



# A Radiological Review of the Unusual Contents of Inguinal Region

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## Abstract

**Background** The inguinal region is an area of complex anatomy that could contain diverse uncommon contents in routine clinical practice. Although inguinal hernia repair is one of the commonest surgeries done routinely, thorough preoperative imaging has a significant impact on the outcome of the surgery, by revealing the presence of unusual contents in the inguinal region.

**Aim** The aim of this article is to review the differential diagnosis of the uncommon inguinal pathologies, which can simulate an inguinal hernia, to determine, and to simplify the treatment approach.

**Conclusions** A profound understanding of the imaging characteristics of uncommon inguinal pathologies is crucial for both the radiologists (to prevent misdiagnosis) and the treating physicians (to avoid surgical complications) and ensure optimal management.

## Keywords

- ▶ inguinal hernia
- ▶ Amyand hernia
- ▶ ureteral hernia
- ▶ undescended testis
- ▶ inguinal canal

## Introduction

An inguinal hernia is a protrusion of the peritoneal sac through the anterior abdominal wall at the region of the inguinal canal. The hernial sac usually contains a part of the small intestine and the omentum. But it can rarely contain unusual contents as elaborated in this article. Their clinical presentations are vague and the imaging findings are subtle. The radiologists should be aware of these unusual presentations to help provide the right management options. An unusual presentation may pose a surgical dilemma during the hernia repair even to an experienced surgeon. This study aims to share our experience of such unusual contents in the inguinal hernia sac with a review of relevant literature.<sup>1</sup>

## Normal Anatomy of the Inguinal Canal

The inguinal canal is an oblique passage in the anterior abdominal wall that acts as a conduit for the spermatic cord to the scrotum in the males and the round ligament of the uterus to the labia majora in the females. It also transmits the ilioinguinal nerve and genital branch of genitofemoral nerve in both the sexes. The inguinal canal connects the two openings: the deep and superficial inguinal rings. The superficial inguinal ring is an inverted V-shaped triangular defect in the medial end of the external oblique aponeurosis, superolateral to the pubic tubercle. The deep inguinal ring is an oval opening in the fascia transversalis that lies halfway along the inguinal ligament posteriorly.<sup>2</sup> The normal contents of the inguinal canal are depicted in **Table 1**, and in **Figs. 1 and 2**.

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**Table 1** Normal contents of the inguinal canal

Male	Female
Spermatic cord	Round ligament
Ductus deferens	Ilioinguinal nerve to the labia majora
Testicular artery and veins Genital branch of the genitofemoral nerve Ilioinguinal nerve	Genital branch of genitofemoral nerve

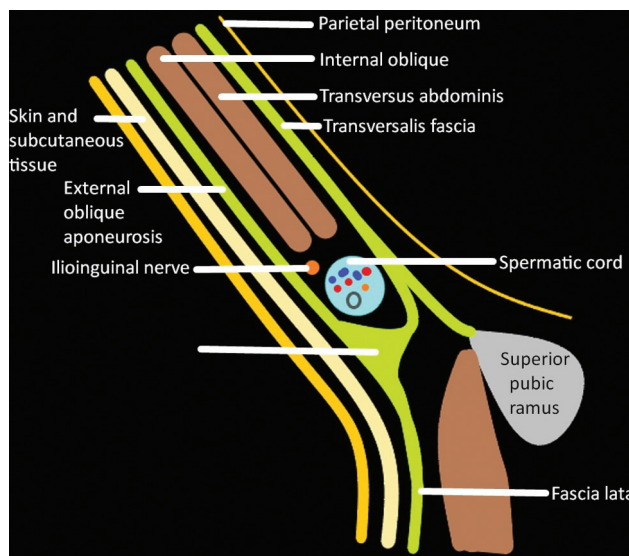
**Boundaries of the Inguinal Canal**

Following are the boundaries of inguinal canal:

- Anteriorly: External oblique aponeurosis and internal oblique aponeurosis
- Posteriorly: Conjoint tendon medially and fascia transversalis laterally
- Superiorly: Internal oblique and transversus abdominis muscles
- Inferiorly: Inguinal ligament and lacunar ligament<sup>2</sup>

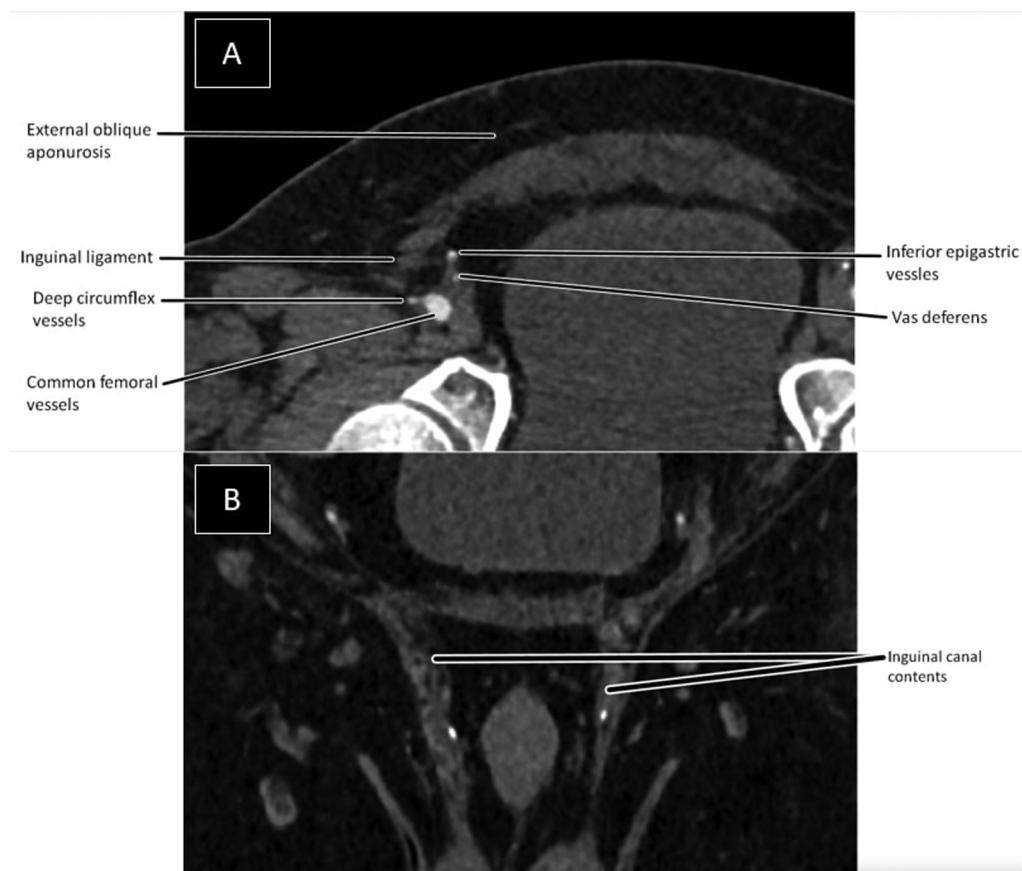
**Inguinal Hernia**

The inguinal hernias account for 75% of abdominal wall hernias, with a lifetime risk of 27% in men and 3% in women.<sup>3</sup> The inguinal hernia is classified into direct and indirect ingui-



**Fig. 1** Normal contents of the inguinal canal.

nal hernias (►Fig. 3). The indirect inguinal hernia is more common, usually congenital due to failure of embryonic closure of the processus vaginalis and it herniates lateral to the inferior epigastric artery. A direct inguinal hernia is usually acquired due to a weakness in the fascial floor of the inguinal canal and it herniates medial to the inferior epigastric artery.<sup>4</sup>



**Fig. 2** Axial (A) and coronal (B) computed tomographic image showing normal contents of the inguinal canal.

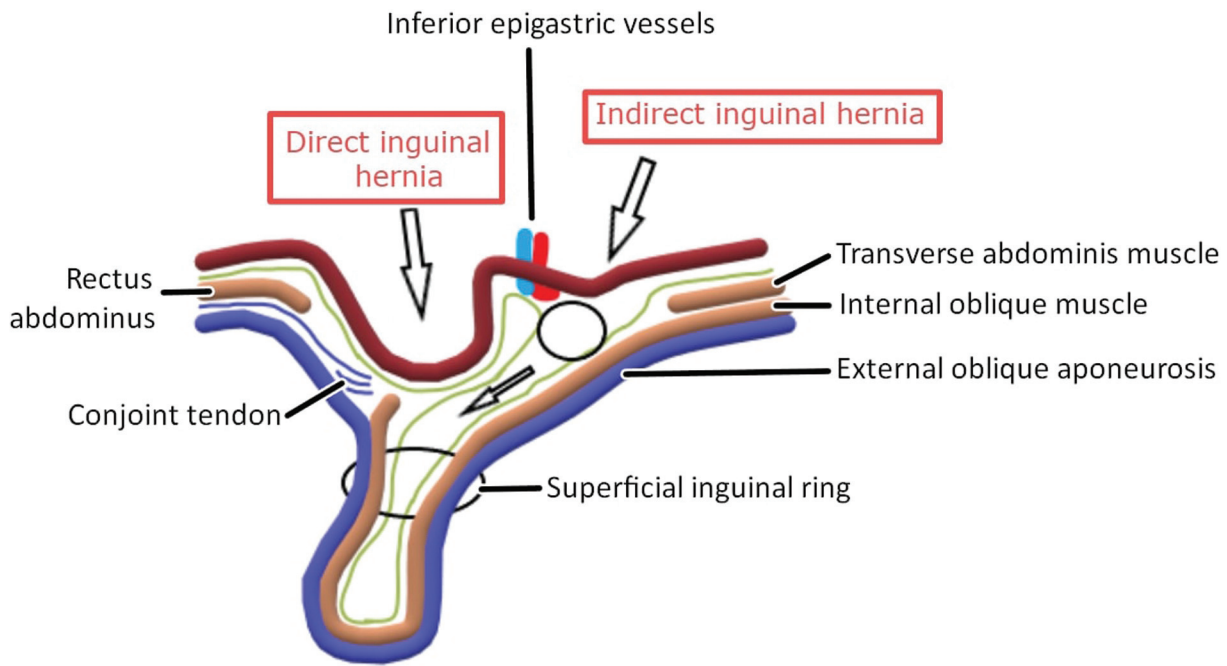


Fig. 3 Types of inguinal hernia.

**Role of Imaging**

Imaging plays a significant role in differentiating direct from indirect inguinal hernia in obese patients and patients with chronic pain. Ultrasound and computed tomography have been significantly used in our institution in clinically uncertain cases, for the preoperative evaluation of strangulated hernia and to assess the presence of any postoperative complications. multidetector computed tomography scan (MDCT) plays an invaluable role in evaluating irreducible inguinal hernia with an excellent spatial resolution and helps in differentiating various lesions that can mimic an inguinal hernia. Early detection of the inguinal region abnormalities can reduce the risk of morbidity and mortality and facilitate proper treatment. The unusual contents of the inguinal canal are broadly classified into two categories such as congenital and acquired pathologies as depicted in ►Table 2.

**Table 2** Unusual contents of the inguinal canal

Congenital	Acquired
Visceral organs	Visceral organs
Testis Ovary Uterus Fallopian tube	Appendix Ureter Urinary bladder Sigmoid colon Stomach
	Malignancy Malignant/metastatic lymph nodes Infection Abscess

**Herniation of Urinary Bladder**

The herniation of the urinary bladder in an inguinal hernia is a rare entity with an incidence ranging from 0.5 to 3% of reported hernia cases. This condition was first described by Levine in 1951 as a “scrotal cystocele.”<sup>5</sup> Various factors contribute to the development of urinary bladder hernias, such as bladder outlet obstruction causing chronic bladder distention and contact of the bladder wall with the hernial orifices, loss of bladder tone, obesity, pericystitis, perivesical bladder fat protrusion, and space-occupying pelvic masses.

These patients usually present with urinary retention or complaints of double voiding. Voiding cystourethrography is the best diagnostic imaging modality for inguinal bladder hernia. Abdominal CT is indicated in obese males, aged more than or equal to 50 years, with inguinal swelling and lower urinary tract symptoms. In such a case, the delayed phase of the contrast-enhanced CT study demonstrated the contrast-opacified urinary bladder lying within the hernia sac (►Fig. 4).

Urinary bladder hernias have been classified into three types based on their relationships with the peritoneum: paraperitoneal hernias, the most common type, in which the extraperitoneal portion of the hernia lies along the medial wall of the sac; intraperitoneal hernias, in which the herniated bladder is completely covered by peritoneum (►Fig. 4); and extraperitoneal hernias, in which the bladder herniates without any relation with the peritoneum.<sup>6</sup>

Anatomically, the inguinal hernias of the urinary bladder may be classified as indirect, entering through the internal inguinal ring and running laterally to the inferior epigastric artery, or direct, protruding through Hesselbach’s triangle of the posterior wall of the inguinal canal and running medially to the vessel.<sup>7</sup>



**Fig. 4** A 51-year-old male with complaints of abdominal distension and lower abdomen pain. Unenhanced computed tomography (CT) abdomen at the level of the pelvis in axial view (A) showing herniation of the urinary bladder (arrow) through the right inguinal canal, which is better visualized in contrast-enhanced scan in delayed phase in axial (B) and reformatted sagittal (C) view as the contrast filled bladder (arrow) is seen within the right inguinal hernia. A 55-year-old male with abdominal pain, vomiting, and burning micturition. Unenhanced CT abdomen at the level of the pelvis in axial (D), reformatted coronal (E), and sagittal (F) views showing herniation of the urinary bladder (arrow) into the right scrotal sac.

The herniation of the urinary bladder is associated with significant urological complications such as obstructive uropathy, urinary tract infections, perforation of the bladder, and bladder infarctions.

#### Ureteral Hernia

Inguinal herniation of the ureter is a rare condition, usually asymptomatic and diagnosed incidentally, but some of the patients may present with urinary symptoms such as dysuria, frequency, and urgency. Ureteral inguinal hernias are more common in the fifth and sixth decades of life with slight male preponderance.<sup>8</sup> It is important to diagnose this condition preoperatively as there is a high possibility of iatrogenic injury to the ureter during hernia repair, if the condition is not recognized.

CT urogram is the best method to identify this phenomenon. It is indicated as the first line of investigation for patients with groin lump and unexplained renal failure or unilateral hydronephrosis on ultrasound scan.

The ureteral inguinal hernia is classified into paraperitoneal and extraperitoneal types based on its relation with the peritoneum.<sup>9</sup>

Paraperitoneal inguinal herniation of the ureter is defined by a loop of the ureter that descends with a peritoneal sac into the hernia (→Fig. 5). This is an acquired pathology,

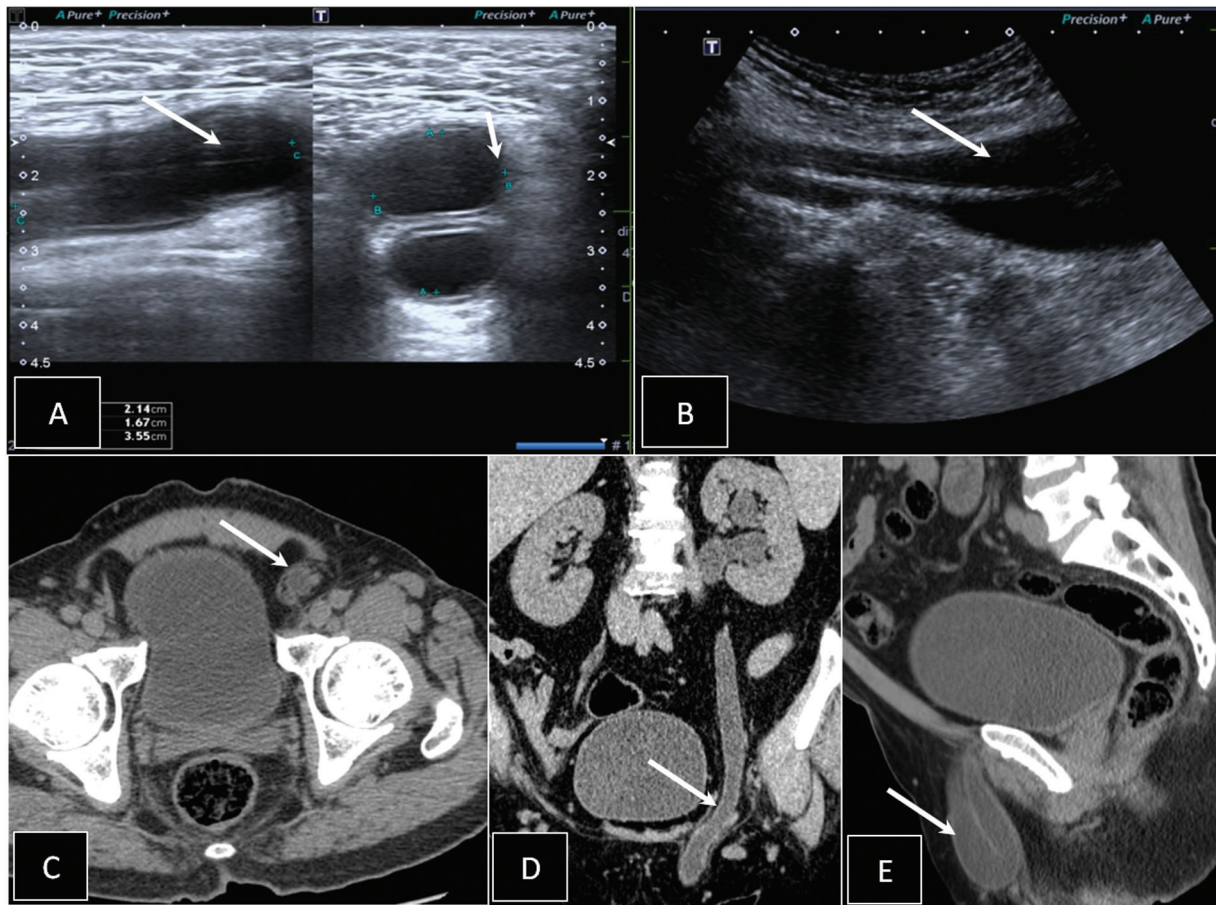
highly associated with kidney transplants, and intra-operative transplant risk factors such as excess length of the grafted ureter and passing the ureter over the spermatic cord.

Extraperitoneal inguinal herniation of the ureter is rarer than the paraperitoneal type. It is mostly due to congenital malformation, caused by the failure of the ureter to separate from the mesonephric duct during development. It is commonly associated with other genitourinary abnormalities such as crossed renal ectopia and nephroptosis.

#### Herniation of Female Genital Organs

Inguinal hernias containing the ovaries (→Fig. 6) and uterus (→Fig. 7) are rare entities but comparatively more common in female infants than adults. It is usually associated with congenital genitourinary tract anomalies such as Mayer-Rokitansky-Küster-Hauser syndrome. A female infant with an inguinal hernia should be thoroughly evaluated to determine whether the contents include ovaries or not because the ovaries are at increased risk of incarceration and infarction.<sup>10</sup> Incarceration of the ovary is common and has been reported in up to 43% of cases.<sup>11</sup> Herniation of female genital organs in inguinal hernia is usually due to incomplete closure of the processus vaginalis of the peritoneum during embryogenesis. Normally the processus vaginalis along with the



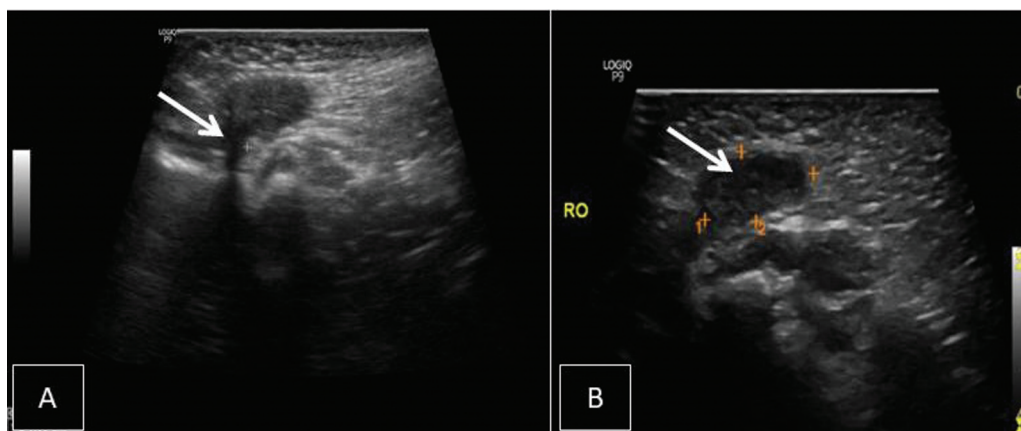


**Fig. 5** A 60-year-old male with swelling in the left groin. Ultrasonogram images (A and B) showing a tubular fluid-filled structure (arrow) seen entering the left inguinal canal, looping within and passing back into the abdominal cavity, suggestive of a possible left ureteral inguinal hernia. Unenhanced computed tomography abdomen at the level of the pelvis in axial (C), reformatted coronal (D), and sagittal (E) views showing the left ureter [arrow] extending into the left inguinal canal and looping back to insert into the bladder.

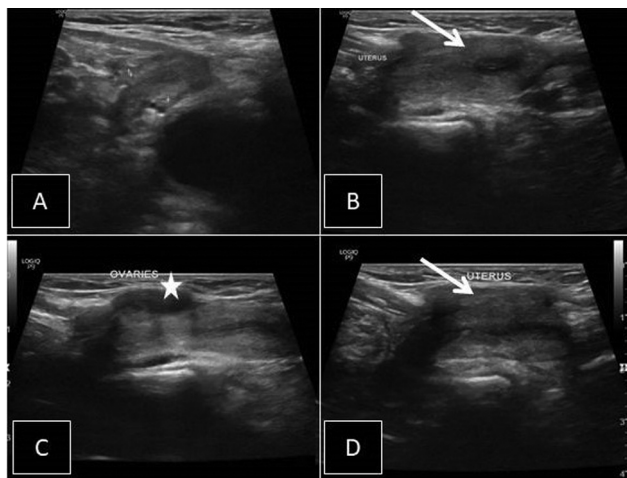
round ligament of the uterus passes through the inguinal canal toward the labia majora. The processus vaginalis usually disappears by 8 months of gestation. If its patency persists, the patent processus vaginalis is termed as the canal of Nuck. Ultrasonography with a high-frequency transducer is the imaging modality of choice for evaluating inguinal hernia in infants.

### Undescended Testis in Inguinal Canal

Testicular descent is a complex kinetic process. The testes develop in the dorsal abdominal wall and migrate toward the inguinal canal through the deep inguinal ring at around 21 weeks of gestation. The gubernaculum connects the testes to the scrotum. Under testosterone influence, the gubernaculum contracts, then the testes migrate into the scrotum at around 30 weeks.<sup>12</sup>



**Fig. 6** A 2-month-old female baby with swelling in the right groin region. Ultrasonogram images showing right direct inguinal hernia with right ovary (arrow in B) as herniating content through a defect (arrow in A).



**Fig. 7** (A–D) A 2-month-old female infant with swelling in the right groin region. Ultrasonogram images showing herniation of the uterus (arrow) and right ovary (star) into the right inguinal hernia.

About 1 to 3% of full-term infants and approximately 15 to 30% of premature infants will have undescended testis at birth.<sup>13</sup> The incidence of undescended testis in the inguinal canal (►Fig. 8) is 70% when compared with other locations of undescended testis.<sup>14</sup> In rare cases of androgen insensitivity syndrome, the phenotypic females despite of having func-

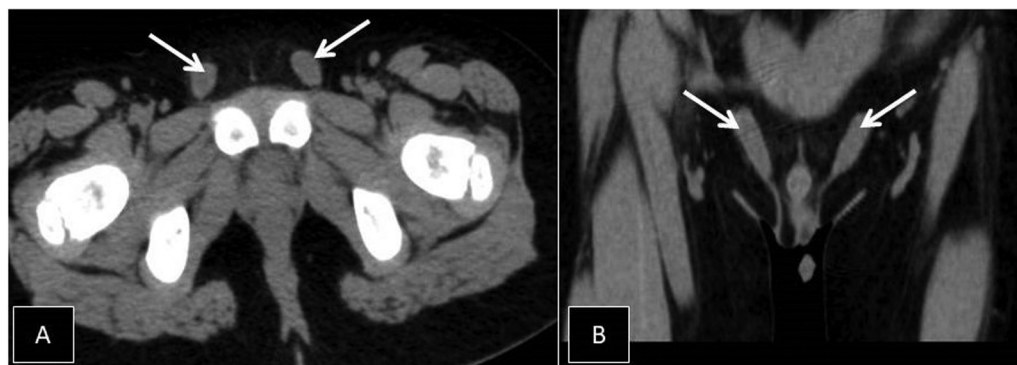
tional testes and normal male karyotype usually present late with primary amenorrhea. Delayed diagnosis in such cases increases the chance of gonadal malignancy. Early diagnosis in such cases with a combined approach of clinical suspicion and imaging in female infants with an inguinal region swelling can reduce the chance of malignant transformation.

### Herniation of Sigmoid Colon

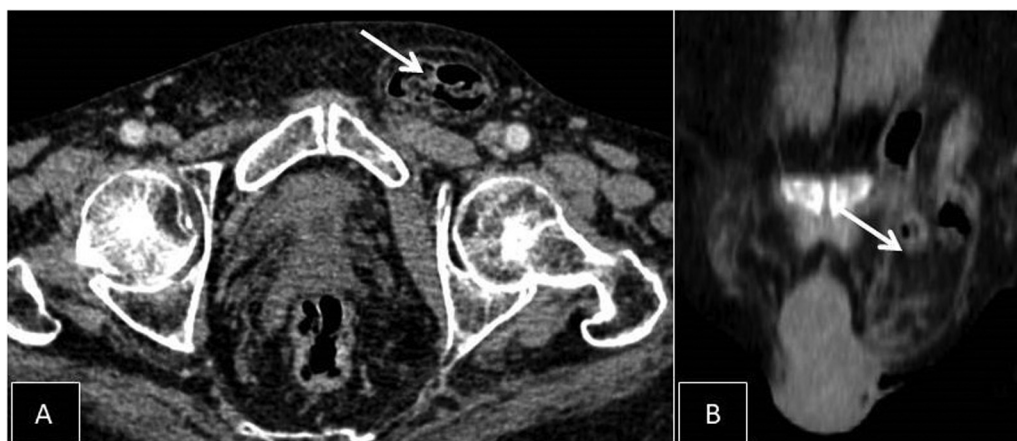
The visceral content of the inguinal hernia sac is commonly a small bowel loop. Rarely, the sigmoid colon can herniate as content (►Fig. 9). Forsaken inguinal hernias may lead to grievous results in certain patients.<sup>15</sup> If a sigmoid colon inguinal herniation is missed, it can lead to devastating complications such as bowel obstruction, strangulation, and infarction. A thorough preoperative evaluation is needed to exclude other associated intra-abdominal pathologies.

### Herniation of Appendix (Amyand Hernia)

Amyand's hernia is a rare type of inguinal hernia in which the appendix is trapped within the herniated sac (►Fig. 10). Though the incidence of Amyand hernia is uncommon, the appendix may become incarcerated within the hernia and can lead to further complications such as strangulation and perforation. Amyand's hernia is named after Claudius Amyand, who performed the first successful appendectomy for an 11-year-old boy who presented with a right inguinal

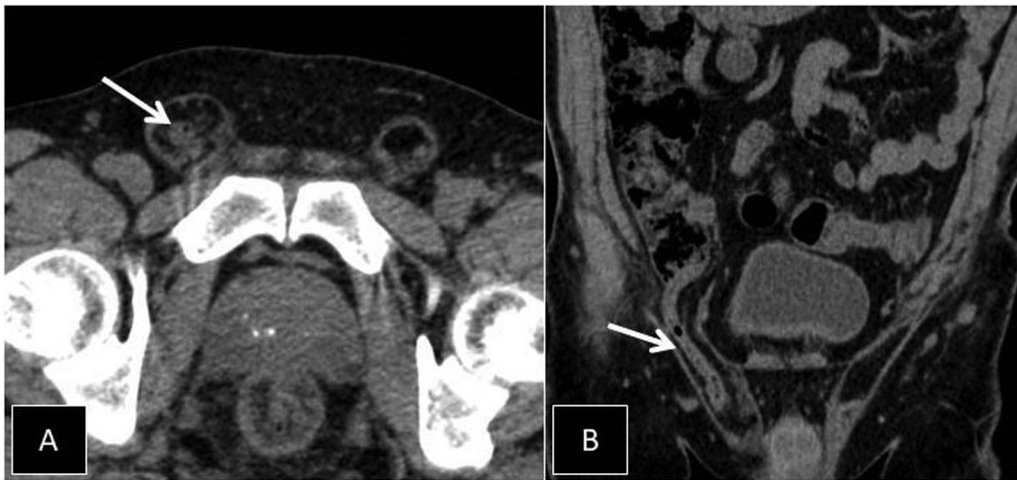


**Fig. 8** A 5-year-old male child with abdomen pain. Unenhanced computed tomography abdomen at the level of the pelvis in axial (A) and reformatted coronal (B) views showing bilateral testis (arrow) in the inguinal canal.



**Fig. 9** (A and B) An 89-year-old male patient's left inguinal swelling. Contrast-enhanced computed tomographic abdomen in venous phase at the level of the pelvis showing sigmoid colon [arrow] herniating content in the left inguinal canal.





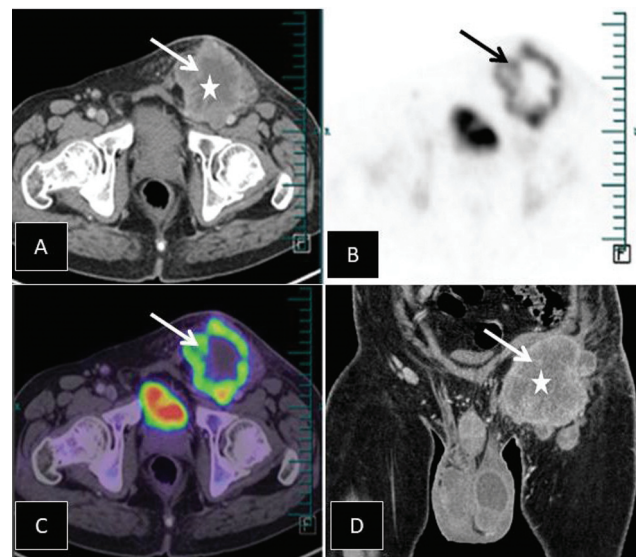
**Fig. 10** A 56-year-old male patient came with abdominal pain and low backache. Unenhanced computed tomography abdomen at the level of the pelvis in axial (A) and reformatted coronal (B) sections showing blind-ending tubular appendix (arrow) arising from the cecum and entering the right inguinal canal.

hernia. The incidence of Amyand's hernia varies from 0.19 to 1.7% of reported hernia cases.<sup>16</sup> Amyand's hernia is more common in children than in adults, due to the patency of the processus vaginalis at a young age. Few works of literature state that Amyand hernia is more common in males and always on the right side.<sup>16</sup>

The clinical symptoms can be misleading and more often resemble those of strangulated inguinal hernia than the classic signs and symptoms of appendicitis. Before the advent of MDCT, these hernias were usually diagnosed during surgery, but now it can be diagnosed preoperatively and help the surgeon be prepared for the course of management.

### Lymph Nodes in Inguinal Region

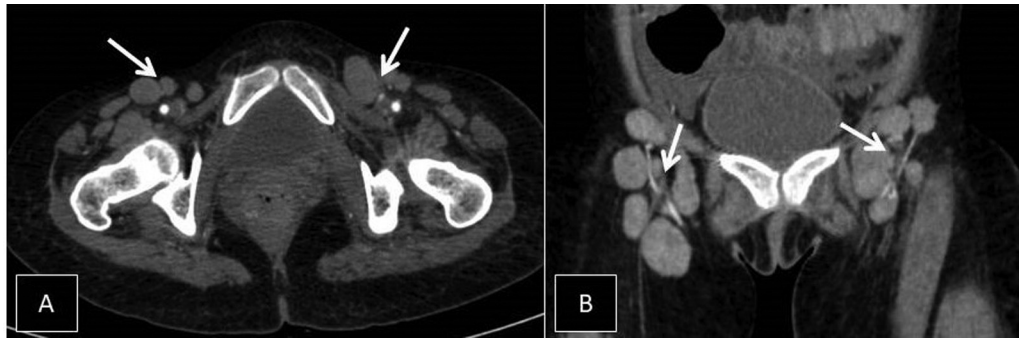
Lymph nodes in the inguinal region are often incidentally identified during routine imaging of the abdomen and pelvis. Distinguishing between reactive lymph nodes (→ Fig. 11) from malignant lymph nodes (→ Figs. 12–14) can be a challenging task. Various imaging methods should be used to characterize lymph nodes with regard to the size, shape, internal characteristics, and blood flow patterns. No standard imaging criteria available to rule out malignancy, as the possibility of lymph node metastasis exists regardless of



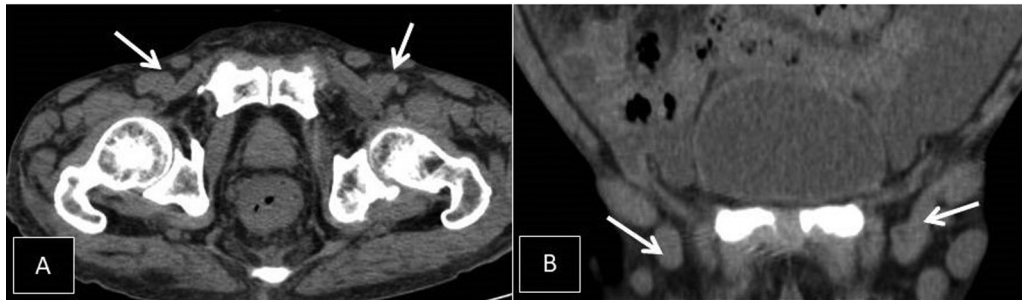
**Fig. 12** A 63-year-old male patient's k/c/o penile malignancy. Contrast-enhanced computed tomography abdomen in venous phase at the level of the pelvis in axial (A) and reformatted coronal (D) views showing large lymph nodal mass lesion (arrow) with central areas of necrosis (star). Increased area of metabolic activity (B, C) in the left inguinal region shown in positron emission tomography-computed tomography.



**Fig. 11** A 59-year-old female patient left inguinal swelling, unenhanced computed tomography abdomen at the level of the pelvis in axial (A) and reformatted coronal (B) views showing enlarged lymph nodes (arrow) in the bilateral inguinal canal.



**Fig. 13** A 25-year-old female patient's k/c/o small bowel (ileocolic junction) B cell lymphoma with abdominal pain. Contrast-enhanced computed tomography abdomen in venous phase at the level of the pelvis in axial (A) and reformatted coronal (B) views showing multiple large lymph nodal mass lesions (arrow) in the bilateral inguinal region.



**Fig. 14** A 78-year-old male patient's k/c/o retroperitoneal lymphoma. Noncontrast-enhanced computed tomography abdomen at the level of the pelvis in axial (A) and coronal (B) sections showing multiple large lymph nodal mass lesions (arrow) in the bilateral inguinal region.

nodal size, as early microscopic involvement may not show any gross abnormalities on imaging. Inguinal lymph nodes are the most common sites of metastasis for malignant lymphoma (►Figs. 13 and 14), squamous cell carcinoma of the anal canal, vulva and penis (►Fig. 12), malignant melanoma, and squamous cell carcinoma of skin over lower extremities or trunk.<sup>17</sup> Metastasis to lymph nodes has a significant impact on staging each pelvic tumor, treatment, and the prognosis.

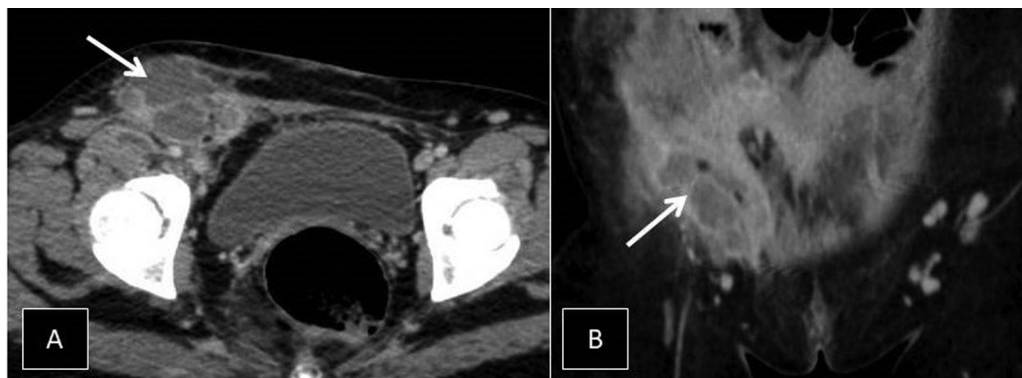
#### Inguinal Region Abscess

Abscesses involving the inguinal region (►Fig. 15) are often seen as manifestations of complex soft-tissue infections or intra-abdominal pathologies. The inguinal region communicates with the peritoneal or retroperitoneal space and thigh

through several paths, such as the psoas sheath, femoral canal, sacrosciatic notch, pudendal canal, and obturator foramen.<sup>18</sup> It has been reported that inguinal abscesses might extend from peritoneal or retroperitoneal abscesses. The primary causes of an inguinal abscess may be ruptured appendicitis, colonic diverticulitis, and pyelonephritis.<sup>19</sup> Hence, the abscess may be of extrapelvic or intrapelvic origin. CT or magnetic resonance imaging helps assess the extent of the abscess and aids in deciding the treatment plan.

#### Conclusions

The unusual inguinal region contents present a diagnostic dilemma to the operating surgeons and hence imaging plays



**Fig. 15** A 29-year-old female patient's c/o right inguinal region swelling. Contrast-enhanced computed tomography abdomen in venous phase at the level of the pelvis in axial (A) and reformatted coronal (B) views showing peripherally enhancing collection (arrow) in the right inguinal region.



a significant role in arriving at an accurate diagnosis and thereby reducing the rate of injury to the organs found in the hernia sac. MDCT is often required to complement the ultrasonography in demonstrating the rare contents.

#### Availability of Data and Material

The data are taken solely from our institution.

#### Author Contributions

G.G. did the major write up of this review article. Majority of the cases in this review article were diagnosed and followed up by R.R. and V.B.R.R. The work was carried under the guidance R.R. and provided us the insight and knowledge to diagnose indeterminate lesions with imaging alone. All the authors read the rough draft and provided valuable suggestions for the final draft. V.B.R.R. reviewed this article for corrections and final draft.

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#### Conflict of Interest

None declared.

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