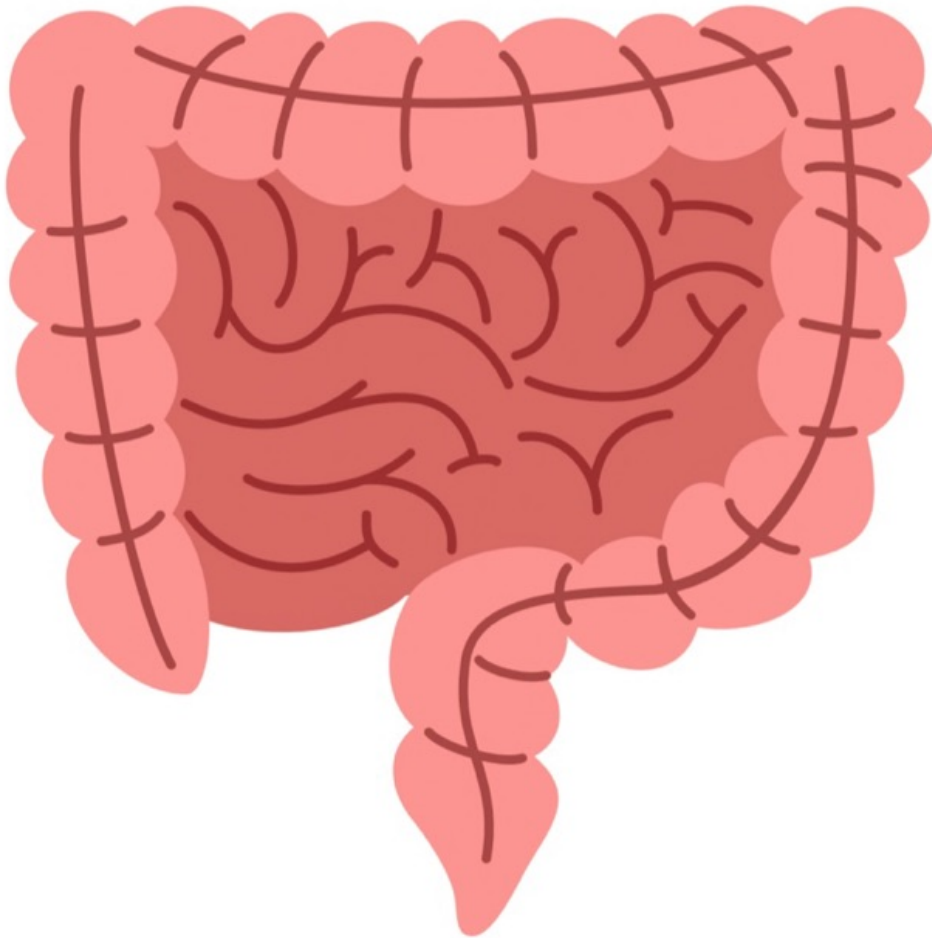


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Sheet no.

Anatomy



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Correction: Dana Oshroq Laban

Doctor: Mohammad Al-mohtaseb

Hi , this is lecture 4 and it is an easy lecture , so don't worry 😊 and let's start:

We will discuss 7 Topics :

- o Rectus Sheath
- o Others Fascia in the Anterior Abdominal wall
- o Action of the Anterior Abdominal Muscle
- o Blood Supply of the Anterior Abdominal Wall
- o Nerve Supply of the anterior Abdominal Wall
- o Lymphatic Drainage of Anterior Abdominal Wall
- o Clinical Notes

Note: I will add extra pictures and put them at the end of the sheet , I will put the pic no. In a star like this ★ to make everything clear for you.

1-Rectus Sheath :

It's a long fibrous sheath, formed mainly by the aponeuroses of the three lateral abdominal muscles. It starts from linea semilunaris(lateral edge of the rectus abdominis muscle) to linea alba.

External,internal and transversus

They start between internal oblique and transversus abdominis muscles to linea semilunaris to enter the rectus sheath and finally become anterior cutaneous nerves of abdomen (sensory)

✓ CONTENTS :

- **Rectus abdominis muscle** : firmly attached to the anterior wall of the sheath by the muscle's tendinous intersections ↓ ,but separated from the posterior wall by the presence of arteries (sup. & inf. Epigastric) .
- **Pyramidalis muscle** (if present) : anterior to the rectus abdominis muscle .
- **The anterior rami of the lower six thoracic nerves** : which gives innervation to the **abdominal muscles** .(Motor)

- ★ 1 ▪ **The superior and inferior epigastric vessels** : inferior epigastric artery is a branch from the external iliac artery-it indicates the difference between direct & indirect hernia-,& superior epigastric artery is a branch from the internal thoracic(mammary) artery, which is a branch from subclavian artery .
- Note// the superior & inferior epigastric veins will run in the opposite direction.

- **Lymphatic vessels.**

✓ **DESCRIPTION THE RECTUS SHEATH IS CONSIDERED AT THREE LEVELS** ; for each level we must know the anterior wall, the posterior wall, and contents (which are constant):

★ 2 1- Above the costal margin: At xiphoid process

- Anterior wall -> Aponeurosis of the external oblique.
- Posterior wall -> Thoracic wall;5th&6th&7th costal cartilages and the intercostal spaces.

2- Between the costal margin and the level of the anterior superior iliac spine: (Above and below the umbilicus)

- Anterior wall ->the external oblique aponeurosis is directed in front of the muscle.
- Posterior wall ->the transversus aponeurosis is directed behind the muscle.

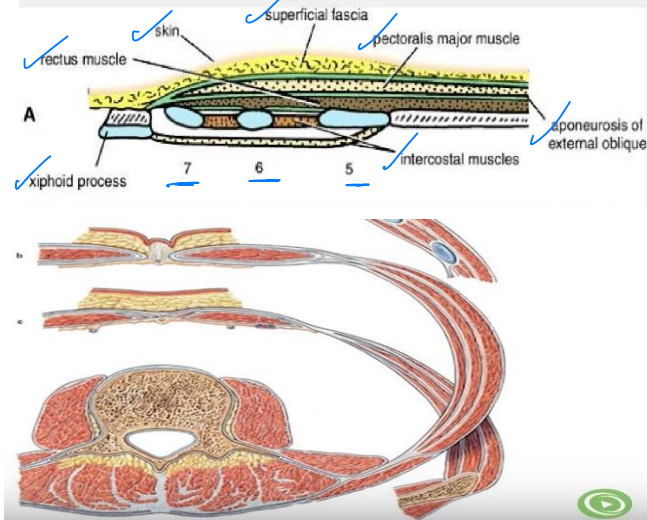
The aponeurosis of the internal oblique splits to enclose the rectus muscle;so it has two layers , one in the anterior wall and one in the posterior wall.

3- Between the level of the anterosuperior iliac spine and the pubis:

- Anterior wall -> the aponeurosis of all three muscles form.
- Posterior wall is absent &the rectus muscle lies in contact with the fascia transversalis

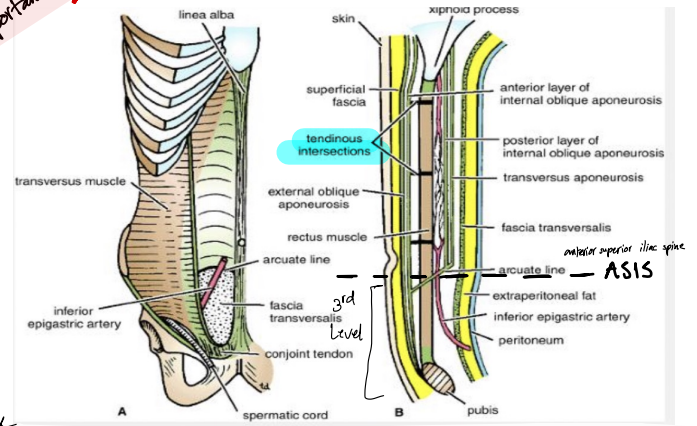
★ 3

First level :-



important!

Rectus Sheath



Arcuate line (semicircular line) : horizontal line that demarcates the lower limit of the posterior layer of the rectus sheath (underneath the rectus abdominis m.), residing one-third the distance between the umbilicus and the pubis.

The three levels

Tendinous intersections

ترتيب العضلات من برا لجوا : External oblique -> rectus abdominis -> transversus muscle :
And we have fascia transversalis underneath the transversus
Rectus sheath is attached by tendinous intersections anteriorly to rectus abdominis m.
only and SEPARATED posteriorly because of the superior and inferior epigastric vessels.

✓ ARCULATE LINE (LINEA SEMICIRCULARIS) :

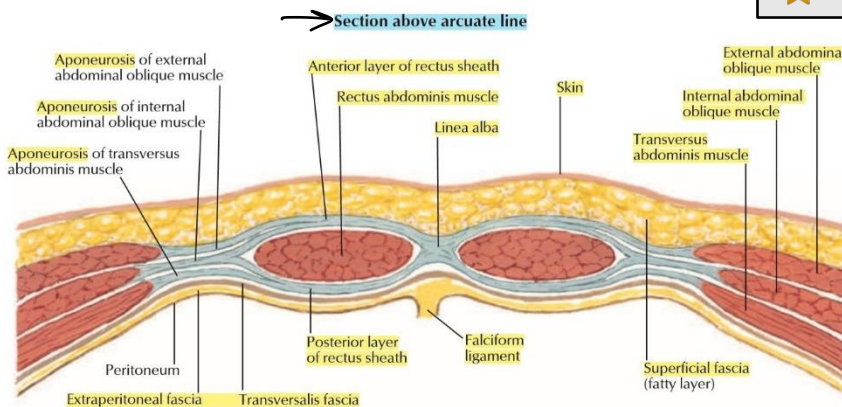
Is a crescent-shaped line marking the inferior limit of the posterior layer of the rectus sheath just below the level of the iliac crest.

★ 4 ★

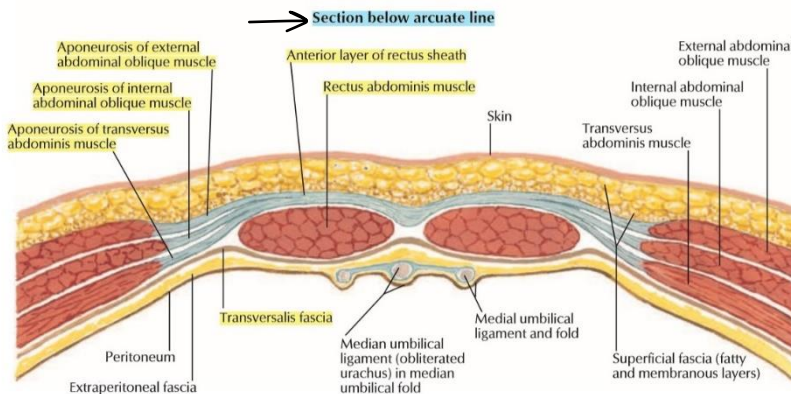
DON'T FORGET ;

what is the structure found in the posterior wall of the rectus sheath, below the level of arcuate line / the level of anterior superior ilia spine ??

TRANSVERSALIS FASCIA
(the third region).

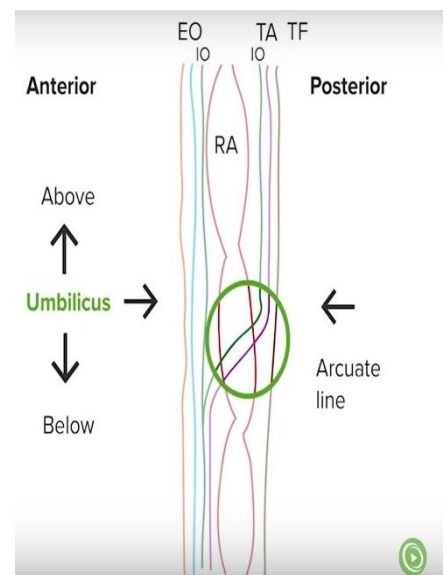


Aponeurosis of internal abdominal oblique muscle splits to form anterior and posterior layers of rectus sheath. Aponeurosis of external abdominal oblique muscle joins anterior layer of sheath; aponeurosis of transversus abdominis muscle joins posterior layer. Anterior and posterior layers of rectus sheath unite medially to form linea alba.



Aponeurosis of internal abdominal oblique muscle does not split at this level but passes completely anterior to rectus abdominis muscle and is fused there with both aponeurosis of external abdominal oblique muscle and that of transversus abdominis muscle. Thus, posterior wall of rectus sheath is absent below arcuate line, leaving only transversalis fascia.

f. Netter



2-Other Fascia in the Anterior Abdominal wall :

✓ TRANSVERSALIS FASCIA

- a thin layer of fascia that lines the Transversus Abdominis muscle(deep to it).
- continue to diaphragm (below it),it goes anterior to the iliac muscle making **pelvic 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 (تذكروا دكتور ماهر وجدار البالون المنفوخ)
 - Continuous below with the parietal peritoneum lining the pelvis-To be discussed later-.
-

3-Action of the Anterior Abdominal Muscles : -they work as one unit-

✓ DEEP EXPIRATION:

- The contraction of the abdominal muscles help in the deep expiration
- Usually after exercise
- The 2 types respiration: 1-shallow 2- deep .
- Inspiration → active movement , needs energy .
- Expiration → passive movement , doesn't need energy because the diaphragm relaxes back by itself.

✓ INCREASE THE INTRAABDOMINAL PRESSURE IN: when it is needed in the following processes:

- Vomiting
- Coughing
- Defecation (معناها الإخراج؛وخصوصاً في حالات الإمساك)
- Labour (حيث ينصح الأطباء الحوامل بلعب الرياضة التي تساعد على تقوية هذه العضلات في الشهرين الأخيرين من الحمل)

✓ PROTECT VISCERA: prevent the traumas from reach the viscera, by their contraction any hit on the abdomen will be reflected.

✓ KEEP VISCERA IN POSITION.

✓ RECTUS ABDOMINIS-→BENDS TRUNK FORWARD

✓ MOVEMENT:

- Bending forward → bilateral contraction
- Bending laterally → one side contraction

✓ LIFTING OF HEAVY OBJECTS: when an athlete lifts weights ; he :

- Opens his legs
 - Hold his breath & increase the abdominal pressure
 - Lift the weight
-

4-Blood Supply of the Anterior Abdominal Wall

✓ ARTERIES

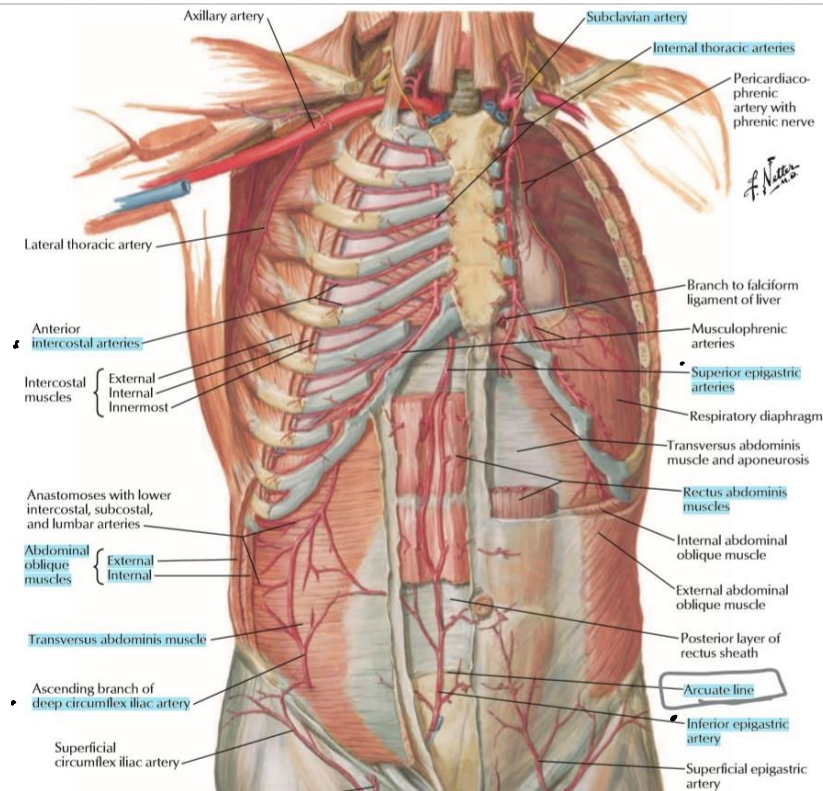
- Superior Epigastric artery
- Inferior Epigastric artery
- Intercostal arteries (lower 6)
- Lumbar arteries : the abdominal aorta gives four lumbar arteries in the posterior abdominal wall ; supply the abdominal muscles, from the back forward .

- Deep circumflex artery ; branch from external iliac artery goes to anterior superior iliac spine and supplies the abdomen in this region .

✓ VEINS

- Lateral Thoracic Vein drains into Axillary Vein
- Superior Epigastric drains into Internal Thoracic Vein → Above the umbilicus
- Inferior Epigastric drains into External Iliac Vein → Below the umbilicus
- Paraumbilical Veins ;
- Ligamentum teres* → portal vein {Porto-systemic anastomosis (to be discussed later)}
- *The remnant of the umbilical vein that exists in the free edge of the falciform ligament of the liver (it was present in the fetus but then got obliterated).

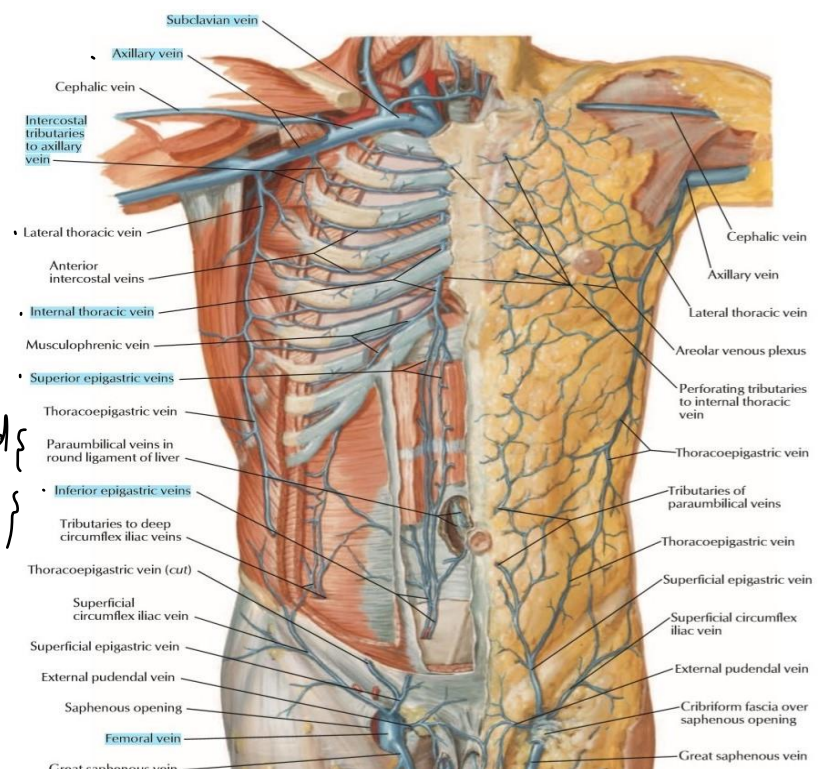
*The Arterial Blood Supply



*The Venous Blood Supply

above
umbilicus

around
below
umbilicus



5-Nerve Supply of Ant. Abdominal wall

✓ THORACOABDOMINAL NERVE:

- Lower 6th thoracic nerves & 12th subcostal nerve
- They come from chest to abdomen
- They enter from lateral to medial ; from linea semilunaris to linea alba, then they end as cutaneous to the abdominal wall ; that's why when we do a surgery, we tighten the rectus abdominis muscle **laterally**; because if we tighten them medially, they may get torn .

✓ DERMATOMES: (nerves to the skin of abdomen , Anterior lateral cutaneous nerve terminal branches of Thoracoabdominal nerve)

- T7.
- T10.
- L1.

{for example ; the pain of appendicitis starts in the region around umbilicus , then it moves to the right iliac fossa. The reason is that the innervation to the appendix is from T10 ; and T10 gives dermatome around the umbilicus}.

✓ L1 NERVE

! Iliohypogastric nerve

Skin of lower abdomen above symphysis pubis

! Ilioinguinal nerve

Enter inguinal canal to give sensation of scrotum

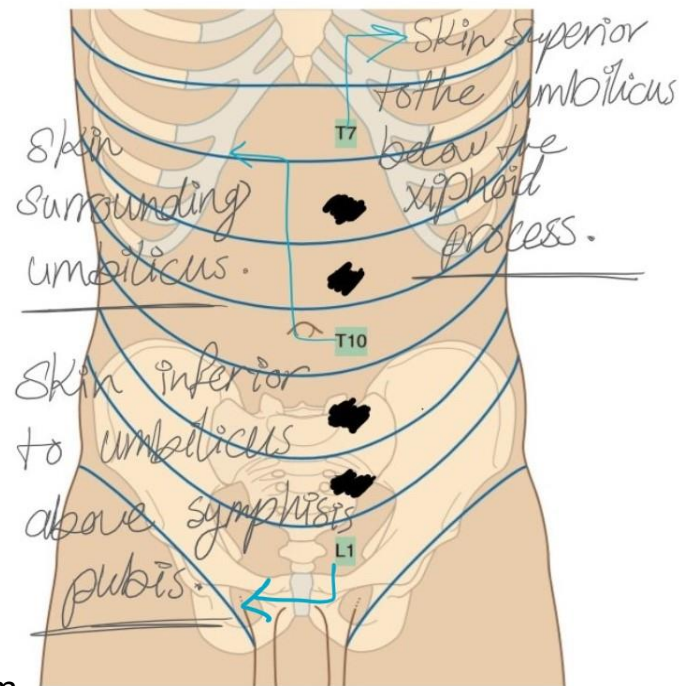
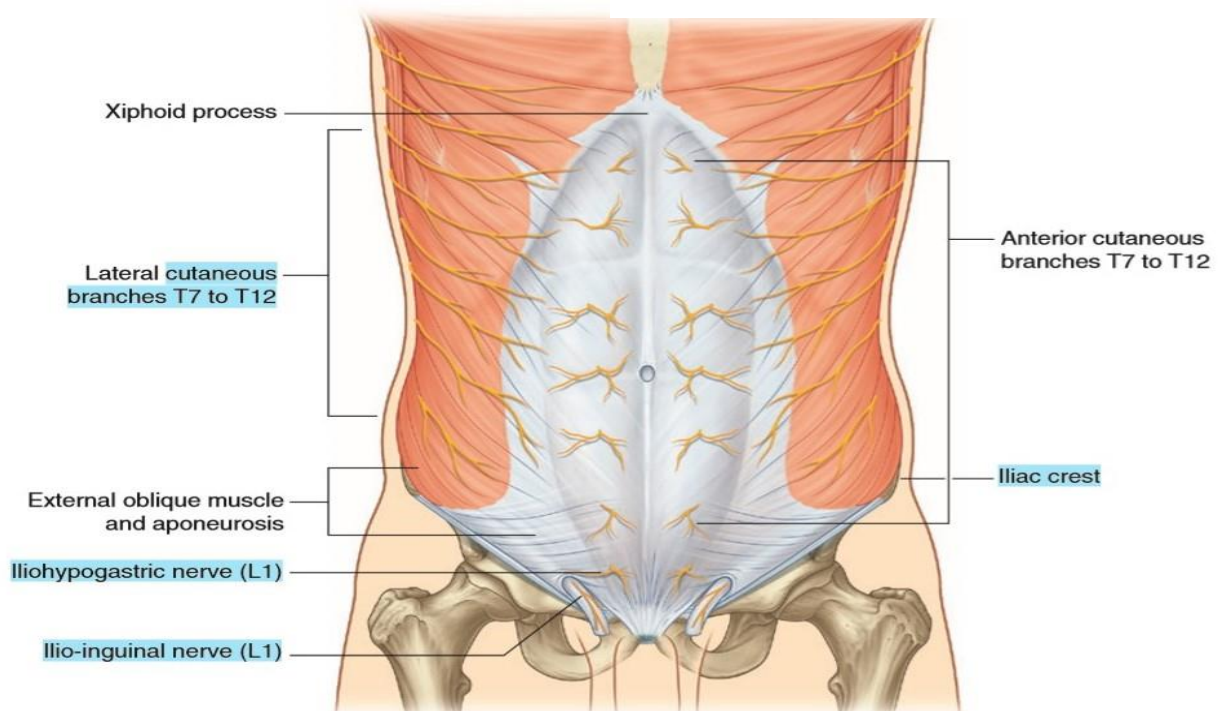


Fig. 4.38 Dermatomes of the anterolateral abdominal wall.



6-Lymphatic drainage of Ant. Abdominal wall : ★ 5

Abdominal lymph nodes are distributed in the anterior wall of the abdomen as following:

- **Above the umbilicus**→Ant. Axillary L.N; which are deep to the pectoralis major muscle.
 - **Below the umbilicus**→Sup. Inguinal L.N, they're located in the femoral triangle.
 - **Above the iliac crest**→Post. Axillary L.N, anterior to the subscapularis muscle on the back.
 - **Below the iliac crest**→Sup. Inguinal L.N.
-

7-Clinical Notes :

Now; let's get in some applied medicine~. ~:

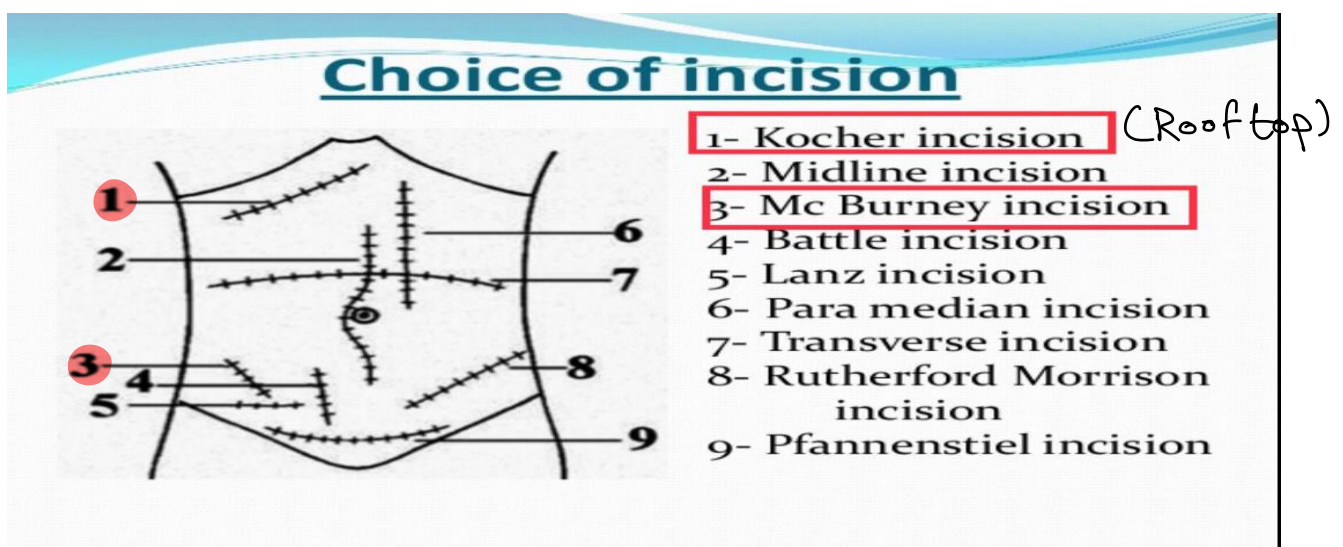
1-A lot of abdominal incisions that you'll see, can be a result of street conflicts, mainly the stab wounds. We care most to detect the site of the penetration & the layers that got injured (anatomical location).For example:

- If the stab injured the abdomen anterior to the rectus sheath, this indicates harm to the rectus abdominus muscle, increasing a risk to find an injury in the superior & inferior epigastric arteries which are part of the content of the rectus sheath.
- When a lateral injury wouldn't affect neither the muscle nor the vessels, the nerves crossing from lateral to medial will get harmed.
- A midline injury is a very rare case, causing an incision in the linea alba.

2-The length and direction of surgical incision through the ant. Abdominal wall to expose the underlying viscera in a surgery are largely controlled by many factors:

- ✓ position & direction of nerves.
- ✓ direction of muscle fibers.
- ✓ arrangement of the aponeurosis forming the rectus sheath.

So, the incision should be made In the direction of the line of cleavage in the skin, so that the hairline scar is produced. The most common incision in a surgery is a midline incision. But let's say we have to operate on a gallbladder. It's incision will be applied under the ribs on the right side of the abdominal wall, which we call a **KOCHER INCISION**. While the appendix surgery is opened by a **MC BURNEY INCISION**

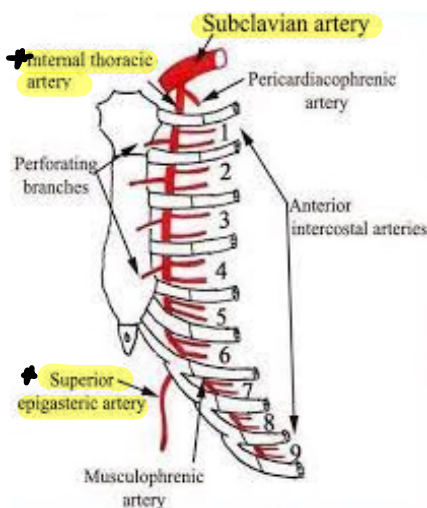
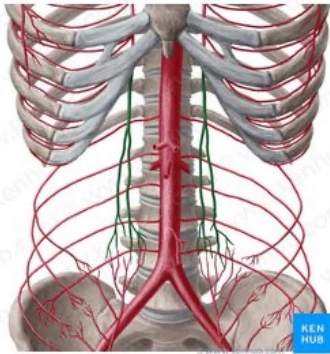


Common types of incisions:

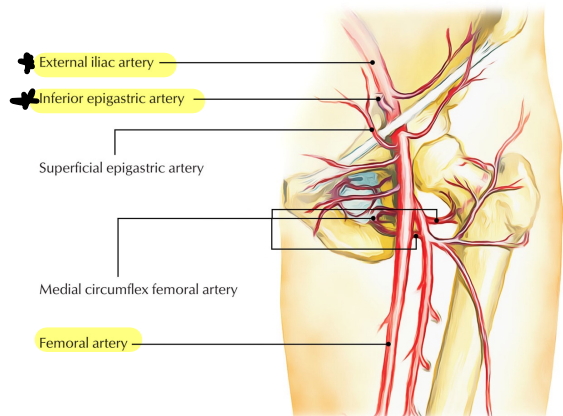
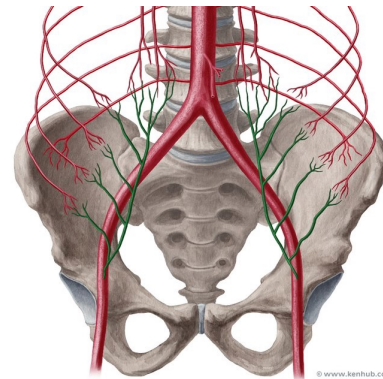
- Paramedian incision.
- Midline incision.
- Transverse incision.
- Abdominothoracic incision.
- Pararectus incision.
- Transrectus incision.
- Muscle splitting.

Incision through the rectus sheath are 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.

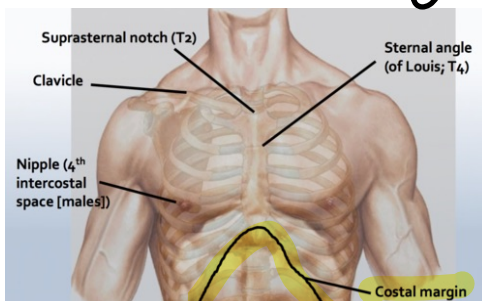
★ 1 Superior epigastric



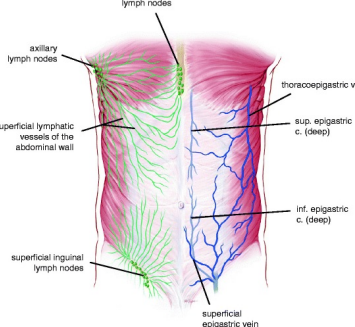
inferior epigastric



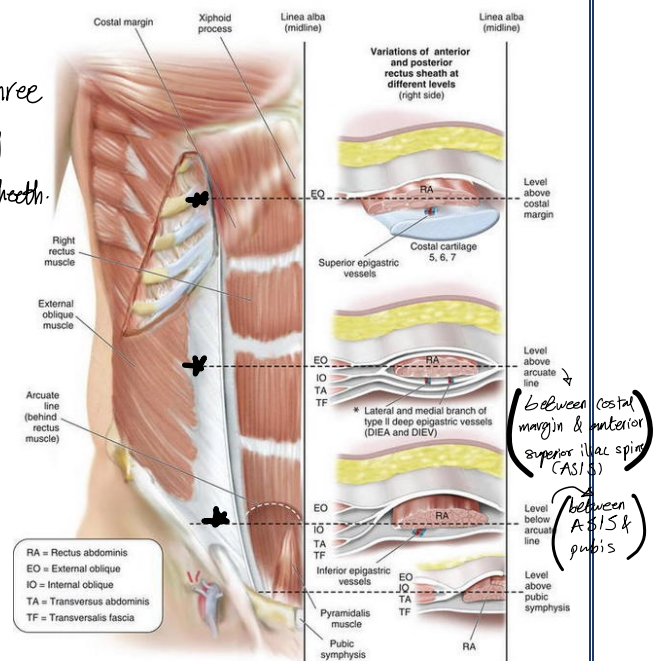
★ 2 Costal Margin (C7-10)



★ 5 Lymph. drainage of Ant. abdomen

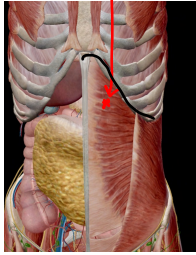


★ 3 the three levels of Rectus sheath.

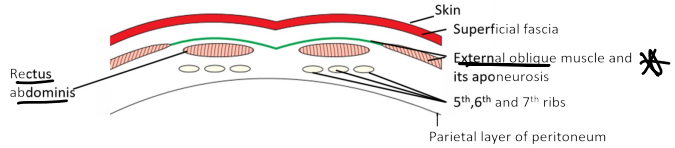


* Common branching patterns:
 - Type I DIEA continues as a single vessel (29%).
 - Type II DIEA divides into two vessels (57%).
 - Type III DIEA is a trifurcation (14%).

← بعد إزالة rectus & external
 لضعف عند transversus و مثل ما بنطق
 انها تحت ال costal margin لذلك
 منه حوجة بال first level of sheath

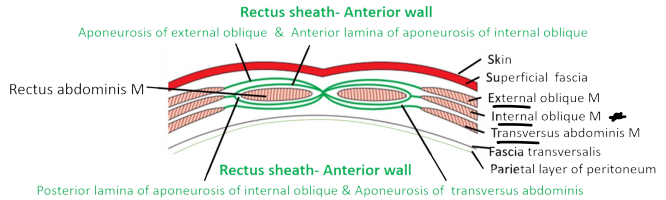


1. Rectus sheath above the costal margin



Notice here that the internal oblique M. splits into anterior & posterior around the rectus abdominis. Anterior is in anterior wall & posterior in posterior wall)

2. Rectus sheath from the costal margin to midway between umbilicus and symphysis pubis



* All aponeuroses are in the Anterior wall.

3. Rectus sheath between the midpoint of umbilicus and pubic symphysis to pubic symphysis

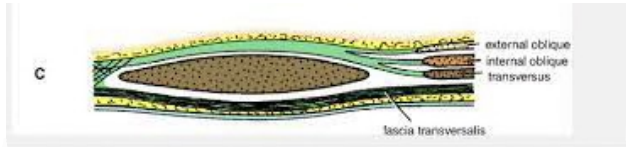


Figure 4-13 Transverse sections of the rectus sheath seen at three levels. **A.** Above the costal margin. **B.** Between the costal margin and the level of the anterior superior iliac spine. **C.** Below the level of the anterior superior iliac spine and above the pubis

Test Your Self :

1] A 2-year-old boy presents with pain in his groin that has been increasing in nature over the past few weeks. He is found to have a degenerative malformation of the transversalis fascia during development. Which of the following structures on the anterior abdominal wall is likely defective?

- (A) Superficial inguinal ring
- (B) Deep inguinal ring
- (C) Inguinal ligament
- (D) Sac of a direct inguinal hernia

2] A 9-year-old boy was admitted to the emergency department complaining of nausea, vomiting, fever, and loss of appetite. On examination, he was found to have tenderness and pain on the right lower quadrant. Based on signs and symptoms, the diagnosis of acute appendicitis was made. During an appendectomy performed at McBurney point, which of the following structures is most likely to be injured?

- (A) Deep circumflex femoral artery
- (B) Inferior epigastric artery
- (C) Iliohypogastric nerve
- (D) Genital branch of Genitofemoral nerve

3] A physical fitness trainer for a young Hollywood movie star explains the reasons for 100 stomach crunches a day. The young star, a medical student before "hitting it big," reaffirms to his trainer that the lateral margin of the rectus abdominis, the muscle responsible for a washboard stomach, defines which of the following structures?

- (A) Linea alba
- (B) Linea semilunaris
- (C) Linea semicircularis
- (D) Transversalis fascia

4] A boy presents to the hospital with a stab wound in the right iliac fossa, which nerve may be affected?

- (A) T12
- (B) L2
- (C) L1
- (D) T11

5] Which one is wrong about tendinous intersection?

- (A) Fibrous band passes transversely or obliquely
- (B) Attaches to posterior border of rectus sheath
- (C) It defines the anatomy of the rectus abdominis
- (D) It assists with physiological movement.

Wish you all the Best ✨

Answers → B, C, B, C, B