

# DEMO – VI

## Anterolateral Abdominal Wall & Inguinal Canal

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**Year III – Unit V**

**(GI & Renal Systems)**



# STATION – 1 (Abdominal wall: Gross Anatomy)

## Fascia of anterolateral abdominal wall:

- **Skin.**

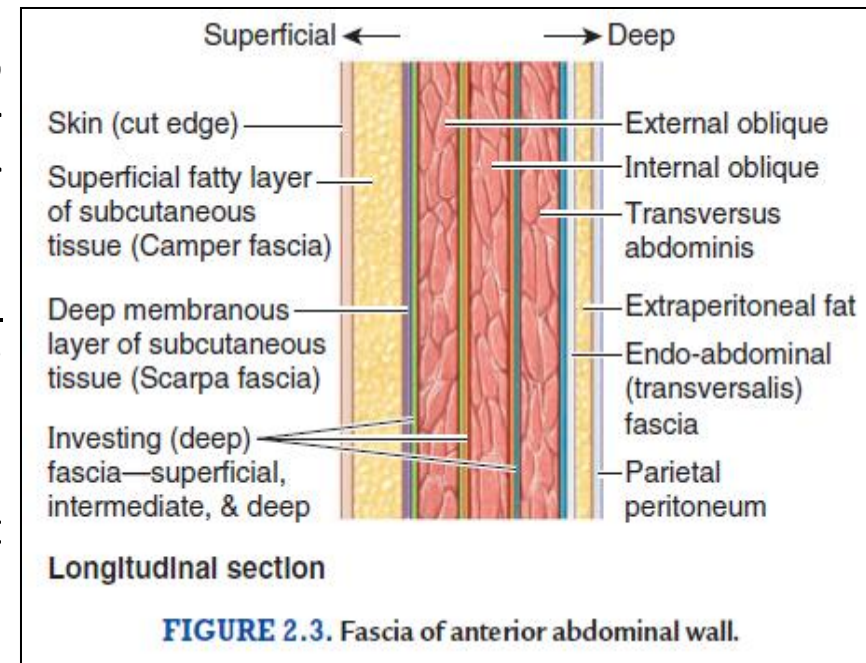
- **Subcutaneous tissue:** which lies deep to the skin; consisting of superficial fatty layer (Camper fascia) & deep membranous layer (Scarpa fascia).

- **Three muscles:** external oblique, internal oblique and transversus abdominis. The external aspect of these muscles is covered by **investing fascia**.

- **Transversalis fascia:** membranous sheet lining the internal aspect of the abdominal wall.

- **Extraperitoneal fat.**

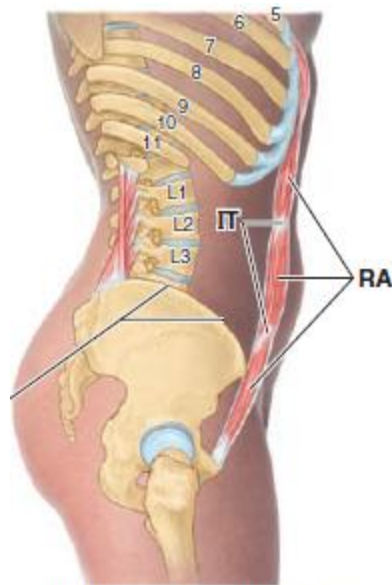
- **Parietal peritoneum.**



# STATION – 1 (Abdominal wall: Gross Anatomy)

## Muscles of Anterolateral Abdominal Wall:

- **External oblique:** the superficial muscle, passing inferomedially & interdigitating with slips of the serratus anterior. The inferior margin of this muscle is forming a fibrous band know as (inguinal ligament) which is passing from the anterior superior iliac spine to the pubic symphysis.
- **Internal oblique:** the intermediate muscle, passing perpendicular to external oblique muscle.
- **Transversus abdominis:** the innermost muscle, running horizontally.
- **Rectus abdominis:** long, broad, strap-like muscle enlosed in the rectus sheath.
- **Pyramidalis:** small triangular muscle that lies in the rectus sheath anterior to the inferior part of the rectus abdominis. It ends in the linea alba and tenses it.



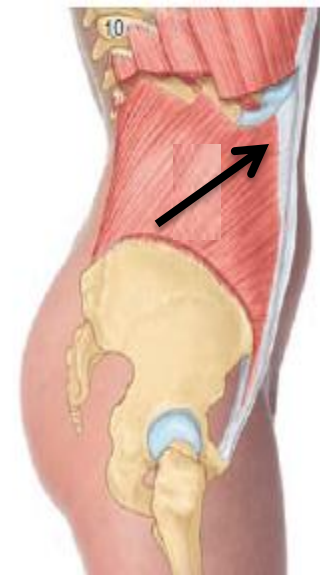
(B) Rectus abdominis (RA)



(C) External oblique (EO)  
(layer 1)



Transversus abdominis



Internal oblique

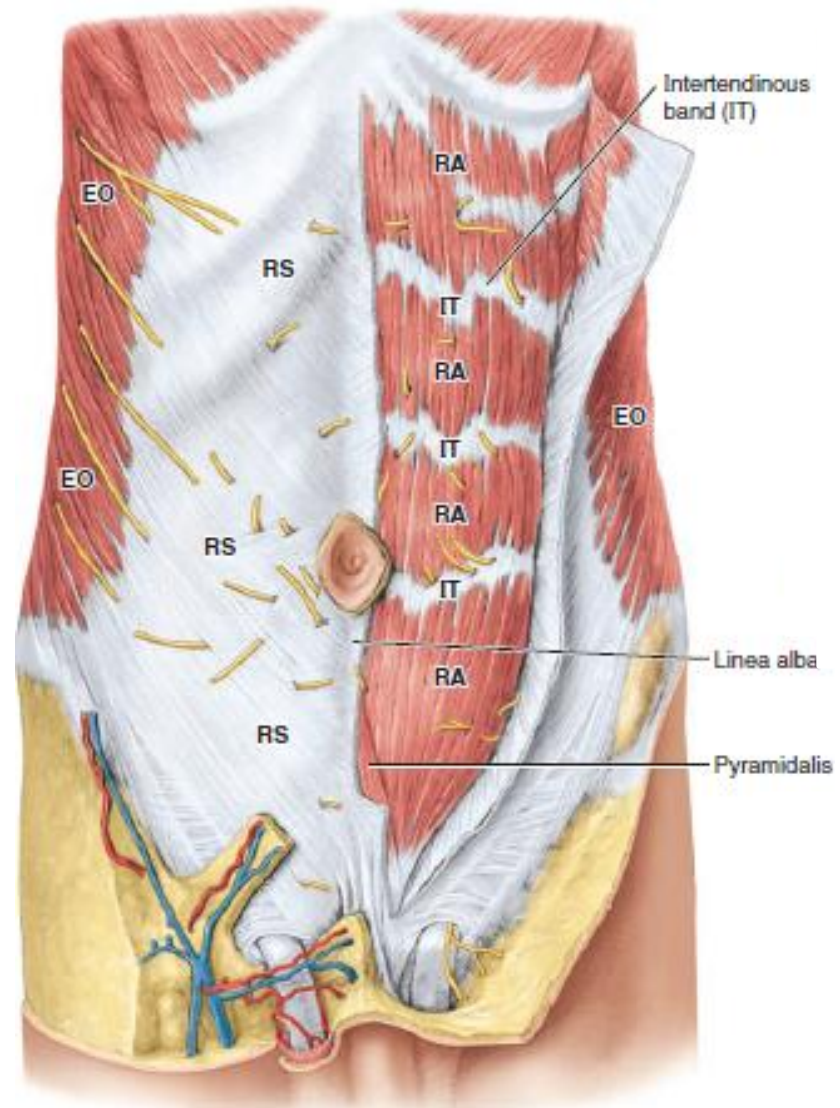
# STATION – 1 (Abdominal wall: Gross Anatomy)

Muscles	Origin	Insertion
<b>External oblique</b>	External surfaces of 5th–12th ribs	Linea alba, pubic tubercle, and anterior half of iliac crest
<b>Internal oblique</b>	Thoracolumbar fascia, anterior two thirds of iliac crest, and connective tissue deep to inguinal ligament	Inferior borders of 10th–12th ribs, linea alba, and pubis via conjoint tendon
<b>Transversus abdominis</b>	Internal surfaces of 7th–12th costal cartilages, thoracolumbar fascia, iliac crest, and connective tissue deep to inguinal ligament	Linea alba with aponeurosis of internal oblique, pubic crest, and pubis via conjoint tendon
<b>Rectus abdominis</b>	Pubic symphysis and pubic crest	Xiphoid process and 5th–7th costal cartilages

# STATION – 1 (Abdominal wall: Gross Anatomy)

- **Functions & Action of The Anterolateral Abdominal Wall:**

- Supporting and protecting the abdominal viscera from injury.
- Compressing the abdominal viscera to increase the intra-abdominal pressure.
- Producing the force required for urination, defecation, vomiting & childbirth.
- Allowing anterior & lateral flexion of the trunk in addition to rotatory movements.

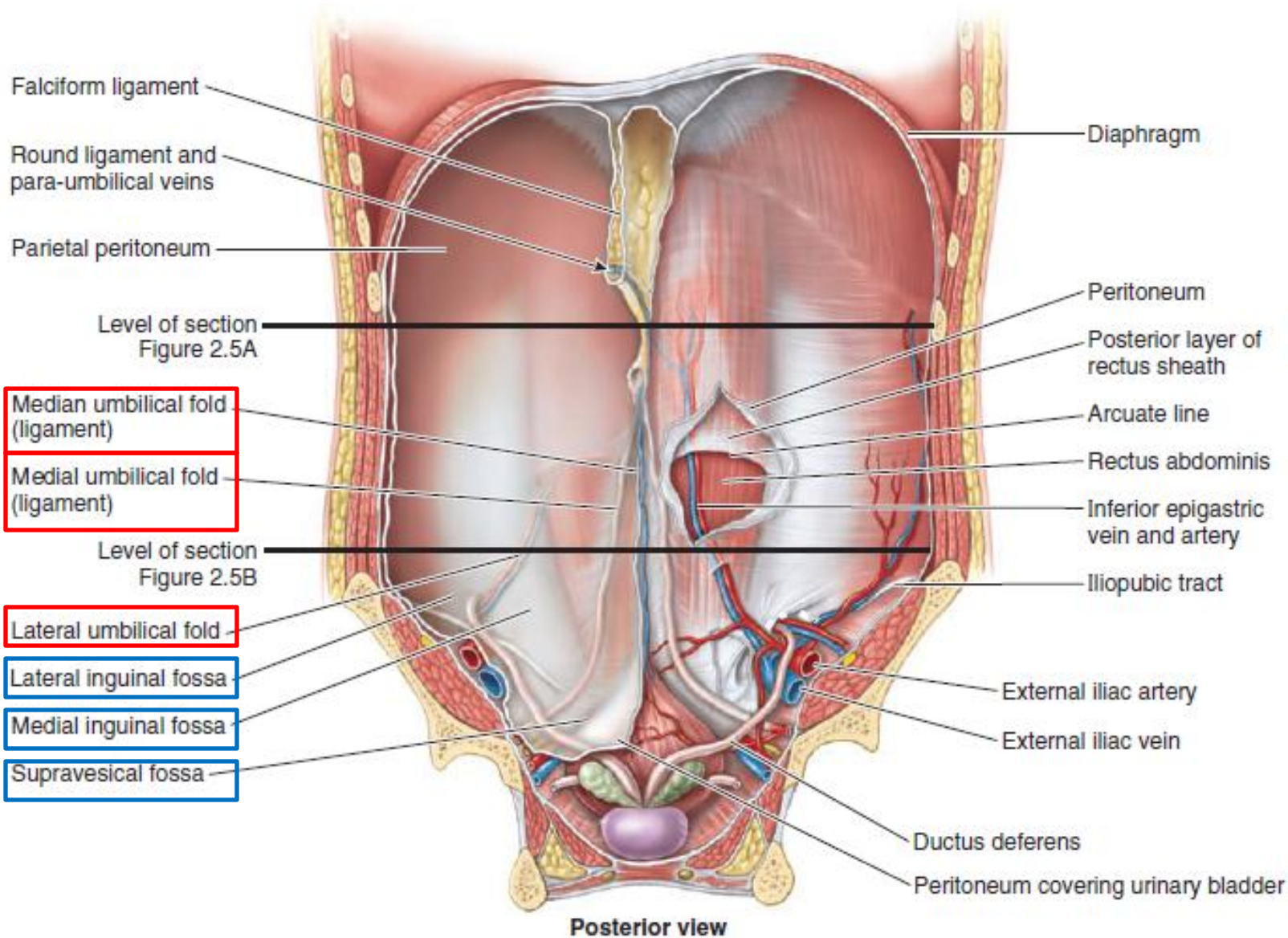


# STATION – 1 (Abdominal wall: Gross Anatomy)

- **Internal Surface of Anterolateral Abdominal Wall:**
  - **Median umbilical fold:** extending from the apex of the urinary bladder to the umbilicus and covers the median umbilical ligament (the remnant of urachus).
  - **Two medial umbilical folds:** lateral to the median umbilical fold and covering the medial umbilical ligaments (occluded parts of the umbilical arteries).
  - **Two lateral umbilical folds:** lateral to the medial umbilical folds and covering the inferior epigastric vessels.
- **The shallow fossae between the umbilical folds are the:**
  - **Supravesical fossae:** between the median and the medial umbilical folds.
  - **Medial inguinal fossae:** between the medial and the lateral umbilical folds (potential sites for direct inguinal hernias).
  - **Lateral inguinal fossae:** lateral to the lateral umbilical folds including the deep inguinal rings (which are the potential sites for indirect inguinal hernia).



# STATION – 1 (Abdominal wall: Gross Anatomy)



**FIGURE 2.6.** Posterior aspect of anterolateral abdominal wall showing peritoneal ligaments, folds, and fossae.

# STATION – 2

## (Vasculature, Lymphatics & Innervation of Anterolateral Abdominal Wall)

# Surface Anatomy

## Anterolateral Abdominal Wall

The **umbilicus** is where the umbilical cord, from the placenta, entered the fetus and is the reference point for the transumbilical plane (Fig. SA2.1A,B). It indicates the level of the T10 dermatome and is typically at the level of the IV disc between the L3 and L4 vertebrae; however, its position varies with the amount of fat in the person's subcutaneous tissue. The **linea alba** is a subcutaneous fibrous band extending from the **xiphoid process** to the **pubic symphysis** that is demarcated by a mid-line vertical skin groove as far inferiorly as the umbilicus (Fig. SA2.1A,B). The pubic symphysis can be felt in the median plane at the inferior end of the linea alba. The bony **iliac crest** at the level of the L4 vertebra can be easily palpated as it extends posteriorly from the **anterior superior iliac spine**.

In an individual with good muscle definition, curved skin grooves, the **semilunar lines** (*L. lineae semilunares*) demarcate the lateral borders of the rectus abdominis and rectus sheath. The semilunar lines extend from the inferior costal margin near the 9th costal cartilages to the **pubic tubercles**. Three transverse skin grooves may overlie the **tendinous intersections** of the rectus abdominis (Fig. SA2.1B). The interdigitating bellies of the **serratus anterior** and **external oblique** muscles are also visible. A skin crease, the **inguinal groove**, indicates the site of the inguinal ligament. The groove is located just inferior and parallel to the ligament, marking the division between the anterolateral abdominal wall and the thigh.

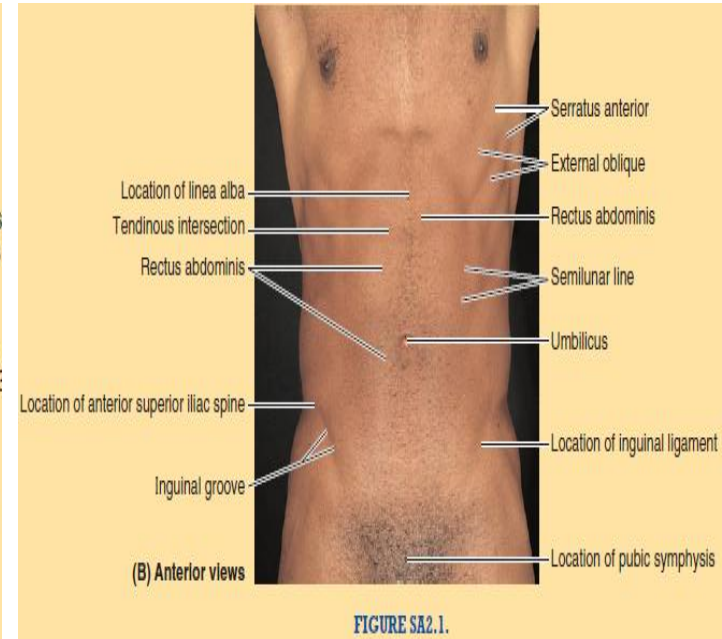
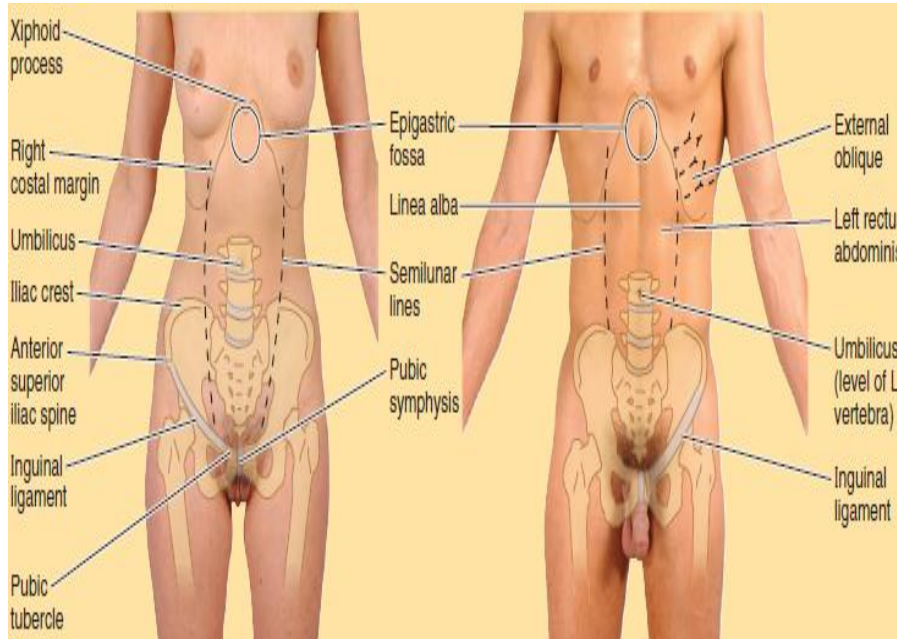
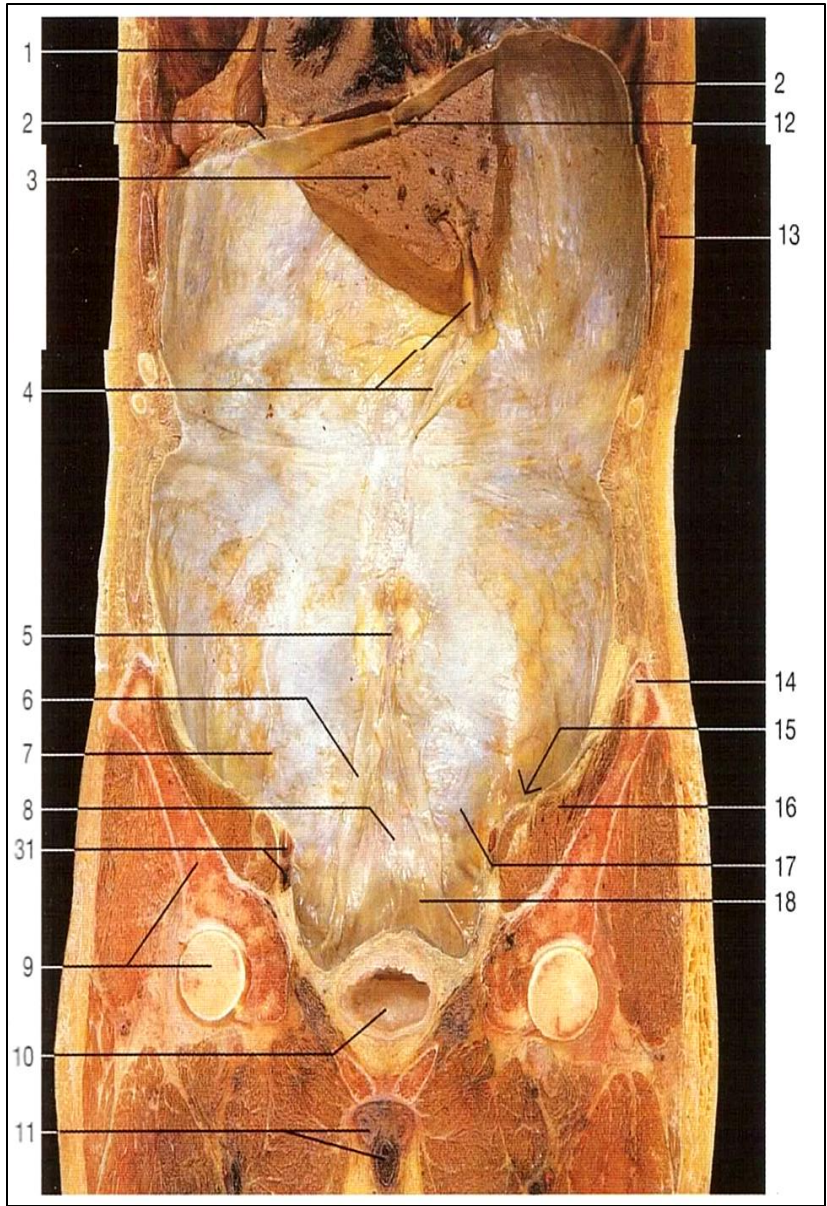


FIGURE SA2.1.



# STATION – 1 (Abdominal wall: Gross Anatomy)



## STATION – 1 (Abdominal wall: Gross Anatomy)

- 1 Left ventricle with pericardium
- 2 Diaphragm
- 3 Remnant of liver
- 4 Ligamentum teres  
(free margin of falciform ligament)
- 5 Site of umbilicus
- 6 Medial umbilical fold  
(containing the obliterated umbilical artery)
- 7 Lateral umbilical fold (containing inferior epigastric artery and vein)
- 8 Median umbilical fold  
(containing remnant of urachus)
- 9 Head of femur and pelvic bone
- 10 Urinary bladder
- 11 Root of penis
- 12 Falciform ligament of liver
- 13 Rib (divided)
- 14 Iliac crest (divided)
- 15 Site of deep inguinal ring and lateral inguinal fossa
- 16 Iliopsoas muscle (divided)
- 17 Medial inguinal fossa
- 18 Supravesical fossa
- 19 Posterior layer of rectus sheath
- 20 Transversus abdominis muscle
- 21 Umbilicus and arcuate line
- 22 Inferior epigastric artery
- 23 Femoral nerve
- 24 Iliopsoas muscle
- 25 Remnant of umbilical artery
- 26 Femoral artery and vein
- 27 Tendinous intersection of rectus abdominis muscle
- 28 Rectus abdominis muscle
- 29 Interfoveolar ligament
- 30 Pubic symphysis (divided)
- 31 External iliac artery and vein

# STATION – 2

## (Vasculature, Lymphatics & Innervation of Anterolateral Abdominal Wall)

- **Rectus Sheath:**

- It is formed by the interlaced (مُتَشَابِك) aponeuroses of the flat abdominal muscles.

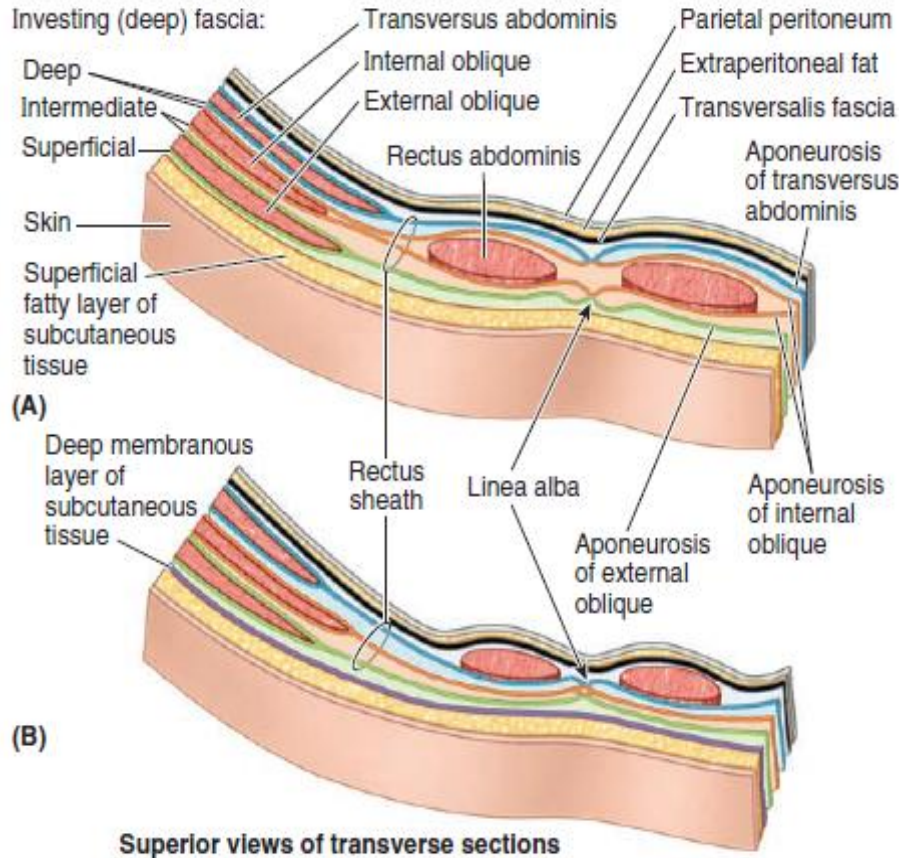
Rectus sheath	Anterior layer of the rectus sheath	Posterior layer of the rectus sheath
<b>Superior three quarters</b>	Formed by the external oblique aponeurosis & the anterior lamina of the internal oblique aponeurosis.	Formed by the posterior lamina of the internal oblique aponeurosis & the transversus abdominis aponeurosis.
<b>Inferior one quarter</b>	Formed by the aponeuroses of all three muscles: external oblique, internal oblique & transversus abdominis.	Formed by the transversalis fascia.

**Note:** arcuate line demarcates the transition between the posterior rectus sheath covering the superior three quarters of the rectus abdominis and the transversalis fascia covering the inferior quarter.

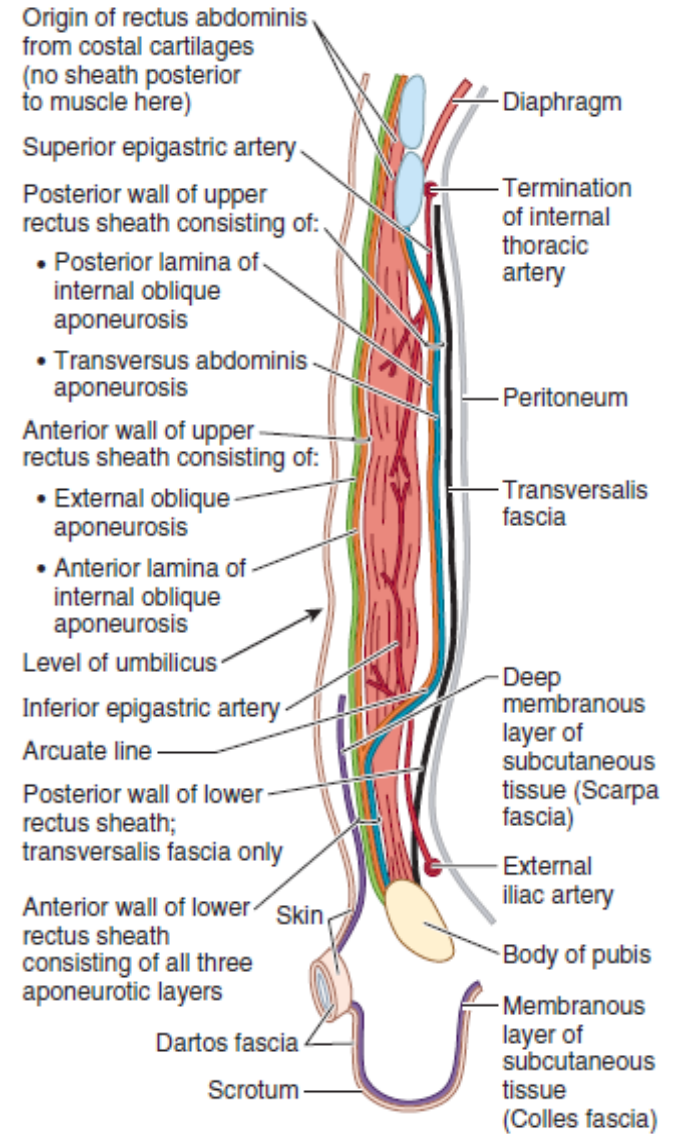


# STATION - 2

(Vasculature, Lymphatics & Innervation of Anterolateral Abdominal Wall)



Layers in A, B, & C	
	External oblique
	Internal oblique
	Transversus abdominis
	Transversalis fascia
	Parietal peritoneum
	Membranous layer of subcutaneous tissue



**(C) Schematic sagittal section**



# STATION – 2

## (Vasculature, Lymphatics & Innervation of Anterolateral Abdominal Wall)

Nerve	Origin	Distribution
<b>Thoraco-abdominal (T7–T11)</b>	Distal, abdominal parts of lower five intercostal nerves	Muscles of anterolateral abdominal wall and overlying skin (T7–T9 superior to umbilicus; T10 around umbilicus; T11 immediately below umbilicus)
<b>Subcostal (T12)</b>	Anterior ramus of T12 spinal nerve	Muscles of anterolateral abdominal wall and overlying skin midway between level of umbilicus and iliac crest, inguinal ligament, and pubic crest inferiorly
<b>Ilio-hypogastric (L1)</b>	Superior terminal branch of anterior ramus of L1 spinal nerve	Skin overlying iliac crest, upper inguinal and hypogastric regions; internal oblique and transversus abdominis
<b>Ilio-inguinal (L1)</b>	Inferior terminal branch of anterior ramus of L1 spinal nerve	Skin of scrotum or labium majus, mons pubis, and adjacent medial aspect of thigh; most inferior internal oblique and transversus abdominis

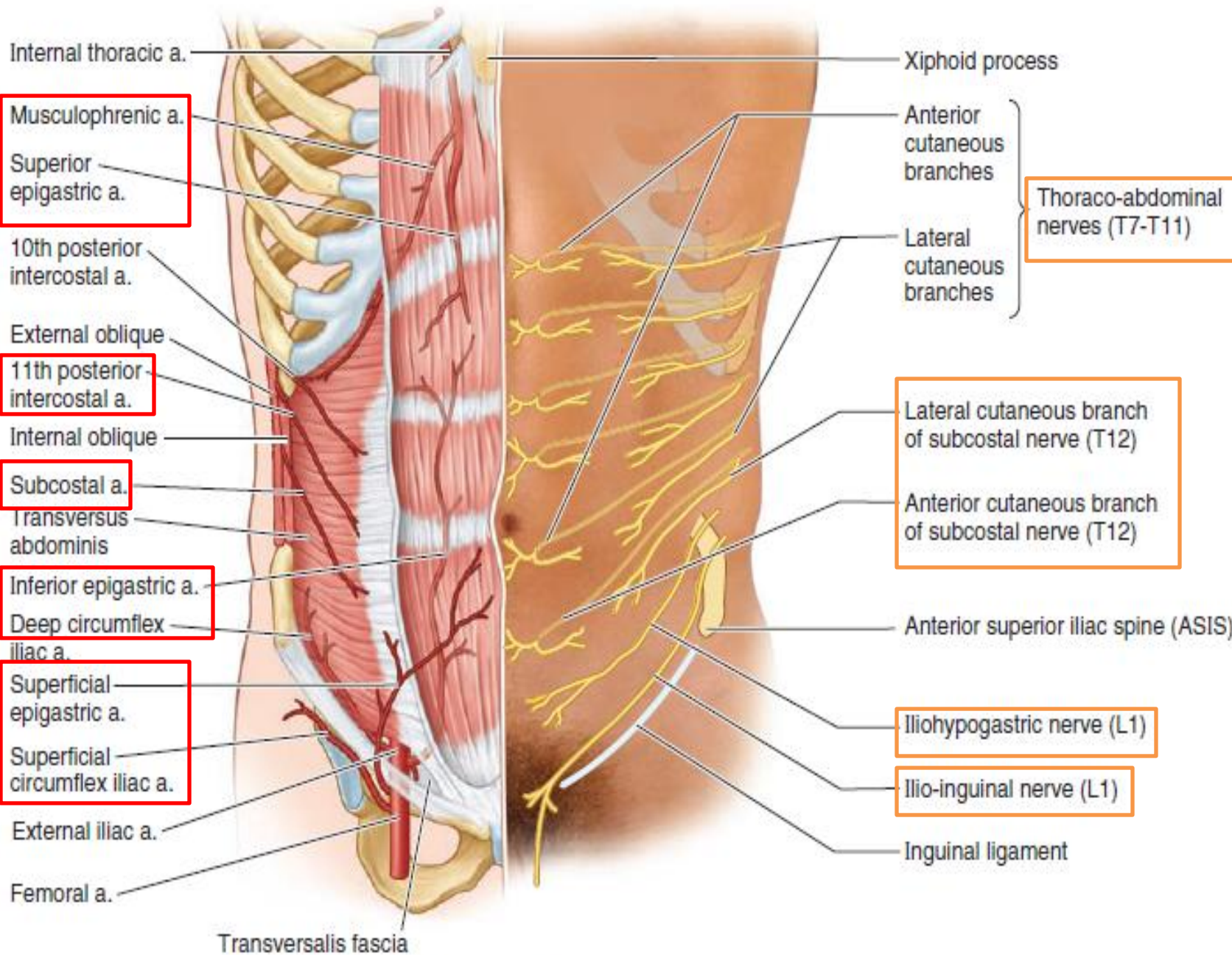
# STATION – 2

## (Vasculature, Lymphatics & Innervation of Anterolateral Abdominal Wall)

- **The blood vessels of the anterolateral wall are the:**
  - **Superior epigastric vessels & musculophrenic vessels** (branches of the internal thoracic vessels).
  - **Inferior epigastric vessels & deep circumflex iliac vessels** (branches of the external iliac vessels).
  - **Superficial epigastric vessels & superficial circumflex iliac vessels** (from femoral artery & great saphenous vein).
  - **Posterior intercostal vessels** (in the 11<sup>th</sup> intercostal space) **& anterior branches of subcostal vessels.**
- **Note:**
  - **Superior epigastric artery:** it is a direct continuation of the internal thoracic artery entering the rectus sheath superiorly through its posterior layer & supplying the upper part of the rectus abdominis. It anastomoses with the inferior epigastric artery.
  - **Inferior epigastric artery:** arises from the external iliac artery & runs superiorly in the transversalis fascia to enter the rectus sheath inferior to the arcuate line. It supplies the lower rectus abdominis.

# STATION - 2

(Vasculature, Lymphatics & Innervation of Anterolateral Abdominal Wall)



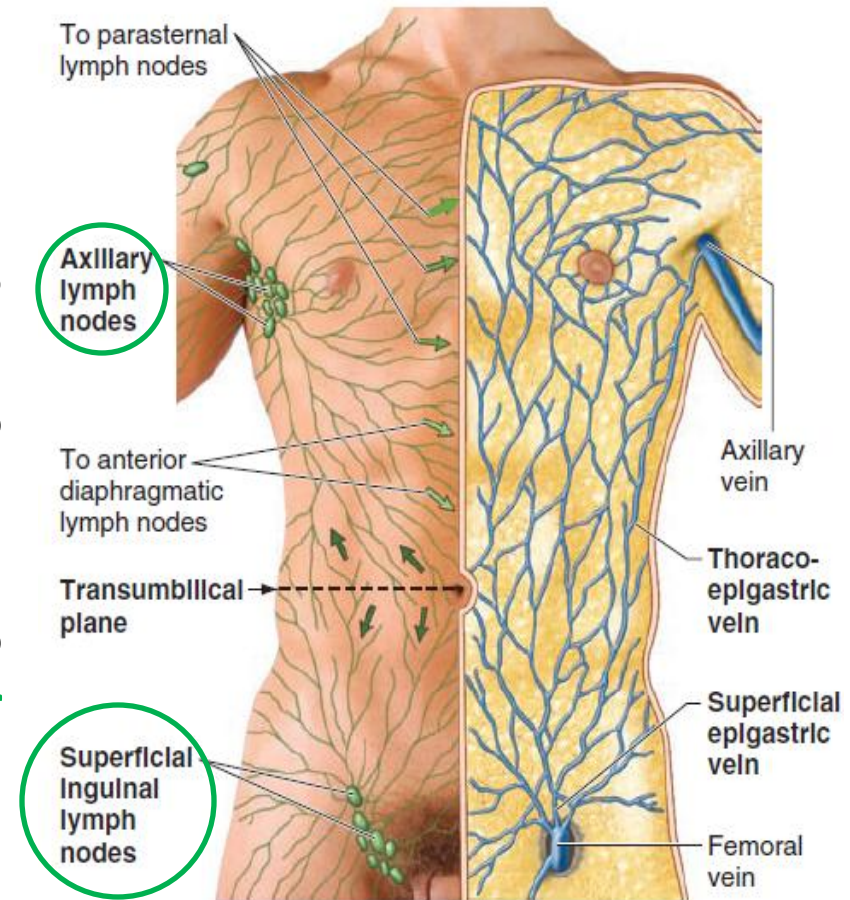
Anterior view

FIGURE 2.7. Arteries and nerves of anterolateral abdominal wall.

# STATION – 2

## (Vasculature, Lymphatics & Innervation of Anterolateral Abdominal Wall)

- **Superficial lymphatic vessels:**
  - Superior to the umbilicus: draining into **axillary lymph nodes**.
  - Inferior to the umbilicus: draining to **superficial inguinal lymph nodes**.
- **Deep lymphatic vessels:**
  - Accompany the deep veins and drain to the **external iliac, common iliac & lumbar lymph nodes**.



Anterior view

**FIGURE 2.8.** Lymphatics and superficial veins of anterolateral abdominal wall.



# STATION – 2

## (Vasculature, Lymphatics & Innervation of Anterolateral Abdominal Wall)

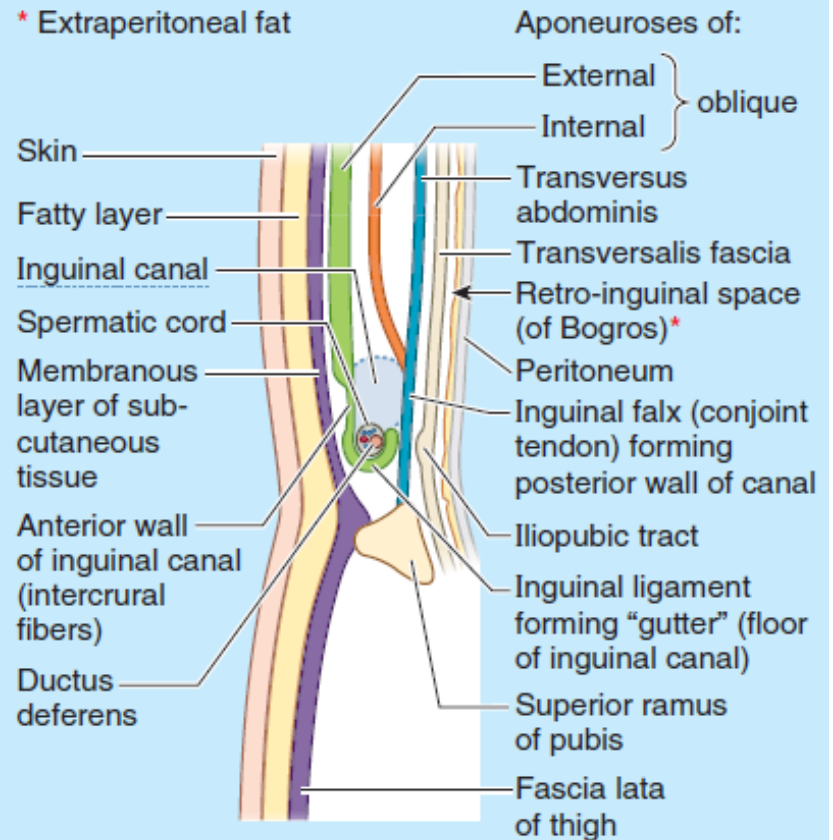
### Clinical Box

#### Clinical Significance of Fascia and Fascial Spaces of Abdominal Wall



When closing abdominal skin incisions, surgeons suture the membranous layer of subcutaneous tissue as a separate layer because of its strength.

Between the membranous layer and the deep fascia covering the rectus abdominis and external oblique muscles is a potential space where fluid may accumulate (e.g., urine from a ruptured urethra). Although no barriers (other than gravity) prevent fluid from spreading superiorly from this space, it cannot spread inferiorly into the thigh because the membranous layer of subcutaneous tissue attaches to the pubic bone and fuses with the deep fascia of the thigh (fascia lata) along a line inferior and parallel to the inguinal ligament (Fig. B2.1).



Schematic sagittal section of Inguinal canal

FIGURE B2.1.

# STATION – 3 (Inguinal Canal)

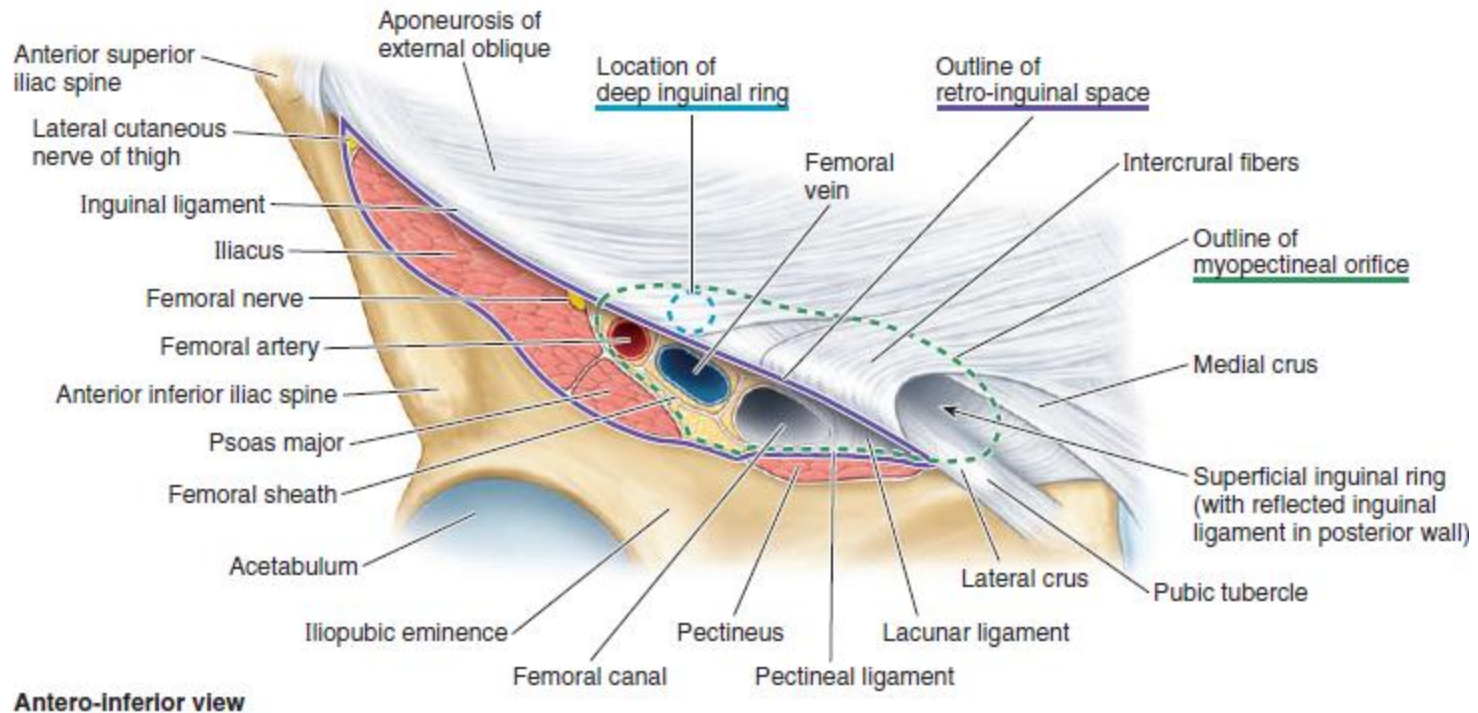
- It is 4-cm-long, inferomedially directed oblique passage (between the superficial & deep inguinal rings) that runs through the inferior part of the anterior abdominal wall.
- The inguinal canal lies parallel and just superior to the medial half of the inguinal ligament.
- **The main occupant of the inguinal canal is the:**
  - Spermatic cord (in males).
  - Round ligament of the uterus (in females).
  - Blood & lymphatic vessels.
  - Ilio-inguinal nerve.

# STATION – 3 (Inguinal Canal)

- The inguinal canal has an opening at each end:

- **Deep (internal) ring:** internal entrance to the inguinal canal. It is superior to the middle of the inguinal ligament & lateral to the inferior epigastric vessels.

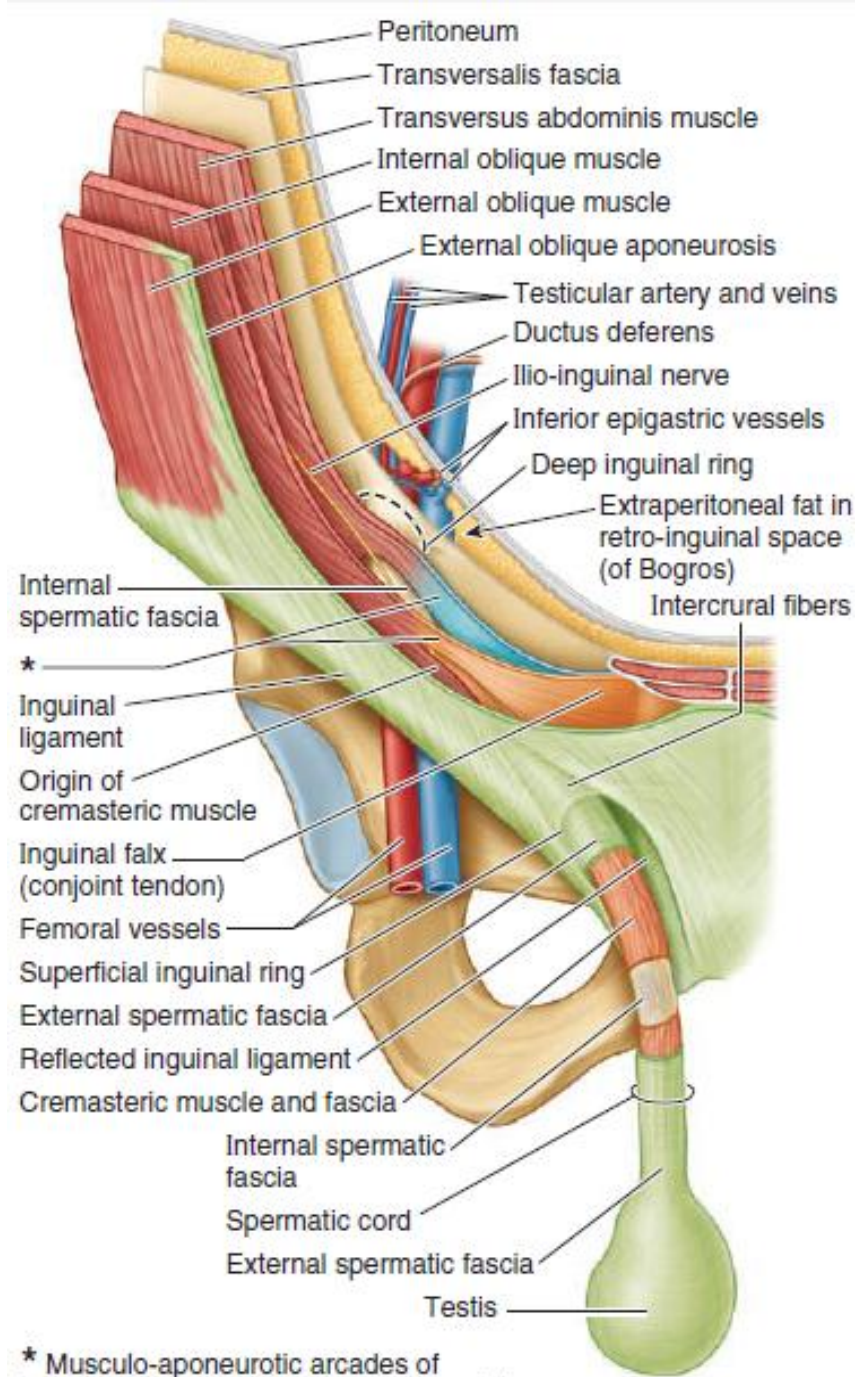
- **Superficial (external) inguinal ring:** it is the exit from the inguinal canal, slit-like opening which is found superolateral to the pubic tubercle.



**FIGURE 2.9.** Inguinal ligament and superficial inguinal ring. Note the lacunar and pectineal ligaments.

# STATION – 3 (Inguinal Canal)

- The inguinal canal has two walls (anterior & posterior) a roof and a floor:
  - **Anterior wall:** formed by the external oblique aponeurosis.
  - **Posterior wall:** formed by transversalis fascia.
  - **Floor:** formed by the inguinal ligament.
  - **Roof:** formed laterally by transversalis fascia, centrally by musculo-aponeurotic arches of internal oblique and transversus abdominis muscles, and medially by the medial crus of the external oblique aponeurosis.

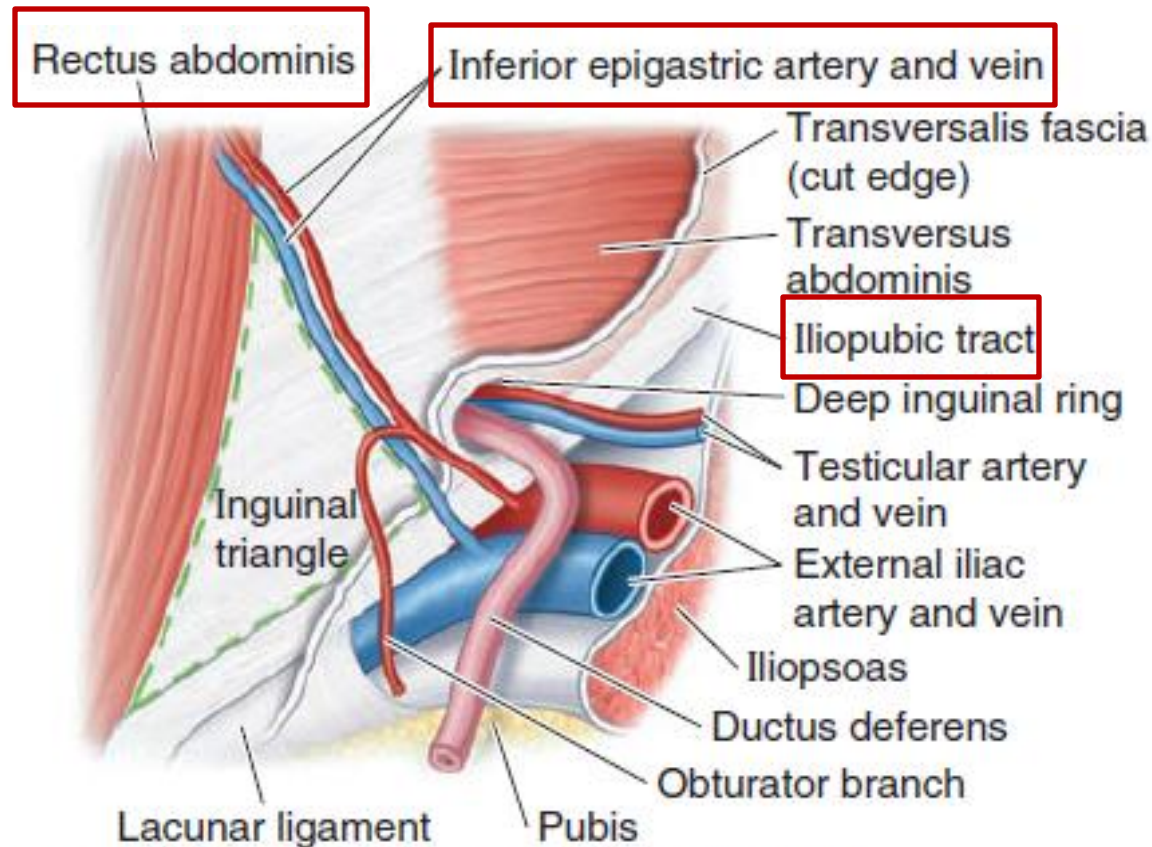


\* Musculo-aponeurotic arches of internal oblique & transversus abdominis

(A) Anterior view



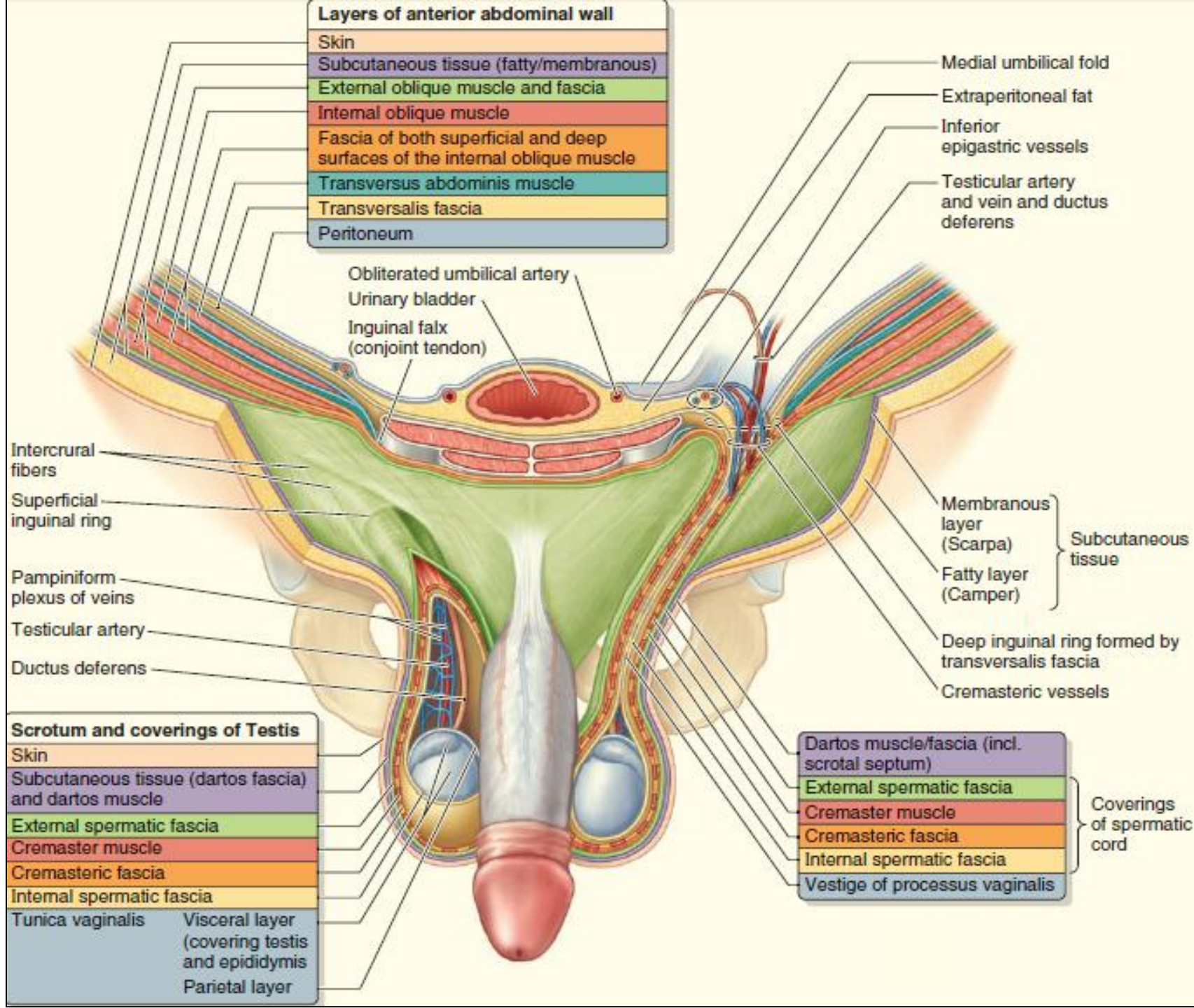
# STATION – 3 (Inguinal Canal)



(B) Posterior view of right anterior abdominal wall

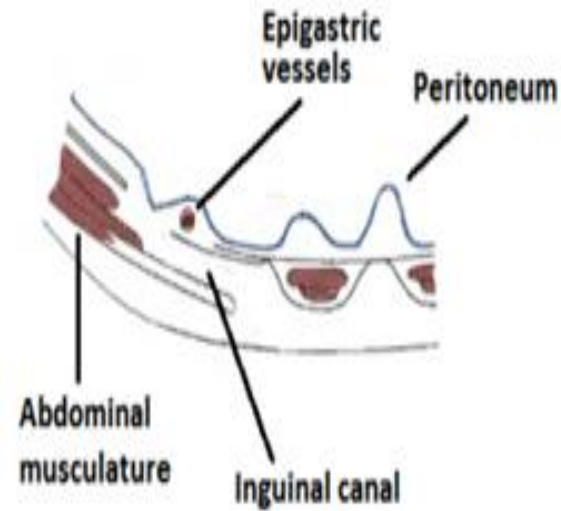
**Hesselbach triangle (inguinal triangle):** it is bounded by rectus abdominis muscle, iliopubic tract (or inguinal ligament) & inferior epigastric vessels. It is a potential site for direct inguinal hernia.

# STATION - 3 (Inguinal Canal)

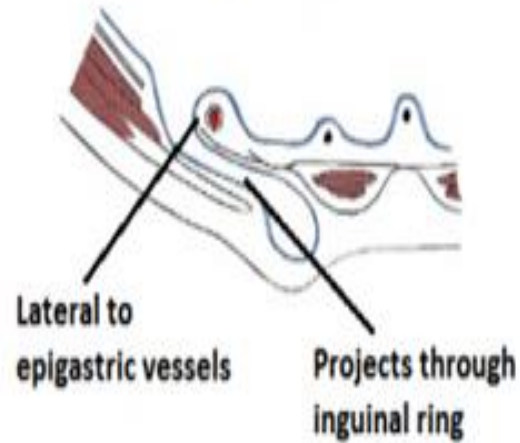


# STATION – 3 (Inguinal Canal)

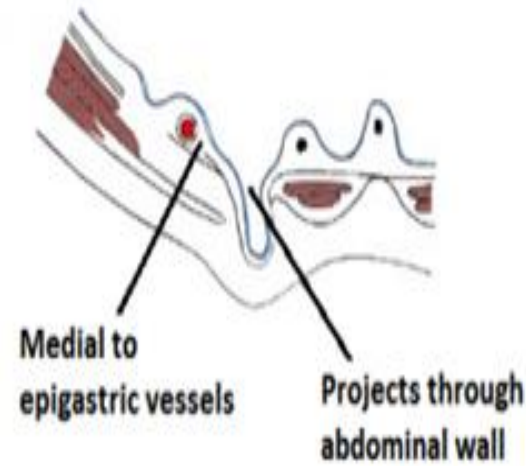
Normal Patient



Indirect Inguinal Hernia

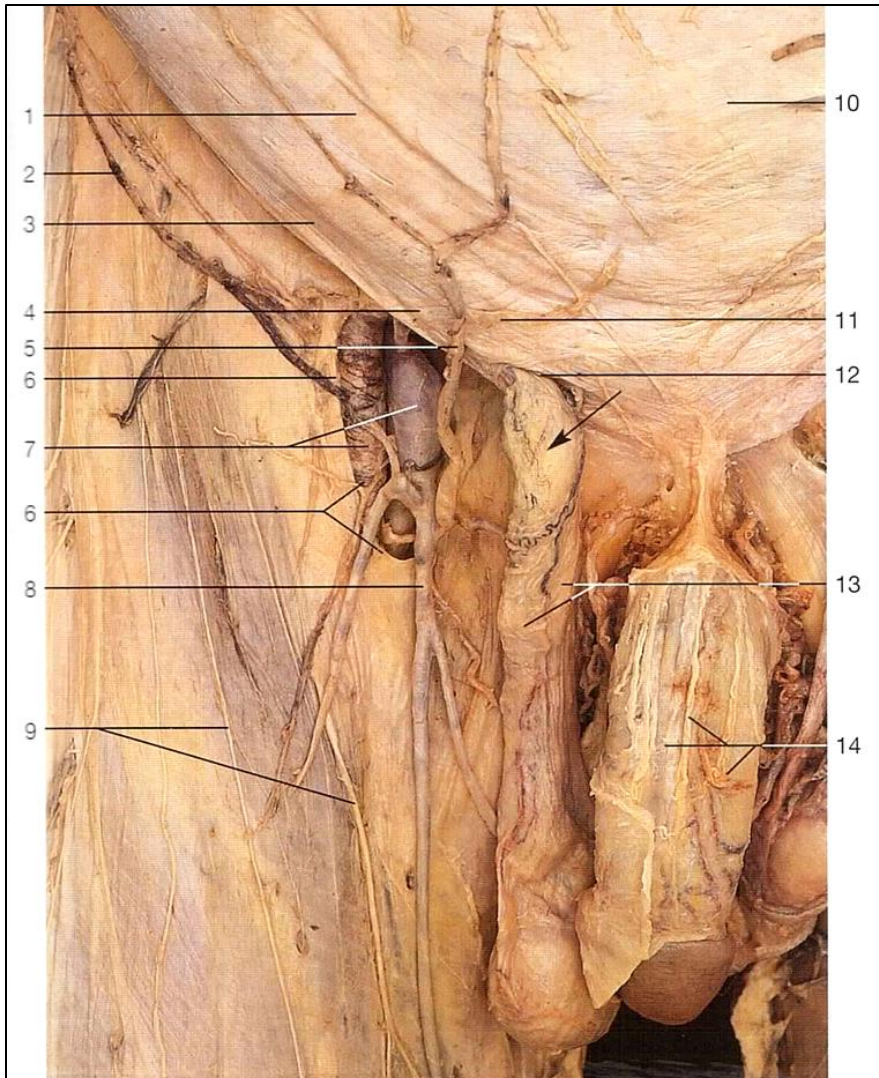


Direct Inguinal Hernia





# STATION – 3 (Inguinal Canal)



Inguinal canal in the male, right side (superficial layer, anterior aspect). There is a small inguinal hernia (arrow).



Inguinal canal in the male, right side (anterior aspect). The external abdominal oblique muscle has been divided to display the inguinal canal.



# STATION – 3 (Inguinal Canal)

- 1 Aponeurosis of external abdominal oblique muscle
- 2 Superficial circumflex iliac vein
- 3 Inguinal ligament
- 4 Lateral crus of inguinal ring
- 5 Superficial epigastric vein
- 6 Saphenous opening
- 7 Femoral artery and vein
- 8 Great saphenous vein
- 9 Anterior cutaneous branches of femoral nerve
- 10 Anterior layer of rectus sheath
- 11 Intercrural fibers
- 12 Superficial inguinal ring
- 13 Spermatic cord and genital branch  
of genitofemoral nerve
- 14 Penis with dorsal nerves and deep dorsal vein  
of penis
- 15 Aponeurosis of external abdominal oblique  
muscle (divided and reflected)
- 16 Internal abdominal oblique muscle
- 17 Ilio-inguinal nerve
- 18 Anterior cutaneous branches of iliohypogastric  
nerve
- 19 Superficial external pudendal veins

**GOOD LUCK!**

