

Ultrasound Imaging of Groin Hernias

Abdominal wall hernias occur where structures that are normally located within the peritoneal cavity protrude through a defect in the abdominal wall muscles.

The worldwide lifetime incidence of abdominal wall hernias is approximately 5%, with 80% of hernias occurring in the inguinal canal and 5% in the femoral canal. The remaining 15% include incisional, spigelian, umbilical, epigastric and other hernia types.¹

Groin hernias are classified into two groups: those originating along the inguinal canal and those originating outside the inguinal canal. The former group include direct and indirect inguinal hernias and the latter, femoral and spigelian hernias.

INGUINAL HERNIAS

Inguinal hernias occur when the processus vaginalis, an embryological channel, fails to obliterate. The testicle is an intraperitoneal organ that develops during the embryological period from the urogenital ridge that lies adjacent to the lumbar spine.² The processus vaginalis opens to allow descent of the testicle from its paraspinal site of origin into the scrotal sac; this descent is completed by around the 36th week of pregnancy (Fig 1). In females, the inguinal canal contains the round ligament of the uterus.

The inguinal canal normally obliterates after passage of the testicle or round ligament. However, it may remain partially or completely open. If incompletely closed, it constitutes a point of weakness that may allow herniation of intra-abdominal contents. The canal courses from lateral to medial through the muscle layers of the abdominal wall from the deep inguinal ring to the superficial inguinal ring (Fig 2). A hernia occurring along the course of the inguinal canal is called an indirect hernia. A direct hernia occurs when weak abdominal wall muscles and tendons bulge directly through the external inguinal ring.

Ultrasound imaging (US) is useful for confirming the presence of a hernia and identifying its type and content. The normal inguinal canal is readily visualised with the US probe positioned just above and parallel to the inguinal ligament (Fig 3).

US is useful in confirming the course of an indirect inguinal hernia that starts at the internal inguinal ring lateral to the inferior epigastric vessels and courses medially anterior to the vessels to the external inguinal ring (Fig 4).

A direct hernia does not follow the inguinal canal; it bulges through the weak lower abdominal wall muscles directly into the external inguinal ring. It therefore lies medial to the inferior epigastric artery (Fig 5). Dynamic imaging during Valsalva manoeuvre or in the standing position is useful since the increased intra-abdominal pressure improves visibility of the hernia and gives a better assessment of its size.

The content of a hernial sac should be clearly identified, which most commonly consists of omentum. However, a hernial sac may contain bowel and occasionally an ovary or uterine fibroid. In females, a persistent processus vaginalis is often referred to as the canal of Nuck. A large canal of Nuck, particularly in female infants, may contain an ovary and/or part or all of the uterus (Fig 6). Complications such as incarceration and strangulation are more likely to occur with non-omental content.

Incarceration is identified on US by the fact that the hernia cannot be reduced by compression with the US probe. Incarceration increases the risk for strangulation, which occurs when the blood supply of the hernial contents is compromised. This may lead to ischaemia and gangrene of the hernial contents. Strangulation is more likely to occur when a narrow neck of the hernial sac is present. US features of strangulation include fluid collections in the sac, bowel wall thickening and diminished perfusion of the contents on colour Doppler imaging (Fig 7).

FEMORAL HERNIAS

Femoral hernias occur in the femoral canal. The canal is located medial to the common femoral vessels within the femoral sheath. The femoral sheath originates as a fibrous extension from the inferior aspect of the inguinal ligament (Fig 8).

On US, femoral hernias lie below the inguinal ligament and medial to the common femoral vein

and may contain omentum, small bowel, and other intraperitoneal structures (Fig 9). Femoral hernias show a predilection for the right side and are more common in females.³

SPIGELIAN HERNIAS

A Spigelian hernia is not a true groin hernia as it occurs well above the groin through a congenital or acquired defect in the Spigelian fascia. The Spigelian fascia is located between the lateral border of the rectus abdominis muscle and the medial borders of the transversus abdominis, internal and external oblique muscles (Fig 10). A spigelian hernia is relatively rare, usually developing after age 50, primarily in men. The cause is usually a weakening of the abdominal wall, trauma, or prolonged physical stress. Spigelian hernias are sometimes challenging to diagnose.⁴

RISK FACTORS FOR COMPLICATIONS AND SELECTING TREATMENT OPTIONS

The risk factors useful in predicting complications in an adult patient with groin hernia are age (older age group), duration of hernia (recent sudden onset), type of hernia (femoral more than inguinal) and coexisting medical illness. In children, the risk factors are age (very young), gender (male), recent sudden onset of hernia and side (right side).⁵

Groin hernias particularly those predisposed to or showing signs of complications should be managed promptly surgically. The aim is to reduce the hernia contents if they are healthy and to close the hernial orifice. Resection of ischaemic contents would be required in case of infarction or gangrene. Elective surgery may be performed laparoscopically, which decreases post operative pain and recovery time but requires general anaesthesia. Open surgery may be done under local anaesthesia, which is safer for high-risk elderly individuals.

CONCLUSION

The inferior epigastric artery at its origin is a critical anatomic landmark in differentiating indirect from direct inguinal hernias. Femoral hernias occur medially to the femoral vein and inferiorly in relation to the inguinal ligament. Spigelian hernias occur at the lateral margin of the rectus abdominis through the Spigelian fascia. Understanding the regional anatomy and the types of hernias that occur in this location assists sonographic diagnosis and helps planning appropriate surgical treatment.

Figure 1: Diagram showing the site of origin of the testis and its path of descent into the scrotum. Ref. <https://www.lecturio.com/concepts/cryptorchidism/>

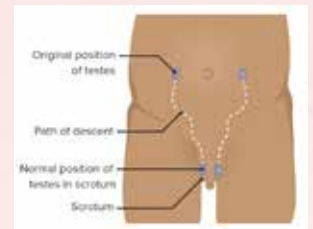


Figure 2: Diagram⁶ showing the inguinal canal in yellow coursing through the abdominal wall muscles. The blue arrow indicates the path of an indirect inguinal hernia, while the red arrow shows that of a direct hernia. The inferior epigastric vessels are used as a landmark to distinguish indirect hernias from direct hernias, with the former originating laterally while the latter originates medially.

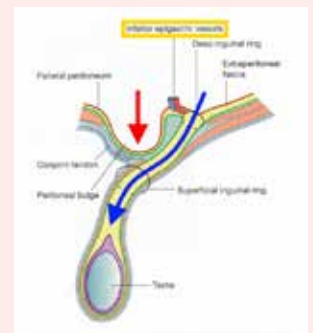


Figure 3: US image oriented parallel to and just above the inguinal ligament showing the normal inguinal canal (C) containing the spermatic cord. The canal starts lateral to the inferior epigastric artery (E) and courses anterior and medial to it. A - external iliac artery, V- external iliac vein.³

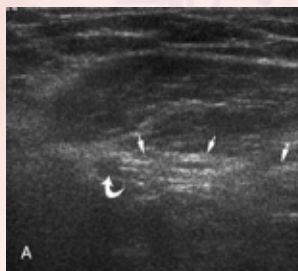


Figure 4: US image oriented parallel to and just above the inguinal ligament shows an omentum-containing indirect inguinal hernia (H) starting laterally at the internal inguinal ring (arrowhead) and coursing medially anterior to the inferior epigastric artery (E). A - external iliac artery, V- external iliac vein.³



Figure 5: US Images¹ of an indirect inguinal hernia.

A. Non-Valsalva image showing the inferior epigastric artery (curved arrow) and the inguinal canal (straight arrows).



B. Valsalva image showing protrusion of a direct inguinal hernia containing omentum (straight arrows) medial to the inferior epigastric artery (curved arrow).



Figure 6: US image of the right groin in an infant shows herniation of an ovary (black arrows) and uterus (white arrows) into the canal of Nuck.⁷



Figure 7: US image of an indirect inguinal hernia that extends into the scrotum. Note thickened walls of small intestinal loops (arrows) and the presence of fluid (F) in the hernial sac. Case courtesy of Townsville radiology training, Radiopaedia.org, rID: 17968.



Figure 8: Femoral Canal Anatomy: The femoral canal (purple) is located in the femoral sheath medial to the common femoral vein (dark blue). <https://teachmeanatomy.info/lower-limb/areas/femoral-canal/>

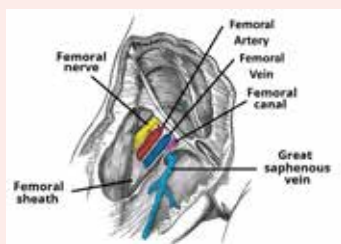


Figure 9: US image of a femoral hernia showing a hernial sac containing omentum (open arrow) lying medial to the femoral vein and artery (FV, FA). Case courtesy of Maulik S Patel, Radiopaedia.org, rID: 25936.

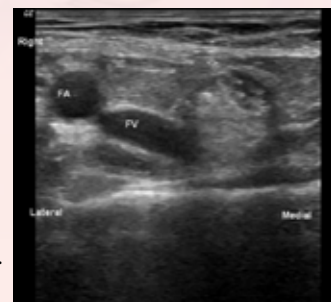


Figure 10: Anatomical diagram showing the location of the Spigelian fascia between the rectus abdominis muscle medially and the transversus abdominis, external and internal oblique muscles laterally. https://www.researchgate.net/figure/Anatomical-diagram-showing-the-relationship-between-the-rectus-abdominis-muscle-RA_fig2_312473946

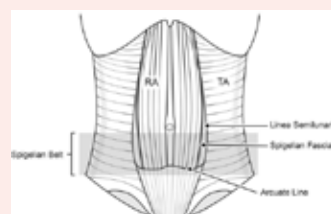


Figure 11: US image of a Spigelian hernia, note that extraperitoneal fat is herniating between the left rectus abdominis muscle medially and the left oblique muscles laterally. Case courtesy of Maulik S Patel, Radiopaedia.org, rID: 29329.



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