

Anatomy, Abdomen and Pelvis, Inguinal Region (Inguinal Canal)

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Introduction

The inguinal canal, located just above the inguinal ligament, is a small passage that extends medially and inferiorly through the lower part of the abdominal wall. This canal is about four to six centimeters in length and runs in a parallel fashion. The canal functions as a passageway for structures that extend from the abdominal cavity to the scrotum. In males, it transmits the spermatic cord, while in females, it transmits the round ligament of the uterus.[1][2]

Structure and Function

The anatomy of the inguinal canal is important to know because it has clinical relevance. When defects occur in the abdominal wall in this location, hernias can develop. These often need to be surgically repaired to avoid long-term complications and to improve patient outcomes. It is important for surgeons to note that the mid-inguinal point marks the area between the anterior superior iliac spine and the pubic symphysis. Deep in this location, the femoral artery in the pelvic cavity enters the lower limb. The femoral artery can only be palpated below the inguinal ligament.[3][4]

Embryology

During embryogenesis, the testes are located in the posterior abdominal wall and gradually migrate into the scrotal area. The ascent and descent of the testes require the cord-like structure called the gubernaculum. It attaches the inferior segment of the testes to the developing scrotum. The gubernacula guide the testes through the inguinal canal. During the early embryological state, the inguinal canal is surrounded by an outpouching of the peritoneum and the walls of the abdomen. This outpouching of the peritoneum is called processus vaginalis. Following the descent of the testes into the scrotum, the processus vaginalis degenerates. If it fails to disappear, the remnant can remain patent resulting in an indirect inguinal hernia. In females, there is also a gubernaculum, but it attaches the ovary to the uterus and the future labia majora. During embryogenesis, the ovaries move into the pelvic cavity. Once the ovary adheres in the pelvic cavity, the gubernaculum becomes the round ligament of the uterus.[5][6]

Muscles

The walls of the inguinal canal include the following:

- An anterior wall that is composed of the aponeurosis of the external oblique muscle and reinforced laterally by the internal oblique muscle. The superficial inguinal ring also contributes to the medial third.
- A posterior wall, also called the floor, is formed by the transversalis fascia, conjoint tendon, and deep inguinal ring.

- A superior wall, also called the roof, is formed by the medial crus of the aponeurosis of the external oblique, the musculoaponeurotic arches of the internal oblique and transverse abdominal muscles, and the transversalis fascia.
- An inferior wall, which is formed by the inguinal ligament, is reinforced medially by the lacunar ligament and laterally by the iliopubic tract.

When an individual develops increased intraabdominal pressure, the contents of the abdominal cavity push down on the inguinal ligament. To prevent herniation of the abdominal contents inside the inguinal canal, the posterior wall of the canal contracts while the muscles of the anterior wall tighten to narrow the canal.

There are two openings to the inguinal canal:

- The deep or internal ring is located just above the midpoint of the inguinal ligament and lateral to the epigastric vessels. The deep ring is formed by the transversalis fascia which provides the posterior covering of the contents of the inguinal ring.
- The superficial or external ring is the terminal end of the inguinal canal. It is located just superior to the pubic tubercle. The superficial ring has a triangular shape that is made by fibers of the external oblique muscle. These fibers continue to cover the inguinal contents as they descend into the scrotal area. Contiguous with the superficial ring are tendinous fibers (i.e., interligamentous fibers) which function to prevent the ring from enlarging.

Surgical Considerations

Contents of the Inguinal Canal

In males, the contents of the inguinal canal include the ilioinguinal and the genitofemoral nerves as well as the spermatic cord. [1]

In females, the contents include the ilioinguinal and genitofemoral nerves as well as the round ligament.

The ilioinguinal nerve is a branch of L1 and provides sensation to the anterior perineum and medial and upper thigh. In males, it also provides sensation to the anterior scrotal area. In women, the nerve provides sensation to the labia majora and mons pubis.

The genitofemoral nerve is derived from the L1-L2 spinal nerve roots and provides a motor function to the cremasteric muscle and sensory innervation to the labia in females and scrotum in males.

Clinical Significance

During inguinal hernia surgery, great care is required to prevent damage to the two nerves as it can lead to significant morbidity. In hernia repairs that utilize a mesh the ilioinguinal nerve can be compressed while suturing around the internal oblique muscle. Postoperatively the patient will complain of significant pain or tingling in the innervated areas.

The spermatic cord is easily recognized as it runs in the inguinal canal. It runs together with several small vessels and nerves that connect with the testis. The structures that are of importance in the spermatic cord include the testicular artery, artery to the ductus deferens and the cremaster artery. In addition, there are lymphatics and the pampiniform plexus and the genital branch running with the cord. Any combination of these structures can be injured if the spermatic cord is handled inappropriately during surgical dissection.

Indirect hernia

An indirect hernia can occur when the peritoneal sac enters the inguinal canal via the deep inguinal ring. There is typically associated failure of the processus vaginalis and atrophy after birth.

Direct hernia

In a direct hernia the peritoneal sac enters the inguinal canal directly via a defect in the posterior wall of the inguinal canal.

Both inguinal hernias often present in the labia majora or inguinal area as swellings which are more prominent when the individual is upright. Once an inguinal hernia has been diagnosed a surgical consultation is necessary as they are prone to incarceration or strangulation.

Hydroceles

A hydrocele occurs because of the persistent patency of the processus vaginalis, and it may coexist with an indirect hernia. The condition presents with fluid accumulation in the scrotum. The fluid accumulation can be significant, and most hydroceles need surgical intervention.

Other Issues

The inguinal area also is associated with lymphadenopathy from infections and malignancies. Malignancies in the inguinal area are rare, but a lymphoma can present with bilateral lymphadenopathy of the groin. Sometimes one may discover lipoma of the spermatic cord. The most malignant tumors of the spermatic cord are rhabdomyosarcomas which are seen in children.

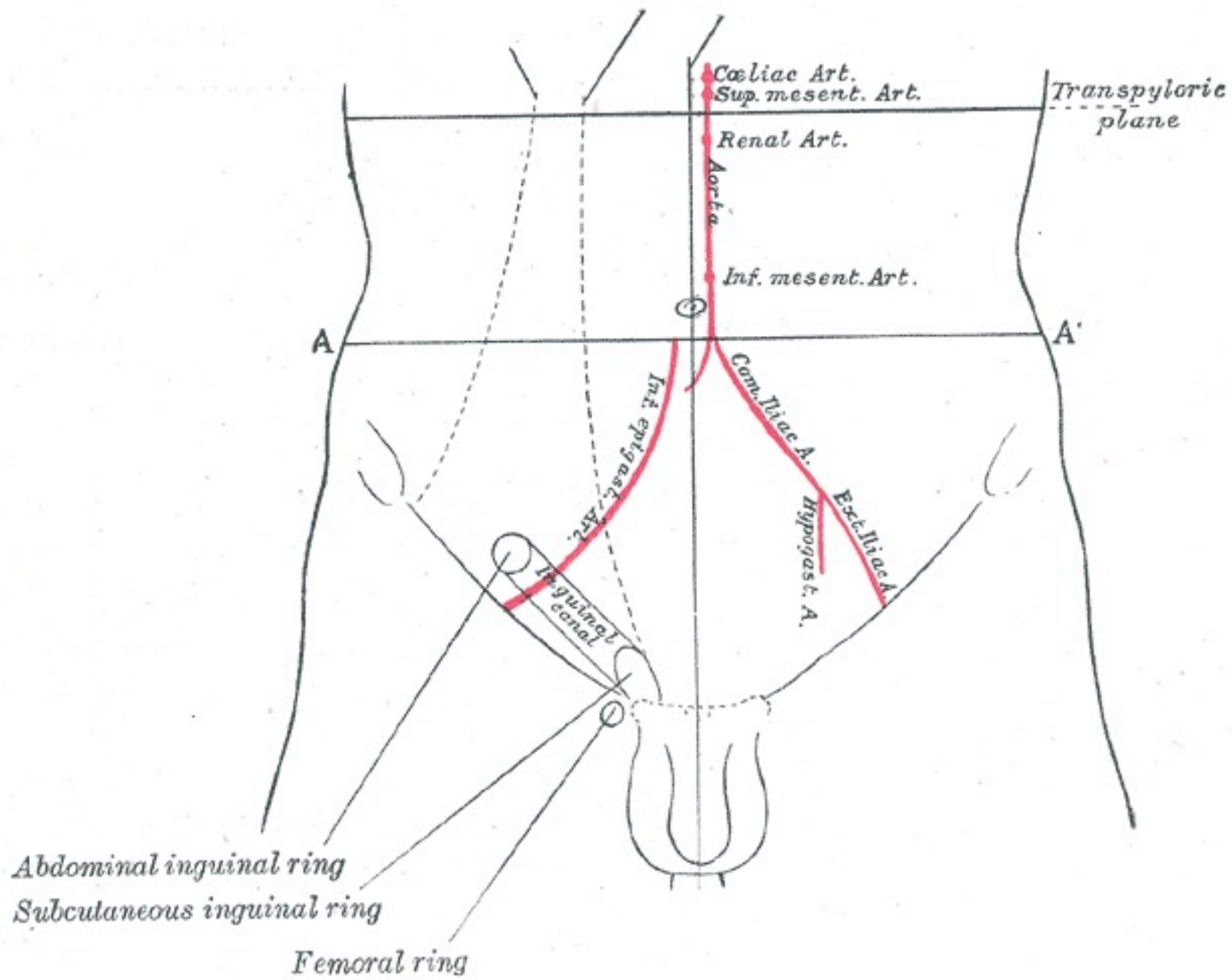
Questions

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Figures



Front of abdomen, showing surface markings for arteries and inguinal canal. Contributed by Gray's Anatomy Plates

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