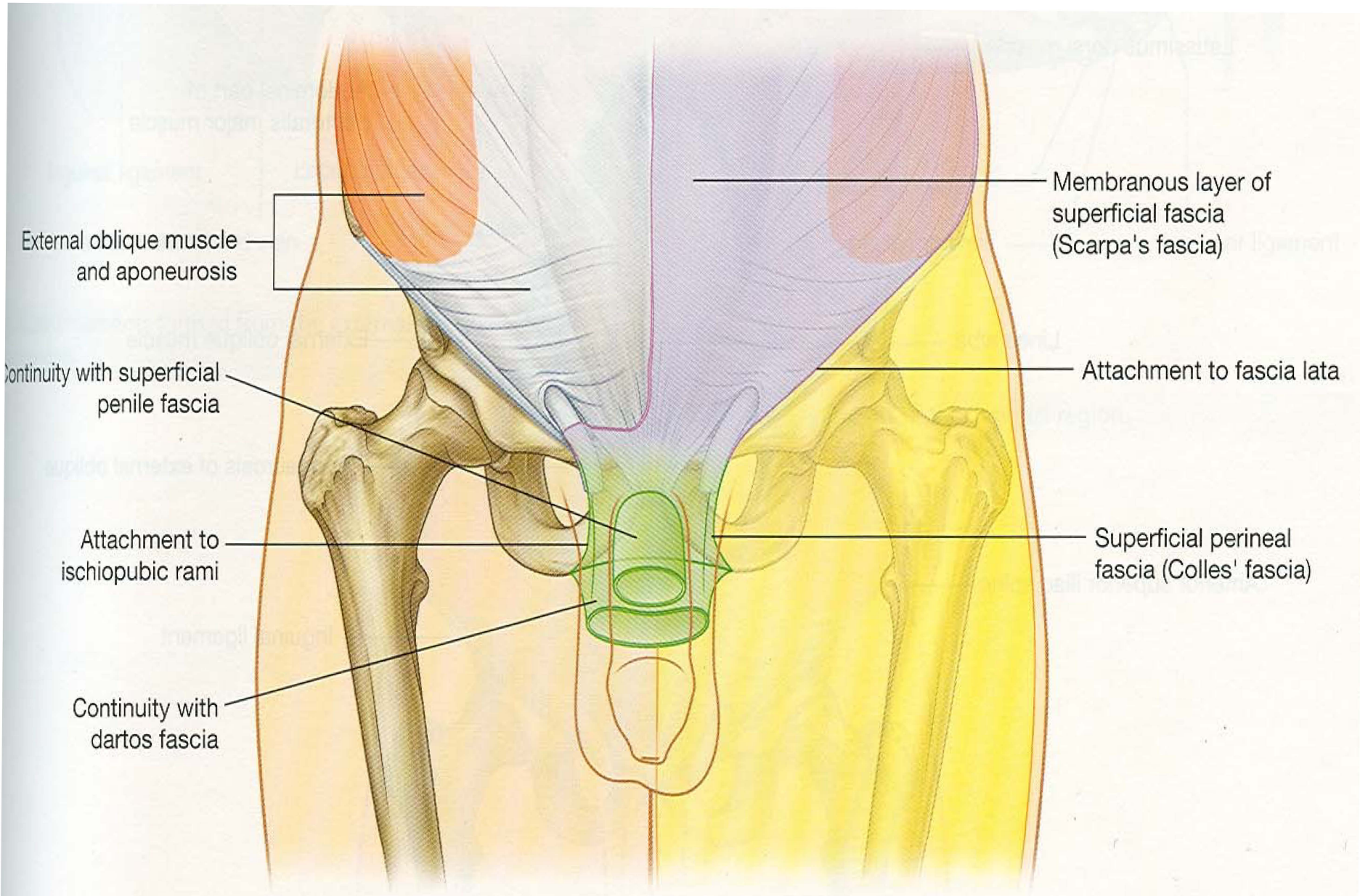
  deep membranous layer

- **Superficial layer**
- Contains fat & varies in thickness
- Continues over inguinal ligament with the superficial fascia of thigh
- In men continues over penis, looses fat & fuses with deeper layer & forms dartos fascia of scrotam
- In women, it retains fat & becomes content of labia majora



uperficial fascia.

- Deep membranous layer
- Contains fat
- continues into thigh
- In men in midline forms fundiform ligament of penis
- continues inferiorly with superficial fascia of perineum. The line of attachment pass over holden’s line, pubic tubercle, body of pubis, margins of pubic arch & posterior border of perineal membrane

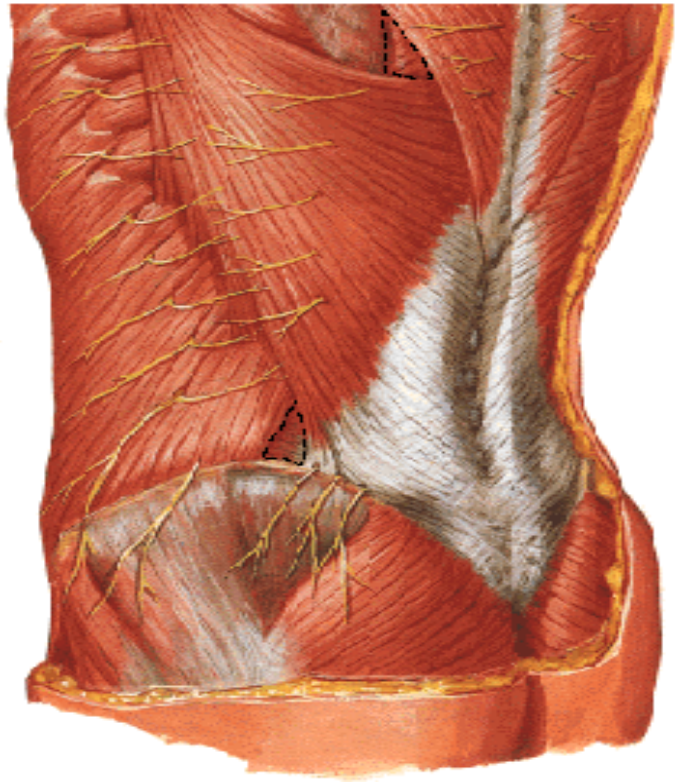


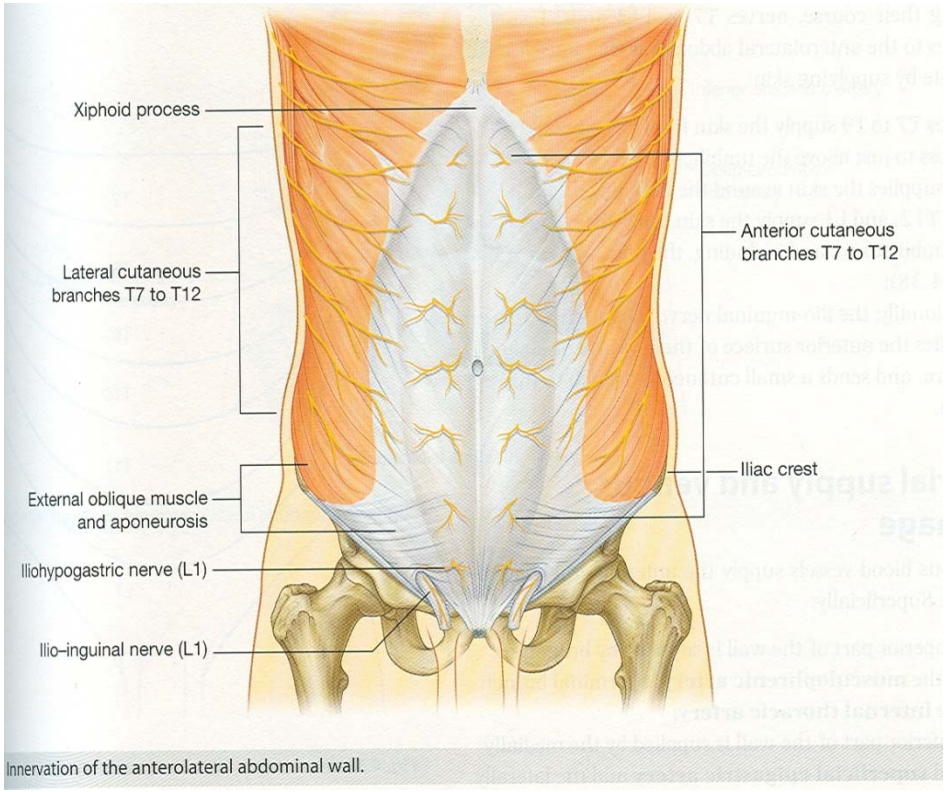
. 4.26 Continuity of membranous layer of superficial fascia into other areas.

Cutaneous nerves

- Lower six thoracic & first lumbar nerves

Posterolateral Abdominal Wall

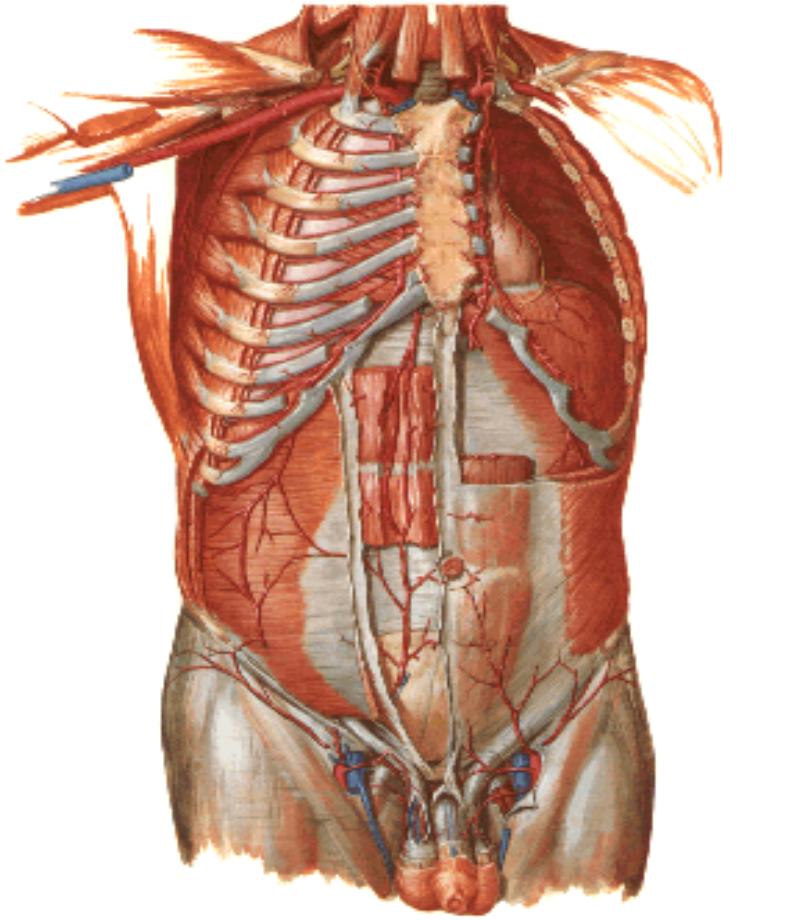




Innervation of the anterolateral abdominal wall.

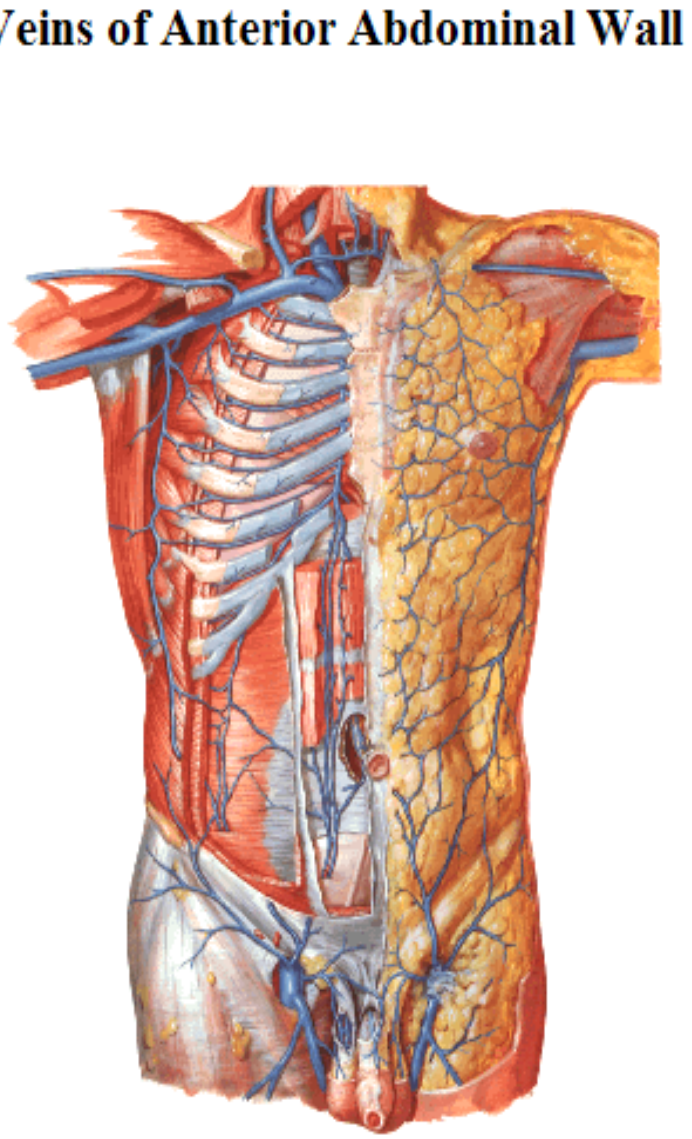
Cutaneous vessels

- Anterior cutaneous art are branches of Superior & inferior epigastric artery
- Lateral cutaneous art are branches of posterior intercostal artery
- Below umbilicus supply is from three suprficial branches of femoral artery
  - Superficial epigastric
  - Superficial external pudendal
  - Superficial circumflex iliac



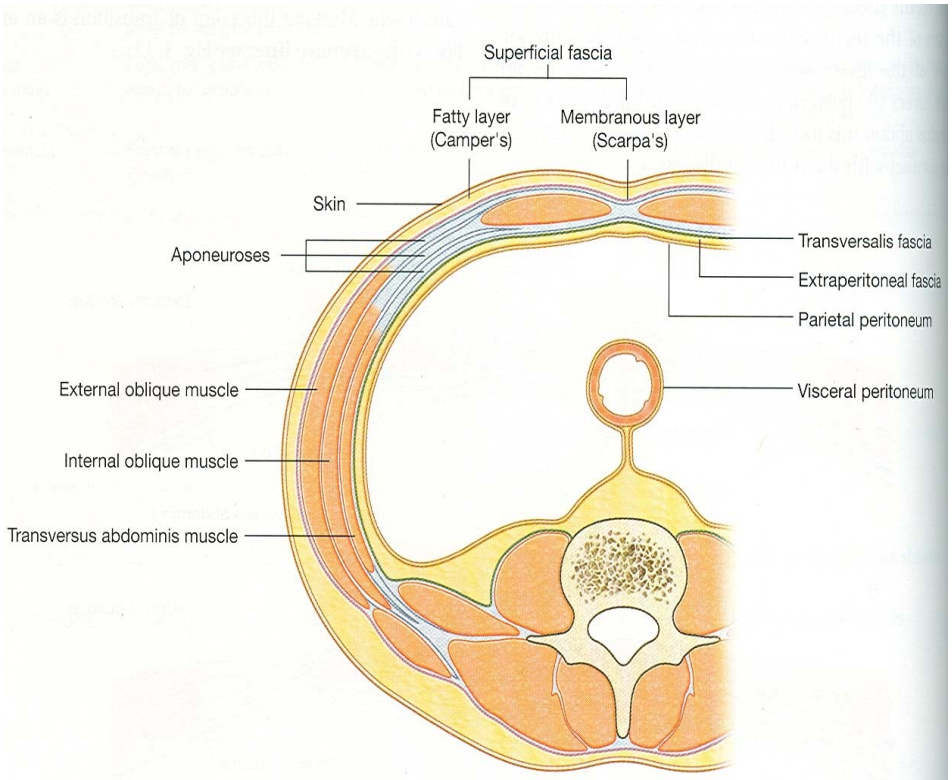
Cutaneous veins

- Accompany arteries
- Below the umbilicus they drain in to great saphenous vein, eventually into inferior vena cava
- Above umbilicus they pass to axilla & in to superior vena cava
- Both group anastomose thru small veins, which open up in case of obstruction in liver, giving a appearance called caput medusae
- Lymphatics also respect water shed line



Anterolateral muscles

- 5muscles
- Three flat muscles whose fiber begin posterolaterally, are replaced anteriorly by an aponeurosis as they continue towards midline. These are external oblique, internal oblique & transversus abdominis muscle
- Two vertical muscles, enclosed within tendinous sheath, rectus abdominis & Pyramidalis



4.34 Transverse section showing the layers of the abdominal wall.

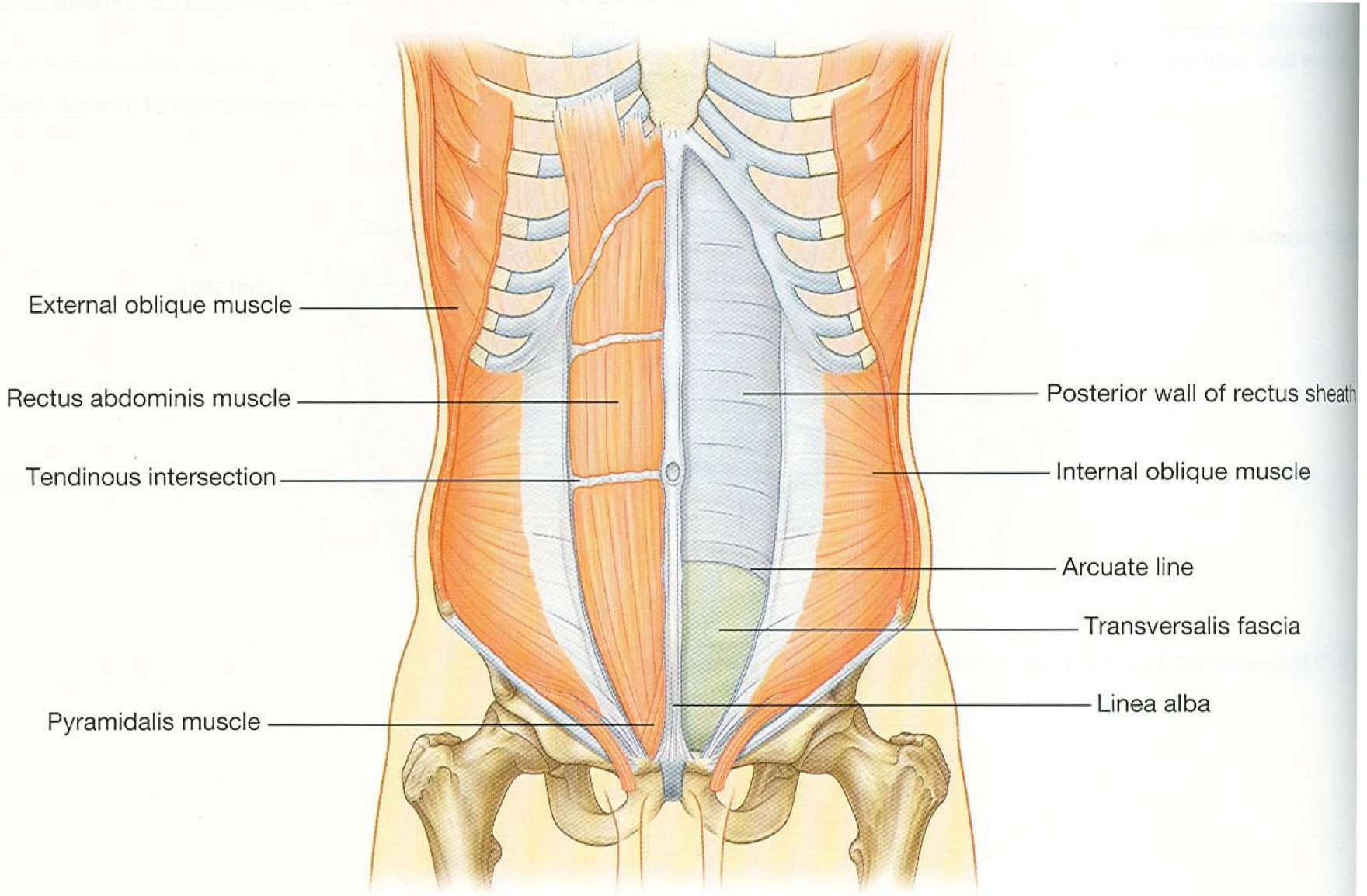
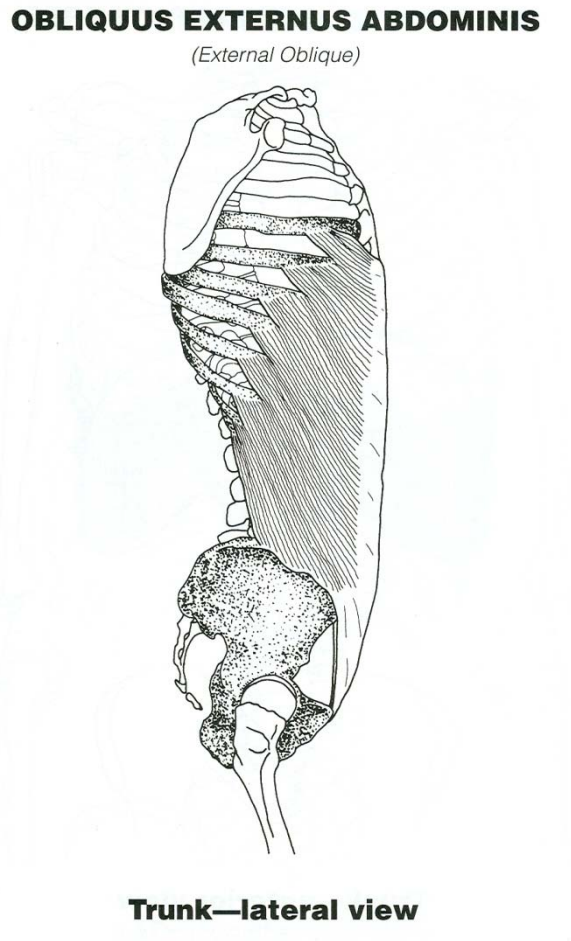


Fig. 4.32 Rectus abdominis and pyramidalis muscles.

External oblique (EO)



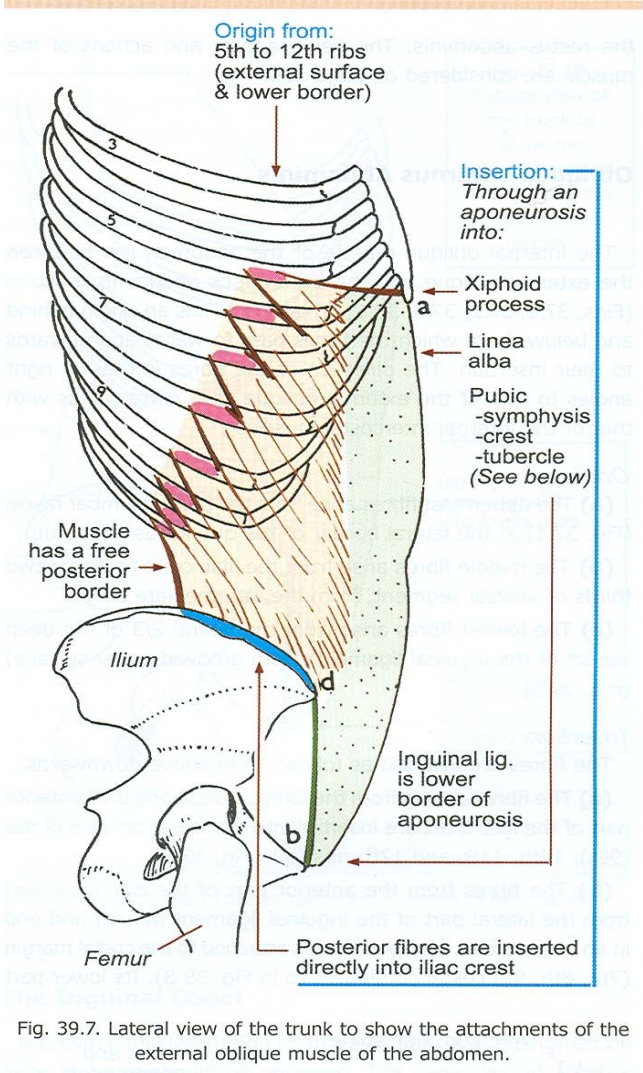
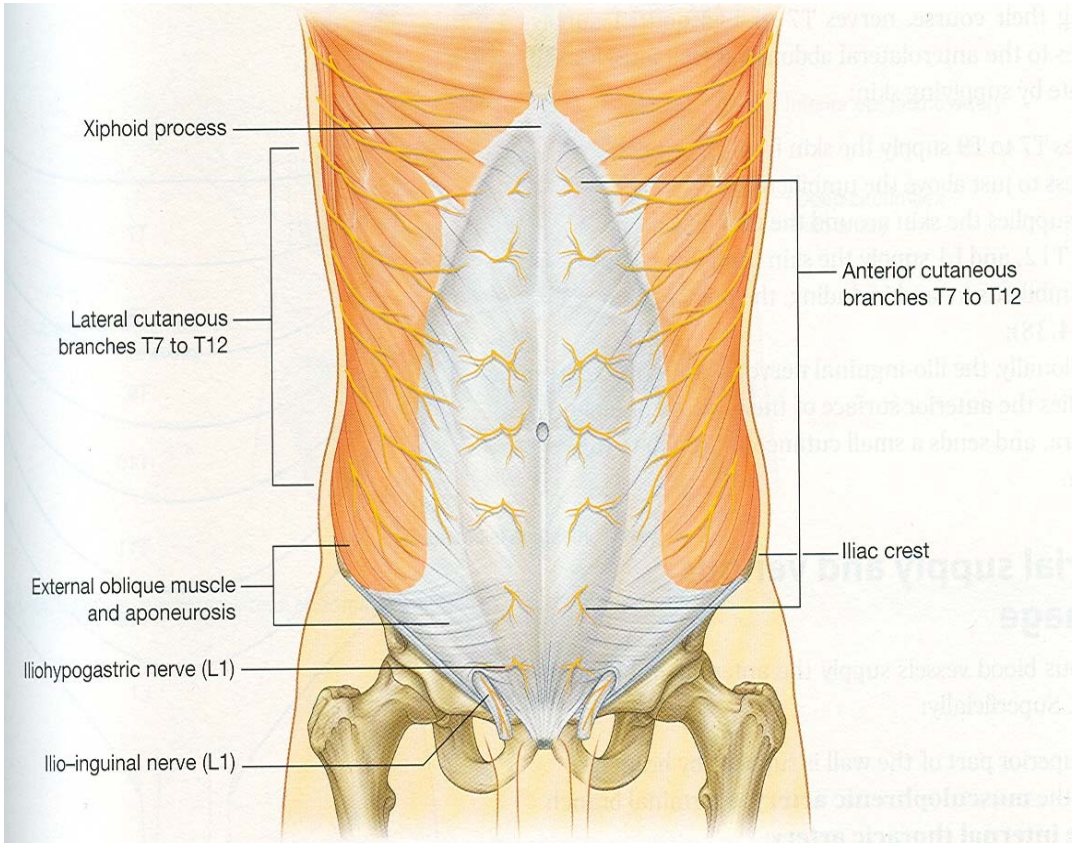


Fig. 39.7. Lateral view of the trunk to show the attachments of the external oblique muscle of the abdomen.

- Nerve supply – lower 6 thoracic nerves
- Has three free borders. Inferior free border forms inguinal ligament
- Has one opening superficial inguinal ring



Innervation of the anterolateral abdominal wall.

Inguinal ligament

- Lower border of external oblique aponeurosis which is rolled backwards on itself
- Fascia lata is attached inferiorly to give it convexity
- Gives origin to IO & TA from its superior surface

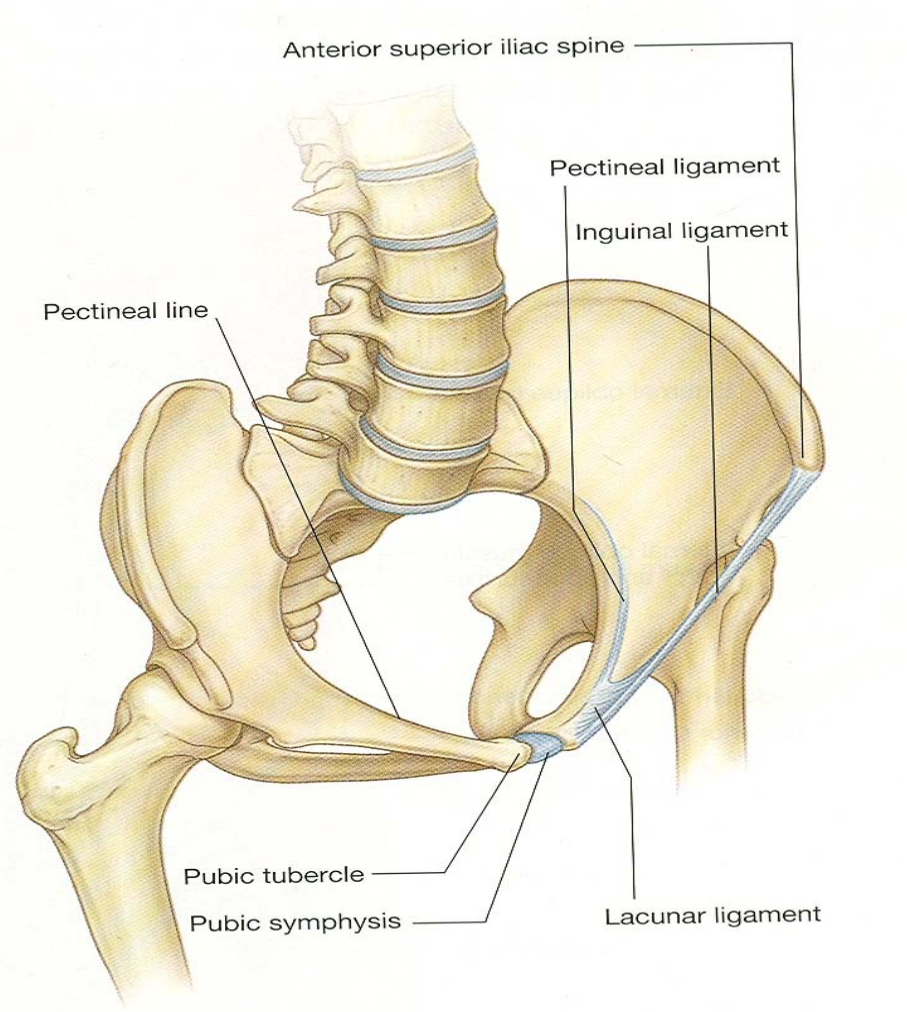


Fig. 4.29 Ligaments of the inguinal region.

- Upper grooved surface in medial half forms inguinal canal

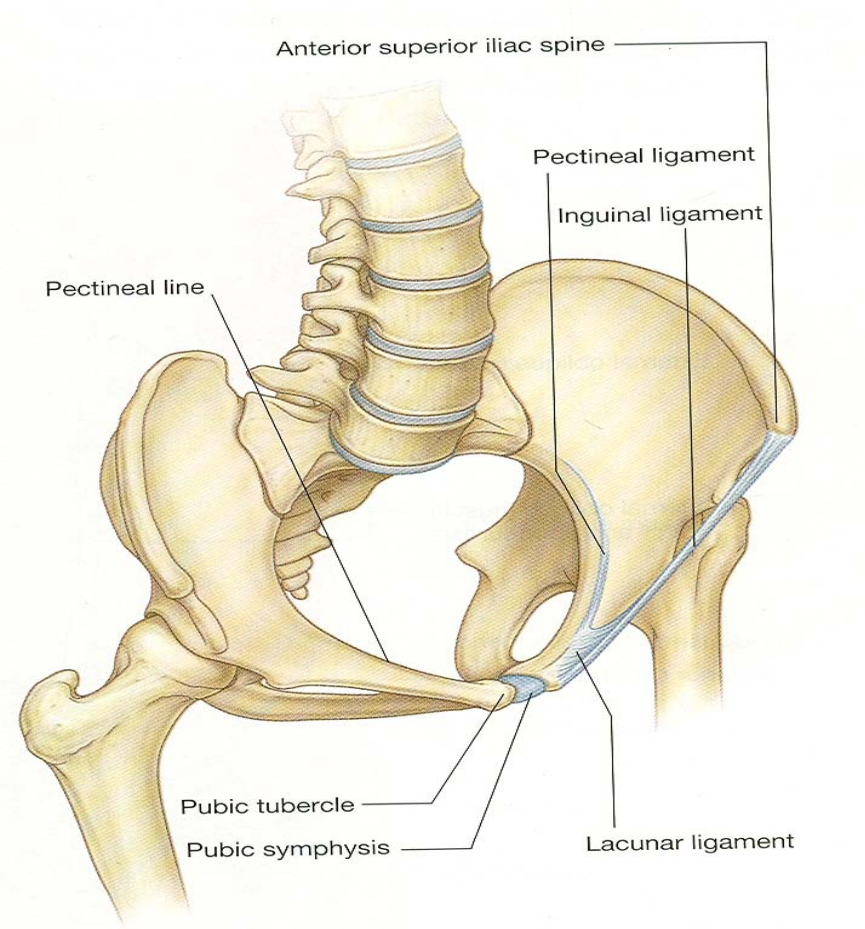


Fig. 4.29 Ligaments of the inguinal region.

Extensions of inguinal ligament

- Lacunar ligament
- Pectineal ligament or ligament of cooper
- Reflected part of inguinal ligament

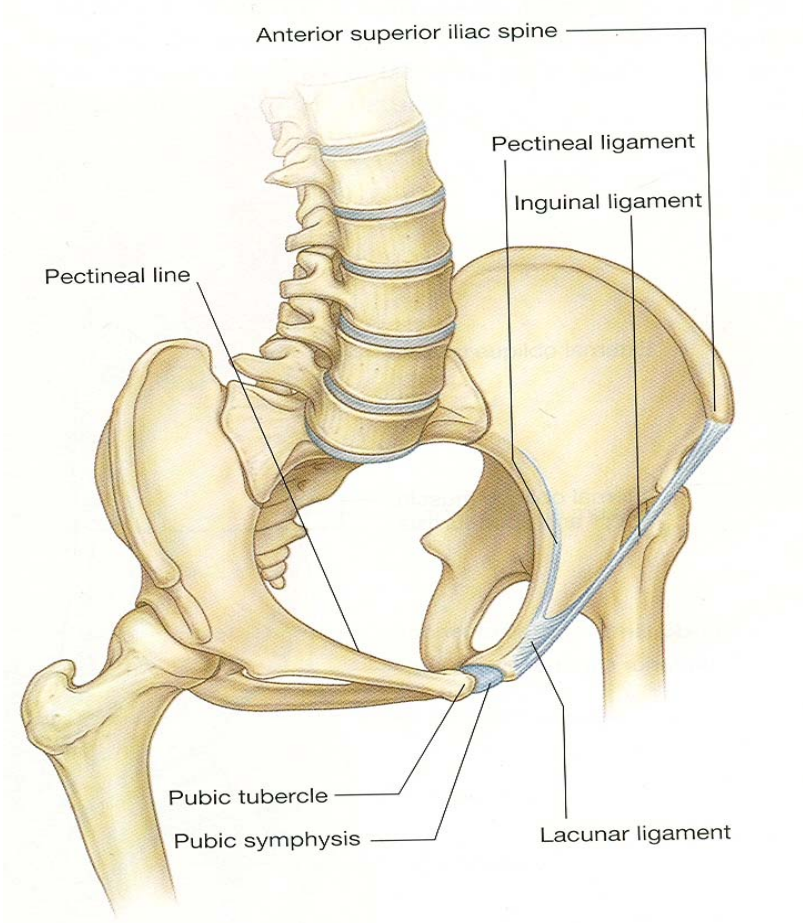
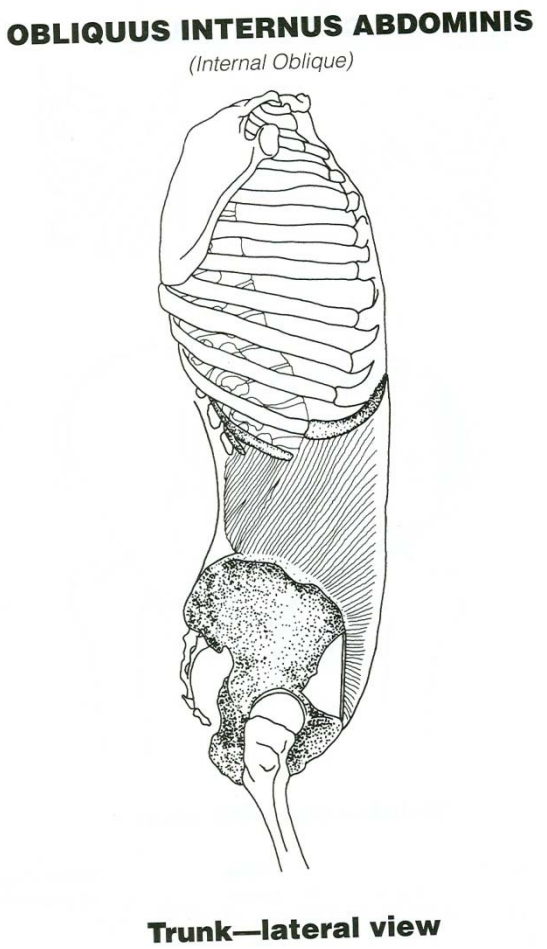


Fig. 4.29 Ligaments of the inguinal region.

Internal oblique (IO)



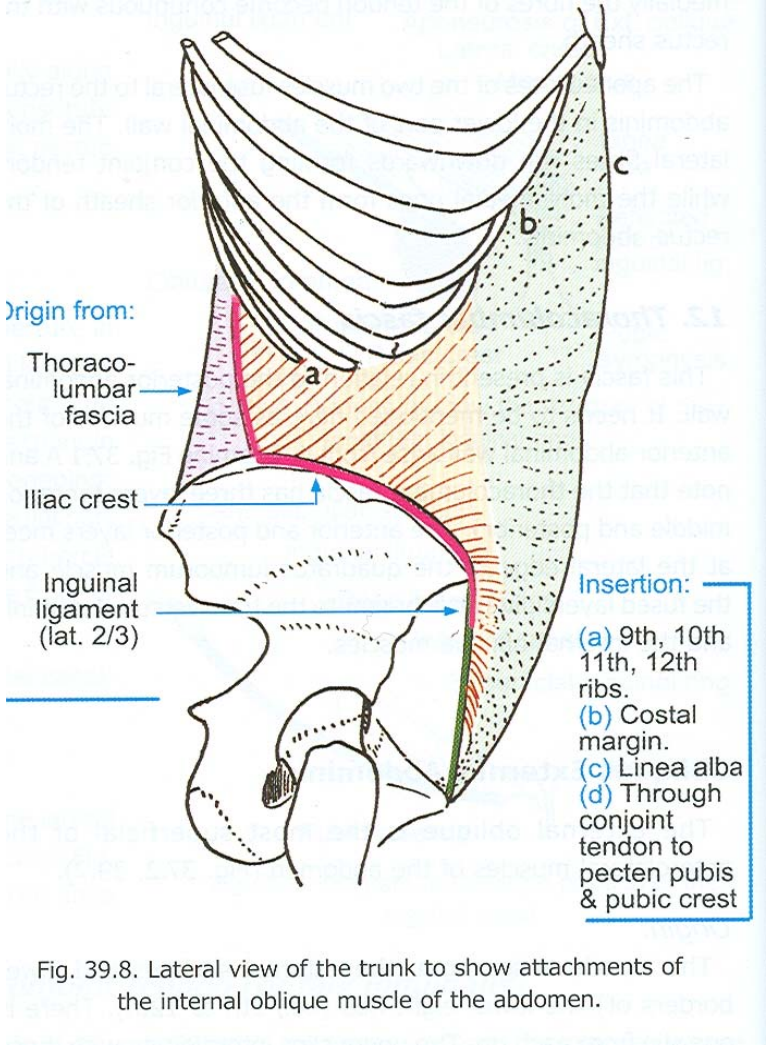
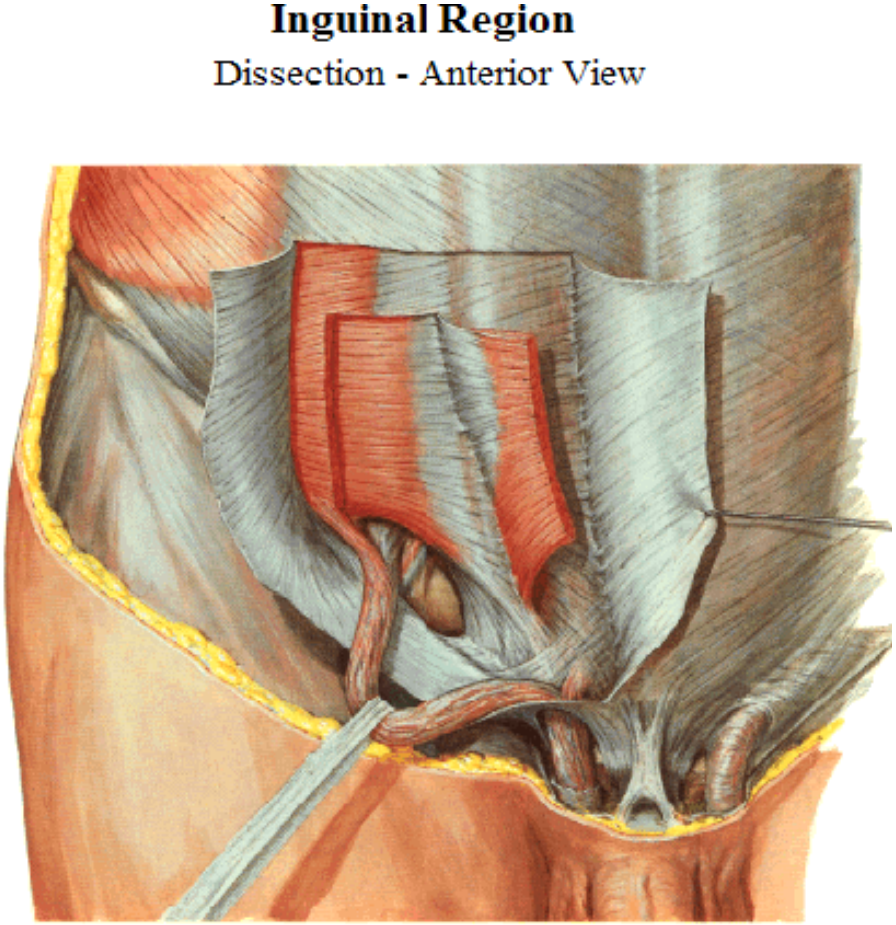


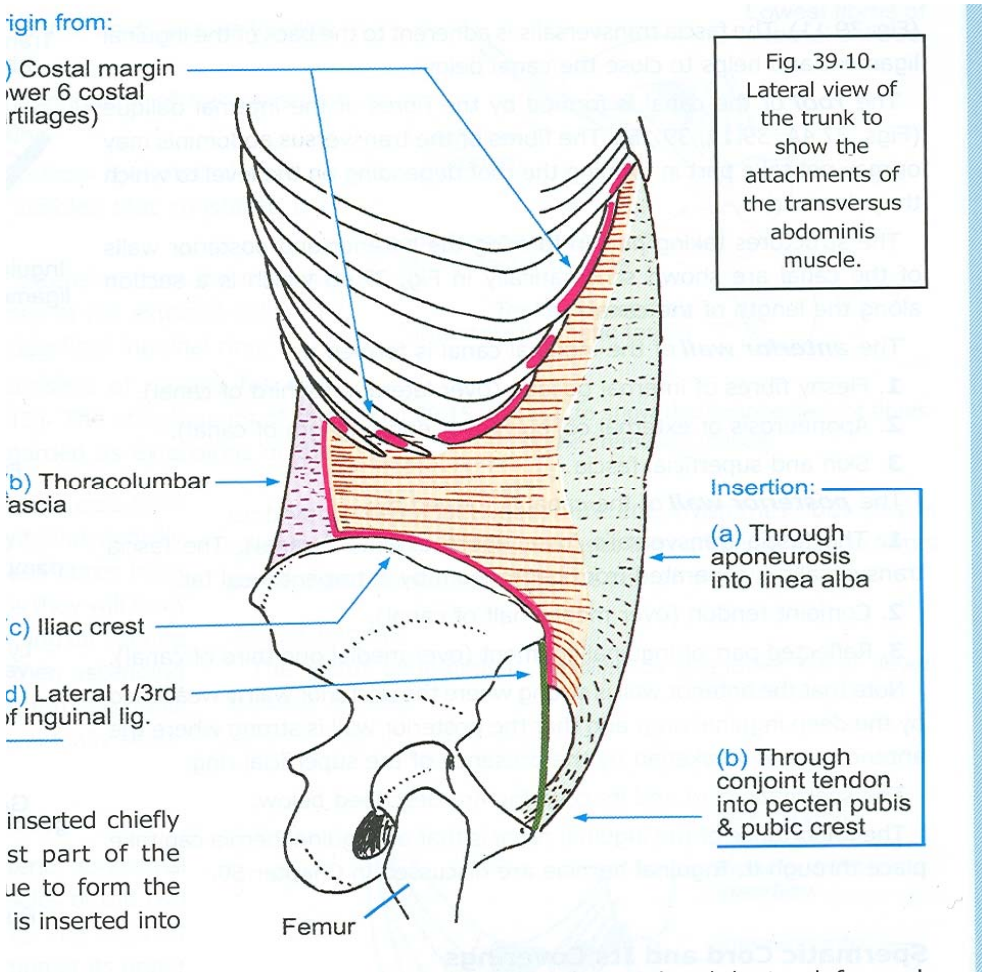
Fig. 39.8. Lateral view of the trunk to show attachments of the internal oblique muscle of the abdomen.

- Nerve supply- Lower 6 thoracic nerve & first lumbar nerve
- Conjoint tendon is formed by the fusion of Lowest aponeurotic fibers of the IO& TA & is attached to pubic crest & median part of pecten pubis. Guards the week point of superficial inguinal ring

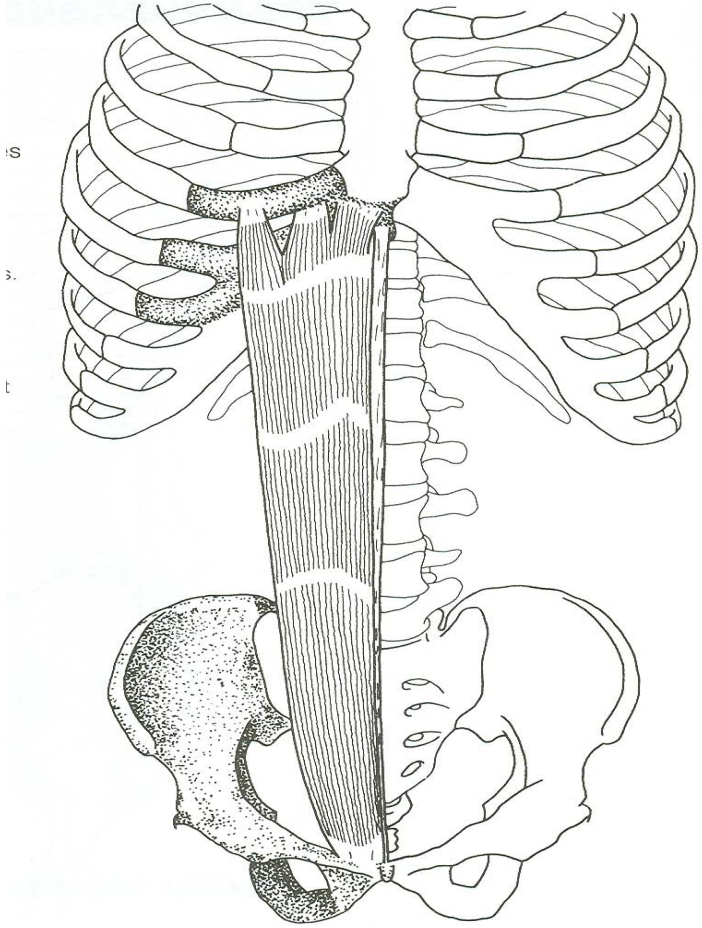


Transversus Abdominis (TA)

- Nerve supply-Lower 6 thoracic nerve & first lumbar nerve



Rectus abdominis (RA)



Trunk—anterior view

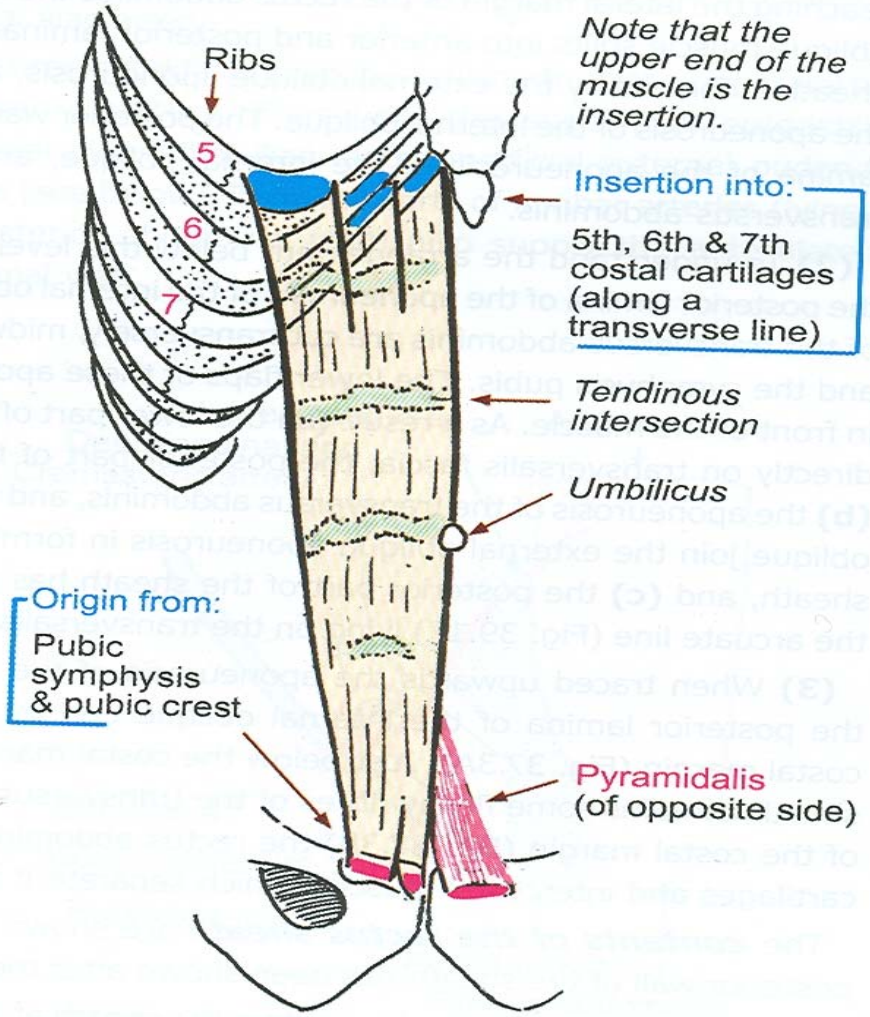


Fig. 39.16. Scheme to show the attachments of the rectus abdominis

- Nerve supply- lower 6 or 7 thoracic nerves
- Enclosed in rectus sheath
- Upper Part Is Crossed With 3 Tendinous Intersection

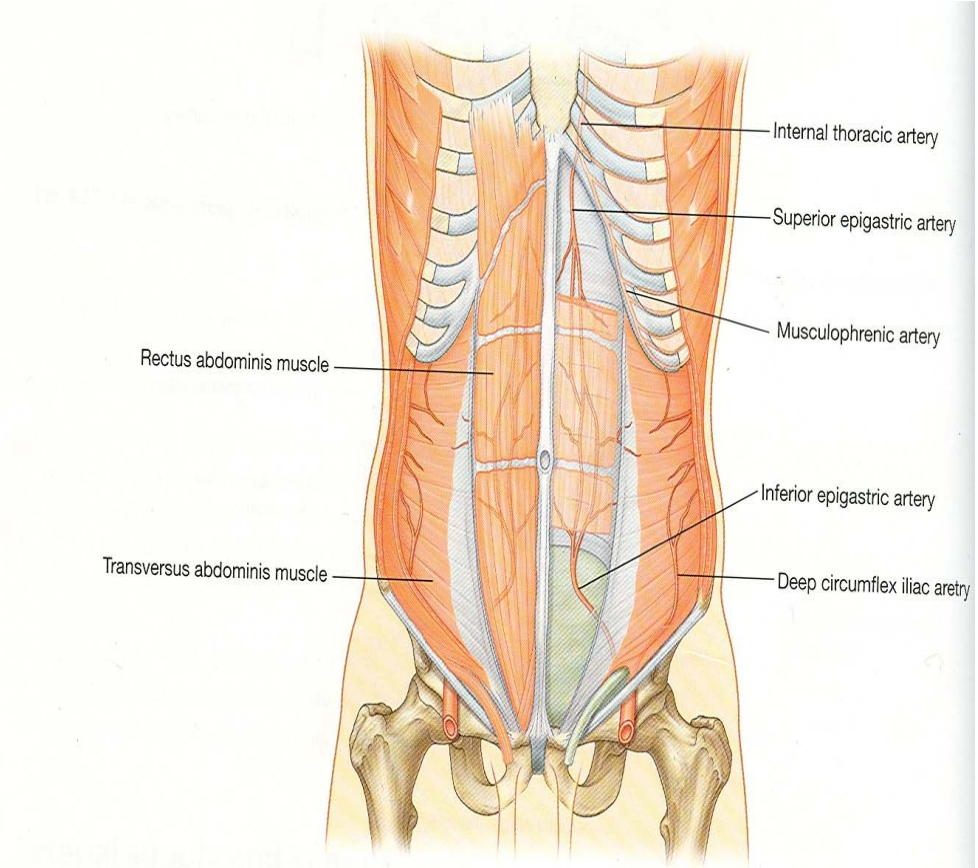


Fig. 4.40 Superior and inferior epigastric arteries.

Pyramidalis

- Small triangular rudimentary muscle
- Nerve supply – sub costal nerve(T12)

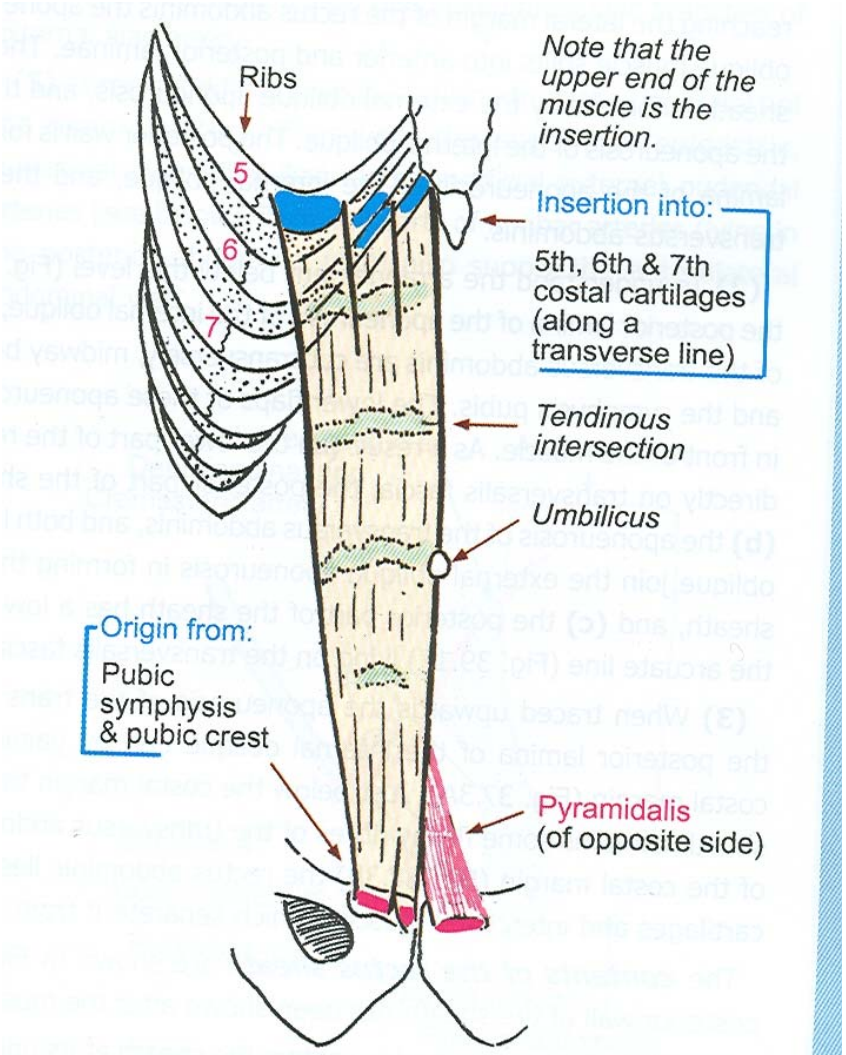
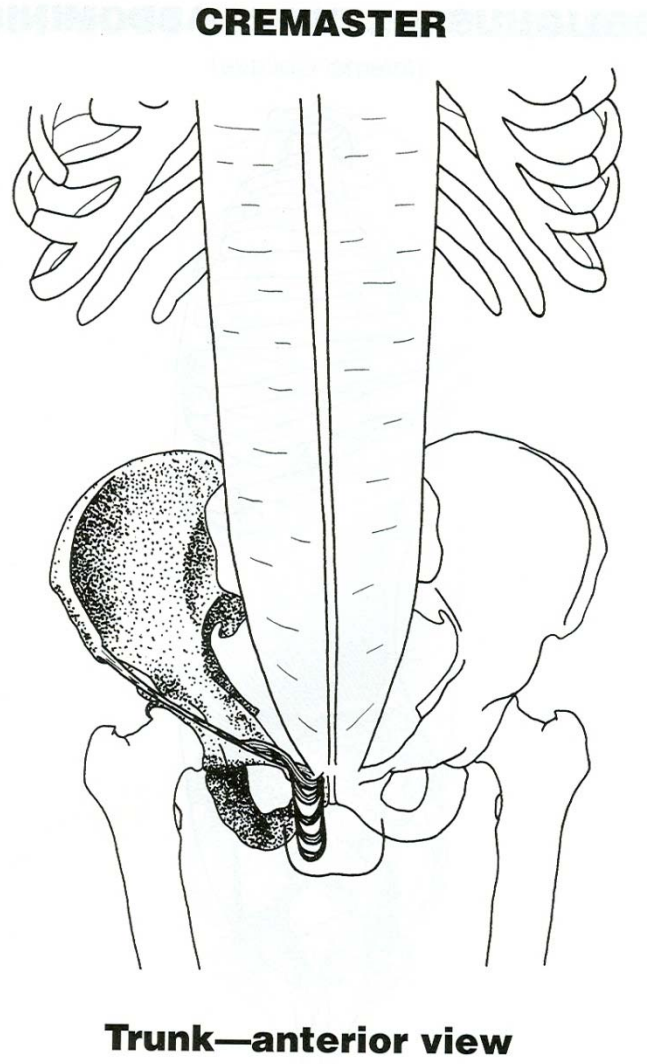


Fig. 39.16. Scheme to show the attachments of the rectus abdominis

Cremaster

- Nerve supply- Genital branch of Genitofemoral nerve



Action of muscles

- Support of abdominal viscera
- Movement of trunk
- Help in forcefuful respiration
- Expulsive acts
- Pyramidalis tenses the linea alba
- Cremaster helps to suspend the testis. Plugs superficial inguinal ring when intra abdominal pressure rises

Deep nerves of anterior abdominal wall

- Lower Six thoracic & first lumbar

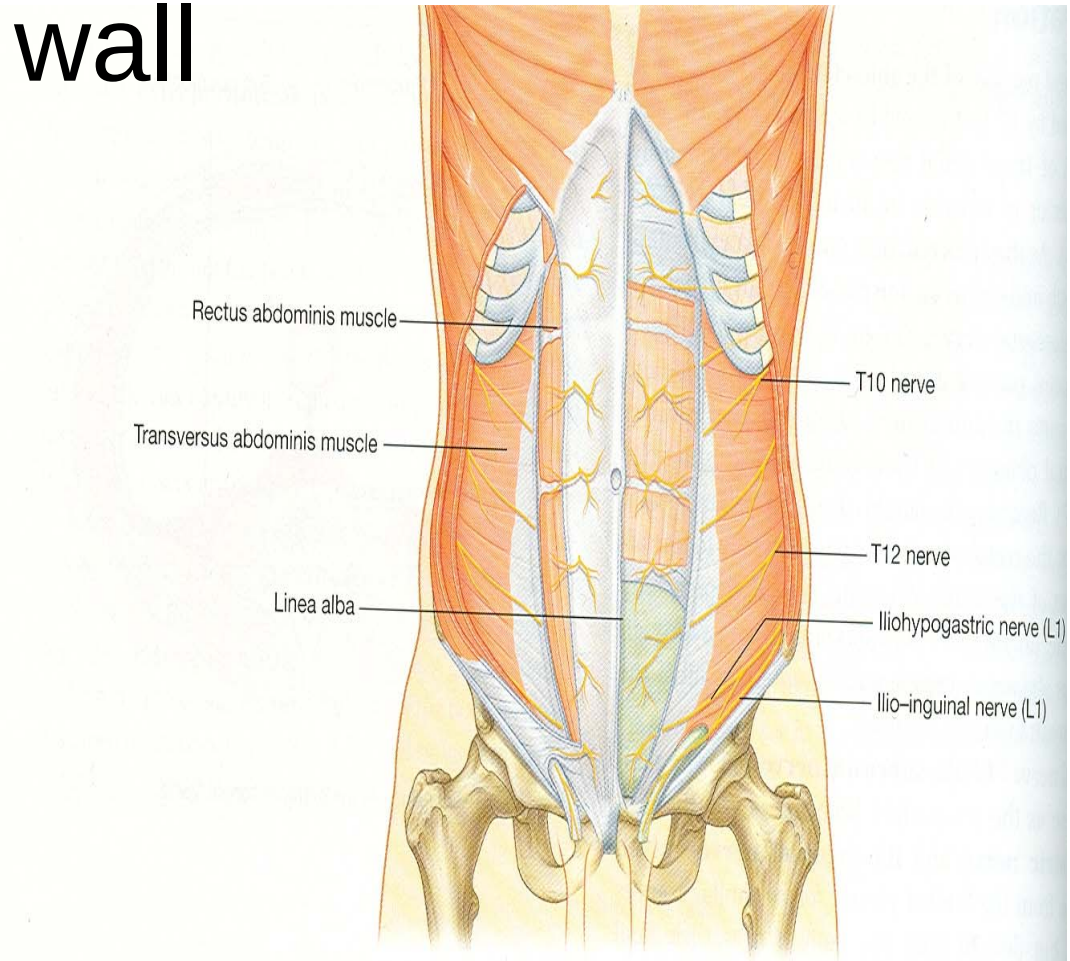


Fig. 4.37 Path taken by the nerves innervating the anterolateral abdominal wall.

Deep arteries of anterior abdominal wall

- Superior epigastric artery
- Musculophrenic artery
- Inferior epigastric artery
- Deep circumflex artery

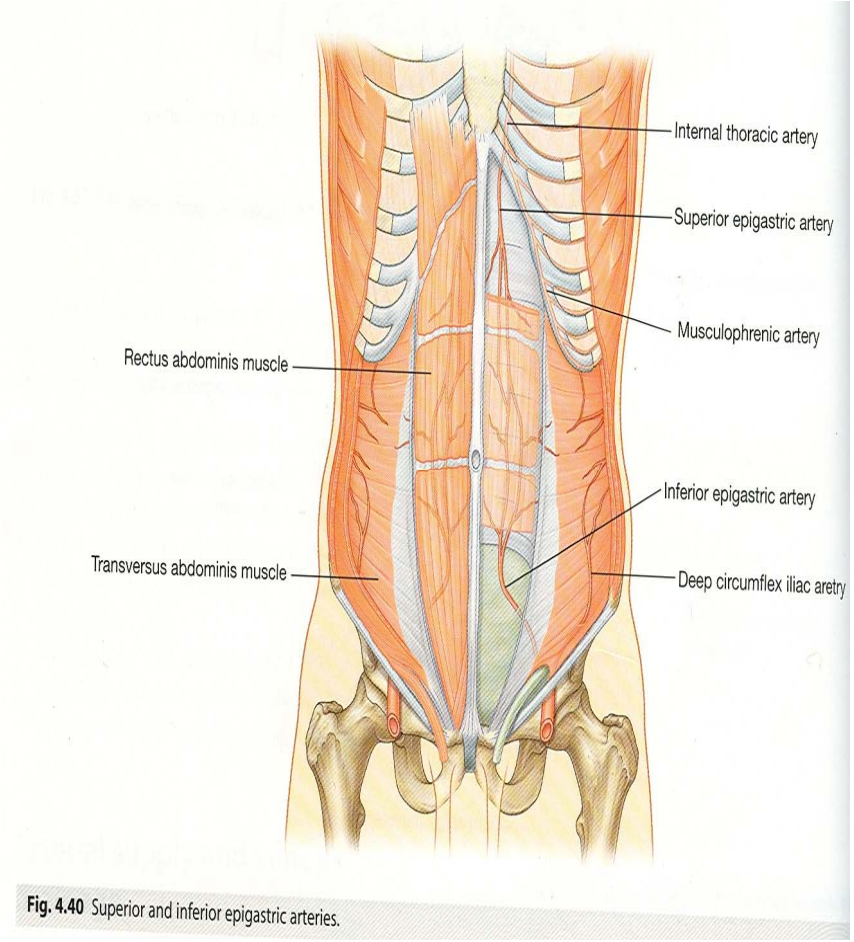
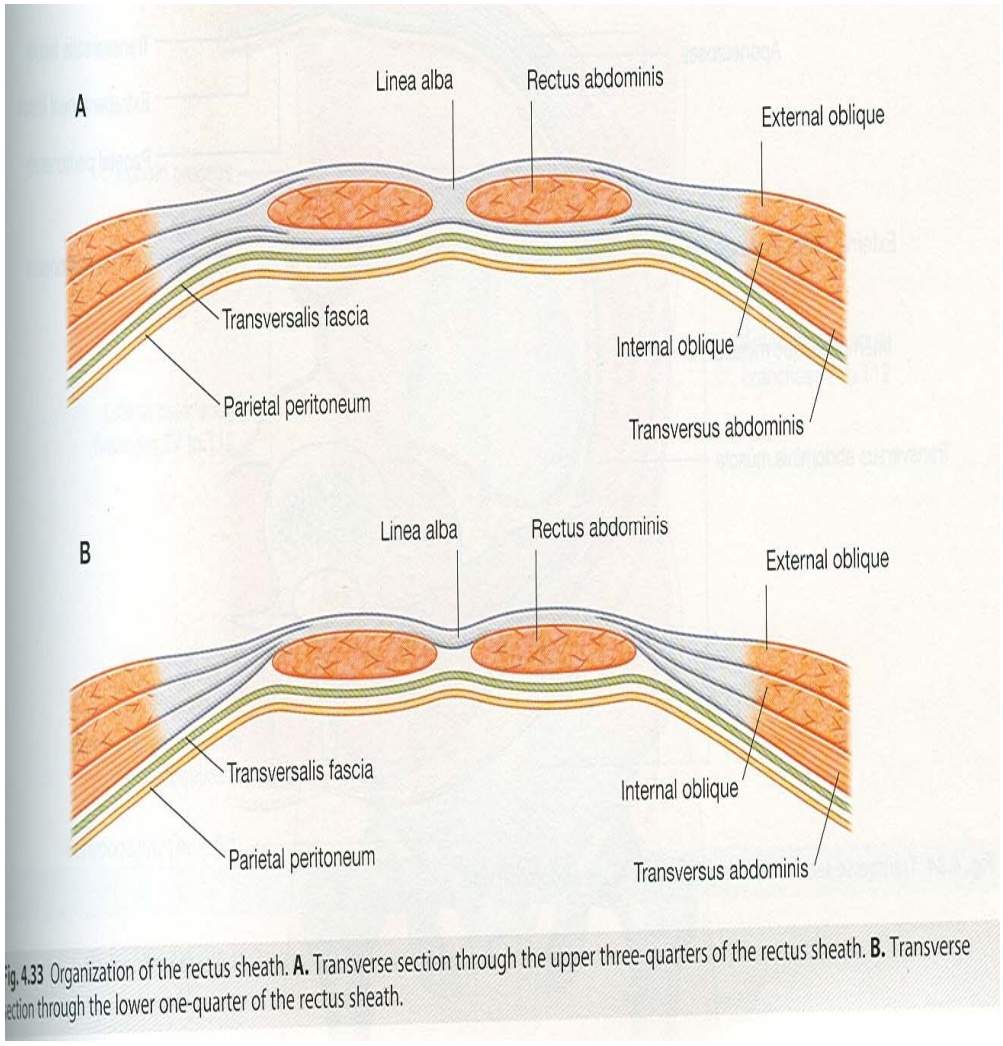


Fig. 4.40 Superior and inferior epigastric arteries.

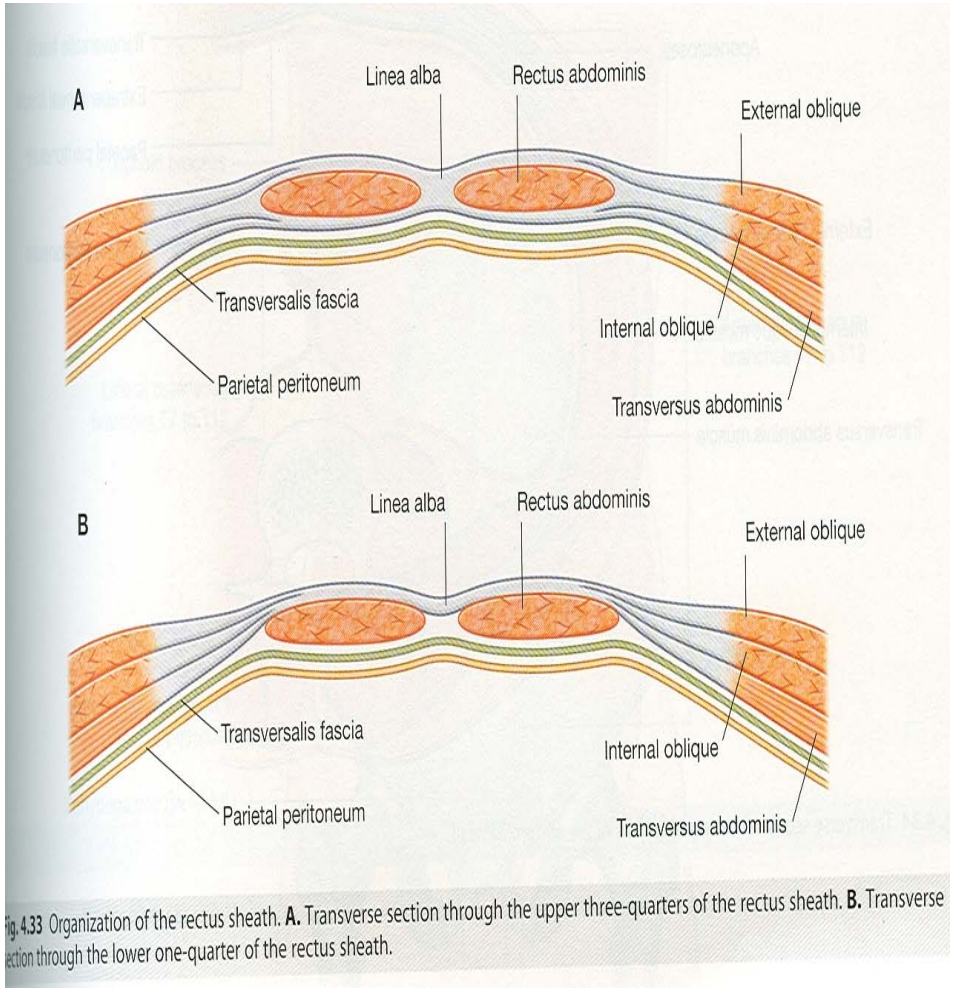
Rectus sheath

- Aponeurotic sheath formed by aponeurosis of EO, IO &TO.
- Checks Bowing Of rectus muscle during contraction
- Maintains the strength of the anterior abdominal wall
- Anterior wall of sheath is complete , covering RA, Pyramidalis from end to end
- Firmly Adherent To Tendinous Intersections Of RA

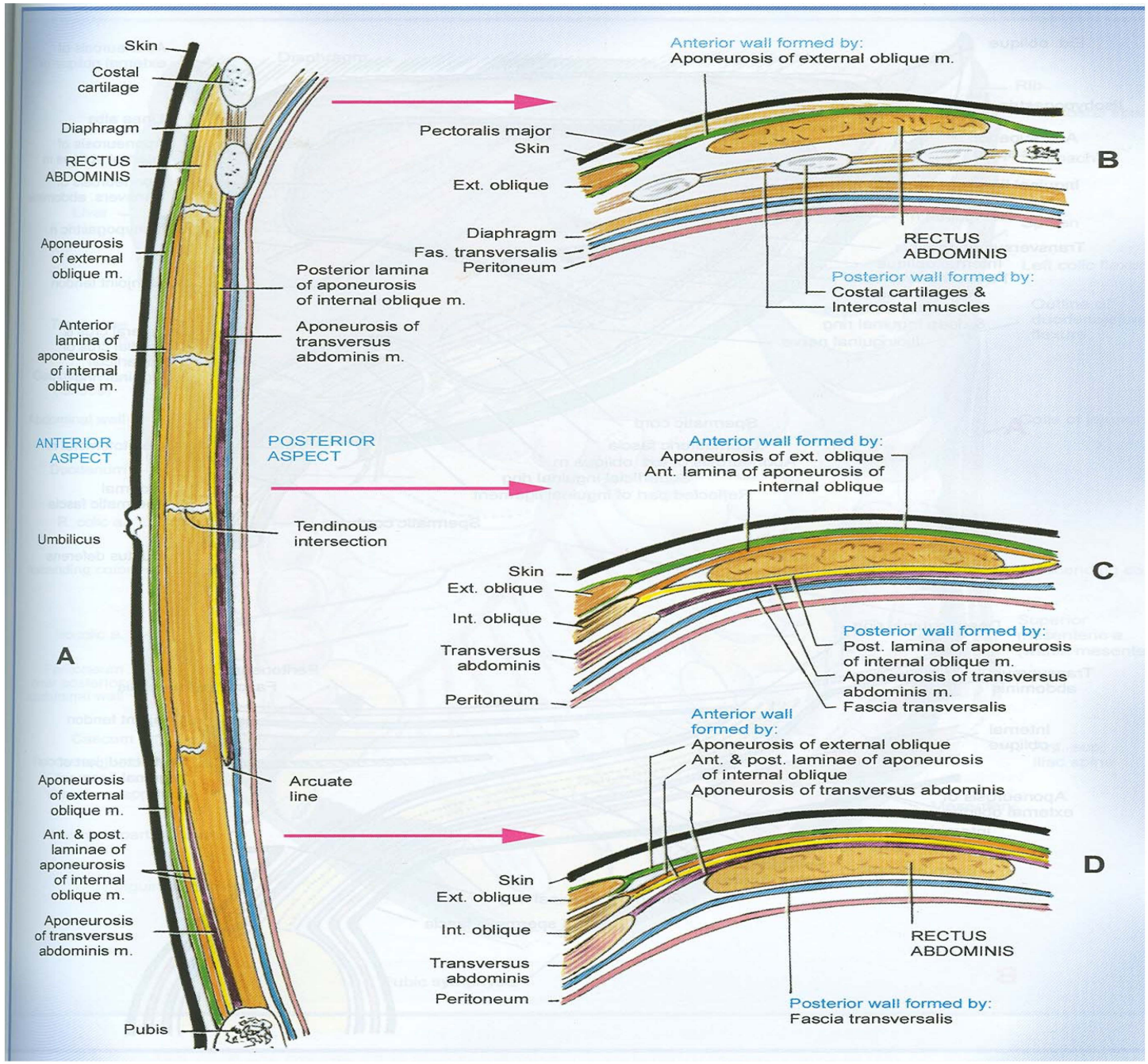


ig. 4.33 Organization of the rectus sheath. **A.** Transverse section through the upper three-quarters of the rectus sheath. **B.** Transverse ection through the lower one-quarter of the rectus sheath.

- Posterior wall above the costal margin- deficient, RA lies directly on costal cartilages
- Midway between umbilicus & pubic symphysis posterior wall ends in a curved margin known as Arcuate line
- Below the Arcuate line- posterior wall is deficient. RA lies directly on fascia transversalis

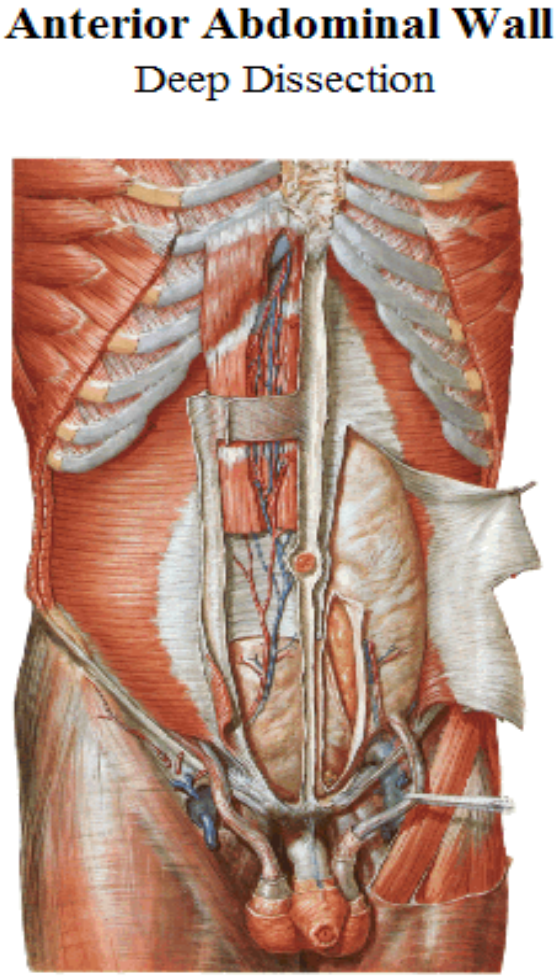


ig. 4.33 Organization of the rectus sheath. **A.** Transverse section through the upper three-quarters of the rectus sheath. **B.** Transverse ection through the lower one-quarter of the rectus sheath.


Skin
Costal cartilage
Diaphragm
RECTUS ABDOMINIS
Aponeurosis of external oblique m.
Anterior lamina of aponeurosis of internal oblique m.
ANTERIOR ASPECT
Umbilicus
Aponeurosis of external oblique m.
Ant. & post. laminae of aponeurosis of internal oblique m.
Aponeurosis of transversus abdominis m.
Pubis
A
Posterior lamina of aponeurosis of internal oblique m.
Aponeurosis of transversus abdominis m.
POSTERIOR ASPECT
Tendinous intersection
Arcuate line
Anterior wall formed by:
Aponeurosis of external oblique m.
Pectoralis major
Skin
Ext. oblique
Diaphragm
Fas. transversalis
Peritoneum
RECTUS ABDOMINIS
Posterior wall formed by:
Costal cartilages &
Intercostal muscles
B
Anterior wall formed by:
Aponeurosis of ext. oblique
Ant. lamina of aponeurosis of internal oblique
Skin
Ext. oblique
Int. oblique
Transversus abdominis
Peritoneum
Posterior wall formed by:
Post. lamina of aponeurosis of internal oblique m.
Aponeurosis of transversus abdominis m.
Fascia transversalis
C
Anterior wall formed by:
Aponeurosis of external oblique
Ant. & post. laminae of aponeurosis of internal oblique
Aponeurosis of transversus abdominis
Skin
Ext. oblique
Int. oblique
Transversus abdominis
Peritoneum
RECTUS ABDOMINIS
Posterior wall formed by:
Fascia transversalis
D

Contents of rectus sheath

- Rectus abdominis & Pyramidalis
- Superior epigastric &inferior epigastric arteries
- Superior epigastric &inferior epigastric veins
- Lower Six Thoracic Nerves



Applied anatomy of Rectus sheath

Divercation of recti

Epigastric hernia

Planning of incision on anterior abdominal wall

Fascia transversalis

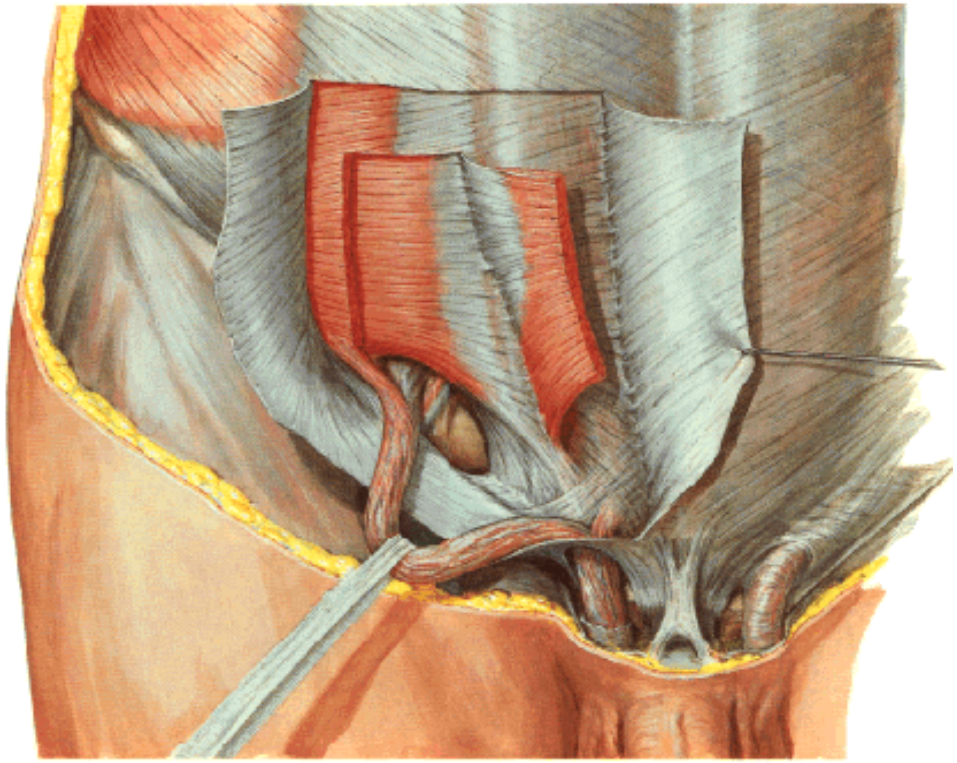
- Fascia deep to transversus abdominis muscle
- Main arteries lie inside but nerves lie outside the fascia
- Continue above with the fascia under diaphragm
- Inferiorly continue with the endopelvic fascia
- Posteriorly cover muscle of posterior abdominal wall
- Anteriorly joins the fascia of the other side
- Deep inguinal ring is an oval opening in fascia
- Prolongation over the femoral Vessel in to the thigh forms anterior wall of femoral sheath
- At the deep inguinal ring, fascia forms internal spermatic fascia over spermatic cord

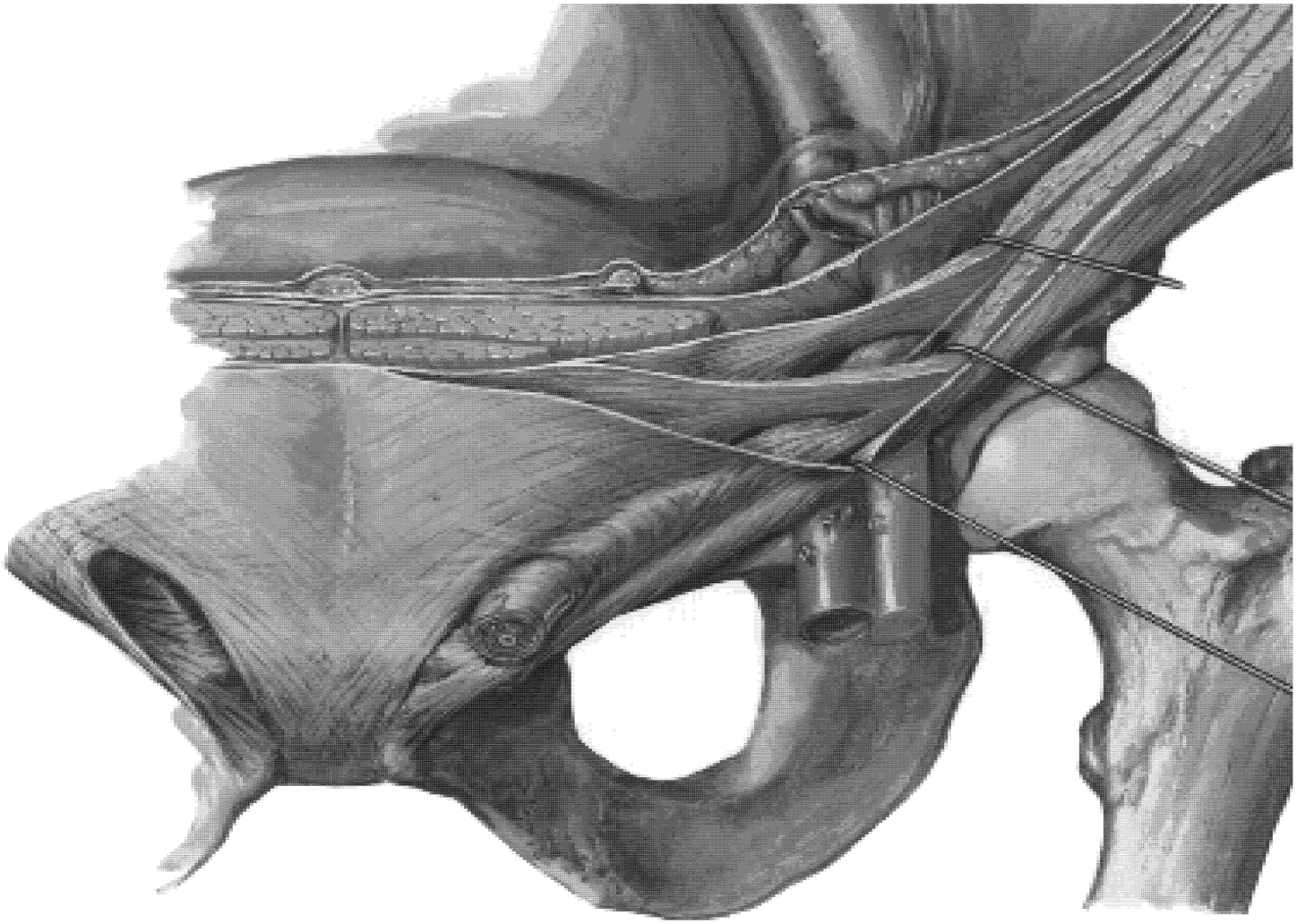
Inguinal canal

- Slit like passage, which extends downward & medially, just above & parallel to lower half of inguinal ligament
- Begins at deep inguinal ring
- About 4 cm long
- Ends at superficial inguinal ring

Inguinal Region

Dissection - Anterior View





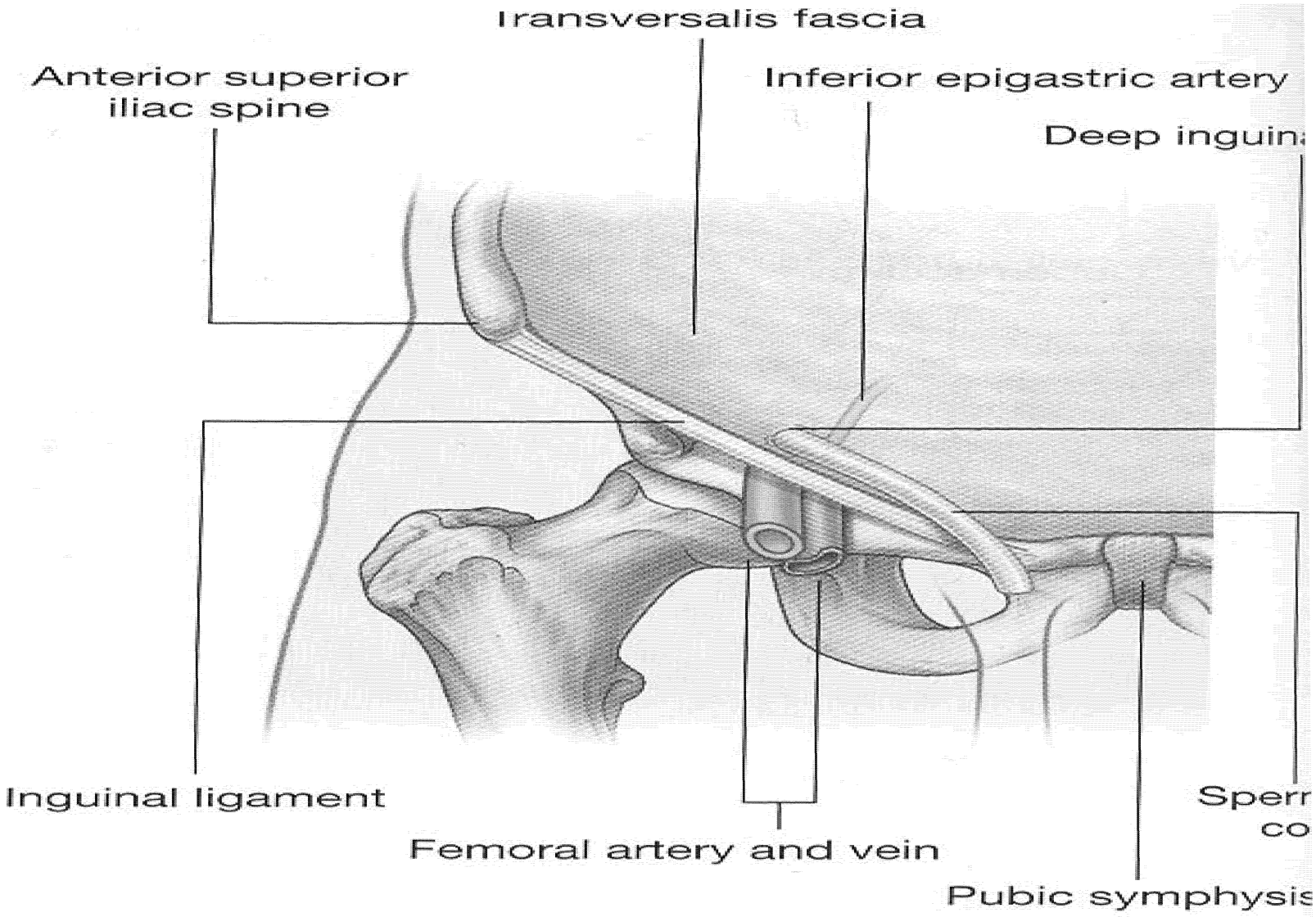
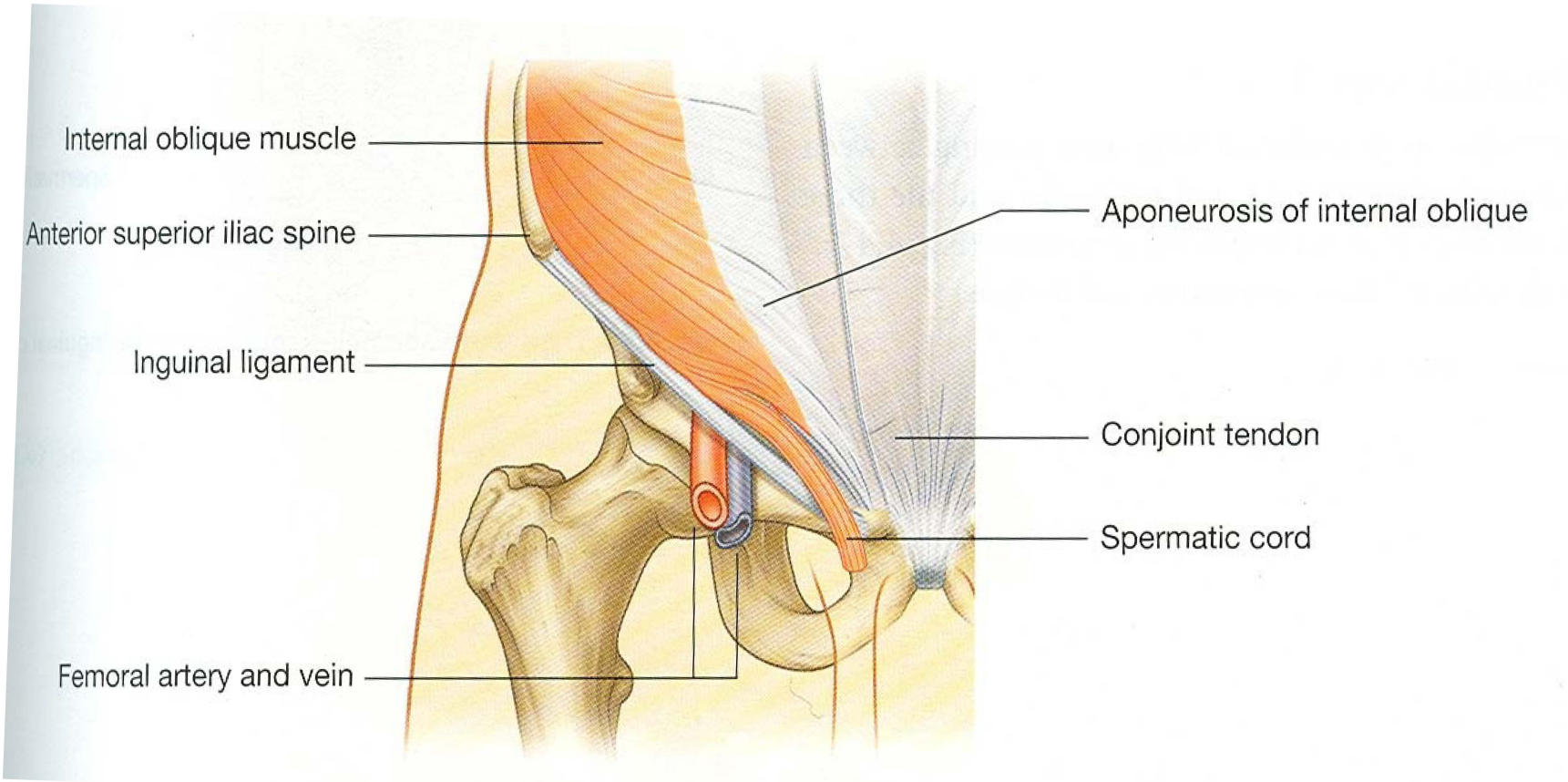
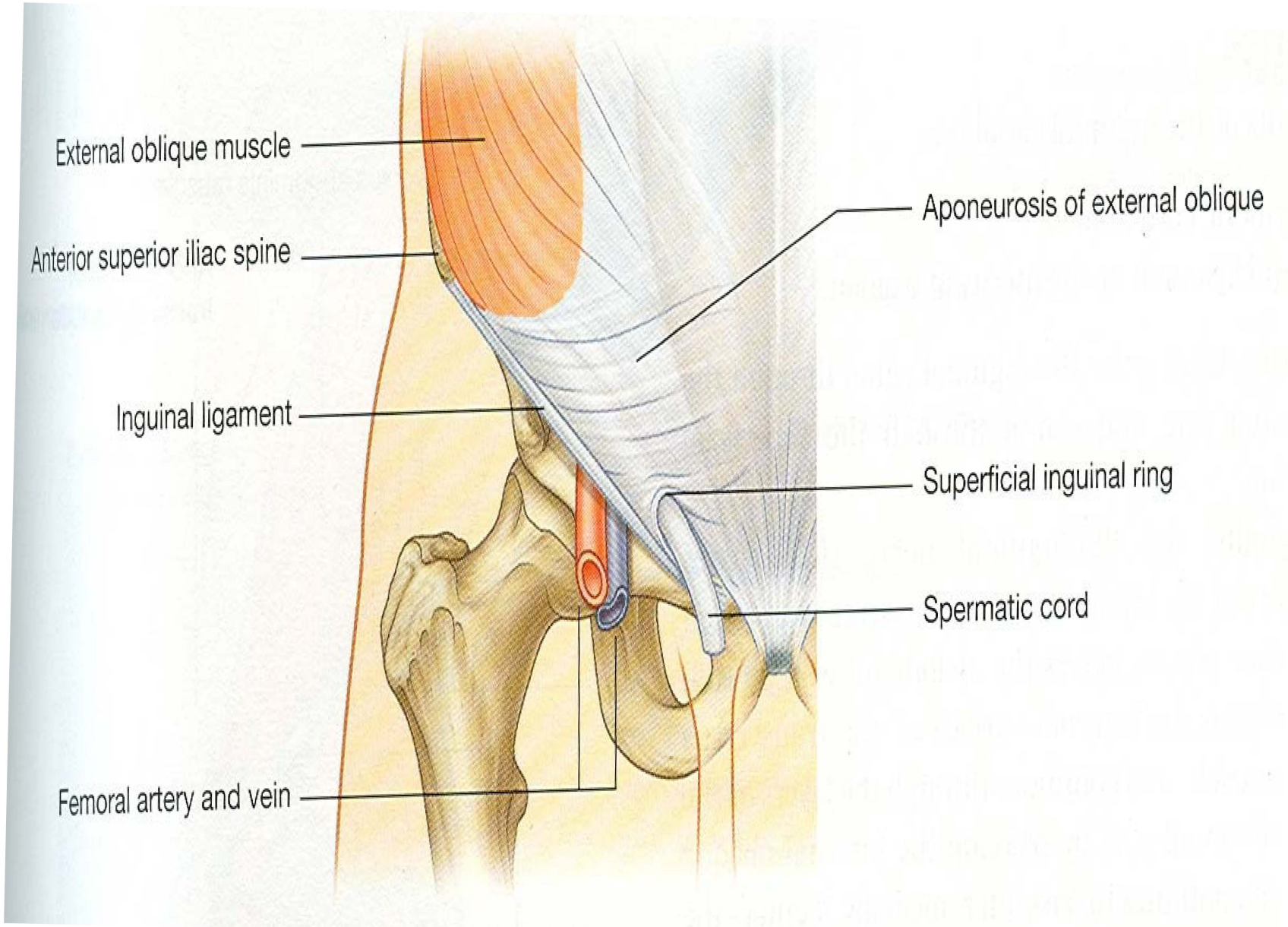


Fig. 4.43 Deep inguinal ring and the transversalis fascia.


Internal oblique muscle
Anterior superior iliac spine
Inguinal ligament
Femoral artery and vein
Aponeurosis of internal oblique
Conjoint tendon
Spermatic cord


External oblique muscle
Anterior superior iliac spine
Inguinal ligament
Femoral artery and vein
Aponeurosis of external oblique
Superficial inguinal ring
Spermatic cord

Boundaries of inguinal canal

- Anterior wall- EO aponeurosis, reinforced in its lateral part by fleshy fibers of IO
- Posterior wall- Transversalis fascia, reinforced in medial 1/3by conjoint tendon, reflected part of inguinal ligament support at the medial end
- Roof- Arched fibers of IO & TA
- Floor- Medial half of inguinal ligament, Lacunar ligament reinforces the medial part

Contents

- Spermatic cord in men
- Round ligament of uterus in women
- Ilioinguinal nerve

Spermatic cord

- Ductus deferens
- Artery to Ductus deference
- Testicular artery
- Pampiniform plexus of veins
- Cremasteric artery & vein
- Genital branch of genitofemoral nerve
- Sympathetic plexus around the artery
- Lymphatics
- Remnants of processus vaginalis

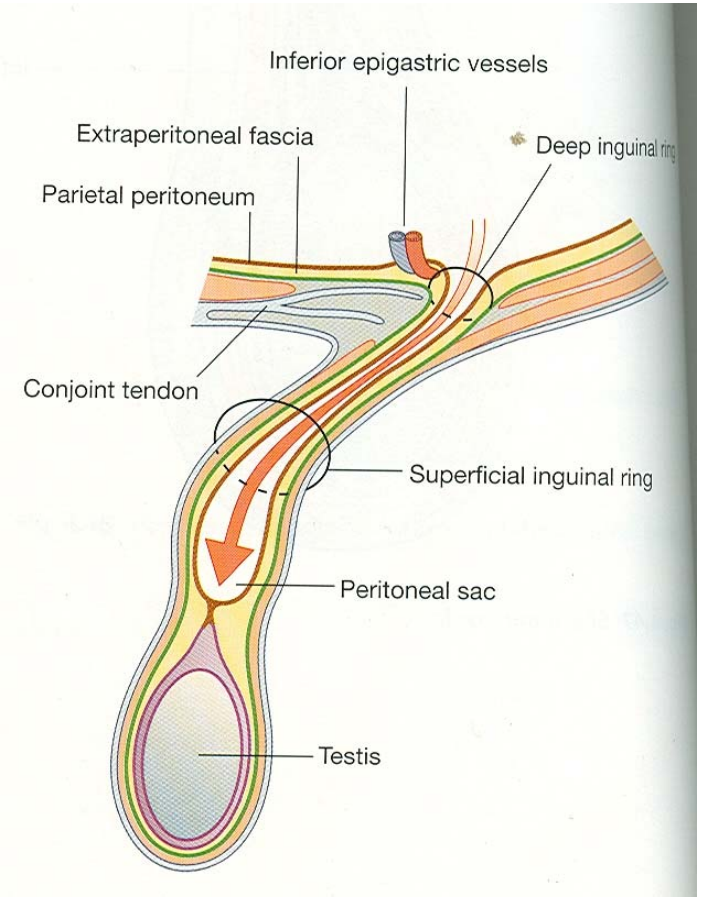
Fascial coverings of spermatic cord

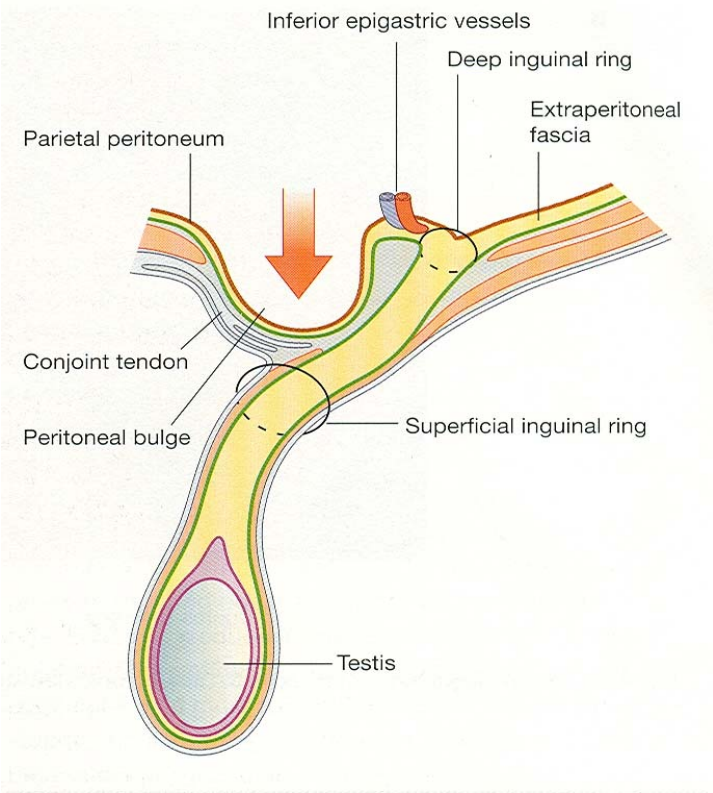
- External Spermatic Fascia- EO aponeurosis
- Cremasteric fascia- IO muscle, contains Cremasteric muscle
- Internal spermatic fascia- Transversalis fascia

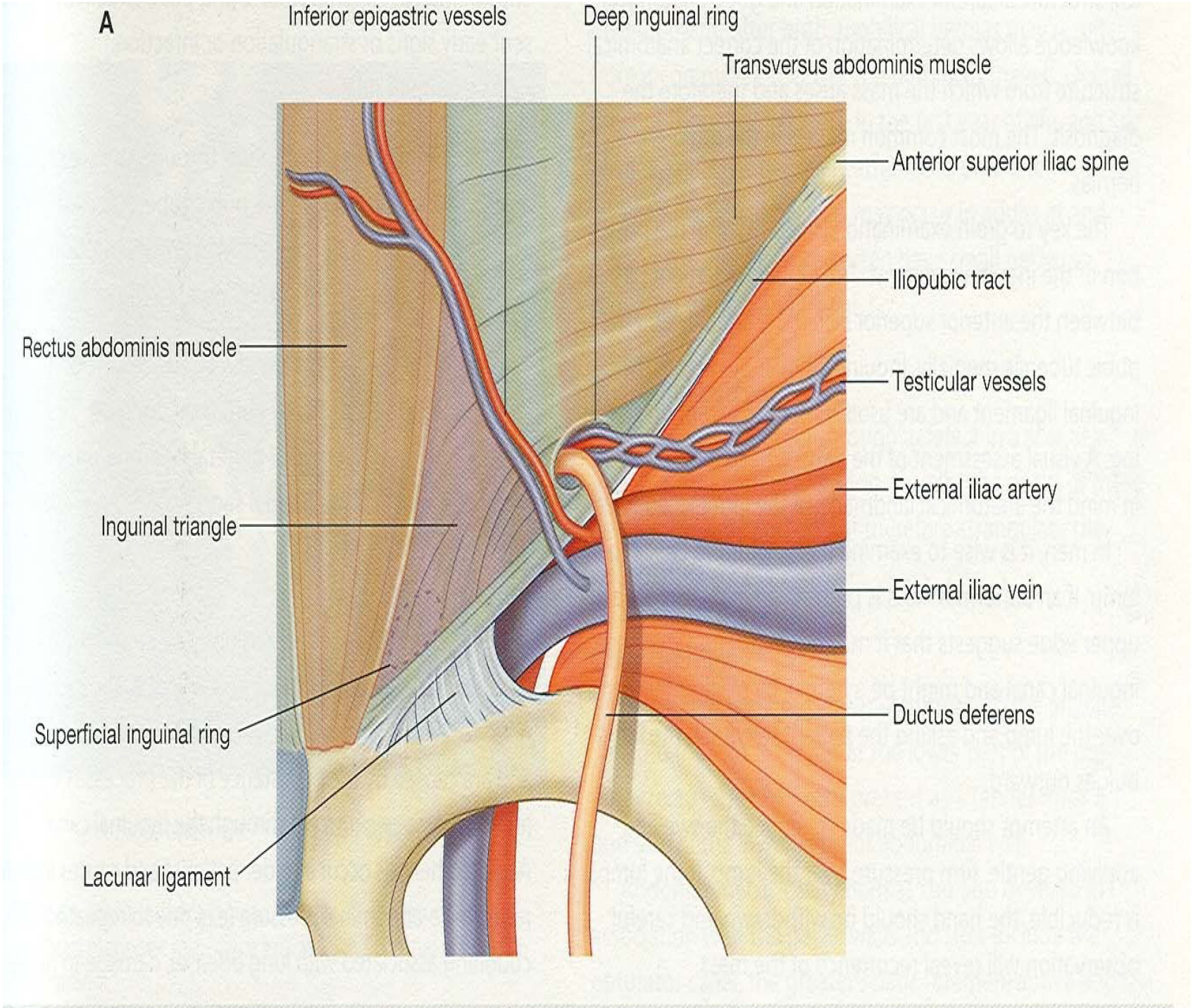
Inguinal hernias

- Protrusion or passage of a peritoneal sac, with or without abdominal contents thru a weekend part of the abdominal wall in the inguinal region.
- Indirecrt inguinal hernia
- Direct inguinal hernia

Indirect inguinal hernia, Direct inguinal hernia



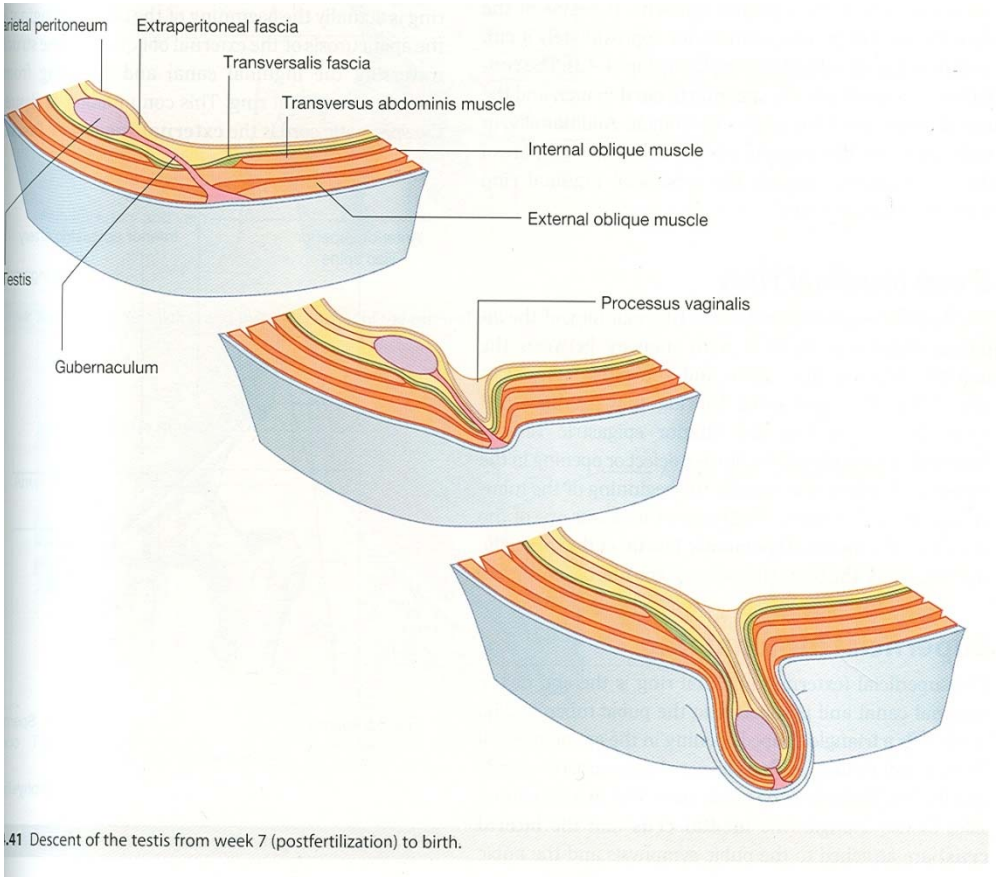



A
Inferior epigastric vessels
Deep inguinal ring
Transversus abdominis muscle
Anterior superior iliac spine
Iliopubic tract
Rectus abdominis muscle
Testicular vessels
External iliac artery
Inguinal triangle
External iliac vein
Superficial inguinal ring
Ductus deferens
Lacunar ligament

- The weakness in the anterior abdominal wall is compensated by the following factor
- Obliquity of canal
- Deep inguinal ring is guarded from ant side by IO
- Superficial ring is guarded by conjoint tendon &reflected part of ligament
- IO forms ant post wall &roof
- Cremaster plugs the suprficial ring when intra abdominal pressure increases
- Contraction of EO result in closure of two crura of superficial ring

Development of inguinal canal

- Gonads develop in inguinal region
- They descend in to scrotum during intra uterine life
- Inguinal canal represent passage of gubernaculum through the abdominal wall
- Gubernaculum extends from caudal end of developing gonad to labioscrotal swelling



.41 Descent of the testis from week 7 (postfertilization) to birth.