Abdominal Wall Hernias: beyond the common

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Authors: A. R. Ventosa¹, C. Carneiro², C. Soares², G. Afonso¹, J. Brito², H. Patricio¹; ¹Faro/PT, ²Portimão/PT
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Learning objectives

• To perceive the wide range of imaging findings associated with abdominal wall hernias, focusing in uncommon features.

• To classify unusual abdominal wall hernias according to their specific features.
Background

Abdominal wall hernias are a common clinical problem, defined as a protrusion of abdominal content through a congenital or acquired defect of the muscular layers of the abdominal wall [1].

In the majority of cases, its common location, typical content, and usual presentation make it a straightforward diagnosis.

However, less common features may result in atypical clinical presentation and more difficult diagnosis.
Findings and procedure details

In this section, we present selected cases of abdominal wall hernias with uncommon features, organized into three categories: 1) unusual location; 2) uncommon content; and 3) rare mechanism or presentation. These categories are not mutually exclusive and some cases fit in more than one group.

Although MDCT is the main imaging technique used in the majority of cases, several additional images of other techniques are also displayed.

1. Abdominal wall hernias with unusual location

Concerning ventral hernias, epigastric and hypogastric types are somehow unusual, unless they are also incisional. Both are midline defects that occur in the linea alba. Epigastric hernias (Fig. 1 on page 9) appear between the umbilical scar and xiphoid process, whereas hypogastric arise below the umbilicus [2-4].

Spigelian hernias (Fig. 2 on page 9) are quite rare, representing about 2% of all abdominal wall hernias [5, 6]. They occur through a weakness along the linea semilunaris, which is formed by the fibrous union between the rectus sheath and the aponeuroses of the transverse and oblique abdominal muscles. Typically, the abdominal content herniates between the lateral abdominal wall muscles and form an interstitial/interparietal hernia (Fig. 2 on page 9B) [1, 4]. However, the hernia may transpose all the aponeurotic and muscle layers, reaching the subcutaneous tissue (Fig. 3 on page 10) [6].

Lumbar hernias are uncommon and involve the posterolateral abdominal wall. Typically, the herniation occurs through one of two points of low resistance: the superior and inferior lumbar spaces, also called Grynfeltt-Lesshaft and Petit's triangles, respectively. The superior lumbar triangle is limited by the 12th rib superiorly, the internal oblique muscle laterally and the erector spinal muscles medially. Herniation through this space gives rise to a Grynfeltt-Lesshaft hernia (Fig. 4 on page 11). The inferior lumbar triangle is bordered by the external oblique muscle laterally, the latissimus dorsi muscle medially and the iliac crest inferiorly. Herniation through this space gives rise to a Petit hernia, rarer than the Grynfeltt-Lesshaft one [2, 6].

Pelvic hernias are also uncommon and comprise obturator, sciatic and perineal hernias. Obturator hernias (Fig. 5 on page 12) are very rare, representing less than 1% of all hernias, and occur mainly in elderly women. They are characterized by a defect in
obturator membrane which allows protrusion of abdominal content through the obturator foramen and extension between external obturator and pectineal muscles or between the layers of obturator membrane [1].

In sciatic hernias, the herniation occurs through the greater or lesser sciatic foramen and reaches to gluteus region crossing the upper or lower edge of the piriform muscle [1, 6].

Perineal hernias are also quite rare and appear through a defect in the pelvic floor. They are usually found in elderly women [1, 4].

Femoral or crural hernias (Fig. 6 on page 13) are somehow unusual, representing less than 10% of groin hernias and only 3% of all hernias. They are more frequent in females and occur through a defect in the attachment of the transversalis fascia to the pubis, being recognized medially to the femoral vein, below the inguinal ligament and laterally to the pubic tubercle [1, 6].

An interparietal or interstitial hernia is characterized by the presence of the hernia sac in the fascial planes between the abdominal wall muscles. This hernia type, although rare, is more frequent at inguinal region [2]. In addition, the classic Spigelian hernia is also an interparietal hernia (Fig. 2 on page 9B) [1].

2. Abdominal wall hernias with uncommon content

Virtually, almost any intraabdominal structure or organ, hollow or solid, normal or pathological, can protrude through an abdominal wall defect, depending, of course, on their size and location.

The commonest content of abdominal wall hernias, namely preperitoneal fat, greater omentum and small bowel loops, will not be discussed here.

Gastrointestinal tract organs

Occasionally, part of the stomach can be included in epigastric (Fig. 7 on page 14) or incisional ventral hernias [5].

Colon, although not rarely, herniate not very often. Segments of the colon, mainly the mobile ones (sigmoid, cecum and transverse), may be found either in ventral hernias (Fig. 8 on page 15) as in inguinal hernias (Fig. 9 on page 16) [4]. According some authors, almost 7% of all inguinal hernias contain colon [7]. Rarely, inflammatory and neoplastic processes affecting the colon, such as diverticulitis and adenocarcinoma respectively, can be identified within the hernia [4].
Appendix may be found in about 1% of inguinal hernias [7]. Less common hernia types, such as femoral, Spigelian (Fig. 10 on page 17) and obturator ones can also contain this structure [4, 8]. In extremely rare cases, an appendix complicated by acute appendicitis can be found in inguinal or femoral hernias, defining Amyand's or Garangeot's hernias, respectively [7, 9, 10].

Rarely, solid organs such as the liver (Fig. 11 on page 18) can protrude through abdominal wall defects, most often related with previous surgical incisions [2, 4].

Richter hernia is uncommon and refers to a hernia involving only the antimesenteric wall of the bowel and not the entire wall circumference (Fig. 12 on page 19) [2, 3].

A very particular case is the Littre hernia, which refers to an inguinal hernia containing a Meckel diverticulum [2, 3].

**Genitourinary tract organs**

In rare cases, kidneys may be contained in the hernia sac of lumbar hernias, most often if they are incisional [2, 4]. Polycystic kidneys may be more susceptible to herniation, given their larger size, and may even appear in ventral hernias (Fig. 13 on page 20).

Distal ureters are unusually found in inguinal (Fig. 14 on page 21, Fig. 15 on page 22) and sciatic hernias [2, 4].

Occasionally, part of the urinary bladder can protrude through abdominal wall defects, mainly inguinal (Fig. 16 on page 23) and obturator hernias [4, 7]. Although more rarely, Spigelian hernias can also contain bladder (Fig. 17 on page 24). It is important to be aware that urinary bladder pathological processes, such as diverticula [9] or tumours (Fig. 18 on page 25), may extend and/or be included in the hernia sac.

Ovarian and tubal herniation is rare, but may occur in inguinal hernias, usually in children [7, 9]. Obturator hernias may also contain adnexal or uterus tissue [4].

Although rarely, other inflammatory and neoplastic processes, in addition to those previously mentioned, may be identified within the hernia. For instance, *pseudomyxoma peritonei* may extend through abdominal wall defects (Fig. 19 on page 26).
In larger abdominal wall hernias, peculiar combinations of abdominal structures may be seen in hernia sac (Fig. 13 on page 20, Fig. 20 on page 27).

3. Abdominal wall hernias with rare mechanism or presentation

Unusually, trauma may be the mechanism causing an abdominal wall hernia (Fig. 21 on page 28). High-impact blunt trauma is involved in most traumatic hernias. Intraabdominal pressure may increase to levels high enough to disrupt the abdominal wall, mainly in areas of anatomic weakness, such as the lumbar region and the lower abdomen [1, 2].

Reduction *en-masse* is a quite rare presentation of complicated inguinal hernias (Fig. 22 on page 29). This entity refers to the reduction of the hernia sac which retains a loop of incarcerated bowel. This situation happens when the neck of the hernia sac is narrow and inflexible due to fibrotic changes resulting from recurrent trauma caused by difficult reductions. These features make the hernia prone to incarceration. If this occurs and is followed by reduction (manual or, less often, spontaneous), the hernia may apparently disappear, but the incarceration persists (Fig. 23 on page 30) [11-13].

**Fig. 22:** A - Representative scheme of a sagittal section at the neck of an inguinal hernia. B - Representative scheme of the reduction "en masse" of an inguinal hernia. The hernial sac takes an intraabdominal location and the constriction at the hernia neck remains due to fibrotic changes.

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A rare presentation may occur in hernias containing ureter segments, compressed at hernia neck (Fig. 15 on page 22). In cases like these, patients can present with flank pain reminding renal colic, decreased renal function and hydronephrosis.
Fig. 1: Epigastric hernia in a patient with no previous abdominal surgeries. Axial MDCT image shows a midline defect (arrows) in anterior abdominal wall with protrusion of fatty tissue and peritoneum folds.

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Fig. 2: Spigelian hernia. Axial (A, B - A obtained at a higher level than B), sagittal (C) and coronal (D) MDCT reformatted images show protrusion of a small bowel segment through a defect in right linea semilunaris (arrows). Note that the hernia sac is located between external (white arrowhead) and internal (blue arrowhead) oblique muscles, configuring an interparietal hernia, the classic Spigelian hernia presentation. Note the free fluid in hernia sac and dilation of intraabdominal bowel loops secondary to small bowel obstruction. Incarcerated Spigelian hernia was confirmed at surgery.

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**Fig. 3:** Spigelian hernia. Axial (A) and coronal (B) reformatted MCDT images depict a Spigelian hernia containing a colon segment (arrows point at hernia neck). Note that the hernia transposes all the muscular layers, reaching the subcutaneous tissue. An hypogastric incisional hernia containing small bowel ansae is also depicted (arrowheads).

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Fig. 4: Grynfeltt-Lesshaft hernia. Axial MDCT image depicts protrusion of retroperitoneal fat (asterisk) through the superior lumbar triangle (white arrows). The patient had no history of lumbar incisions. Note the latissimus dorsi muscle (blue arrow) between the hernia and subcutaneous tissue.

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Fig. 5: Obturator hernia. Axial MDCT image (A) depicts a small-bowel loop filled with fluid and air (white arrow) between the pectineal (blue arrowhead) and external obturator (white arrowhead) muscles. Sagittal reformatted MDCT image (B) better depicts the path of the herniated bowel segment (blue arrow) through the obturator foramen, between superior ramus of pubis and ischiopubic ramus (inferiorly).

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**Fig. 6:** Right femoral hernia containing a small-bowel loop. Axial MDCT image (A) obtained through the hernia neck level (blue arrow). Axial MDCT image (B) obtained at a lower level than A shows a dilated fluid-filled small-bowel loop contained in the hernia (white arrowhead). Coronal (C) and sagittal (D) reformatted MDCT images are more obvious showing the path of the bowel segment contained in the hernia (white arrows). Note the small amount of free fluid in the hernia sac and dilated fluid-filled small-bowel loops within the abdominal cavity. Strangulated femoral hernia was confirmed at surgery.

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Fig. 7: Epigastric hernia containing part of stomach. Axial (A) and sagittal (B) reformatted MDCT images depict an epigastric midline defect (arrowheads) through which part of stomach herniates (asterisk).

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Fig. 8: Spigelian hernia (arrowheads) containing part of the sigmoid colon.

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**Fig. 9:** Inguinal hernias containing colon segments. A - Radiograph from a single-contrast barium enema study shows a segment of the sigmoid colon (blue arrow) in a right-sided inguinoscrotal hernia. B - Axial MDCT image depicts an inguinal hernia at right, containing cecum (blue arrowhead), ileocecal valve (white arrowhead) and distal ileum. Note the free-fluid (asterisk) within the hernia sac. C and D - Axial (C) and coronal (D) reformatted MDCT images showing a left-sided inguinal hernia containing part of descending and sigmoid colon (white arrows). D better depicts the path of the herniated bowel segment (green arrow).

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Fig. 10: Spigelian hernia containing the appendix. Axial MDCT image shows the gas-filled appendix (arrow) protruding through a defect in the anterolateral abdominal wall. Note that the hernia is interparietal, being located between external and internal oblique muscles.

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**Fig. 11:** Midline incisional hernia containing the left hepatic lobe (asterisk) is depicted in axial (A) and sagittal (B) reformatted MDCT images. Note that transverse colon loops also protrude through the hernia defect.

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**Fig. 12:** Richter hernia (arrows). Axial (A) and sagittal (B) reformatted MDCT images depict a small part of the cecum wall herniated through an anterior and right paramedian abdominal wall defect. Note that the cecum is distended by gas and its location is more central and anterior than usual.

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**Fig. 13:** Large incisional ventral hernia containing a polycystic kidney. Axial MDCT image shows a large anterior abdominal wall defect (blue lines) through which the right (polycystic) kidney (white arrowheads) herniates, along with colon and small-bowel segments. The colon was collapsed and the small-bowel, distended. This patient presented with small-bowel subocclusion, caused by compression at hernia neck. Note that the inferior vena cava is retracted (blue arrowhead) by the anomalous position of the right kidney and, therefore, the right renal vein.

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Fig. 14: Inguinal hernia containing a transplanted ureter segment. Axial MDCT images at urinary excretory phase (A obtained at a higher level and the remainder at gradually lower levels) depict the ureter path (arrows), which enters into the inguinal hernia (D to F). Note the implantation site of the transplanted ureter at the urinary bladder (arrowhead).

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**Fig. 15:** Right-sided inguinal hernia containing an ureter segment. Axial MDCT images at urinary excretory phase (A - E, A obtained at a higher level and the remainder at gradually lower levels) depict right uretero-hydronephrosis and the ureter path (white arrows), which enters into the inguinal hernia (C). The ureter segment contained at the hernia sac (D and E) is also dilated. Further images showed that the ureter obstruction was located at the exit of the hernia neck. Note that there is no contrast in the right distal ureter, the opposite of what happens at the left side (blue arrows), according to the ureteral obstruction. Sagittal reformatted MDCT image (F) better depicts the path of the right ureter through the inguinal hernia (white arrow). Note the large hepatic mass (asterisk), suggestive of a cavernous angioma. White arrowheads (B) point at primitive iliac arteries aneurysms with endoluminal thrombus.

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Fig. 16: Inguinal hernia containing the urinary bladder. Axial (A, B), sagittal (C) and coronal (D) MDCT reformatted images show herniation of the bladder (arrows) through a right inguinal hernia. Note that the bladder herniation is more clearly depicted on sagittal and coronal images.

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**Fig. 17:** Spigelian hernia containing the urinary bladder. Axial MDCT (A) and MR T2 (B) images show herniation of the bladder (arrows) through a left Spigelian hernia.

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Fig. 18: Inguinoscrotal hernia containing a neoplasm of the urinary bladder. Axial (A, B, C), sagittal (D) and coronal (E) MDCT images depict a left inguinoscrotal hernia containing part of the urinary bladder (arrows). Note that there is an exophytic mass within the herniated bladder lumen (asterisk). Anatomopathological study confirmed an high-grade urothelial carcinoma.

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**Fig. 19:** Incisional hypogastric hernia containing pseudomyxoma peritonei lesions. Axial MDCT image depicts a midline hypogastric defect, through which the gelatinous material protrudes (asterisk). The patient had an history of a mucinous tumour of the appendix.

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Fig. 20: Large lumbar hernia containing stomach, duodenum, small-bowel and colon segments. Axial (A, B), sagittal (C) and coronal(D, E, F) reformatted MDCT images depict a large abdominal wall defect in the lumbar region (blue lines), through which stomach (white asterisks), duodenum, small-bowel (orange arrowheads) and colon (blue arrowheads) segments protrude. The patient presented with acute epigastric pain and rigidity at abdominal palpation. Note the gastric perforation (white arrows), pneumoperitoneum (red arrowheads), retropneumoperitoneum (yellow asterisks) and the dilation of the stomach and intraabdominal small-bowel loops.

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Fig. 21: Traumatic abdominal wall hernia caused by a high-impact motor vehicle accident (frontal collision against a building). The patient was a front-seat passenger. Axial (A, B) and coronal (C, D) reformatted MDCT show a traumatic disruption of the abdominal wall musculature (blue arrowheads) caused by the desinsertion of transverse and internal and external oblique muscles from the left iliac bone. Note the protrusion of descending colon (white arrows) through the defect.

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Fig. 22: A - Representative scheme of a sagittal section at the neck of an inguinal hernia. B - Representative scheme of the reduction "en masse" of an inguinal hernia. The hernial sac takes an intraabdominal location and the constriction at the hernia neck remains due to fibrotic changes.

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Fig. 23: Reduction "en masse" of an inguinal hernia. Axial (A) and oblique coronal (B) reformatted MDCT images depict an inguinal hernia sac with intraabdominal location (blue arrowheads). Note that there are features of closed loop small bowel obstruction conditioned by the fibrotic constriction around the neck of the hernia sac (white arrows). Surgery confirmed incarcerated left inguinal hernia with intraabdominal hernia neck.

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Conclusion

Abdominal wall hernias are a frequent finding on the daily routine of a radiologist, either as a clinical problem justifying the investigation, or as an incidental finding in studies performed for another reason.

The majority of abdominal wall hernias represent an easy diagnosis. However, when unusual features are present it may become a challenging diagnosis. It is essential for radiologists to be aware of the wide range of that features, since, particularly in these cases, their role may be crucial for an accurate diagnosis.
Personal information

Department of Radiology, Centro Hospitalar do Algarve - Portugal.

- Ana Rita Ventosa
- Carolina Carneiro
- Carla Bahia
- Graça Afonso
- Jorge Brito
- Henrique Patrício
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