

Digestive System

University of Jordan
Faculty of Medicine
Batch of 2013-2019



Slide Sheet Handout Other

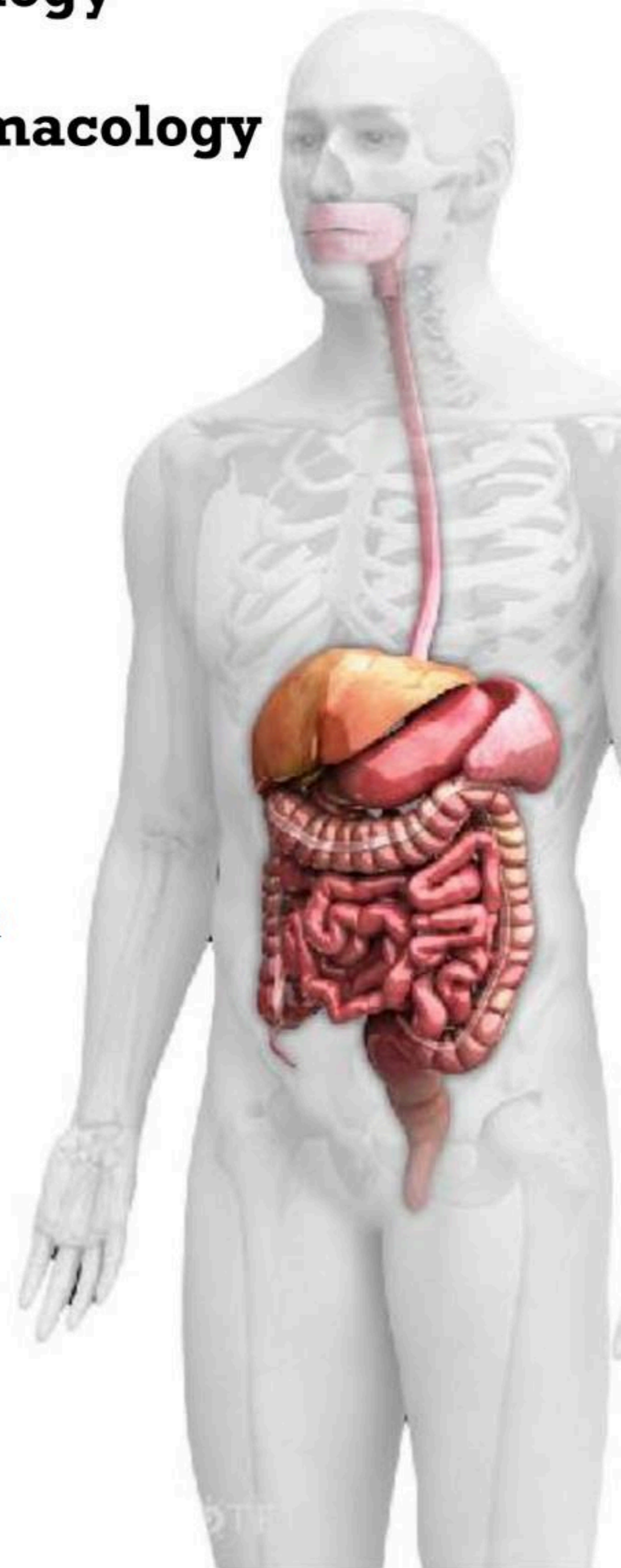
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Sheet #: 3

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Price:



Abdominal wall

This sheet is done at section 1 record from minute 48:46 to the end of the record.. it explains the whole second slide.. I have collected the separated information together so you will notice a little difference in the arrangement.

Now we want to talk about the abdominal wall, we have finished a big part from the GI of the head & neck..Now we will talk about the abdomen.

❖ The abdominal wall borders:

- Abdomen is the region of the trunk that lies between the diaphragm above and the inlet of the pelvis below.

You know that the diaphragm separates the thoracic cavity from the abdominal cavity, also it has three major orifices; one for the **abdominal aorta**, one for the **esophagus** and the last for **inferior vena cava**. So there is a connection through major orifices of diaphragm.

- *Superior border:* lower 6 costal cartilage (7-12) & Xiphoid process.
- *Inferior border:* inlet of the pelvis which is the iliac crest & symphysis pubis anteriorly at the level of L4.
- Note that the umbilicus is at the level of the disc between L3 and L4

P.S: we will talk about the posterior abdominal wall at the end of the abdomen.

Let's start talking about **the anterior abdominal wall**..

When a patient comes to your clinic for examination, you have to stand beside his left side; first we want to see the respiration for the patient by the abdomen movement.

Second I have to know the contents of all the sites of the abdomen.. In the past the abdomen was divided into 4 quadrants:

- 1- **Lower right**; has cecum , appendix & ascending colon .
- 2- **Lower left**; has descending colon & sigmoid colon.
- 3- **Upper left**; has stomach & spleen.
- 4- **Upper right**; Liver & gallbladder.

But they found that it's a weak description and they didn't use it anymore..

Then they divided the abdomen into **9 regions** : 3 upper, 3 middle & 3 lower
,, by two pairs of planes:

1-Vertical Planes

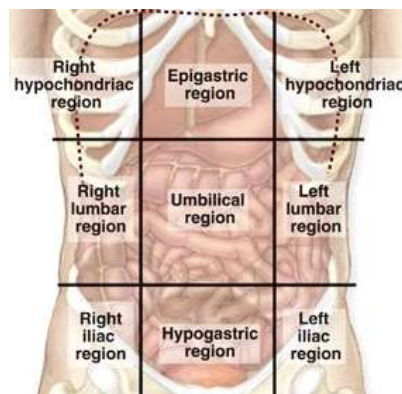
Consists of 2 verticals lines named as Midclavicular line(from the mid of clavicle downward to the mid of inguinal ligament)

2- Horizontal Planes ,, Consists of ;

A) *Subcostal plane*: at level of L3 vertebra, below the last costal cartilage

B) *Intertubercular plane*: at the level of L5 vertebra & it's between the tubercles of iliac crests (on the hip bone).

❖ Names of the nine abdominal regions :



• upper three :

- 1- Epigastric region: means above the stomach.

- 2- Right Hypochondriac: it means below "hypo" the costal cartilage "chondriac" at the right side.
- 3- Left Hypochondriac: on the left side of the epigastric.
 - So if the patient has pain in the stomach, it will be at the epigastric region, but if he had cholecystitis it will be at the Right Hypochondriac region, if he had enlargement in the spleen with pain so there is a problem in the Left Hypochondriac region SO every region has its own organs

- **Middle three :**

- 1- Umbilical
- 2- right lumbar (flank) region
- 3- left lumbar (flank) region

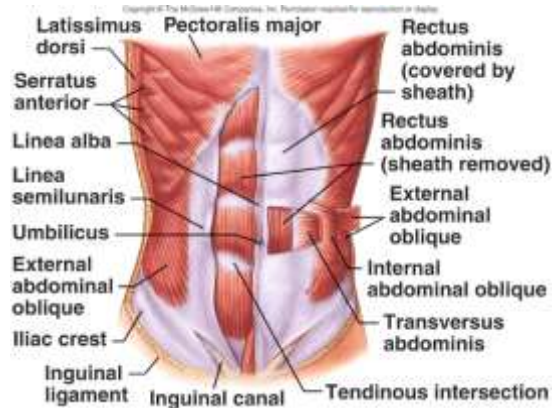
- So if the patient have intestinal colic (المغص المعوي) the problem will be at the umbilical region because most of the small intestine is present there ... as well as the renal colic (المغص الكلوي) at the lumber region whether right or left (if the dr wants to examine this disease he puts one hand at the posterior lumber region & one at the anterior abdominal wall.. and produces pressure to see if the pain increases or not) .

- **lower three :**

- 1- suprapubic (hypogastric) : has urinary bladder .
- 2- right iliac (inguinal) region : contains the appendix and right ovary (note that if a patient came to you complaining about severe pain in this region.. if it was a male so it's appendicitis, but if you have a female patient so maybe it's a pain from the menstrual cycle) .
- 3- left iliac (inguinal) : in females it has the left ovary.

❖ NOW... THE ANTERIOR ABDOMINAL WALL CONTENTS

From the picture below, look at:



-the rectus abdominis muscle

-Also you can see white areas named as tendinous intersection (came from the MYOTOMES of the embryo..) divides the rectus abdominis into 4 parts, these parts are the six pack we see on bodybuilders when they stretch their abdomen.

-Linea alba: (from xiphoid to the symphysis pubis), it's a fibrous tissue for the insertion of all abdominal muscles.

-external abdominal Muscle .

-Internal abdominal Muscle .

-Transversus abdominal Muscle .

P.S: We will talk about them later....

❖ Layers of the abdominal wall: (it's important for people who want to be surgeons)

1) Skin

2) Superficial Fascia :

- -above the umbilicus : it is one layer
- -below the umbilicus : it is two layers ;
 - a. fatty layer : **camper's fascia**, in males continues and reaches the scrotum → forms the dartos muscle
 - b. membranous layer : **scarpa's fascia**, in the scrotum it forms colle's fascia ... this layer in the lower limb attaches to the fascia lata (below inguinal ligament) & at the side of pubic arch posteriorly perineal body (will talk later about) .

#Clinical note: the membranous layer (scarpa's fascia), surrounds the penis, scrotum.. present at anterior wall of abdomen below the umbilicus and can reach the perineal body...

So if a patient had rupture of the urethra due to severe trauma , this means **extravasation of urine** (spreading of the urine outside the urethra) .. Now the membranous layer prevents this spreading to the lower limb because the it is attached to the fascia lata of the lower limb (which is found 2 fingers below the inguinal ligament) but it can spread to the abdominal wall below the umbilicus, also in the penis, scrotum until perineal body.

#Note that there is attachment of the membranous layer to the fascia lata -we took it in the lower limb- , which extends only two fingers below the inguinal ligament, so the extravasation will not reach the lower limb.

3) **Deep fascia:** NO deep fascia or very thin layer.. as the anterior abdominal wall of a pregnant women in her 9th month is so big and extended.. so that gave her a space for the enlargement of the abdomen, since deep fascia prevents any expansion.

4) **Muscular layer** : a. Rectus abdominis muscle b. external oblique muscle
c. internal oblique(abdominis) muscle d. transversus abdominis muscle .

5) **Transversalis Fascia** : its extension forms the posterior wall of the femoral sheath .

6) **Extra peritoneal fascia** (or fat) : located before parietal peritoneum .

7) **Parietal peritoneum** : (it's the lateral membrane of the peritoneal sac), so the abdomen is a cavity lined by this layer (enclosed by it) (will talk about it later) .

Q: Can the surgeon reach the stomach or the small intestine before opening the parietal peritoneum? **NO**, it's impossible, he has to make incision in the parietal peritoneum to open the abdominal cavity reach them.

Q: But can the surgeon reach the kidneys without opening the Parietal cavity? **YES** , because they are at the lumbar region outside the abdominal cavity (retro peritoneal: behind the peritoneal cavity)

❖ MUSCLES:

(the dr will focus on the muscles in a clinical way)

▪ 1) External oblique muscle:

It's a broad, thin muscle. Its fibres directed downward forward medially.

(Remember that the insertion of all the abdomen muscles is in the linea alba) .

- Origin: outer surface of lower 8 ribs.
- Insertion: Xiphoid process, Linea alba, pubic crest, pubic tubercle, iliac crest .
- Nerve Supply:
 - 1- Lower 6th intercostal nerves (remember that the number of intercostal nerve is 12.. the lower six goes to the abdomen.. and the last one

named as subcostal nerve), So the lower six & the subcostal innervate external oblique muscle.

2- L1; (Iliohypogastric n., Ilioinguinal n.) .

#IMPORTANCE OF THIS MUSCLE# :

The muscle has an aponeurosis (fibrous connective tissue at the end of the muscle) for making:

1* **Inguinal ligament**; which is a folding of aponeurosis of external oblique muscle upon itself. The inguinal ligament extends from ASIS to pubic tubercle

2* **Superficial inguinal ring**; It's a defect in external oblique aponeurosis for the passage of the spermatic cord.

3* **Lacunar ligament**; Forms the medial boundary of the femoral ring also its an extension of aponeurosis of external oblique muscle attached to the pectineal line of the body of pubis .

4***Pectineal ligament**; a more extension of lacunar ligament on the pectineal line.

5***inguinal canal**; In the anterior abdominal wall behind the external oblique aponeurosis.

6*formation of **rectus sheath**; all the abdomen muscles contribute in making it. (will be mentioned after some pages)

** Look at the pictures in the slides for clarification...

The second muscle..

▪ 2)Internal Oblique muscle:

Direction of the fibers: upward & medially (unlike the external) .

- Origin: Lumbar Fascia, iliac crest, lateral two thirds of inguinal ligament. (similar to the insertion of the external muscle)
- Insertion: Lower three ribs & costal cartilage, Linea alba .
- Nerve Supply: (like external) Lower 6th thoracic nerves, iliohypogastric nerve & ilioinguinal nerve .

#IMPORTANCE OF THIS MUSCLE# :

1***Conjoint tendon;** Consists of fibers of the internal oblique muscle and transversus abdominis, attaches medially to linea alba, supports the inguinal canal and has lateral free borders.

2***Cremasteric fascia;** Extends from internal oblique, surrounding the spermatic cord to the scrotum.

**Note that the Internal oblique makes arching and roofing to the inguinal canal (makes the roof of the inguinal canal).

▪ 3)Transversus Abdominis

- Direction to its fibers; run transversely (horizontally).
- Origin: Inner surface of lower six costal cartilage, lumbar fascia.
- Insertion: Linea alba(mainly), Xiphoid process.
- The lower part fuses with internal oblique to form conjoint tendon.
- Nerve Supply (similar to external and internal); Lower six thoracic nerves, L1;(iliohypogastric nerve & ilioinguinal nerve) .

#IMPORTANCE OF THIS MUSCLE# :

1***Conjoint tendon;** important in the surgery of hernia.. when making a stitch in the hernia, this stitch goes with the conjoint tendon because it's a tough structure.

2*Rectus sheath

- The last muscle is.. **4) RECTUS ABDOMINIS**
- Consists of squares surrounded by the linea alba.. Why is that? Because its pierced by Tendinous intersection (which came from the embryo "Myotomes") .
- Note that there are three or four Tendinous intersections: one at the level of umbilicus, the other between xiphoid and umbilicus and sometimes there is one above.
- Origin : From downwards; Symphysis pubis, pubic crest.
- Insertion: upwards; 5th, 6th and 7th costal cartilage & xiphoid process.
- Nerve Supply; Lower 6th thoracic nerves(doesn't take from L1 which innervates all other abdominal muscles)

#IMPORTANCE OF THIS MUSCLE# :

1***Linea semilunaris** : it's the lateral edge of the muscle

2***Tendinous intersection**

❖ Lines & Land marks of the Anterior Abdominal Wall:

- Linea alba:

Located along the midline between the xiphoid process & symphysis pubis

It's important when we have large abdominal tumour, so we make a "midline incision" through it because it provides us with a wide field for the surgery.

But there is a disadvantage for linea alba; (because its fibrous), that the healing is very poor and takes long time.

- Linea semilunaris: Lateral edge of rectus abdominis muscle.

- Tendinous intersection: present:

- 1- one at level of xiphoid process.
- 2- one at level of umbilicus.
- 3- & one at the half way between xiphoid and umbilicus.

**And we can see another one above or below..

❖ Pyramidalis muscle:

(in the lower part anterior to rectus abdominal muscle) in the rectus sheath,, and sometimes can be absent.

- Origin: Anterior Surface of the pubis .
- Insertion: Linea alba and in front of the lower part of the rectus abdominis muscle .
- Nerve supply: 12th subcostal nerve .
- Function: Tense the linea alba.
- It's called pyramidalis according to its shape.

❖ RECTUS SHEATH:

It's a fibrous sheath, Starts from linea semilunaris (lateral edge of rectus abdominis) and ends in linea alba

Formed mainly by the aponeurosis of the three lateral abdominal muscles; External, Internal, Transversus.. & Rectus(inside),, all these muscles start at the level of semilunaris and **split** to give one layer anterior to the rectus muscle and another layer posterior,,,,, forming the RECTUS SHEATH.

And then they finally meet and inset into linea alba.

- **Contents of rectus sheath:**

1-Rectus abdominis muscle (inside the sheath).

2-Pyramidalis muscle (if present) .

3-Lower six intercostal nerves (thoracic nerves), also the lower subcostal nerve.

4-The superior and inferior epigastric vessels (deep to rectus muscle).

5-Lymphatic vessels.

P.S: remember that **ALWAYS** the contents of the sheath are rectus abdominis + blood vessels + nerves...

- **Description of the rectus sheath is considered at three levels :**

- 1- Above the costal cartilage ,section at the level of xiphoid process .
- 2- Midway BETWEEN "xiphoid and umbilicus" & midway BETWEEN "symphysis pubis and umbilicus".. (Wide range).
- 3- Below ASIS

***Explanation about level one:**

- ✓ Anterior wall of rectus sheath is formed by :

Skin + superficial fascia + pectoralis major muscle + external oblique aponeurosis(important) .

- ✓ Posterior wall of rectus sheath:

Only the intercostal muscles and between them the costal cartilage (5 , 6 , 7) .

***Explanation about level two:**

- ✓ Anterior wall:

- 1- Skin .
- 2- Superficial fascia.
- 3- The aponeurosis of one layer of **internal** oblique, which **splits** to anterior layer and posterior layer to enclose the rectus muscle.

4- The external oblique aponeurosis is directed in front of the rectus muscle.

✓ Posterior wall:

1) One layer from **internal** oblique.

2) The transversus aponeurosis is directed behind the muscle.

3) Transversalis fascia.

4) Extra peritoneal fascia.

5) Parietal peritoneum.

***Explanation about level three:**

- ✓ The anterior wall : the all aponeurosis of three muscles (external & internal & transversus) .
- ✓ The posterior wall only the transversalis fascia. It's a very thin membrane.
- Something important... at the level of ASIS we have arcuate line; which is crescent-shaped and lined at the beginning of posterior wall of rectus sheath by transversalis fascia.

A Quick Summary:

So we have to know three levels: 1-at the level of xiphoid process (at the posterior wall we have costal cartilage).

2-The most important one.. which is between midway between xiphoid and umbilicus & midway between symphysis pubis and umbilicus.

& the last 3-below ASIS

❖ Other fascia in the anterior abdominal wall:

- Transversalis Fascia: is present in the posterior wall of the abdomen and makes the posterior wall of the rectus sheath below ASIS.
- 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.

**Note the inferior epigastric artery which is a branch from the external iliac artery and its one of the contents of rectus sheath. So it enters deep and passes to the rectus sheath to be one of its contents.


- AGAIN; The contents of the rectus sheath:

1-Two muscles; rectus abdominis & pyramidalis (if present) .

2-Two arteries; inferior epigastric (branch of external iliac) & superior epigastric (branch from internal thoracic “mammary”: a branch from the subclavian artery.


*** both of them make anastomosis and both present behind RECTUS ABDOMINIS muscle.

3-Lower six intercostal nerves; they come from lateral to medial giving innervation to abdominal muscles ,, then ends as anterior cutaneous nerves.

 **A QUESTION;** if I made an incision in the rectus sheath.. does the rectus abdominis muscle pull it laterally or medially??

-**Lateral...** because the nerve supply came from lateral to medial.

*If it was pulled medially the nerve may be cut...

 **A QUESTION;** How does the subcostal nerve reach the rectus sheath? It passes between two muscles (internal oblique & transverses abdominis muscle), and reaches the rectus sheath from lateral to medial, ending as anterior cutaneous nerve.

❖ DERMATOMES OF THE SUBCOSTAL NERVES:

- Around the xiphoid comes from T7 .

- Around the umbilicus from T10 .

- Above symphysis pubis T12 .

P.S: Tendinous intersections make connections with the anterior rectus wall , NOT THE POSTERIOR!

The Lumber Triangle is not included!! (from slide 39 - 43)

❖ The action of anterior abdominal wall:

1) The muscle fibers are making a **network** (some ascends upwards , some downwards & some are transverse) , so this network strengthens the abdominal muscles.

SO... CONTRACTED abdominal muscles have an important function in protecting the abdominal viscera (e.g. boxing).. BUT if it was relaxed (e.g. the boxer got tired), it won't protect anything, so any punch to the abdomen there will cause severe abdominal pain and may cause bleeding.

-The nervous system is very important because it gives impulses to the muscles..so there is a protection that keeps the viscera in position.

2) Rectus abdominis bends the trunk, increasing the intra-abdominal pressure which we need in vomiting, coughing, defecation and labour.

3) Deep expiration.

❖ Blood supply of the anterior Abdominal wall:

✓ Arteries:

- 1- Sup. Epigastric artery (in rectus sheath) .
- 2- Inf. Epigastric artery (in rectus sheath) .
- 3- Intercostal arteries (branches from descending thoracic aorta) .
- 4- Lumbar arteries (branches from abdominal aorta “from the back to anterior”) .
- 5- Deep circumflex artery (a branch of external iliac artery) .

✓ Veins:

- 1- *Above the umbilicus:* Goes from Lateral Thoracic vein to Axillary vein.
- 2- *Below the umbilicus:* From Inferior Epigastric to Femoral vein.
- 3- *Paraumbilical veins* (present around the umbilicus): Go to portal vein, (making the Porto- systemic anastomosis).

Note that,, “portal” means that they are going to the liver.

❖ Nerve supply of the anterior Abdominal wall:

- ✓ All muscles from; Lower 6 thoracic nerves & the 12th subcostal nerve & L1 ... EXCEPT the rectus which doesn't take from L1 and pyramidalis which takes from T12 only.

- ✓ L1 nerve;
- ✓ Iliohypogastric nerve (goes to the skin above the symphysis pubis) .
- ✓ Ilioinguinal nerve (will be present in the inguinal canal and goes to the scrotum).

P.S: Note if we want to make retraction for rectus abdominis it will be lateral.

❖ Lymphatic drainage of anterior abdominal wall:

- ✓ Above the umbilicus → Anterior to anterior axillary Lymph Node & posterior to posterior axillary L.N (sub-scapular) .
- ✓ Below the umbilicus → Anterior & Posterior go to Superficial Inguinal L.N

THE LAST TOPIC...

➤ Clinical notes:

- 1- Abdominal stab wounds
- 2- Surgical incision

1- *Abdominal stab wounds:* may be at;

- a) Lateral to rectus sheath .
- b) Anterior to rectus sheath .
- c) In the Linea alba (midline) .
- d) Or sometimes transversely below the subcostal cartilage.
- e) Above inguinal ligament .

2- *Surgical incision:* (important)

- a) midline incision in linea alba: (the bleeding there will be very minimal because it's a fibrous tissue).

- b) Over the rectus sheath so we can open the anterior wall of rectus sheath and make retraction of rectus abdominis muscle then open the posterior wall of rectus sheath.
- c) Pararectal (lateral to linea semilunaris) .

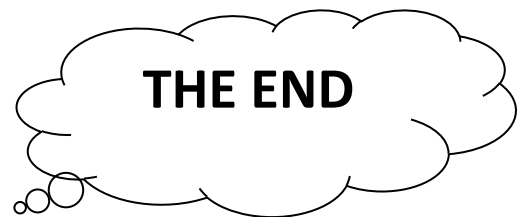
➤ **TYPES:**

- ✓ a , b , c (above) ... is a **longitudinal incision..**
- ✓ Also we have a McBurney's incision in the appendix (**obliquely** parallel to inguinal ligament) ...
 - The procedure is by:
 - 1- Opening the skin .
 - 2- Superficial fascia .
 - 3- Separating the fibers of the muscle .
 - 4- Reaching the parietal peritoneum,opening it to see the abdominal cavity.
- ✓ In the gallbladder we have kocher's incision (at subcostal on the right side).

#Note: The incisions are largely controlled by the position & direction of nerves.

#Note: In the muscles incision mainly we make retraction or separation....

- So the common types of incisions is:
 - 1- Paramedian incision
 - 2- Pararectus incision
 - 3- Midline incision
 - 4- Transverse incision
 - 5- Muscle splitting
 - 6- McBurney's incision



*Be kind.. for everyone you meet is fighting a battle, you
know nothing about...*

Best of success... :)

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