<At this lecture will be discussing>:

*The inguinal canal.*

*Contents of the inguinal canal.*

*What is the inguinal hernia and how it occurs.*

*To distinguish between the two types of the inguinal hernia.*

*How to link the inguinal canal and the scrotum in males illustrating the contents of the scrotum.

**The inguinal canal:**

- It’s an oblique passage in the lower abdominal wall, Lies parallel and immediately above the inguinal ligament.
- It’s about 4 cm long, extending from the deep inguinal ring downwards and medially to the superficial inguinal ring.
- Present in both sexes.
- Clinically, it’s important in what called inguinal hernia that is divided into: direct and indirect hernia.
- As a function in males, it allows the spermatic cord to pass from the abdomen to the testes in the scrotum, so if hernia occurs it may go down with the spermatic cord to the scrotum, on the other hand in females, it permits the passage of round ligament of uterus from the uterus to the labium majus.
  - Round ligament: stabilizes the uterus with the labium majus.
  - Labium majus : folding of skin on the vulva (external genitalia in females).
- Also as a content of the inguinal canal, there are two nerves:
  1. Genital branch of genitofemoral nerve: goes from the deep inguinal ring to the superficial inguinal ring
  2. ilioinguinal nerve: doesn’t start from the deep ring to the superficial ring, but penetrates the posterior wall of the inguinal canal and goes to the scrotum.
To summarize: Round ligament, the spermatic cord and the genital branch of the genitofemoral nerve all go from the deep inguinal ring to the superficial ring. Meanwhile, the ilioinguinal nerve penetrates the posterior wall of the inguinal canal and goes through the superficial opening to the scrotum.

**Structures lies directly below the inguinal canal** (from medial to lateral):
the femoral canal, external iliac (femoral) vein, external iliac (femoral) artery.

**Deep inguinal ring:**
- It's an oval opening on the transversalis fascia, 1.3 cm above the midpoint of the inguinal ligament. Normally closed by connective tissue and fat.
- In chronic cough or chronic constipation with an increase in the intra-abdominal pressure causing the ring to open allowing small intestine or greater omentum to enter the scrotum causing hernia.
- It has an important landmark in anatomy, that it lies lateral to the inferior epigastric artery (epigastric artery is a branch from the external iliac artery and one of the contents of the rectus sheath).

**Midpoint which is the midway between anterosuperior iliac spine and the symphysis pubis.**

**Superficial inguinal ring:**
- Triangular in shape
- Defect in the aponeurosis of the external oblique muscle
- Above and medial to the pubic tubercle
- In newborn the deep inguinal ring is almost directly posterior to the superficial inguinal ring (opposite to each other in children)
- Its margins are called crura (medial and lateral crus) give attachment to the external spermatic fascia
Boundaries of the inguinal canal:

1. **Anterior wall:**
   - Formed by the external oblique aponeurosis
   - Reinforced in the lateral third by the origin of the internal oblique muscle
   - The wall is strongest, at the lateral third, where it lies opposite to the weakest part of the posterior wall that is the deep inguinal ring.

2. **Posterior wall:**
   - Formed by transversalis fascia
   - Reinforced in the medial third by conjoint tendon, which is made by the tendon of internal oblique and transversus, so the conjoint tendon supports the posterior wall behind the superficial inguinal ring

**To summarize:** the internal oblique muscle reinforce the lateral third of the anterior wall opposite to the deep inguinal ring, and the conjoint tendon reinforce the medial third of the posterior wall opposite to the superficial inguinal ring.

3. **Inferior wall (floor):**
   - Formed by the inguinal ligament
   - Medially by the lacunar ligament which is a reflection from the inguinal ligament in the most medial part attached to the pectined wall (superior ramus of pupil)

4. **Roof:**
   - Formed by arch by the lowest fibers of internal oblique and transverses abdominis muscle
**Inguinal triangle:**

- Direct inguinal hernia occurs in the inguinal triangle.
- Indirect inguinal hernia occurs in the inguinal canal.

** boundaries:
1. inferior border : inguinal ligament.
2. lateral border : inferior epigastric vessels specially the artery (important in pulse sensation)
3. medial border : lateral edge of rectus sheath (linea semilunaris)

** direct inguinal hernia common in old age because of the weakness of the anterior abdominal wall muscles, specially smoking old people how have coughing in the morning.

**The spermatic cord:**

- it’s a collection of structures that pass through the inguinal canal to and from the testes, and covered with 3 concentric layers of fascia.
- begins at deep inguinal ring lateral to the inf. Epigastic artery and end at the testes.

**Consists of many structures like:**

1. Vas deferens
2. Testicular artery, vein and lymph
3. Ilioinguinal nerve
4. Artery to vas deferens
5. Genital branch of genitofemoral nerve
6. Sympathetic fibers
7. Processus vaginalis

**the 3 covering fascia:**

1. External spermatic fascia: originates from the external oblique aponeurosis and attached to the margins of the superficial inguinal ring

2. Cremasteric fascia: derived from internal oblique muscle

3. Internal spermatic fascia: derived from fascia transversalis and attached to the margins of deep inguinal ring

**Vas deferens:**

-cord like structure, 45 cm long.

-starts from the tail of epididymis and ends in seminal vesicle behind the urinary bladder, can be palpated between finger and thumb in the upper part of scrotum.

-function: transports the sperms from epididymis to the seminal vesicle

**Note:** the ejaculatory duct transports the sperms from seminal vesicle to prostatic urethra

****vasectomy:** ligation of the vas deferens in case the male doesn’t want to have kids, and the female refuses to do tubal ligation

**Testicular artery and vein:**

-The artery originates from the abdominal aorta at the level of L2 and goes to the testes.

-descends in the posterior abdominal wall, transverse the inguinal canal and supplies the testes and epididymis

-In females, it's called ovarian artery and vein coming from abdominal aorta to the ovary
-now the testicular vein exists as a plexus of veins called: pampiniform plexus units in the inguinal canal forming testicular vein at the deep inguinal ring.

- the left testicular vein comes from the left testes going up perpendicular and ends in the left renal vein.

- the right testicular vein goes up obliquely ending in the inferior vena cava

** for that, the varicocele (dawale al 5e9yatain) is more common in the left testes than the right one, because the left testicular vein is perpendicular causing a higher percent of stagnation of blood in the vein.

(Varicocele is one of the factors causing infertility)

**Autonomic nerves:**

- coming from the renal or aortic sympathetic plexus

- Sympathetic fibers run around testicular artery and goes to the scrotum, epididymis and blood vessels

**Processus vaginalis:**

- Embryologically, the testes develops at the posterior abdominal wall at the level of L1, and goes downward by gubernaculum and processus vaginalis (pouch of peritoneum) reaching the scrotum before the 8th month.

- after that processus vaginalis obliterates.

- what remains from processus vaginalis around the testes is called: tunica vaginalis.

- if the processus vaginalis doesn’t obliterante and the deep inguinal ring doesn’t close, the baby will born having congenital hernia

** Congenital inguinal hernia occurs on both sides (bilateral), on the other hand the inguinal hernia occurs on one side (unilateral)

** Congenital >> type of indirect hernia
At this picture be sure to note these things:

At the 7th week → gubernaculum and part of the peritoneum (processus vaginalis) in the abdomen.

At the 7th month → processus vaginalis reaches the scrotum.

At the 9th month → testes reaches the scrotum.

→ processus vaginalis obliterates making tunica vaginalis
Cremasteric artery:
Is a branch of inferior epigastric and goes to cremasteric muscle

Artery of vas deferens:
Goes to vas deferens

Genital branch of genitofemoral nerve:
- From L1 and L2 but mainly from L2
- Supplies the cremasteric muscle
- As we remember the genitofemoral nerve gives 2 branches: genital branch and femoral branch which goes to the upper anterior surface of the thigh...we can test the genital branch by scratching the upper thigh so the stimulus goes to the genitofemoral then to the genital branch which causes contraction of the cremasteric muscle and pulls the testes upwards and that is called: cremasteric reflex

The scrotum:
An outpouching of the lower part of the anterior abdominal wall, contain testes, epididymis, and the lower ends of spermatic cord.
- The skin is wrinkled because of the dartos muscle (which comes from the fatty layer)
- Blood supply: testicular artery
- Lymph drainage: Para-aortic

From outside to inside the layers are:
Skin >> subcutaneous (dartos fascia) >> dartos muscle >> membranous layer >> external spermatic fascia from the external oblique >> cremasteric fascia from the internal oblique >> cremasteric muscle >> internal spermatic fascia coming from transversalis fascia >> tunica vaginalis.
**Tunica Vaginalis** is derived into two layers:

1. Parietal layer
2. Visceral layer

**Hydrocele of the testis**: accumulation of fluid between the two layers of tunica vaginalis.

Treatment: by tapping by penetrating the scrotum layers by a syringe until we reach the space between the two layers (parietal and visceral) and extracting the fluid.

**Testicular lymphatic vessels**: ascend through the inguinal canal and go to the lumbar (Para-aortic) lymph nodes in the posterior abdominal wall at the level of L1.

- The drainage of the scrotum goes to the superficial inguinal lymph nodes.

**Skin of the scrotum**: 

- Skin of the scrotum is thin, wrinkled, and pigmented and forms a single pouch.
- A ridge in the midline indicates the line of fusion of the two lateral labioscrotal swellings.

**Superficial fascia**: 

Superficial fascia is continuous with the fatty and membranous layer of the anterior abdominal wall.

- The fat is replaced by the smooth muscle called dartos muscle.
- Its responsible for wrinkles of the skin.
- Membranous layer referred to as colle’s fascia.
- Innervated by sympathetic nerve fibers.
Both layer of sup. Fascia contribute to a median partition that crosses the scrotum and separate the testes from each other.

**Spermatic fasciae:**
- Lies beneath the superficial fascia
- Derived from three layer of anterior abdominal wall on each side
- The external spermatic fascia is derived from internal oblique
- The internal spermatic fascia is derived from the fascia transversalis
- The cremasteric fascia is derived from internal oblique

**Inguinal hernia:**
- To occur there must be a weak point in the anterior or posterior abdominal wall, but usually in the anterior one
- Weak points like: deep inguinal ring or femoral ring
- Usually they are closed, but sometimes they might open if there is chronic cough or chronic constipation
- When they open, the omentum or small intestine get out the abdomen causing an opening that is called: hernia
- When hernia occurs, the peritoneum is the first layer of the small intestine to get out.
- Hernia is the protrusion of part of the abdominal wall contents beyond the normal confines of the abdominal wall.
- Hernia consists of 3 parts:
  1. The sac (peritoneum of the small intestine)
  2. Contents of the sac: small intestine or greater omentum
3. covering of the sac: are formed from the layers of the abdominal wall through which the hernia sac passes.

(1) **Indirect inguinal hernia:**
- occurs in the inguinal canal
- most common form of hernia
- the hernia sac is the remaining from processus vaginalis
- enters the inguinal cord through the deep inguinal ring lateral to the inferior epigastric vessels
- it may extend part of the way along the canal or as far as the superficial inguinal ring
- sometimes it may reach the scrotum if the processus vaginalis has undergone no obliteration, then the hernia is complete as it extends through the superficial inguinal ring down into the scrotum or labium majus.
- 2 times more common in young males than females
- more common in the right side (the right testis descends later than the left testis)

(2) **Direct inguinal hernia:**
- more common in old age people because of the weakness in the anterior abdominal wall
- direction: forward only, don’t reach the inguinal canal or the scrotum
- wide opining
- usually bilateral because the weakness happens all over the abdominal wall.

Femoral hernia is more common in females than males as we studied in the mss.
** to distinguish between direct and indirect hernia :**

We push on the deep inguinal ring using our thumb, asking the patient to cough, if the hernia appears it’s a direct hernia, if it doesn’t appear it is indirect hernia.

>> the DOCTOR said we must read the clinical points from the book ;)

Good luck guys ...

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