Diagnostic imaging for inguinal and pelvic hernia

Fumio KOTAKE1,2, Yosinori WATANABE2, Motoi NISHIMURA2
Keiji MORIMOTO1, Taizou OZUKI1

1Department of Radiology, Tokyo Medical University, Kasumigaura Hospital
2Fourth Department of Surgery, Tokyo Medical University, Kasumigaura Hospital

Abstract

Hernia of the inguinal region is a very frequent condition, accounting for about 80-90% of all abdominal hernias. Inguinal hernia involves prolapse of organs into the inguinal region on the ventral side of the inguinal ligament. It is subdivided into indirect inguinal hernia and direct inguinal hernia. Indirect inguinal hernia involves prolapse of intraperitoneal organs through the inguinal canal. The hernia sac is located outside the inferior epigastric artery. This is the most frequent type of inguinal hernia and often develops in boys during infancy or early childhood and males aged over 50. Diagnosis of this type of hernia is easy when prolapse of intraperitoneal organs into the inguinal canal or scrotum is visible on computed tomography (CT) scans. Direct inguinal hernia involves direct prolapse of intraperitoneal organs from inside the inferior epigastric artery, without passing through the inguinal canal. This type of hernia, often seen in elderly males, presents only mild symptoms and rarely causes impaction. In cases with this type of hernia, the inferior epigastric artery can be identified by contrast-enhanced CT, but multidetector-row CT is more useful for the diagnosis of direct inguinal hernia since it can yield coronal images through multiplanar reconstruction.

Hernia involving prolapse of intraperitoneal organs through the femoral canal on the dorsal side of the inguinal ligament is called femoral hernia. It causes a mass to be formed in the inguinal region. It is often seen in females after middle age and has a high probability of impaction. Richter's hernia is also frequently seen in cases of femoral hernia. Special attention is needed in cases of this type of hernia, since only minimal symptoms of ileus are presented even when necrosis of the intestinal wall has developed. Distinction of this type of hernia from direct inguinal hernia is possible if the hernia sac is visible on the dorsal side of the inguinal ligament on CT scans.

Obturator hernia is a type of pelvic hernia. On external appearance, this type of hernia causes no mass. Therefore, diagnostic imaging is important for its diagnosis. This type of hernia is often seen in elderly and slim females. Because the hernia orifice is sharp and solid for this type of hernia, impaction is likely to occur. Careful observation is needed as Richter's hernia is also frequently seen in cases of obturator hernia. Obturator hernia is diagnosed easily by CT scan, as the prolapsed intestine is often visible between the pectineal muscle and the external obturator muscle. When conducting CT scans for the diagnosis of this type of hernia, it is essential to take images down to the lower margin of the ischial bone to see the obturator canal.

Received May 24, 2007, Accepted June 25, 2007

Keywords : Inguinal hernia, Pelvic hernia, Computed tomography

Corresponding author : Fumio KOTAKE, Department of Radiology, Tokyo Medical University, Kasumigaura Hospital 3-20-1 Ami-machi chuo, Inashikigun, Ibaraki 300-0395, Japan
Tel: 029-887-1161 (ext. 7120) Fax: 029-988-1512 E-mail: kotake@tokyo-med.ac.jp
Introduction

Hernia of the inguinal region is very frequent, accounting for about 80–90% of all abdominal hernias. It can be divided into indirect inguinal hernia, direct inguinal hernia and femoral hernia, all of which present as bulges in the groin area. Preoperative diagnosis of this type of hernia is sometimes difficult. A precise diagnostic imaging is essential for preoperative diagnosis of this condition. Pelvic hernia can be divided into obturator hernia, sciatic hernia and perineal hernia. Since pelvic hernia has no mass on external appearance, diagnostic imaging is an important means for its diagnosis. Plain abdominal X-ray, ultrasonography, herniography, CT and magnetic resonance imaging (MRI) of these modalities, ultrasonography and herniography have been reported to be useful for the diagnosis of this type of hernia. CT is superior to the other modalities because it allows simple and rapid examination and is useful when checking the contents of hernia or its continuity to the intraperitoneal structures. For this reason, this study will outline representative types of hernia in the inguinal region and the pelvis, focusing on CT findings.

1. Anatomy of the inguinal region by imaging

Figure 1 illustrates the anatomical relationship of the area affected by hernia in the inguinal region. The inguinal ligament is a part of the aponeurosis of the external abdominal oblique muscle; it is the thickened area spanning from the anterior superior iliac spine to the pubic tubercle. On CT scans, this ligament is depicted as a linear shadow in rich subcutaneous fat, while it is less clear in slim individuals (Fig. 2a). Also, in the latter cases, better images may be obtained by thin slice imaging. Recently, multidetector-row CT (MDCT) has often been used. With this technique, imaging is easier than before, since the required areas can be presented as thin slice images at the end of imaging (Fig. 2b). Inguinal hernia is a type of hernia in which prolapse of the intraperitoneal organs occurs into the inguinal region on the ventral side of the inguinal ligament. Inguinal hernia can be divided into indirect inguinal hernia and direct inguinal hernia. The term “femoral hernia” is used to indicate the hernia characterized by prolapse of organs through the femoral canal on the dorsal side of the inguinal ligament.

The inguinal canal is anteriorly surrounded by the transverse muscle of the abdomen and internal oblique muscle and posteriorly surrounded by the inguinal ligament. The spermatic cord passes through this canal in males, while the round ligament of the uterus passes through it in females. In cases of indirect inguinal hernia, prolapse of the intraperitoneal organs takes place via the inguinal canal in the inferomedial direction.
Fig. 3 The inferior epigastric artery (arrow) is clear on the arterial phase contrast-enhanced CT image. The course of the inferior epigastric artery is clear on the MIP coronal image.
a: Transverse arterial phase contrast-enhanced CT image at the femoral head level
b: Coronal image with MIP

Fig. 4 Contrast-enhanced CT at the level of pubic symphysis. The obturator artery and vein (arrow) are visible within the obturator canal.

With this type of hernia, the contents of the hernia and hernia sac are located outside the inferior epigastric artery (a branch from the external iliac artery). In cases of direct inguinal hernia, prolapse occurs directly inside the inferior epigastric artery, without passing through the inguinal canal. Although identification of the inferior epigastric artery is possible with contrast-enhanced CT (Fig. 3a), MDCT is more useful for diagnosis of this type of hernia since it can yield coronal images with multiplanar reconstruction (MPR) or maximum intensity projection (MIP) (Fig. 3b). However, it is rare that contrast-enhanced CT is performed for diagnosing hernia of the inguinal region. Identification of the inferior epigastric artery is often difficult by plain CT scans alone.

The obturator canal is a passageway through which the obturator artery and the obturator nerve run. This canal has a diameter less than 1 cm and a length between 1 and 2 cm. If the medial anterior part of the hipbone is observed downwards on CT images, a pit leading to the lateral side of the bone is visible. This pit is filled with fat, and the obturator artery and vein are visible within it (Fig. 4). The term “obturator hernia” is used to indicate a type of hernia in which the obturator canal serves as the hernia orifice.

2. Indirect inguinal hernia

The term “indirect inguinal hernia” is used to indicate the type of hernia in which the intestine or other intraperitoneal organs show partial prolapse from the lateral inguinal fossa via the internal inguinal ring and the inguinal canal towards the external inguinal ring, scrotum, or large pudendal lip. This is the most frequent type of hernia affecting the inguinal region. It develops mostly during childhood, particularly during infancy and early childhood. This type of hernia occurs more frequently in males than in females, with the male/female ratio being 8 : 1. In boys, this hernia often occurs on the right side. In girls, the incidence of this hernia does not differ between right and left sides. In adults, this hernia often develops after age 50.

On CT scans, the internal inguinal ring (located lateral to the rectus abdominis muscle) shows bulging on the medial anterior part of the external iliac artery and vein (Fig. 5a), accompanied by dilatation of the inguinal canal (Fig. 5b). In males, the diagnosis of this hernia is easy if asymmetry relative to the contralateral inguinal canal is checked. The prolapse into the scrotum can also be visualized clearly (Fig. 5c). In females, identification of the round ligament of the uterus is sometimes difficult, but the diagnosis of this hernia is possible by checking its location and continuity to the intestine within the peritoneal cavity. The contents of the hernia and the hernia sac are often located lateral to the inferior epigastric artery. Distinction of undescended testis from this type of hernia is difficult by diagnostic imaging alone (Fig. 6). However, medical history and absence of testis in the scrotum on the affected side are useful for differential diagnosis. The lack of continuity...
to the intraperitoneal structures on CT images is also useful.

3. Direct inguinal hernia
In cases of direct inguinal hernia, intraperitoneal organs protrude from the medial inguinal fossa via the external inguinal ring into subcutaneous tissue, without passing through the inguinal canal\(^3\). The area affected by this type of hernia is called the “Hasselbach triangle.”

---

**Fig. 5** Indirect inguinal hernia (64-year-old man)
- a: Plain CT at the femoral head level
- b: Plain CT at the level of the pubic symphysis
- c: Plain CT at the level of scrotum
Bulging of the internal inguinal ring (arrow) is visible on the lateral side of the right rectus abdominis muscle. The right inguinal canal is markedly dilated compared to the left counterpart (arrowhead). Prolapse of the intestine and fat tissue is visible from the inguinal canal into the scrotum.

**Fig. 6** Undescended testis (81-year-old man)
A mass is noted in the right inguinal canal (arrow). It can be distinguished from indirect inguinal hernia because the right testis is absent in the scrotum and that the mass is not contiguous to the intraperitoneal structures.

**Fig. 7** Direct inguinal hernia (53-year-old man)
- a: Contrast-enhanced CT at the femoral head level
- b: Contrast-enhanced CT (coronal image with MIP)
A mass is visible subcutaneously on the medial side of bilateral inguinal regions (arrowhead). The mass is located on the ventral side of the inguinal ligament and on the medial side of the inferior epigastric artery (arrow).
where the inferior epigastric vessels serve as the superolateral border, the outer margin of the rectus abdominis muscle serves as the medial border, and the inguinal ligament serves as the lower border. Direct inguinal hernia often occurs in elderly individuals with loose abdominal wall muscles. It accounts for about 10% of the inguinal hernias seen in adults. It often develops in elderly males and is bilateral in many cases. Its symptoms are mild, and impaction is rare. On CT scans, a mass is visible in the subcutaneous tissue on the medial side of the inguinal region (ventral side of the inguinal ligament) (Fig. 7a). The contents of the hernia and the hernia sac are located at the medial side of the inguinal epigastric artery (Fig. 7b).

4. Femoral hernia

In cases of femoral hernia, prolapse of intraperitoneal organs takes place along the medial side of the femoral vein, i.e., from the femoral ring (dorsal to the inguinal ligament) via the femoral canal and saphenous opening to subcutaneous tissue. In patients with this type of hernia, the hernia sac is located in subcutaneous tissue on the upper anterior part of the thigh, making its distinction from direct inguinal hernia sometimes difficult. Of all cases of femoral hernia, more than 80% are middle-aged or elderly females. It accounts for slightly more than 10% of all hernias of the inguinal region. Because the hernia orifice is small and the surrounding tissue is tough, impaction occurs at a high probability in cases of femoral hernia. Richter's hernia, characterized by impaction due to strangulation of the intestinal wall on the mesentery non-attached side alone is also seen frequently in cases of femoral hernia. Symptoms of ileus are sometimes minimal even when the intestinal wall has become necrotic. Careful observation is necessary as this can cause a delay in diagnosis. On CT scans, the hernia sac is located on the dorsal side of the inguinal ligament, allowing this type of hernia to be distinguished easily from direct inguinal hernia (Fig. 8). However, if the femoral hernia becomes large, it is sometimes seen that the hernia sac protrudes from below the inguinal ligament and its tip extends upwards through subcutaneous tissue, possibly reaching the level above the inguinal ligament (Fig. 9). In such cases, distinction from direct inguinal hernia is difficult.

5. Obturator hernia

In cases of obturator hernia, prolapse of the organs takes place via the obturator canal into the extrapelvic space. With this type of hernia, the small intestine most frequently protrudes, followed by the colon, greater omentum, ovary, uterus, etc. This type of hernia is often seen in slim females, but its absolute incidence is low. A possible responsible factor for this hernia is age-related loosening of pelvic muscles and dilatation of the obturator foramen due to decrease in fat tissue constituting the obturator canal. Because the hernia orifice is sharp and tough, impaction is likely to occur. Richter's hernia is also seen in cases of obturator hernia, and only minimal signs of ileus are sometimes seen even in the presence of necrotic intestinal wall. Detection of this hernia tends to be delayed because this area is covered by pectineal muscles and visual detection is difficult unlike with inguinal or femoral hernia. On plain abdominal X-ray, dilatation of the small intestine is often seen. The abnormal air is sometimes seen on the

---

Fig. 8 Femoral hernia (57-year-old woman)
A mass is visible in the right inguinal region (arrowhead). It is located on the dorsal side of the inguinal ligament (arrow). No sign of ileus is noted. Richter's hernia is diagnosed at surgery.

Fig. 9 Femoral hernia (81-year-old woman)
A mass (arrowhead) is visible on the ventral side of the inguinal ligament of the right inguinal region (arrow). The woman was initially suspected of having direct inguinal hernia. During surgery, however, she was found to have femoral hernia in which the hernia sac protruded below the inguinal ligament, its tip extending through subcutaneous tissue to appear on the ventral side of the inguinal ligament.
Conclusion

The features on diagnostic imaging have been outlined above for representative types of hernia of the inguinal and pelvic regions. CT is useful as a means of differential diagnosis of hernia of the inguinal region. Clinical diagnosis of obturator hernia is difficult, but treatment is possible with removal of strangulation alone, without enterectomy, if the disease is diagnosed and treated at an early stage. However, the delay in diagnosis or treatment can lead to fatal outcome. In this sense, CT can play a significant role in the diagnosis of this type of hernia.

References

8) Boocock GR, Todd PJ: Inguinal hernias are common in preterm infants. Arch Dis child 60: 669–670, 1985
9) Araki T: CT of acute abdomen. (In Japanese) 2–18 Medical sciences international (Tokyo), 2002
12) Gray SW, Skandalakis JE, Soria RE, Rowe JS:
鼠径部・骨盤部ヘルニアの画像診断

小竹文雄1) 渡辺善徳2) 西村基2) 森木恵爾1) 小椝泰三1)

1)東京医科歯科大学第二病院放射線科
2)東京医科歯科大学第二病院第四外科

【要旨】 鼠径部のヘルニアは非常に頻度の高い疾患で腹部ヘルニアの約80～90%を占める。鼠径部の腹側で鼠径部に脱出するヘルニアが鼠径部ヘルニアで間接鼠径ヘルニアと直接鼠径ヘルニアとがある。鼠径管を通じて腹腔内腔器が脱出するのは間接鼠径ヘルニアでヘルニア囊が下腹壁動脈の外側にみられる。鼠径部ヘルニアの中で最も多く、乳幼児の男児と50歳を越える男性に好発する。CTでは鼠径管内や陰囊内への腹腔内腔器の脱出が認められれば診断は容易である。一方、下腹壁動脈の内側から鼠径管を通らずに直接脱出するもののが直接鼠径ヘルニアである。高齢男性に多いが、自覚症状は軽度で嵌頓することもまれである。下腹壁動脈の同定は造影CTを施行すれば可能であるが、多列検出器型CT（MDCT）で撮影すれば多断面画像が撮影されるため、断面画像の読影は可能となる。CTでは鼠径動脈の内側でヘルニア囲が下腿を作り、直接鼠径ヘルニアと鑑別が可能となる。骨盤部ヘルニアである閉鎖孔ヘルニアは外見上では腸管を認めないため、画像診断が重要となる。高齢でやせた女性に多いが、ヘルニア口が絞め細く強固なため診断を来しやすい。また、Richter's herniaも多発するが、直腸の腫瘍を膵脂の削減が難しいこともあり注意が必要である。CTでは腫瘤と内側に、切開を含むため診断を容易にする。また、Richter's herniaも概ね認められ、注意が必要である。CTでは骨髄と外臓筋縫の間に脱出した腸管が認められることが多い診断は容易であるが、閉鎖孔レベルまで撮像されないと診断できないため、坐骨下緑まで撮像することが肝要である。

キーワード 鼠径部ヘルニア、骨盤部ヘルニア、CT