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Urinary bladder herniation: CT evaluation

Dimitrios Kourdakis MD[1], Maria-Michailia MD[1], Eleni Makridou MD[1], Elena Hadjichristou MD[1], Ouroumidou Kristina MD[2], Manavi Aikaterini MD[1]

[1]*Agios Dimitrios General Hospital, Department of Radiology*

[2]*G. Gennimatas General Hospital Thessaloniki, Department of Radiology*

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ABSTRACT

Purpose: To evaluate the role of computed tomography (CT) in the diagnosis and characterization of urinary bladder herniation, an uncommon and often underdiagnosed condition, with emphasis on its anatomical patterns and imaging features essential for accurate diagnosis and preoperative planning.

Material and Methods: A retrospective review was conducted over a six-year period, from January 2019 to May 2025. Inclusion criteria were (1) imaging-confirmed urinary bladder herniation and (2) availability of complete clinical history, including presenting symptoms and physical examination findings. Imaging protocols included pre-contrast, post-contrast, and delayed-phase scans with a focus on the lower pelvis. Multiplanar reconstructions were routinely performed.

Results: Urinary bladder herniation was identified in six patients, in which four of them the herniated bladder extended into the scrotum, consistent with inguinoscrotal herniation. Four of the patients were diagnosed incidentally on CT scans for other purposes and two presented with symptoms. All hernias were unilateral, with five occurring on the right side and one on the left. The cohort included four male and two female patients.

KEY WORDS

Inguinal hernia, Urinary bladder, CT, Urinary bladder hernia

CORRESPONDING AUTHOR, GUARANTOR

Dimitrios Kourdakis, MD
Agios Dimitrios General Hospital, Department of Radiology
Thessaloniki, Greece, Elenis Zografou 2, 54634
E-mail: dimitriskourd1@gmail.com
Tel: +306980385351

Conclusions: Urinary bladder herniation is a rare condition but should always be considered in the differential diagnosis of inguinal hernias, particularly in older male patients. CT imaging plays a pivotal role in the detection and evaluation of urinary bladder herniation, providing crucial information for diagnosis and surgical planning.

Introduction

Urinary bladder hernia is an uncommon clinical entity. It was first recorded in the Middle Ages by Plater in 1550. Most bladder hernias involve the inguinal and femoral canals (75% and 23% respectively), with a predisposition/ tendency for the right side been reported. Rarely, herniations through ischiorectal, obturator, rectus abdominus (Gironcoli hernia) and abdominal wall openings have also been described (2%).[1],[2] The incidence rate of bladder involvement is ranging between 1-4% of all inguinal hernias and around 10% in men older than 50 years.[3]

The majority of patients present with no symptoms and bladder herniation is found incidentally on diagnostic imaging examinations or intraoperatively at the operation theatre. In symptomatic cases, patients usually present with atypical symptoms such as dysuria, urinary urgency, inguinal swelling and left or lower quadrant abdominal pain. The standard treatment of bladder hernias is the surgical repair with a mesh to prevent recurrence.

Material and Methods

We searched for patients with herniation of the urinary bladder in a period of 6 years, from January 2019 to May 2025. Inclusion criteria were (1) imaging confirmation of urinary bladder herniation and (2) availability of complete clinical history, including symptoms and physical examination findings. Patients who did not meet these criteria were excluded from the study. All patients underwent computed tomography (CT) imaging using Siemens Somatom 32-slice CT scanner.

The CT protocol included scans before and after intravenous contrast administration, as well as delayed phase images focused on the lower abdomen and pelvis to better assess the extent of bladder involvement. Multiplanar reconstructions were systematically performed in sagittal and coronal planes to enhance visualization of the herniated bladder component, assess its anatomical relationships, and confirm continuity with the orthotopic portion of the urinary bladder.

Results

A total of six adult patients (four males and two females), aged between 40 and 76 years (mean age: 61.3 years), were included in the study. All patients had imaging-confirmed urinary bladder herniation identified on CT scans. One patient was excluded due to lack of clinical information. None of the patients had a prior diagnosis of bladder herniation before the CT examination.

The majority of patients (n=5, 83,3%) presented with right-sided inguinal herniation of the bladder. (Figure 1A, 1B, 2) Only one case (n=1, 16.7%) involved the left inguinal canal. (Figure 3A, 3B) In four of the patients, the herniated bladder extended into the scrotum, consistent with inguinoscrotal herniation.

Clinical presentation varied among patients. Two individuals reported lower urinary tract symptoms such as dysuria, urinary frequency, or a sensation of incomplete emptying. The remaining four cases were asymptomatic and diagnosed incidentally during CT scans performed for unrelated reasons. No signs of bladder wall ischemia, diverticula, stones or urinary bladder cancer were identified in any of the cases.

Delayed-phase imaging was essential in clearly delineating the extent of bladder involvement and confirming the communication between the herniated segment and the orthotopic portion of the urinary bladder.

Discussion

Epidemiology

As mentioned above, inguinal bladder hernias account for 1-4% of all inguinal hernias and mostly occur in male patients over the age of 50, usually on the right side, in contrast to femoral bladder hernias which are more commonly observed in women. The incidence in the pediatric population is extremely low, with only two cases identified in a cohort of 6,361 inguinal hernia patients (0.03%) reported by a single author.[4] Becker et al. classified inguinal hernias in regard to their relation to the peritoneum in three categories:

1) Paraperitoneal hernias: the bladder remains extraperitoneal and is medial to the peritoneal herniation (most common category). This can be seen in either direct or indirect inguinal hernias,

2) Intraperitoneal hernias: the bladder is completely covered with peritoneum in the hernial sac and

3) Extraperitoneal hernias, where the bladder herniates alone without the peritoneum. The degree of herniation can vary from a small protrusion to whole bladder herniation, always containing all segments of the bladder wall.[1] Anatomically, inguinal bladder hernias can be classified as direct or indirect, depending on whether they protrude medially through Hesselbach's triangle or laterally through the internal inguinal ring.[5]

Pathophysiology and Risk Factors

Bladder herniation is thought to occur due to persistent elevation of the intravesical pressure and weakening of the bladder's musculature leading to loss of bladder tone, in combination with an increased abdominal wall compliance. The aforementioned create a weak spot in the abdominal wall, allowing the "stretched" urinary bladder to protrude. Risk factors associated with bladder herniation are increased age, obesity, male gender (especially for inguinal bladder hernia), bladder outflow obstruction (due to benign prostatic hyperplasia, prostate cancer, bladder neck strictures, direct inguinal hernia, pelvic masses) causing urinary bladder distention and movement proximal to the hernia orifices[6], pericystitis and perivesical bladder fat protrusion[5], [positive family history, chronic obstructive pulmonary disease, smoking, increased intraabdominal pressure, weak pelvic musculature, collagen vascular disease].[2]

Clinical Image and Physical Examination

Patients with urinary bladder hernia are typically asymptomatic. In asymptomatic patients, diagnosis is made as an incidental finding in imaging examination or intraoperatively. According to research, less than 7% of bladder hernias are diagnosed preoperatively, around 16% are diagnosed postoperatively because of existing complications and the rest percentage perioperatively.[3] In our opinion, due to recent technological advances and vast increasing number of imaging examinations, these percentages have changed in favor of preoperative finding in imaging both in asymptomatic and symptomatic patients. Our opinion is also supported by Branchu et al. [7]. When patients are symptomatic, they usually present with non-specific symptoms such as urinary frequency, inguinal swelling, left or right lower quadrant abdominal pain, urinary urgency, hematuria, nocturia. In cases with large hernias, when the herniated bladder gets trapped within the inguinal canal, it could make its way to the scrotum, condition referred as scrotal cystocele. (first description was made in 1951 by Levine)[8].

This entity can present as intermittent scrotum swelling, urinary tract infection or in more advanced cases as two-stage micturition, a situation in which initially the patient empties the normally located bladder and then voids again after manual compression of the hernia sac in the scrotal region. After that, a reduction in the size of the hernia is observed. In literature this is known as Mery's sign.[7] The two-stage urination symptom or the reduction in size of the hernia mass after micturition appears to be pathognomonic of inguinal-scrotal bladder hernia.

On physical examination especially in large hernias, when maneuvers are attempted to reduce the hernia, the patient may complain of urinary urgency. In a review of 190 cases, Oruç et al. found that 23.5% of bladder hernias were associated with various complications.[9] Larger hernias are particularly prone to adverse outcomes such as bladder incarceration or necrosis, bladder hemorrhage, ischemia or infarction (due to strangulation)[10], bladder rupture, obstructive or neurogenic bladder dysfunction, urinary tract infections, epididymitis, scrotal abscesses, vesicoureteric reflux, cystolithiasis (due to poor drainage), hydronephrosis and renal failure (especially in cases when a ureter herniates into the sac along with the bladder or independently[11]).[12],[9] Another interesting complication is malignancy. Oruç et al revealed 11% (13/116 cases) incidence of genitourinary malignancy in patients with inguinal bladder hernia. (9/116 were reported as bladder carcinoma, 3/116 as prostate carcinoma and 1/116 as a neoplasm).[9]

Pediatric Population

Bladder herniation is a very rare entity in pediatric population. In young infants less than 6 months of age, is thought to represent a variation of normal development.[5] In infants and young toddles, the bladder is positioned more superficially within the abdomen compared to adults. Due to anatomical differences—including a relatively large inguinal ring and the more anterior and caudal position of the bladder—the lateral

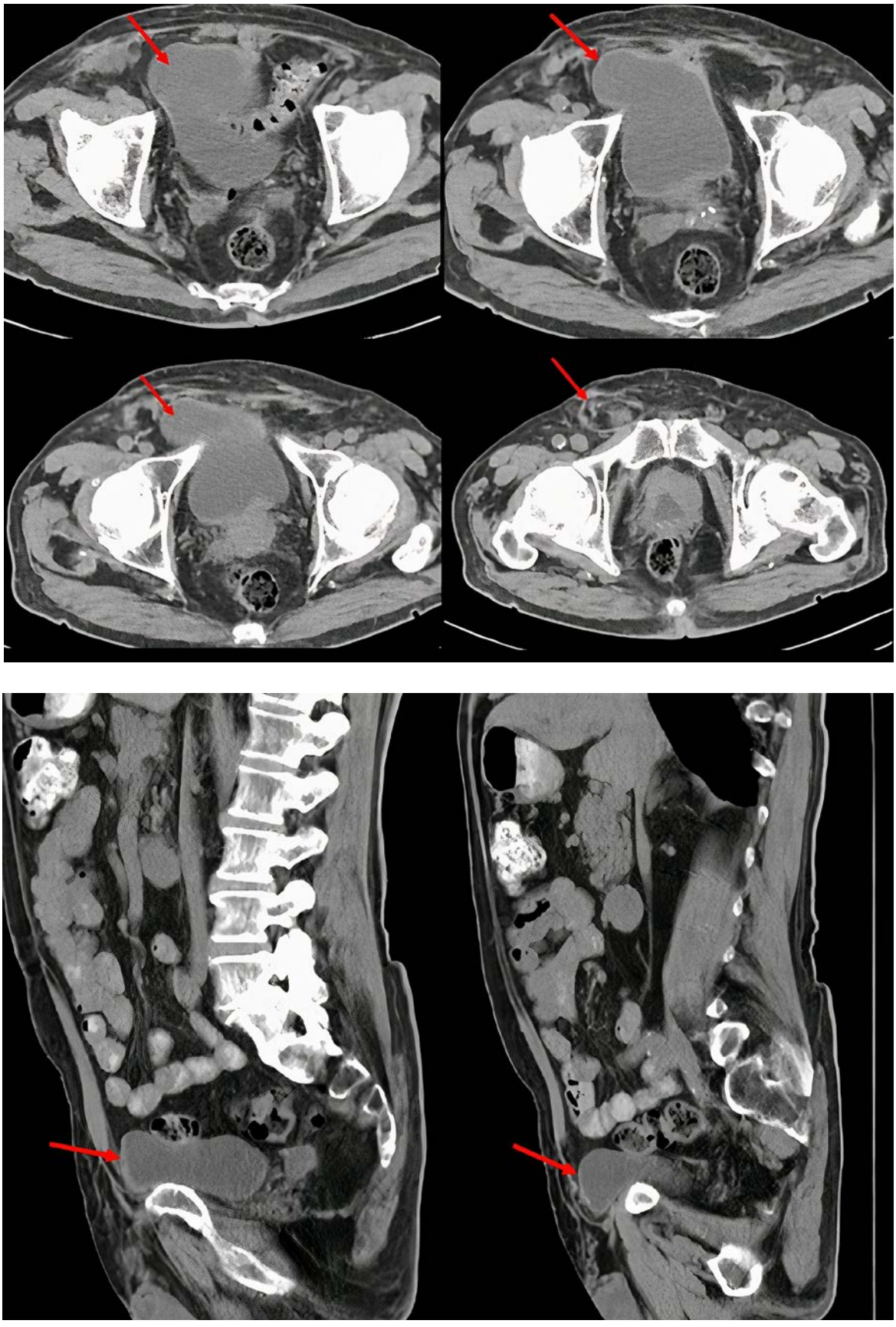

Figure 1 A(Axial) and B (Sagittal): *CT images which reveal right inguinoscrotal herniation of the urinary bladder.*

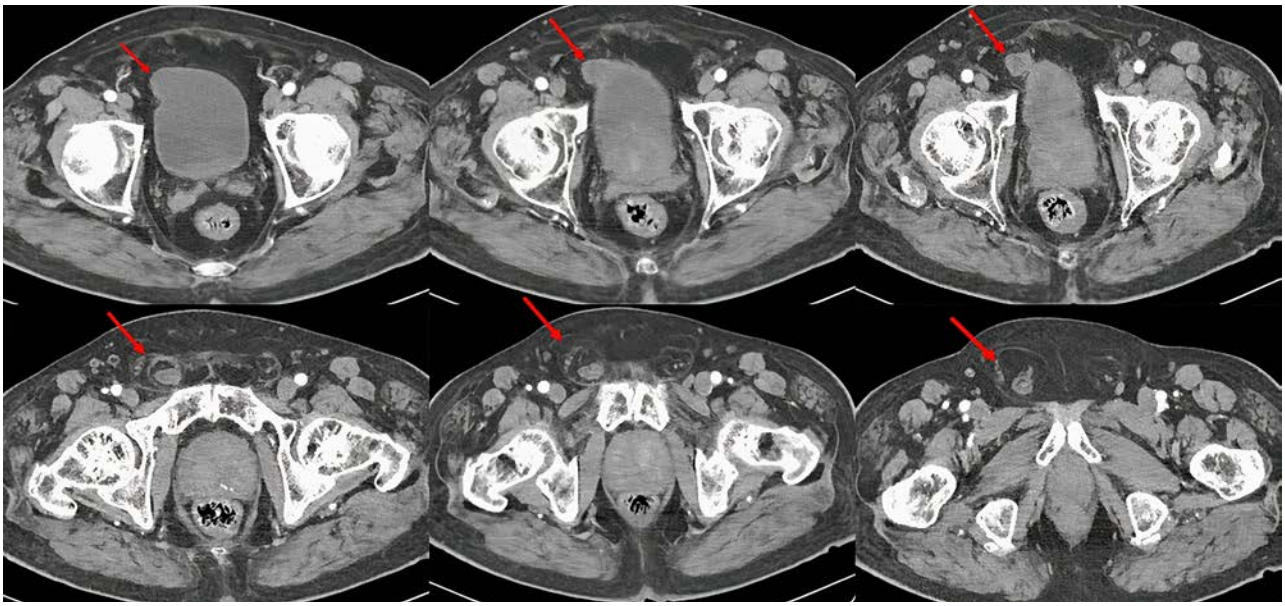

Figure 2: (Axial): *CT images which reveal right inguinoscrotal herniation of the urinary bladder.*

bladder wall lies closer to the internal inguinal ring, allowing greater lateral mobility. This can result in transient bladder protrusions, known as bladder ears. Allen et al. also observed that these bladder ears occurred when the bladder was only partially filled and disappeared with complete filling of the bladder or with the onset of micturition.[13]

As in adults, in children it is more common in males and appears more often on the right side. However, unlike adults, children usually don't present with typical symptoms or cannot articulate them due to their age limitations. The incidence of bladder hernias is more prevalent in premature infants, where increased intra-abdominal pressure due to CPAP ventilation and repeated squeezing of the immature intestine appear as contributing factors. Diagnosis is usually made post-operatively from the complications, such as urinary leakage, fluid seeping from the incision, abdominal distention, anuria, peritonitis or swelling in the inguinal and scrotal region or intraoperatively.[14]

This differentiates from the adults, because of the limited number of diagnostic exams in small age groups, as well as the increased movement ability of the bladder in small ages —frequently shifting depending on its filling status— (protrusions disappearing with full-filled or full empty bladder). To avoid inadvertent injury, Aloi et al. suggests the emptying of the bladder before any surgery on the inguinal canal in infants and young children.[15]

Imaging

Incidental detection of urinary bladder herniation most commonly occurs via ultrasound (US) or Computed Tomography (CT), which are frequently employed in the evaluation of groin-related symptoms or other abdominal pathologies. It may also be identified on Magnetic Resonance Imaging (MRI), especially during staging procedures for prostate cancer or for the assessment of lower abdominal masses. In symptomatic cases, US and CT are also the first line imaging modality. Male, obese patients over 50 years old with urinary tract symptoms, with or without history of inguinal hernia should raise high clinical suspicion for containing part of the urinary bladder in the hernia sac. The high clinical index could avoid surgical complications including bladder injury, which occurs in 12% of hernia repairs.[16] That is the reason why a correct preoperative management is necessary to prevent any iatrogenic injury to the bladder.

- **Ultrasound:** is usually helpful in large blader hernias which protrude in the scrotal region. US is requested for initial characterization of a scrotal mass. Diagnostic criteria can be a hypoechogenic "mass like lesion" protruding from the bladder through the inguinal canal[11], a fluid-filled lesion at the scrotum that can often be followed cranially to join the intraabdominal portion of the bladder. Changing in the position, the volume and the thickening of the lesion after urination is highly diagnostic.[5]

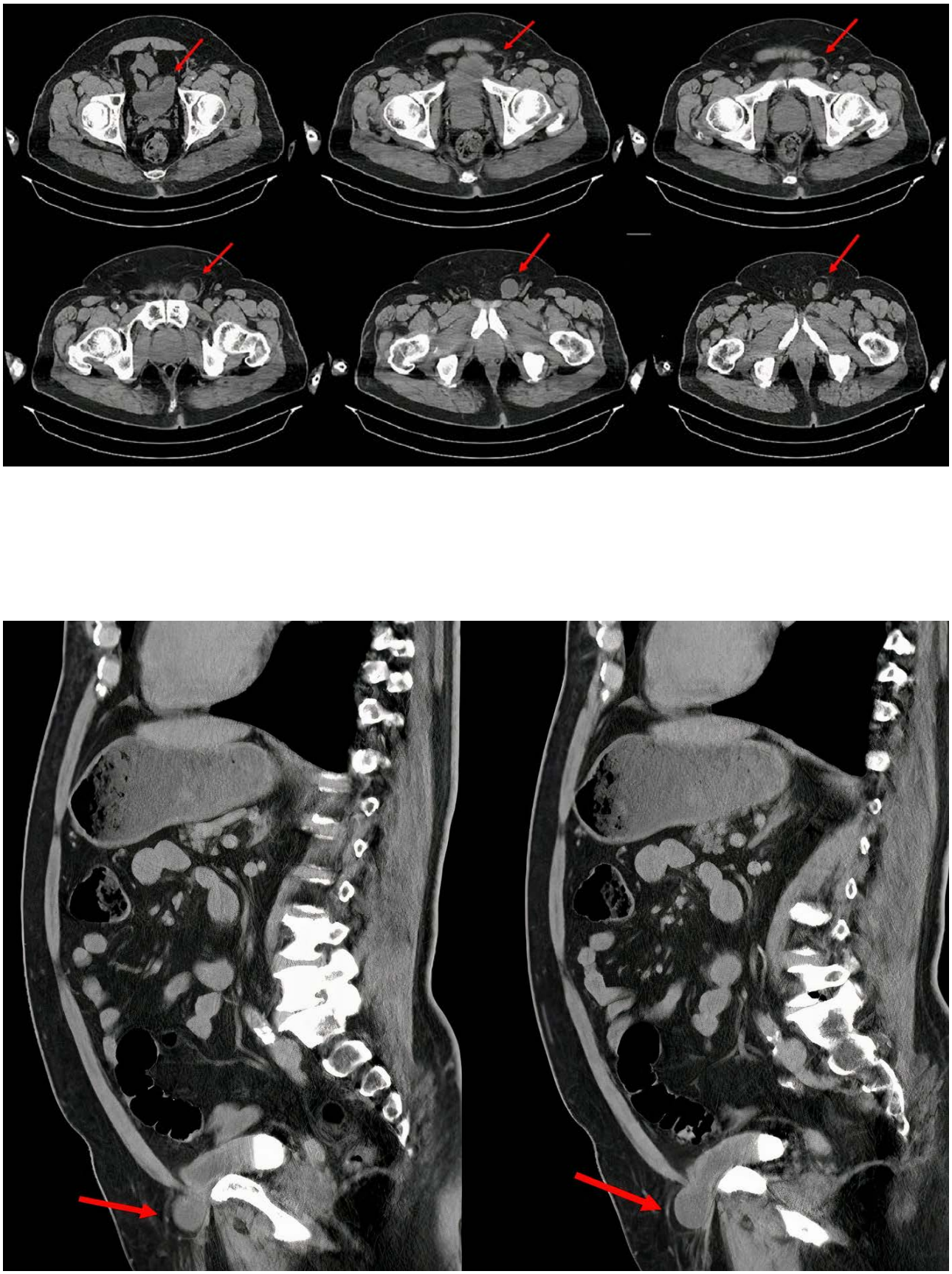

Figure 3 A(Axial) and B (Sagittal): *CT images which reveal left inguinoscrotal herniation of the urinary bladder.*

- **CT:** CT scan can be more beneficial than US in cases of obese patients, patients with inguinal swelling and patients with multiple bladder diverticula. In small bladder hernias, the sign pointing at bladder herniation is direction/bending/expanding of the bladder towards the side of the hernia. In larger bladder hernias, it is possible to locate part of the bladder into the inguinal canal or in the scrotal area with mild thickening and irregular border of the hernial part. In cases when contrast medium cannot be administered, identification of bladder's thick wall surrounding unopacified urine can suggest the diagnosis.[5] Coronal and sagittal reconstruction can be also helpful, especially in complexed cases. Furthermore, CT allows simultaneous comprehensive assessment of potential complications, surrounding pelvic anatomy, as well as in the identification of other possible coexisting hernias.
- **MRI:** Bladder herniation is usually an incidental finding on MRI examinations performed for other purposes, most commonly for prostate gland or pelvic mass evaluation. Nevertheless, it can be used to clarify the sonographic or CT findings. MRI's high resolution can provide useful information about the rest of the structures in the inguinal or femoral canal and about the relation of the hernia to the vascular landmarks, such as the inferior epigastric vessels.
- **Retrograde Cystography:** It is considered to be the gold standard technique to image a bladder hernia. Filling phase of cystography may not reveal the bladder herniation, which could be visible only in voiding or post-voiding phases. This could be explained due to the high intravesical pressure during voiding which allows the contrast medium to slide through the herniated portion of the bladder.[5] The defining feature is a "dog-ear" or "dumbbell" shape of the bladder, found in the voiding phase.[2] Voiding cystourethrography is recommended in cases where the suspicion of inguinal bladder hernia is high, or in cases where initial imaging with US or CT is inconclusive.[17]
- **Excretory Urography:** Bladder herniation may be suspected when asymmetry of the bladder wall is seen in the pelvis.[1] Possible findings may be a rounded protrusion of the bladder wall directed downward in anteroposterior projections and protruding areas laterally and inferiorly in oblique projections. Moreover, patient's position plays a very important role, as bladder hernias can be reliably identified in 100% of cases only when erect imaging is performed. Comparably, only 30% of hernias can be detected on supine films and more than 50% on prone position.[5]
- **Cystoscopy:** is usually used to confirm diagnosis after an inconclusive CT scan and to rule out additional pathology of the bladder.[17]

Conclusion

Although urinary bladder herniation remains a rare and usually incidental finding, increased awareness among radiologists and clinicians is essential in order to prevent misdiagnosis and avoid potential intraoperative bladder injury. CT imaging represents a highly valuable diagnostic tool for urinary bladder herniation due to its wide availability, short examination time and capability to simultaneously evaluate surrounding pelvic and abdominal structures, making it an indispensable tool in preoperative assessment. R

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