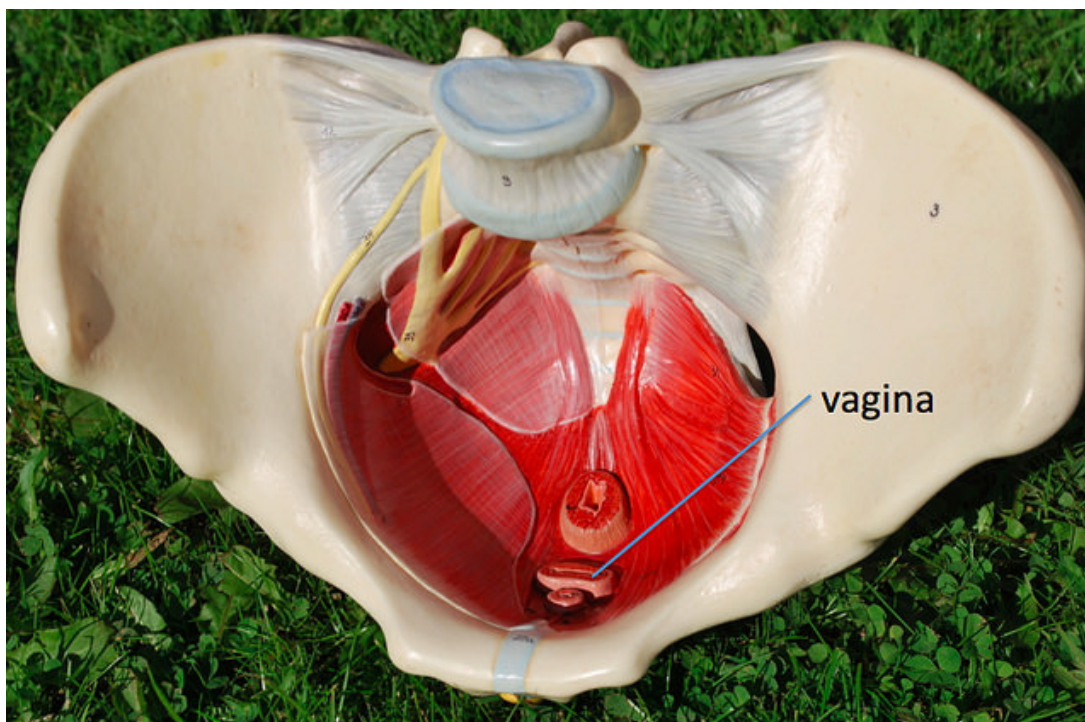


Anatomy of the Abdominal Wall and Pelvic Floor

[See online here](#)

Do not fear the pelvic floor—although this topic is popular amongst examiners and seems to be complicated at first glance, there is no need for fear. Here, you get a compact overview and learn everything you need to know about the pelvic floor, the abdominal wall, and the inguinal canal.



Structure of the Bony Pelvis

The pelvis consists of the **sacral bone**, **coccygeal bone**, and paired **hip bone**. The bones are connected with each other via strong ligaments. On the anterior side, the hip bones fuse to form the **pubic symphysis**. Dorsally, they are connected to the sacral bone via the taut **sacroiliac joint**.

The symphysis is sealed by the fibrocartilage **interpubic disc**. Ligament structures reinforce the connection. The sacroiliac joint is an amphiarthrosis with little mobility. It is secured by strong ligaments. During pregnancy, the ligaments between the symphysis and the sacroiliac joint loosen, which allows for the enlargement of the birth canal.

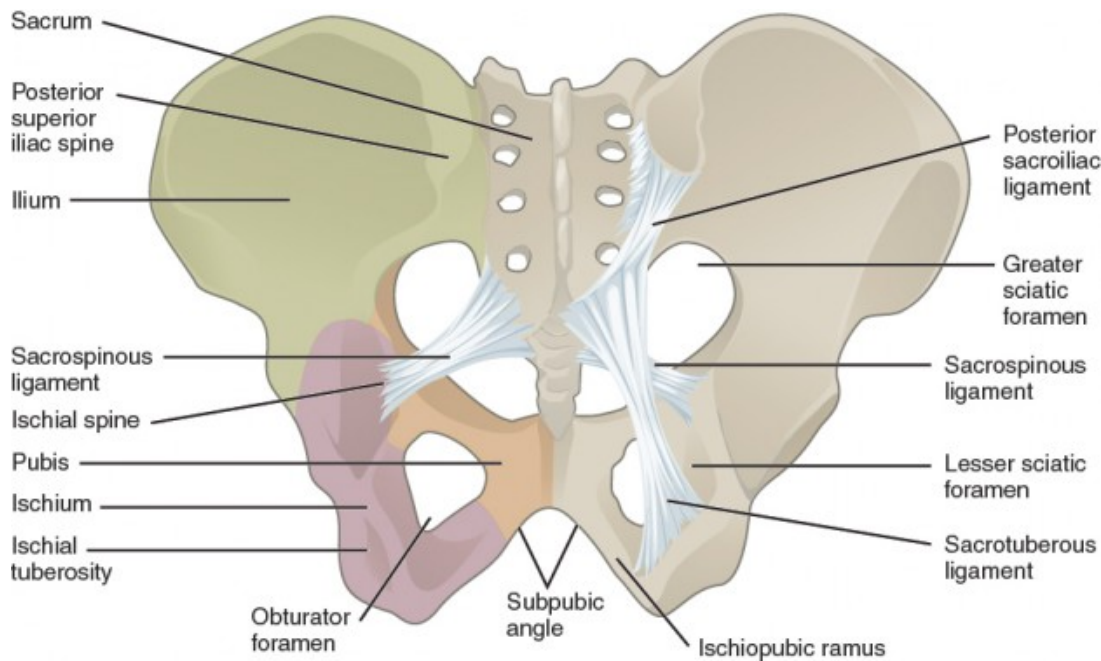


Image: Ligaments of the Pelvis. By Phil Schatz, License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

Parts of the Pelvis

The pelvic skeleton, with the hip bone and the sacral bone, forms a bony funnel. It is divided into an upper **greater pelvis** (pelvis major)—formed by the wings of the ilium, which enclose the bowels—and a **lesser pelvis** (pelvis minor) located below it.

The border between the greater and lesser pelvis is the **terminal line**, which runs from the superior margin of the symphysis over the **pecten ossis pubis** and the **arcuate line** to the **promontory**.

The parts of the skeleton below the terminal line form the lesser pelvis, which contains the pelvic bowels. The lesser pelvis forms the pelvic canal, which, in women, also is the birth canal. It begins at the **superior pelvic aperture**, which is limited by the terminal line and ends with the **inferior pelvic aperture**, which is formed by the tip of the coccygeal bone, the ischial tuberosities, and the inferior pubic branches.

Pelvic Floor

The pelvic canal is caudally sealed by muscles and connective tissue plates. They form the pelvic floor. Its purpose is to safeguard the position of the abdominal and pelvic organs. Its muscles also contribute to the closure of **the anus** and **urethra**.

Parts of the Pelvic Floor

The pelvic floor is divided into **3 muscle tiers**: the muscular **pelvic diaphragm** (superior tier) and the muscular/connective tissue **urogenital diaphragm** (middle tier). Below the urogenital diaphragm (and therefore located furthest on the 'outside') are the sphincter and cavernous body muscles (inferior tier).

The muscles of the pelvic floor are innervated by branches of the **pudendal nerve** and the **sacral plexus**.

Structure and Function of the Pelvic Diaphragm

The **pelvic diaphragm** is the uppermost (innermost) layer of the pelvic floor. **It consists of the levator ani muscle with its three parts:**

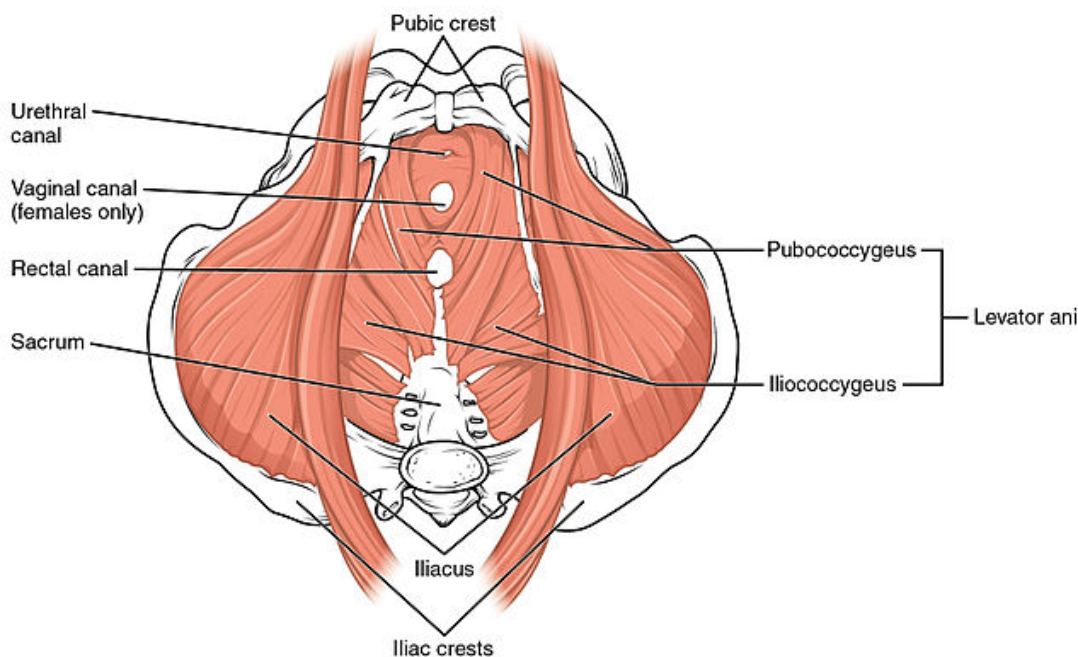
- Puborectalis muscle
- Pubococcygeus muscle
- Iliococcygeus muscle

The fibers of the levator ani muscle, which originates from the backside of the pubic bone (levator leg), form a V-shaped orifice that is open in a ventral direction and called **levator hiatus**. Ventrally, the **urethra** runs through the hiatus levatorius; dorsally, it runs through the **rectum**. In women, the **vagina**, which lies between the rectum and urethra, also runs through it.

The muscle fibers insert around the anus in a funnel shape. They give fibers to the **external anal sphincter** and radiate into the **central tendinous point of the perineum** in front of the rectum. Dorsally, the levator ani muscle is complemented by the inconsistent **ischiococcygeus muscle**, which runs along the **sacrospondinal ligament**.

In a tense state, the levator ani muscle forms a transversal plate, which ensures anal continence by deviating the rectum. During defecation and in corpses, the muscles slacken and form a funnel shape.

The muscles of the pelvic diaphragm are innervated by the **sacral plexus (S2–4)** and arterially supplied by the **internal pudendal artery**.



Pelvic diaphragm (superior view)

[Image](#): Muscles of the pelvic floor. By OpenStax College, License: [CC BY 3.0](#)

Structure of the Urogenital Diaphragm

Caudal from the pelvic diaphragm, there is a plate made out of connective tissue (**central tendinous point of the perineum**) and muscles (**deep transverse perineal muscle**), which seals the ventral part of the levator hiatus. This plate also is referred to as the urogenital diaphragm.

The deep transverse perineal muscle seals the levator hiatus with its horizontally running muscle fibers. It gives off fibers that form the **external urethral sphincter muscle**. The urethra and (in women) the vagina run through it.

At the dorsal margin of the deep transverse perineal muscle, there is the narrow **superficial transverse perineal muscle**.

The central tendinous point of the perineum (**centrum tendineum**) is situated between the rectum and the urogenital diaphragm. It is a small area made of rough connective tissue; smooth muscle fibers, tendons, and fasciae of the pelvic floor radiate into it. It separates the **urogenital hiatus** from the **anal hiatus**.

Passages through the Pelvic Floor

The anterior part of the levator hiatus is referred to as the **urogenital hiatus**, which is covered by the deep transverse perineal muscle. The urethra and the vagina pass through it.

The **anal hiatus** (anal canal) is formed by the posterior edge of the deep transverse perineal muscle (urogenital diaphragm) and the medial parts of the levator thighs.

Fasciae of the Pelvic Floor

The muscles of the pelvic diaphragm are covered by a fascia on the upside and a fascia on the underside; these are the **superior and inferior fasciae of the pelvic diaphragm**.

Correspondingly, the urogenital diaphragm is covered by a **superior fascia and inferior fascia of the urogenital diaphragm**.

The fasciae form the borders for the cavities in the pelvic space and the perineal region.

Outermost Layer of the Pelvic Floor

The sphincter and cavernous body muscles form the most caudally situated layer of the pelvic floor. They include the **external anal sphincter muscle** and the **bulbospongiosus muscle**. Their fibers also radiate into the central tendinous point of the perineum.

Laterally, there is the **ischiocavernosus muscle**, which reinforces the cavernous bodies of the penis and clitoris and the urogenital diaphragm.

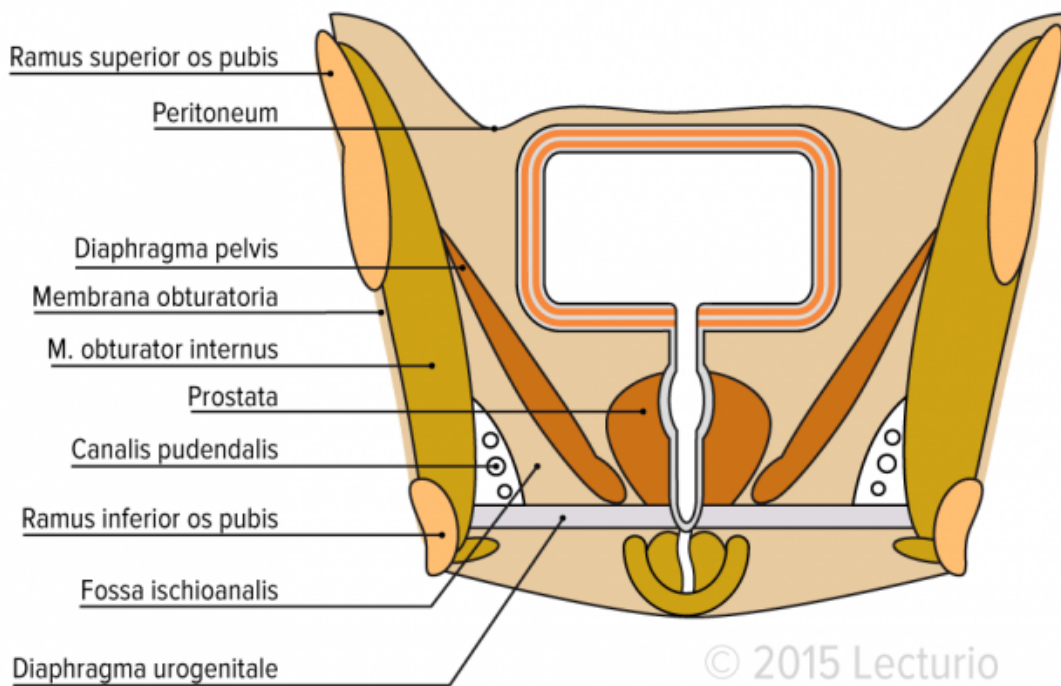


Image: Image depicting the various structures of the outer pelvis. By Lecturio

Divisions of the Pelvic Space

The abdominal space located in the lesser pelvis, the **pelvic cavity**, is divided into several spaces by the peritoneum and the pelvic floor. Cranially, there is the peritoneal cavity of the lesser pelvis. Caudal of the peritoneum, there is the subperitoneal (supralelevator) space, which is limited caudally by the upper fascia of the levator ani muscle (pelvic diaphragm). The infralevator space, also called the **ischioanal fossa**, is below the levator ani muscle.

Caudally, there are the perineal spaces: the **deep perineal space**, which is almost completely covered by the deep transverse perineal muscle and its fasciae, and the **superficial perineal space**, which is followed caudally by the subcutaneous perineal space.



Image: Pelvis. By Phil Schatz, License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

Vessels and Nerves of the Pelvic Floor

The arterial supply of the pelvic wall and the pelvic floor is provided by branches of the **internal iliac artery**. It gives off the **iliolumbar artery** and the **lateral sacral arteries** toward the pelvic wall, as well as the **internal pudendal artery**, which supplies pelvic and reproductive organs and the muscles of the pelvic floor.

The internal pudendal artery leaves the pelvis alongside the **pudendal nerve** through the **foramen infrapiriforme**, runs around the **sacrospinal ligament**, and then goes back into the lesser pelvis into the ischioanal fossa through the **minor ischiadic foramen**. There, it courses alongside the pudendal nerve through the **pudendal canal (Alcock's canal)**, a duplicature of the fascia of the **internal obturator muscle**, in the ventral direction. On its way, it gives off branches to the anal canal, to the perineal region, and to the outer genitals and the urethra.

Innervation of the muscular pelvic floor is provided by direct branches of the **sacral plexus (S2 - 4)** or by the **pudendal nerve** from the same plexus. The pudendal nerve also provides sensory innervation of the outer genital organs, the skin of the perineum, and the perianal skin.

Venous drainage

Foregut

Esophagus:

- Esophageal > left gastric > hepatic portal

Stomach:

- Left and right gastric > hepatic portal
- Left gastro-omental > splenic > hepatic portal
- Right gastro-omenta > superior mesenteric > hepatic portal

Gallbladder:

- Cystic > hepatic portal

Midgut and hindgut

Ileum and jejunum:

- Ileal and jejunal > superior mesenteric > hepatic portal

Cecum and appendix:

- Ileocolonic (appendicular) > superior mesenteric > hepatic portal

Ascending and transverse colon:

- Right colic/middle colic > superior mesenteric > hepatic portal

Descending colon

- Middle colic/ left colic > inferior mesenteric > splenic > hepatic portal

Sigmoid colon and rectum

- Sigmoidal/superior rectal > inferior mesenteric > splenic > hepatic portal

Formation variation

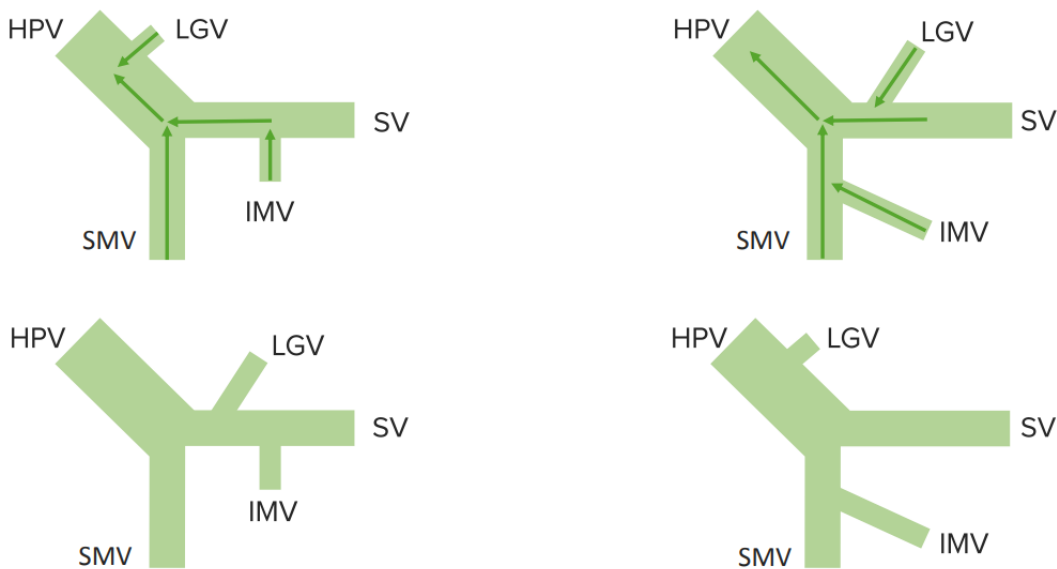


Image: Anatomic variations of portal system venous drainage. By Lecturio

Pelvic Floor Insufficiency: Development and Consequences

The pelvic floor has several responsibilities. On one hand, it is supposed to seal the pelvic space and, thus, secure the abdominal and pelvic organs. On the other hand, it controls the sphincter function of the rectum and urinary and genital tracts. Providing passages to those structures lowers the mechanical capacity of the pelvic floor. Weakening of connective tissue and/or muscles can lead to the insufficiency of the pelvic floor.

Pelvic organs (e.g., the uterus) might be displaced downward (prolapse of the uterus, or **descensus uteri**). This can be the result of, for instance, numerous childbirths. In extreme cases, displacement of the uterus can go so far as to leave it entirely outside the

vagina (**third-degree prolapse**). Secondary to uterine prolapse, descent of the urinary bladder can occur.

Descent of the pelvic floor often is accompanied by incontinence. In mild cases, training of the pelvic floor muscles with pelvic re-education is sufficient treatment; in severe cases, surgical intervention should be considered.

Abdominal Wall and Inguinal Region

The **abdominal cavity** and **pelvic cavity** are surrounded by muscles of the abdominal wall. The pelvis and the pelvic floor muscles seal the abdominal and pelvic cavity in a caudal direction; in the cranial direction, the abdominal cavity is bordered by the **diaphragm**.

Dorsally, there are the posterior abdominal muscles, the back muscles, and the lumbar spine. The anterior and lateral abdominal muscles—the actual abdominal wall—are located ventrally and laterally.

Muscles of the Abdominal Wall

The abdominal muscles are divided into the following:

- Lateral group: **obliquus externus abdominis, obliquus internus abdominis, transversus abdominis muscle**
- Medial group: **rectus abdominis muscle, pyramidalis muscle**
- Posterior group: **quadratus lumborum muscle, psoas major muscle**

The tendons of the lateral abdominal muscles (**aponeuroses**) intertwine at the midline to form a longitudinal tendinous line (**linea alba**, or white line). In the middle of that line lies the navel (**umbilicus**). Lateral of the linea alba, the aponeuroses of the lateral abdominal muscles, together with the fasciae of the abdominal wall, form the rectus sheath. This sheath surrounds the rectus abdominis muscle up to a point about 4–6 cm below the navel.

Structure of the Rectus Sheath

The aponeurosis of the obliquus externus abdominis covers the **rectus abdominis muscle** ventrally from the outside, whereas the aponeurosis of the obliquus internus abdominis splits into 2 sheets lateral of the muscle. One of those sheets runs ventral of the rectus abdominis muscle, whereas the other runs dorsally. The anterior sheet fuses with the aponeurosis of the obliquus externus; the posterior one merges with the transversus abdominis aponeurosis.

From about 4–6 cm below the navel (caudal of the so-called **arcuate line**), until reaching the **symphysis**, all aponeuroses of the lateral abdominal muscles run in front of the rectus muscle. The rectus sheath, located anteriorly, is formed by the aponeurosis of the obliquus externus and both sheets of the aponeurosis of the obliquus internus, as well as by the aponeurosis of the transversus abdominis. Dorsally, the rectus abdominis muscle is covered only by the thin **transversal fascia** and the **peritoneum**.

Fasciae of the Abdominal Wall and Inguinal

Ligament

The inner fascia of the abdominal and pelvic wall is the **transversalis fascia**. It extends into the **inguinal canal**, and there it continues as the **internal spermatic fascia**.

The outer **superficial abdominal fascia** radiates (along with the fascia lata of the thigh) caudally from the outside into the **inguinal ligament**.

The inguinal ligament originates from the **superior anterior iliac spine** and runs to the **pubic tubercle**. Between the ligament and the bony pelvis, there is free space: the **subinguinal region**. The **iliopectineal arch**, made out of connective tissue, divides the subinguinal region into the **lacuna vasorum** (medial) and the **lacuna musculorum** (lateral).

The lacuna musculorum contains the following:

- Iliopsoas muscle
- Femoral nerve
- Lateral femoral cutaneous nerve

The following structures run through the lacuna vasorum:

- Femoral artery (lateral)
- Femoral vein (medial)
- Femoral nerve, genitofemoral nerve
- Proximal deep inguinal lymph node (Rosenmüller node)

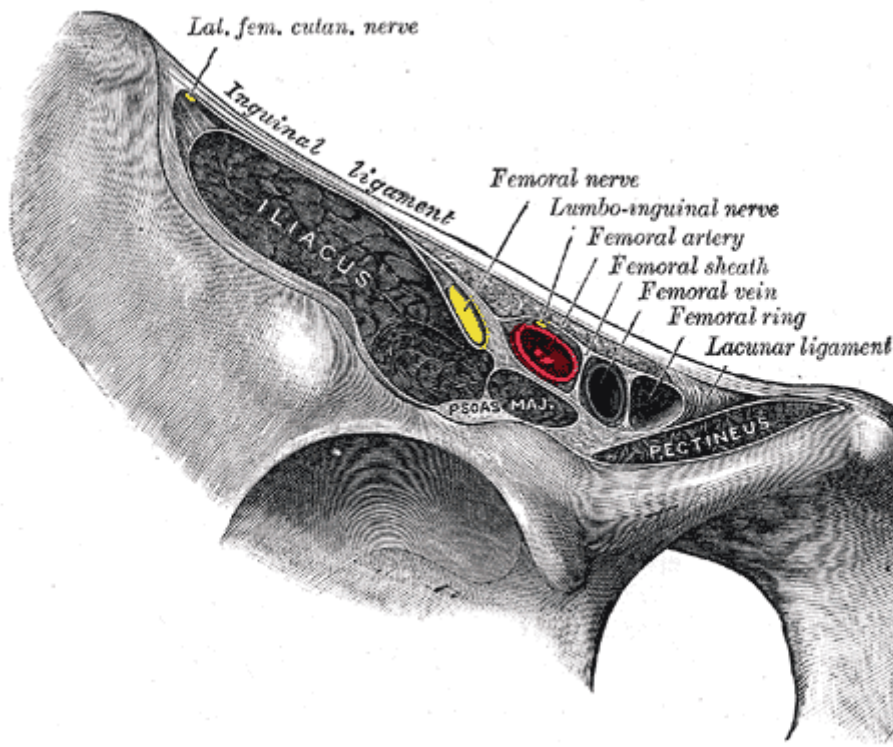


Image: Inguinal ligament. By Henry Gray, License: Public Domain

Course of the Inguinal Canal

The **inguinal canal** is situated in the anterior abdominal wall, above the inguinal ligament. There, it runs from the upper lateral to the inferior medial direction, connecting the inner and outer abdominal wall. The inguinal canal has a length of approx. 4 cm.

The inner orifice of the inguinal canal is the **deep inguinal ring** (internal inguinal ring). It is formed by the evagination of the **transversalis fascia**, which surrounds the spermatic cord as the **internal spermatic fascia**. The deep inguinal ring lies in the **lateral inguinal fossa**, lateral of the **inferior epigastric vessels**.

The **superficial inguinal ring** (external inguinal ring) also lies above the inguinal ligament. It is formed by a fissure in the aponeurosis of the obliquus externus abdominis. Projected on the inner abdominal wall, it is situated in the **medial inguinal fossa**, medial of the **inferior epigastric vessels**.

Contents of the Inguinal Canal

In men, the inguinal canal contains the **funiculus spermaticus** with the **cremaster muscle** and the **internal and external spermatic fascia**, the **ilioinguinal nerve**, and the **genital branch of the genitofemoral nerve**.

In women, the **teres uteri ligament**, the **teres uteri artery**, the **ilioinguinal nerve**, and the **genital branch of the genitofemoral nerve** run through the inguinal canal.

Boundaries of the Inguinal Canal

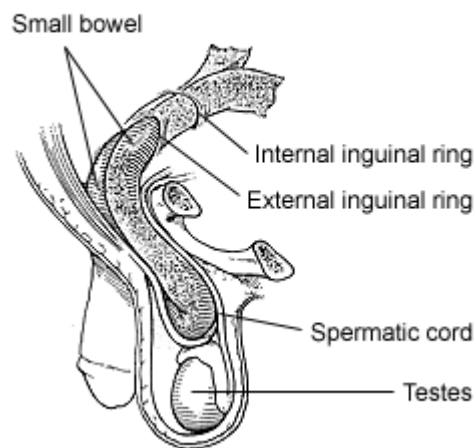
A popular subject on exams are the boundaries of the inguinal canal:

- Cranial: an inferior edge of the **obliquus internus abdominis muscle and the transversus abdominis muscle**
- Caudal: **inguinal ligament (ligamentum reflexum**, caudal fibers of the aponeurosis of the obliquus externus)
- Ventral: aponeurosis of the obliquus externus abdominis muscle
- Dorsal: **transversalis fascia, interfoveolar ligament**

Inguinal Hernia

In parts of the abdominal wall where the musculature is not continuous, chronically increased pressure in the abdominal cavity can lead to evagination (protrusion) of the parietal peritoneum and parts of organs through surrounding muscles. This is called **hernia**.

Inguinal Hernia



[Image](#): Inguinal hernia. By National Institutes of Health, License: Public Domain

Inguinal hernias are the most common. Inguinal hernias can be distinguished between indirect (lateral) and direct (medial), as well as congenital and acquired.

Congenital inguinal hernias are always indirect. The hernial orifice is the **deep inguinal ring**. The hernial sac makes its way through the inguinal canal and the external inguinal ring into the scrotum.

Through expansion of the internal inguinal ring, an indirect inguinal hernia also can form in advanced age (acquired indirect inguinal hernia).

A direct inguinal hernia is always acquired. The inner hernial orifice is located in the **medial inguinal fossa**; the hernial sac passes through the thin abdominal wall, which at that point consists only of **transversalis fascia** and the **peritoneum**, and protrudes to the outside through the **superficial inguinal ring**.

Thus, both direct and indirect inguinal hernias come out through the external inguinal ring above the inguinal ligament. In a **femoral hernia**, however, the hernial sac comes through the **lacuna vasorum** and appears below the inguinal ligament.

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