



Anatomy

Faculty of Medicine - JU2017

Number >>

4

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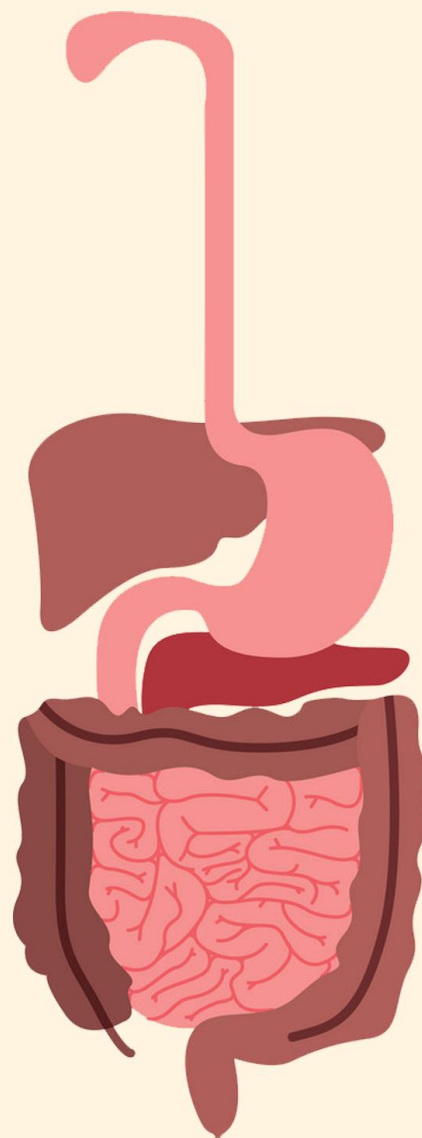
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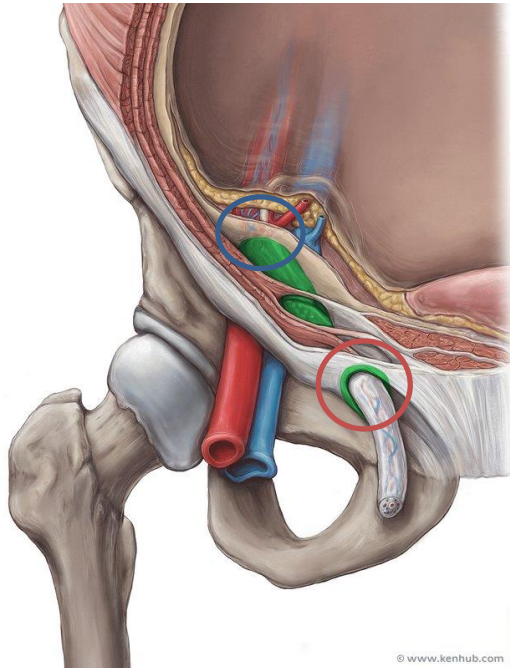
2nd system - GI



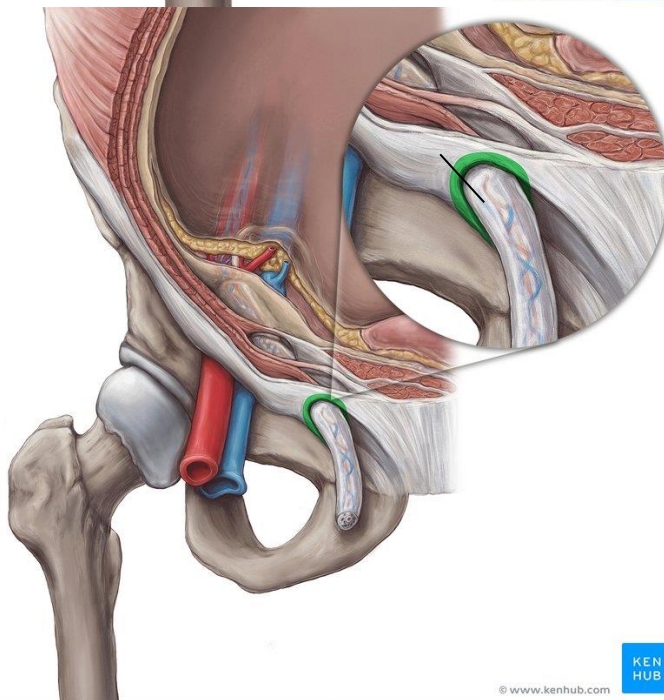
Inguinal Canal:

It is a 4 cm tube that lies above and medial to the inguinal ligament.

- It is an oblique passage in the anterior abdominal wall
- Present in both sexes; in males it allows passage of the spermatic cord towards the testes inside the scrotum, and in females it lets the round ligament to go from the uterus to the labia majora
- It also lets the ilioinguinal nerve and genital branch of genitofemoral nerve through in both sexes, both supplies the genitalia.

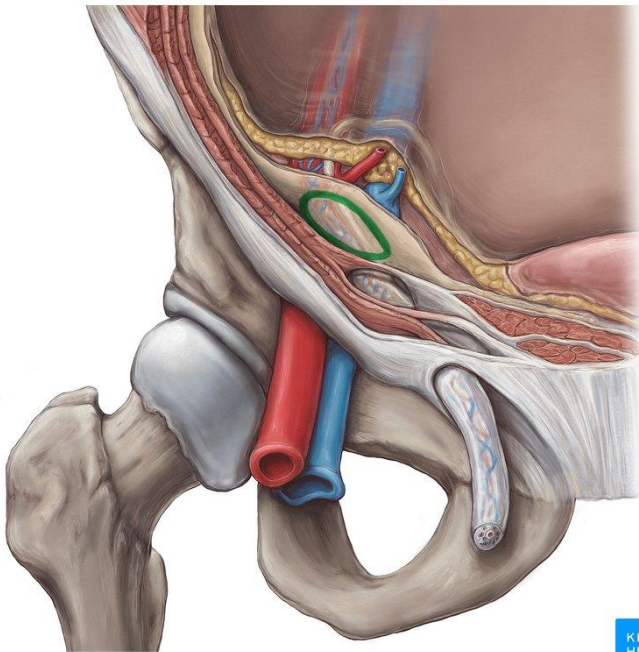


You can think of the inguinal canal as a tube that connects two rings, the **deep inguinal ring** and the **superficial inguinal ring**. The deep inguinal ring lies superolateral to the superficial one, and the canal runs almost parallel to the inguinal ligament **in adults**. In children, the deep and superficial rings lie on top of each other, making the canal very short. As the child grows, the canal lengthens and the rings grow away from each other.



Superficial Inguinal Ring:

- Triangular defect in the aponeurosis of the external oblique muscle
- Attaches to the external/superficial spermatic fascia (external oblique apon. → external spermatic fascia)
- Its margins form two crura; lateral and medial crus (split by the line), and an inter crus above.



Deep Inguinal Ring:

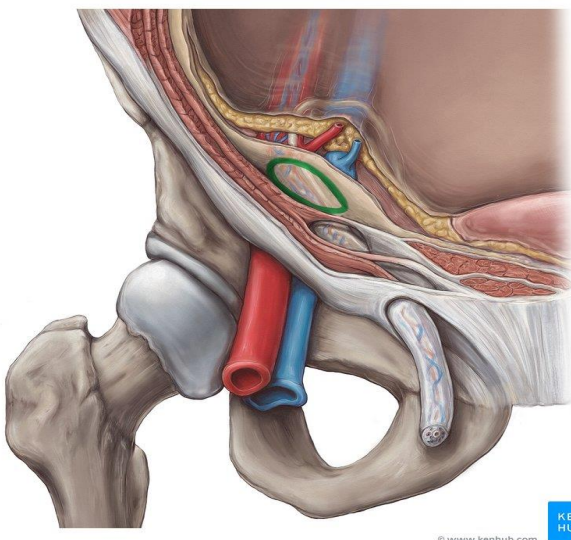
- It is an oval shaped ring in the transversalis fascia (deepest layer of ant. abdominal wall)
- It's covered by the peritoneum, and it's closed. If it didn't close, it leads to congenital indirect inguinal hernia.
- It lies half an inch (1.3cm) above the inguinal ligament, and midway between the ASIS and the symphysis pubis. It's also located 1.5-2cm above the pulsation of femoral artery.

- The edges of the ring continue with the spermatic cord in males to give the deep/internal spermatic fascia (transversalis fascia → internal spermatic fascia)

With these two rings forming the beginning and end of the inguinal canal, the tube itself is formed by the internal oblique, and continue on as the cremasteric muscle and fascia, which continues to cover the spermatic cord and testes in males.

So, inguinal canal is made of three layers, and forms the covering of the spermatic cord in males, and goes as follows:

1. Transversalis fascia → Deep inguinal ring → Internal spermatic fascia
2. Internal oblique → Inguinal canal → Cremasteric muscle and fascia
3. External oblique → Superficial ring → External spermatic fascia

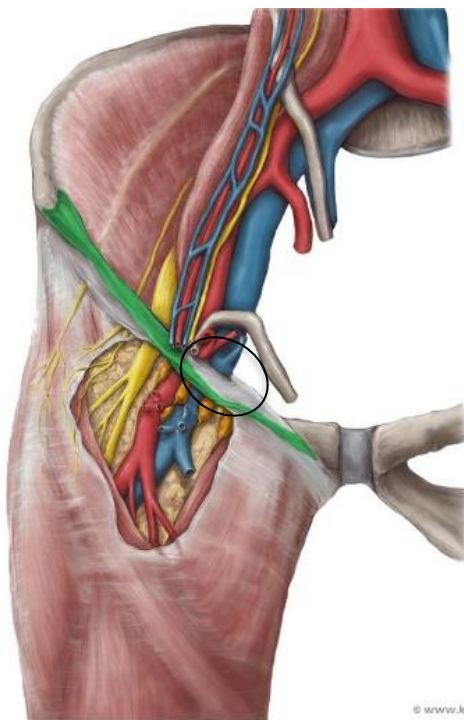
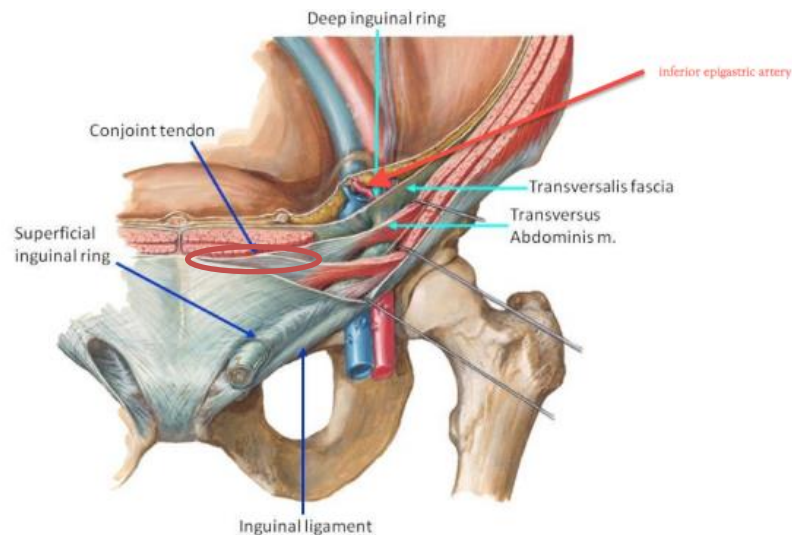


Anterior Wall of inguinal canal:

- It is mainly formed of the aponeurosis of the external oblique
- It is reinforced in the lateral third by the origin of internal oblique muscle from the inguinal ligament. The fleshy fibers of the origin of the internal oblique support the deep ring
- It is strongest opposite (superficial) to the deep inguinal ring

Posterior Wall:

- The entirety of the posterior wall is formed by the transversalis fascia, but it is supported by other structures
- In the medial third, the transversalis fascia (of transversus abdominis) joins with the aponeurosis of the internal oblique to form the **conjoint tendon**, where they continue on to insert at the pectineal line and pubic crest (Superior ramus). It also supports the superficial inguinal ring
- This wall is strongest opposite (deep) to the superficial inguinal ring.

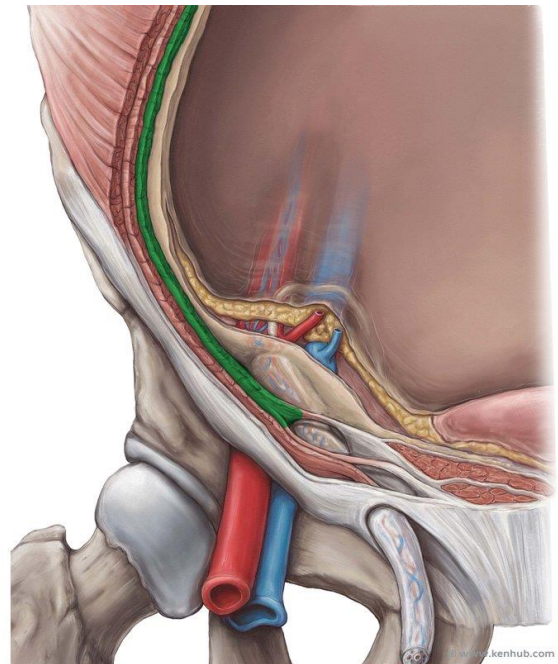
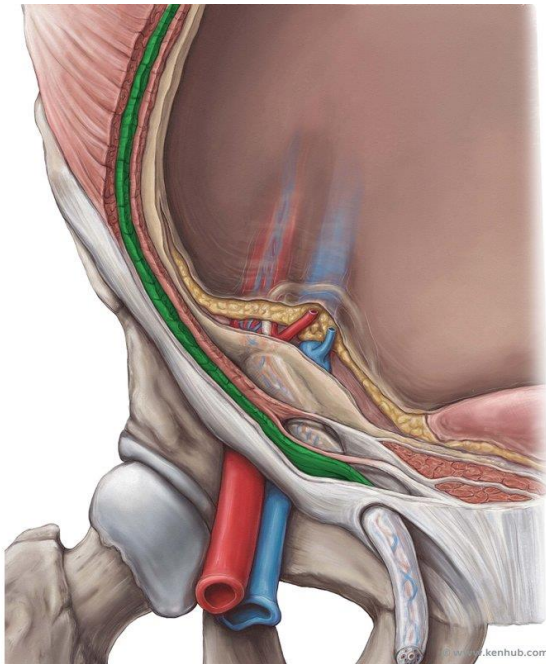


Inferior Wall (Floor):

- Formed by the inguinal ligament, which is a rolled-under continuation of the external oblique aponeurosis that extends from the ASIS to the pubic tubercle.
- Also formed by the lacunar ligament at the medial end of the canal (lacunar ligament is circled)

Superior Wall (Roof):

- Formed by the lowest arching fibers of the internal oblique (left) and transversus abdominus (right)

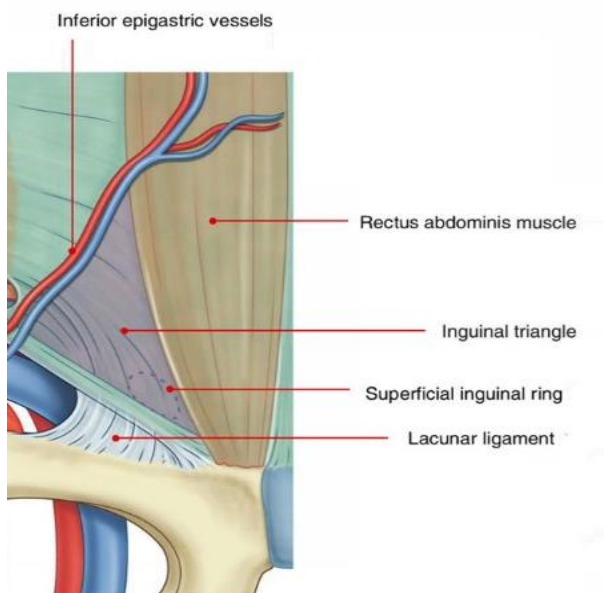


Functions of Inguinal Canal:

- Allows the spermatic cord to pass from abdomen to testes in males
- Allows the round ligament of the uterus to pass to the labia majora in females

Contents of Inguinal Canal:

- Spermatic cord and its content (males)/round ligament (females)
- Genital branch of genitofemoral nerve (sensory for external genitalia)
- Ilioinguinal nerve (**DOES NOT** go through the deep inguinal ring. Passes between the internal oblique and transversus abdominus, just like the intercostal nerves and vessels supplying the abdomen)



Inguinal (Hesselbach's) Triangle:

Boundaries:

Inferior border (Floor): Inguinal ligament

Medial border: Lateral margin of rectus sheath (linea semilunaris)

Lateral border: Inferior epigastric vessels

- Important because it is where direct inguinal hernias occur.
- Associated with old age.
- Lateral border (Inferior epigastric vessels) is medial to deep inguinal ring

Clinical Importance – Hernias:

Remember, a hernia is a protrusion of the abdominal viscera through a **weak point** in the anterior abdominal wall (deep ring). A hernia consists of a sac which has a neck, a body, and a fundus, as well as the hernia contents. An **increase in the intra-abdominal pressure** can push the viscera through the weak point. There are two types of inguinal hernias, direct (inguinal triangle) which is more common in old age, and indirect (inguinal canal). We distinguish between them using the inferior epigastric vessels (lateral border of inguinal triangle), indirect is lateral while the direct is medial. Indirect inguinal hernias can pass through the entirety of the inguinal canal and reach the scrotum. Hernias can also be congenital, if the baby is born and the deep ring didn't close, it can lead to a hernia. So, we see hernias in three cases; congenital, old age, increase in intra-abdominal pressure (chronic cough, constipation, etc.).

Spermatic Cord:

- Collection of structures that pass through the inguinal canal to and from the testis
- It is formed of three layers of the anterior abdominal wall
- Its contents can be remembered using FANO x 3:
 - **F**ascia – internal spermatic, cremasteric muscle and fascia, external spermatic (as well as tunica vaginalis which is the serous membrane covering the testes)
 - **A**rteries – testicular artery, cremasteric artery, artery of vas deferens
 - **N**erves – ilioinguinal, genital branch of genitofemoral, autonomic nerve fibers

- Others – vas deferens, pampiniform plexus of veins, testicular lymphatics
- The processus vaginalis is an outpouching of the peritoneum and is responsible for the descending of the testis (males) and ovaries (females) from the posterior abdominal wall, at level of L1, to the scrotum (males) or to the ovarian fossa in pelvis (females), through the inguinal canal during the 8th month of gestation. It undergoes obliteration and fibrosis, closes the deep inguinal ring, and it forms the **tunica vaginalis**, which consists of two layers; the visceral which covers the epididymis and testes, and the parietal which continues superiorly with the vas deferens.

NOTE: If the ring doesn't close, it leads to congenital indirect inguinal hernia.

- Failure of the testes to descend through the inguinal canal can happen and requires immediate surgery.
- The function of the testis is the formation of sperm. Sperm is then transferred to the epididymis found on top of testis; it consists of head, body, and tail. The function of the epididymis is maturation of sperm.
- Vas deferens; a 45 cm long muscular tube that moves mature sperm from the tail of epididymis, it ends in the seminal vesicle, then sperm continues inside the right and left ejaculatory ducts towards the prostatic urethra
- Testicular artery (right and left); branch of abdominal aorta at L2, descends on the posterior of the anterior abdominal wall and goes through inguinal canal to supply the epididymis and testes
- Testicular vein/pampiniform plexus; forms a net or spider web around the testes and continues as a plexus through the inguinal canal (it becomes the singular testicular vein at the level of deep ring), on the right side it goes to the inferior vena cava (obliquely), and on the left side it goes straight up (perpendicular) and ends in the left renal vein
 - Because the left testis is lower, it goes straight upward, and has a higher pressure, which can cause varices on the left side
 - Varicocele of the testis leads to infertility due to increase in temperature of the testis. Sperm production occurs at 2-3 degrees below body temperature, that's why they are located in the scrotum outside the body. Removal of varicocele returns the testis to their optimum temperature and the patient is fertile again.
- Autonomic nerves are sympathetic fibers that go with the testicular artery as well as an afferent sensory nerve from the testes

- The genital branch of genitofemoral nerve is a branch of L1 and L2, and it supplies the cremasteric muscle (the cremasteric muscle pulls the testes upwards towards the body in cold weather to maintain the temperature needed for sperm production). Itching of the upper medial side of the thighs leads to contraction of the cremasteric muscle, which is called **cremasteric reflex**, **HOW?** This reflex happens from the femoral branch of the genitofemoral nerve then it goes to the spinal cord and it returns in the genital branch leading to contraction of the cremasteric muscle.
- The testicular lymphatics drains the testis and epididymis and goes through the inguinal canal to pour into the **para-aortic** lymph nodes at level of L1. While the lymphatic drainage of the scrotum goes to the **inguinal** lymph nodes in the femoral triangle

Key Facts	
Walls	Roof – formed by Muscles : internal oblique, transversus abdominis (M) Anterior – formed by Aponeuroses : internal oblique, external oblique (A) Floor – formed by Ligaments : inguinal ligament, lacunar ligament (L) Posterior – formed by Tendon and transversalis fascia (T) <i>Mnemonic: MALT</i>
Openings	Deep Inguinal ring – at the midpoint of the inguinal ligament Superficial Inguinal ring – 'V' shaped defect in the external oblique aponeurosis within the Hasselbach's triangle
Content	Male : spermatic cord and ilioinguinal nerve Female : round ligament of the uterus and ilioinguinal nerve (*ilioinguinal nerve enters the scrotum through superficial ring, but does not travel through the inguinal canal)
Spermatic cord content	3 arteries : testicular, cremasteric, ductus deferens artery 3 fascial layers : external spermatic, cremasteric, internal spermatic 3 nerves : genital branch of genitofemoral nerve, sympathetic fibers, ilioinguinal nerve
Clinical Importance	Herniations 