

Cysts of the Lower Male Genitourinary Tract: Embryologic and Anatomic Considerations and Differential Diagnosis¹

TEACHING POINTS

See last page

Haytham M. Shebel, MD • Hashim M. Farg, MSc • Orpheus Kolokythas, MD • Tarek El-Diasty, MD

Cysts of the lower male genitourinary tract are uncommon and usually benign. These cysts have different anatomic origins and may be associated with a variety of genitourinary abnormalities and symptoms. Various complications may be associated with these cysts, such as urinary tract infection, pain, postvoiding incontinence, recurrent epididymitis, prostatitis, and hematospermia, and they may cause infertility. Understanding the embryologic development and normal anatomy of the lower male genitourinary tract can be helpful in evaluating these cysts and in tailoring an approach for developing a differential diagnosis. There are two main groups of cysts of the lower male genitourinary tract: intraprostatic cysts and extraprostatic cysts. Intraprostatic cysts can be further classified into median cysts (prostatic utricle cysts, müllerian duct cysts), paramedian cysts (ejaculatory duct cysts), and lateral cysts (prostatic retention cysts, cystic degeneration of benign prostatic hypertrophy, cysts associated with tumors, prostatic abscess). Extraprostatic cysts include cysts of the seminal vesicle, vas deferens, and Cowper duct. A variety of pathologic conditions can mimic these types of cysts, including ureterocele, defect resulting from transurethral resection of the prostate gland, bladder diverticulum, and hydroureter and ectopic insertion of ureter. Accurate diagnosis depends mainly on the anatomic location of the cyst. Magnetic resonance imaging and transrectal ultrasonography (US) are excellent for detecting and characterizing the nature and exact anatomic origin of these cysts. In addition, transrectal US can play an important therapeutic role in the management of cyst drainage and aspiration, as in cases of prostatic abscess.

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Abbreviations: BPH = benign prostatic hypertrophy, 3D = three-dimensional, TURP = transurethral resection of the prostate, 2D = two-dimensional

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¹From the Department of Radiology, Urology and Nephrology Center, Mansoura University, El-Gomheria St, Mansoura 35516, Egypt (H.M.S., H.M.F., T.E.D.); and Department of Radiology, University of Washington Medical Center, Seattle, Wash (O.K.). Presented as an education exhibit at the 2011 RSNA Annual Meeting. Received May 25, 2012; revision requested June 20; final revision received March 19, 2013; accepted March 22. All authors have no financial relationships to disclose. **Address correspondence to H.M.S.** (e-mail: haythamshebel@gmail.com).

Introduction

Cysts of the lower male genitourinary tract are challenging diagnostic abnormalities because they are uncommon and their origin is uncertain (1). In 1996, Dik et al (2) examined 704 patients with symptoms of bladder outlet obstruction or lower urinary tract symptoms with transrectal ultrasonography (US) and reported that 34 patients (5%) had a median prostatic cyst.

Cysts of the lower male genitourinary tract are associated with a variety of symptoms, including urinary tract infection, pain, postvoiding incontinence, recurrent epididymitis, prostatitis, hematospermia, and infertility (1). Cysts are also associated with various genitourinary abnormalities, including hypospadias, intergender disorders, cryptorchidism, and ipsilateral renal agenesis (2). In this article, we discuss cysts of the lower male genitourinary tract in terms of the embryologic development and normal anatomy of the tract and the magnetic resonance (MR) imaging and transrectal US features of these cysts.

Embryologic Development

Initially, both male and female embryos have two pairs of genital ducts: mesonephric (wolffian) ducts and paramesonephric (müllerian) ducts. The normal development of the male genital tract is the result of the differentiation of wolffian derivatives and the involution of müllerian derivatives (3). However, wolffian and müllerian remnants sometimes persist in adult males.

The mesonephric duct is thus included in an area called the vesicourethral canal within the urogenital sinus. The mesonephric duct becomes the vas deferens, which normally drains into the urethra at the ejaculatory duct, where it is surrounded by the prostatic glands. Separate symmetric buds extend from the distal mesonephric duct just proximal to the ejaculatory duct to form the seminal vesicles (3).

The mesonephric duct also matures into the appendix of the epididymis and hemitrigone of the bladder. However, the paramesonephric ducts

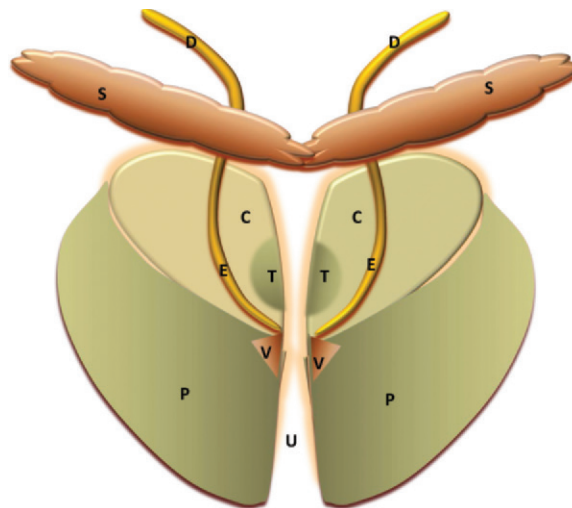


Figure 1. Coronal diagram (frontal view) illustrates the zonal anatomy of the prostate. *C* = central zone, *D* = vas deferens, *E* = ejaculatory ducts, *P* = peripheral zone, *S* = seminal vesicles, *T* = transitional zone, *U* = urethra, *V* = verumontanum.

in men degenerate except for a small portion at their cranial ends that contribute to the appendix testis and the prostatic utricle (4,5).

The urogenital sinus arises from the cloaca and develops into the bladder and urethra. The prostate gland derives from the urethra (4).

Normal Anatomy

The prostate lies immediately anterior to the rectum and inferior to the bladder. McNeal et al (6) first proposed the histologic division of the prostate into (a) an outer peripheral zone, which envelops the posterior, lateral, and apical portions of the prostate; (b) a central zone, located posteriorly and superiorly between the peripheral zone and the proximal urethra; and (c) a transitional zone, located anterior and lateral to the proximal urethra (Fig 1).

The prostate is composed of glandular tissue embedded in fibromuscular stroma. The peripheral zone represents 70% of the glandular tissue, the central zone represents 25%, and the transitional zone represents 5%. The fibromuscular stroma is located mainly anteriorly (7).

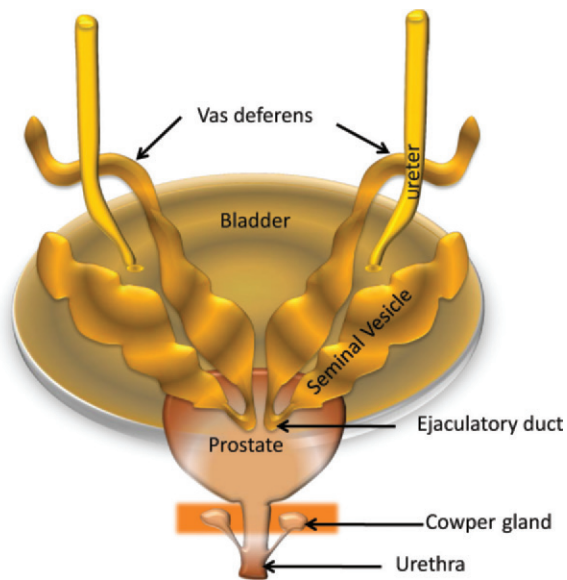


Figure 2. Coronal diagram (posterior view) illustrates the anatomy of the seminal vesicles, ejaculatory ducts, and vas deferens.

The seminal vesicles are located at the base of the prostate, posterior to the bladder and distal ureters. They have a smooth, saccular appearance and should be symmetric. The seminal vesicle joins the distal portion of the vas deferens and becomes the ejaculatory duct, which drains into the prostatic urethra through the verumontanum (Fig 2). The proximal portions of the vas deferens are continuous with the epididymal tail and course within the spermatic cord and through the inguinal canal. After entering the abdominal cavity, they course posteriorly in the lateral pelvis and then inferiorly behind the bladder medial and caudal to the distal ureters, finally joining the ducts of the seminal vesicles (7).

The normal seminal vesicles measure about 3 cm in length and about 1.5 cm in diameter, with a normal volume of about 13.7 mL. The walls of the seminal vesicles are normally 1–2 mm thick at MR imaging. The ampullae of the vas deferens measure 0.4 cm \pm 0.1 in diameter. The ejaculatory ducts measure approximately 4–8 mm in diameter (7).

The Cowper (bulbourethral) glands are paired accessory sexual organs analogous to the Bar-

tholin glands in women. Just before ejaculation, the Cowper glands secrete a mucoid material that provides an alkaline milieu and lubricant for the spermatozoa. The main glands lie within the urogenital diaphragm. Their ducts drain into the bulbar urethra (4).

Normal MR Imaging and Transrectal US Findings

At MR imaging, the central and transitional zones together are referred to as the central gland and cannot be differentiated. The peripheral zone is typically hypointense on T1-weighted images and homogeneously hyperintense on T2-weighted images. The central gland appears heterogeneously hyperintense on T2-weighted images. The seminal vesicles are seen as elongated fluid-containing structures with thin septa. The seminal fluid demonstrates low signal intensity on T1-weighted images and high signal intensity on T2-weighted images (Fig 3). The intraabdominal portions of the vas deferens are seen as bilateral symmetric tubular structures with low signal intensity on both T1- and T2-weighted images.

Teaching Point

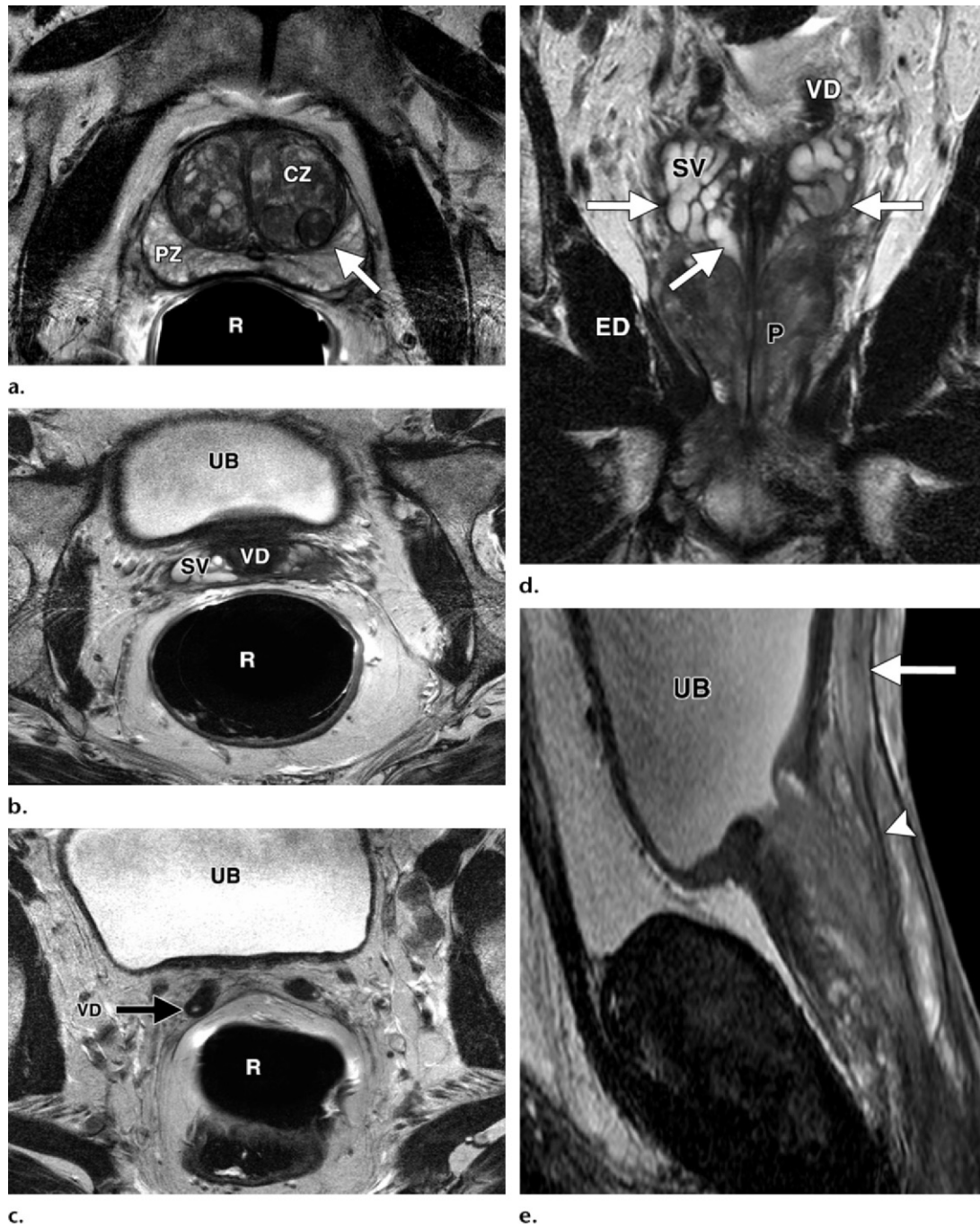


Figure 3. Anatomy of the prostate, seminal vesicles, and vas deferens at 3.0-T spin-echo T2-weighted MR imaging with an endorectal coil. **(a)** Axial image shows the peripheral zone (*PZ*) of the prostate with homogeneous hyperintensity and the central zone (*CZ*) with hypointensity, with a well-defined lesion representing benign prostatic hypertrophy (*BPH*) (arrow). *R* = rectum. **(b, c)** Axial images show the normal hyperintense lobulated pattern of the seminal vesicles (*SV*) and the hypointense junction of the vas deferens (*VD*) and the seminal vesicles. *R* = rectum, *UB* = urinary bladder. **(d)** Coronal image shows the relationships between the prostate (*P*), seminal vesicles (*SV*) (top arrows), ejaculatory duct (*ED*) (bottom arrow), and vas deferens (*VD*). The seminal vesicles are located at the base of the prostate; the ejaculatory duct courses through the prostate to join the prostatic urethra. **(e)** Sagittal image shows the normal anatomy of the vas deferens (arrow) and ejaculatory duct (arrowhead). *UB* = urinary bladder.

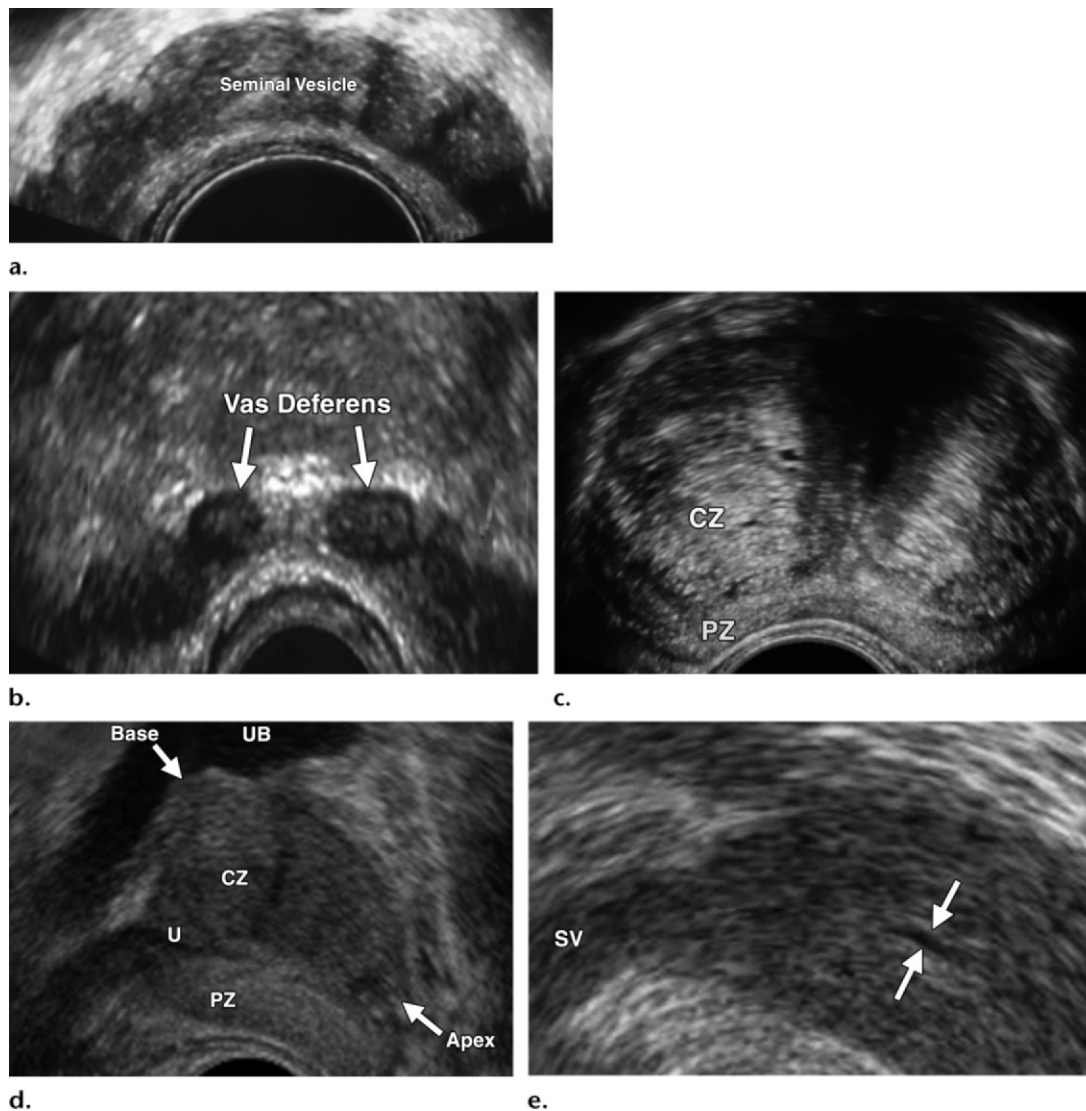


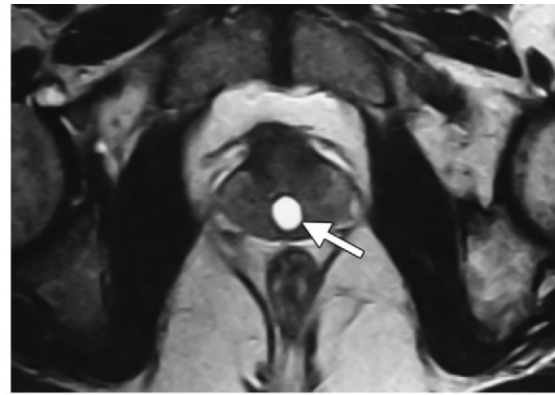
Figure 4. Anatomy of the prostate and seminal vesicles at transrectal US. (**a–c**) Transverse images obtained in the craniocaudal direction show the seminal vesicles as an oblong septate cystic structure (**a**), the distal portion of the vas deferens as a slightly dilated tubular structure medial to the seminal vesicles (**b**), and the central zone (CZ) and peripheral zone (PZ) of the prostate (**c**). (**d**) Sagittal image obtained in the superoinferior direction shows the peripheral zone (PZ) of the prostate with an echogenic pattern, with a rounded, hypoechoic urethra (U) in the central zone (CZ). UB = urinary bladder. (**e**) Sagittal image obtained in the superoinferior direction shows a normal ejaculatory duct as a small, thin-walled tubular structure (arrows). The position of the seminal vesicle (SV) indicates the superior orientation of the prostate.

They can be traced from the internal ring of the inguinal canal to the level of the ejaculatory duct in most cases. A small amount of high-signal-intensity intraluminal fluid can be seen in the ampullae of the vas deferens on T2-weighted images, similar to that seen in the seminal vesicles (7).

At transrectal US, the central and peripheral zones have a homogeneous echogenic appearance, whereas the anteriorly situated transitional zone is more heterogeneous. Frequently, calcifications along the surgical capsule known as “corpora amy-

lacea” highlight the plane between the peripheral and transitional zones (8). The seminal vesicles are seen as elongated septate cystic structures above the prostate. The distal portion of the vas deferens is seen as a slightly dilated tubular structure (ampulla) medial to the seminal vesicle. On oblique images, the seminal vesicle and the terminal portion of the vas deferens can be seen joining to form the ejaculatory duct, which may be traced to the region of the verumontanum (Fig 4) (7).

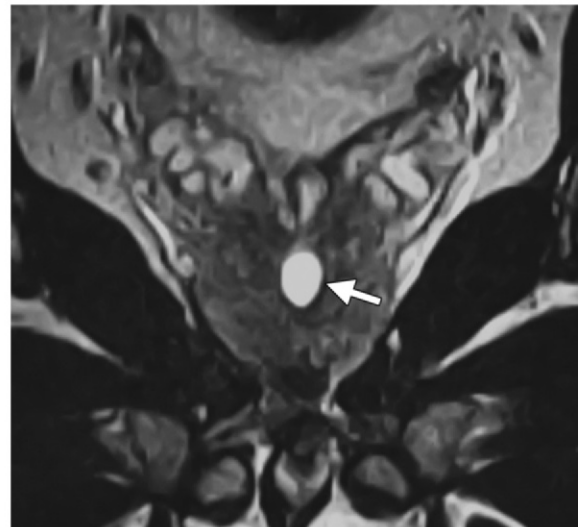
Figure 5. Prostatic utricle cyst in a 32-year-old man. Axial (a), sagittal (b), and coronal (c) spin-echo T2-weighted MR images obtained with a torso array coil show a midline high-signal-intensity prostatic utricle cyst (arrow).



a.



b.



c.

Classification of Cystic Lesions

In the literature, prostatic cysts are usually classified as either (a) median, paramedian, and lateral cysts (9), or (b) intraprostatic and periprostatic cysts (5). In this article, we discuss cystic lesions of the lower male urogenital tract under the following headings: intraprostatic cysts, extraprostatic cysts, and mimics of prostatic and periprostatic cysts (Table 1).

Intraprostatic Cysts

Median Cysts

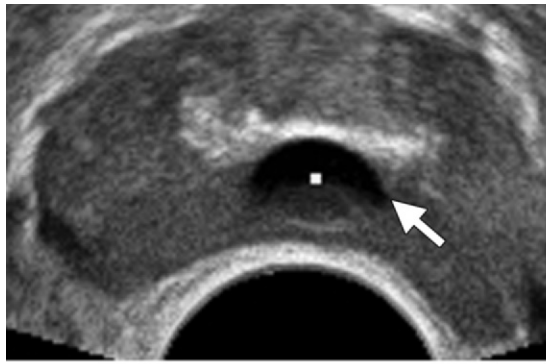
Median cysts (prostatic utricle cysts, müllerian duct cysts) are located in the midline behind the upper half of the prostatic urethra.

Prostatic Utricle Cysts.—Prostatic utricle cysts are an embryologic remnant of the müllerian duct system, resulting in incomplete regression of this structure during embryologic development. They are most commonly found in males under 20 years of age. They reportedly occur in about 1%–5% of the general population (10,11).

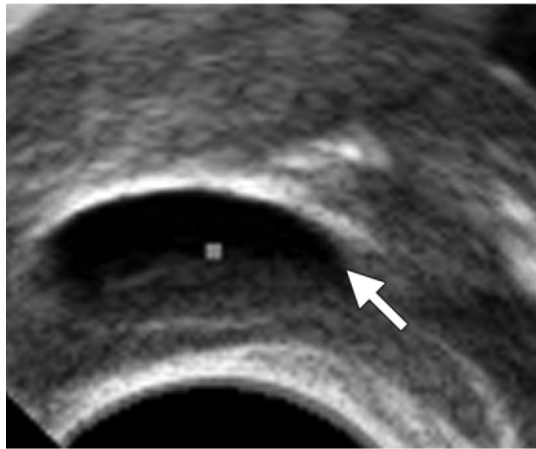
Prostatic utricle cysts are associated with various genitourinary abnormalities, including hypospadias, intersex disorders, cryptorchidism, and ipsilateral renal agenesis (4,12).

Utricle cysts may manifest with various signs and symptoms, including urinary tract infection, pain, postvoiding incontinence, recurrent epididymitis, and hematospermia (10).

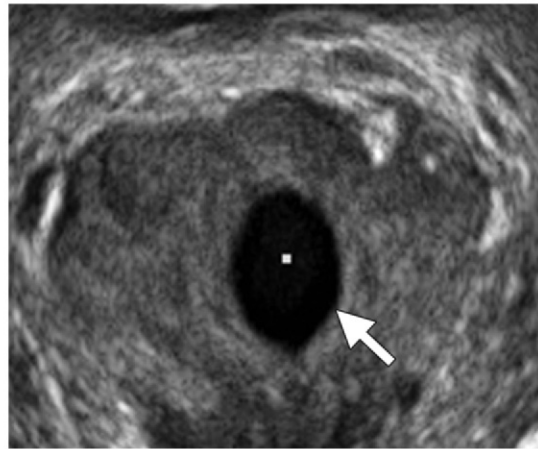
Because utricle cysts communicate with the urethra, they may result in postvoiding dribbling. Prostatic utricle cysts can become infected and



a.



b.



c.

Figure 6. Prostatic utricle cyst in the same patient as in Figure 5. Axial (a), sagittal (b), and coronal (c) three-dimensional (3D) transrectal US images show a midline hypoechoic cystic lesion (arrow). The cyst does not extend above the base of the prostate on either MR or US images.

Table 1
Cystic Lesions of the Lower Male Urogenital Tract

Intraprostatic cysts

Median cysts

- Prostatic utricle cysts
- Müllerian duct cysts

Paramedian cysts

- Ejaculatory duct cysts

Lateral cysts

- Prostatic retention cysts
- Cystic degeneration of BPH
- Cysts associated with tumors
- Prostatic abscess

Extraprostatic cysts

- Seminal vesicle cysts
- Cysts of the vas deferens
- Cowper duct cysts

Mimics of prostatic and periprostatic cysts

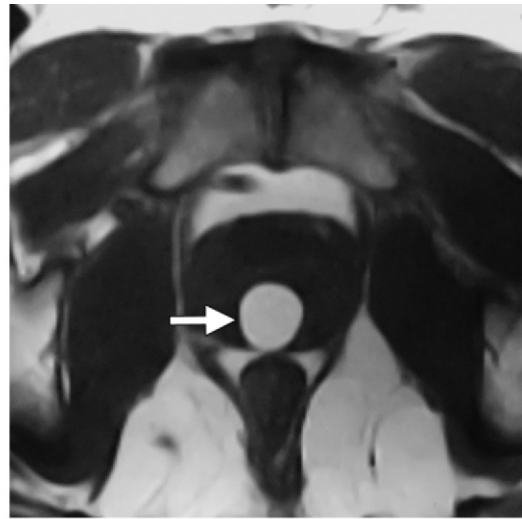
- Ureteroceles
- Defect resulting from TURP
- Bladder diverticula
- Hydroureter and ectopic insertion of ureter

may contain pus or hemorrhage, which can cause confusion at imaging because their appearances overlap with those of abscesses and cystic tumors of the prostate (9).

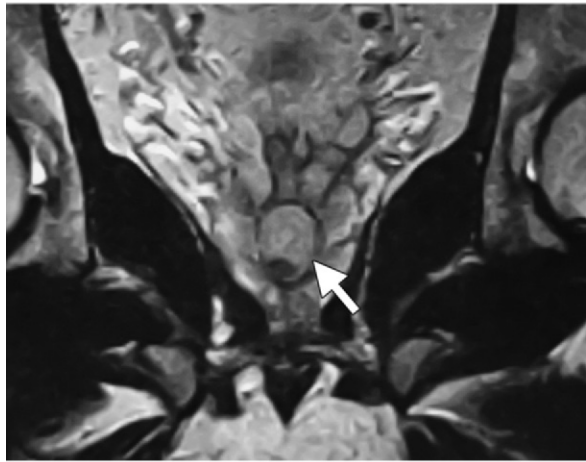
Utricle cysts are pear-shaped structures that, unlike müllerian duct cysts, do not extend above the base of the prostate. They communicate freely with the prostatic urethra (4). Utricle cysts are typically smaller than müllerian cysts and are usually 8–10 mm long. They contain fluid, which has high signal intensity on T2-weighted images (9). At transrectal US, they manifest as a midline anechoic cystic cavity posterior to the urethra (Figs 5, 6). In some cases, due to infection or hemorrhage, a utricle cyst exhibits high signal intensity with both T1- and T2-weighted sequences (Fig 7).

Teaching Point

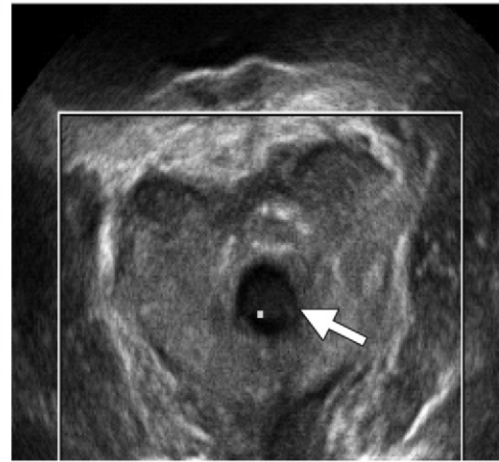
Figure 7. Prostatic utricle cyst in a 28-year-old man. (a, b) Axial spin-echo T1-weighted (a) and coronal spin-echo T2-weighted (b) MR images show a midline high-signal-intensity prostatic cyst (arrow) indicative of hemorrhagic content (proved at aspiration). The cyst does not extend beyond the base of the prostate. (c) On a coronal 3D transrectal US image, the cyst (arrow) is hypoechoic with low-level internal echoes.



a.



b.



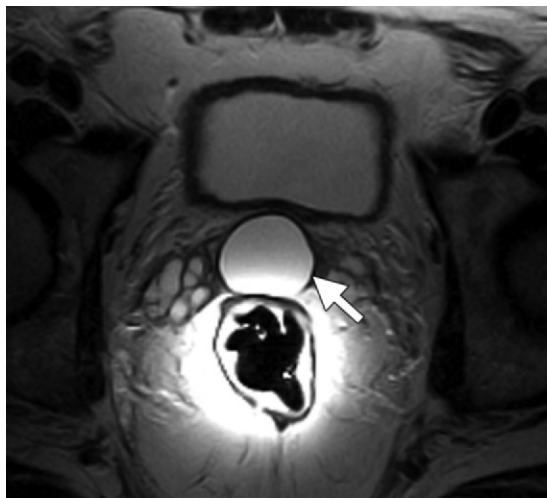
c.

Müllerian Duct Cysts.—Müllerian duct cysts result from focal failure of regression and focal saccular dilatation of the mesonephric duct. They are occasionally associated with renal agenesis, but external genitalia are normal (12).

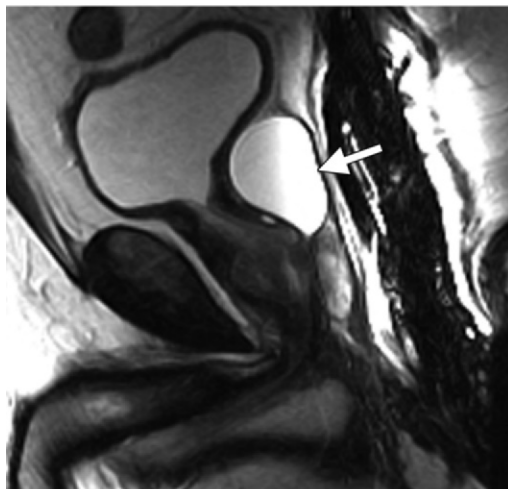
The peak incidence of müllerian duct cysts is between the ages of 20 and 40 years. A few cases have been reported to occur in infancy (13). According to an older autopsy series, the reported prevalence in men is 1%. However, the frequency of occurrence may be underreported, since some

authors found a prevalence of 5% in urologic patients (9).

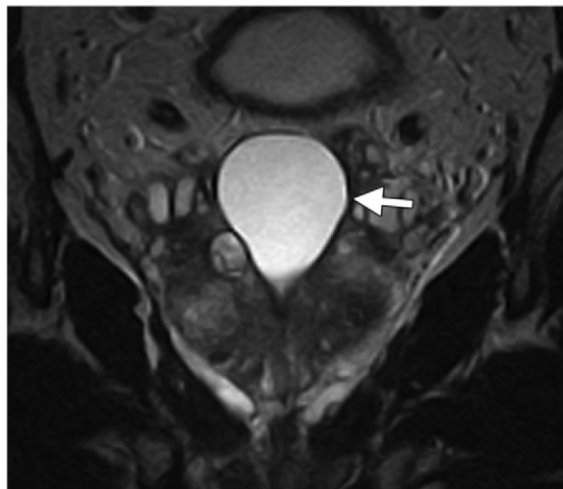
Müllerian duct cysts are usually asymptomatic but may manifest in early adulthood with urinary retention and urinary tract infection (11). They may also cause ejaculatory impairment by obstructing the ejaculatory duct in the midline. Like utricle cysts, müllerian cysts can become infected; their imaging appearance resembles that of abscesses or cystic tumors of the prostate (5). At aspiration, müllerian duct cysts never contain spermatozoa, but they do commonly contain calculi. There have been case reports of müllerian



a.



b.



c.

Figure 8. Prostatic müllerian duct cyst in a 42-year-old man with lower urinary tract symptoms. Axial (a), sagittal (b), and coronal (c) T2-weighted MR images obtained with an endorectal coil show a midline high-signal-intensity prostatic cyst (arrow) extending above the base of the prostate to the level of the seminal vesicles.

duct cysts and prostatic utricle cysts containing carcinoma (5).

Surgical excision of a müllerian duct cyst may be performed depending on the size and location of the cyst and the presence of clinical symptoms (4). Transurethral resection and percutaneous aspiration are used to treat small müllerian duct cysts. The use of laparoscopic excision has also been reported. For a large pelvic or abdominal cyst, open surgical excision is the treatment of choice (9).

Müllerian duct cysts appear as teardrop-shaped midline cysts extending above the pros-

tate. They do not communicate with the posterior urethra (13).

MR imaging and transrectal US are the most useful diagnostic tools. At MR imaging, müllerian duct cysts are usually hypointense on T1-weighted images and hyperintense on T2-weighted images (Fig 8). However, they may demonstrate increased signal intensity on both T1- and T2-weighted images, reflecting increased concentration of mucinous material, hemorrhage, or pus (13). At transrectal US, such a lesion manifests as a midline anechoic cystic cavity posterior to the urethra and

Figure 9. Prostatic müllerian duct cyst in the same patient as in Figure 8. Axial (a), sagittal (b), and coronal (c) 3D transrectal US images show a midline anechoic cystic lesion (arrow) originating from the prostate and extending beyond the prostatic base. The lesion is located between the seminal vesicles and the urinary bladder (UB).

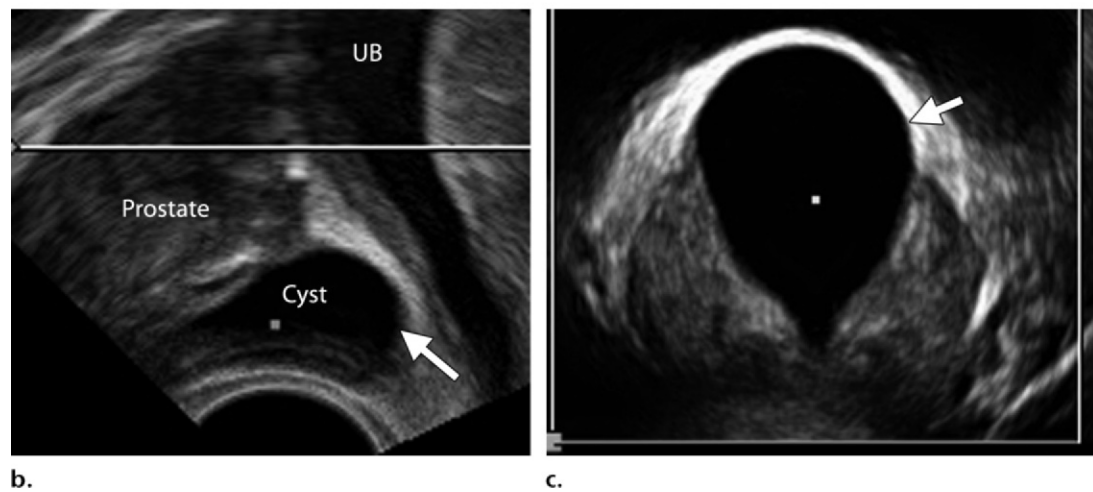


Table 2
Prostatic Utricle Cysts versus Müllerian Duct Cysts

Parameters	Utricle Cysts	Müllerian Cysts
Patient age (y)	0–20	10–30
Origin	Embryologic remnant of the müllerian duct system	Failure of regression and focal saccular dilatation of the müllerian duct
Configuration	Pear shape	Teardrop shape
Extension above base of prostate	No	Yes
Communication with prostatic urethra	Yes	No
Spermatozoa present	Yes	No
Malignancy reported	Yes	Yes

may extend above the base of the prostate (Fig 9). Table 2 shows a comparison of prostatic utricle cysts with müllerian duct cysts.

Paramedian Cysts

Paramedian cysts (eg, ejaculatory duct cysts) are located laterally, close to the midline, and posterior to the prostatic urethra.

Ejaculatory duct cysts are rare and are caused by either congenital or acquired obstruction of the ejaculatory duct (14).

Symptoms.—Ejaculatory duct obstruction is a major cause of male infertility. Patients usually present with low-volume oligospermia or azospermia, hemospermia, normal physical examination findings, and a normal serum gonadotropin level (15). At aspiration, the cysts

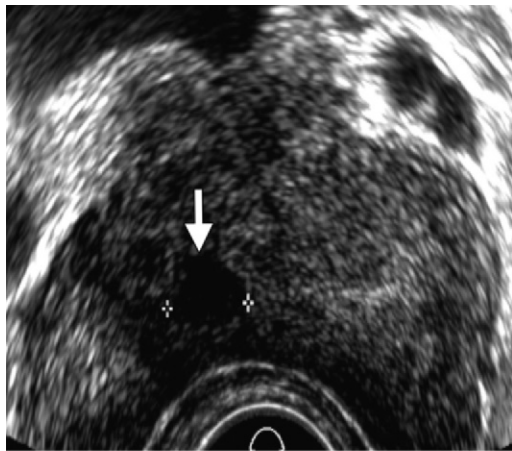
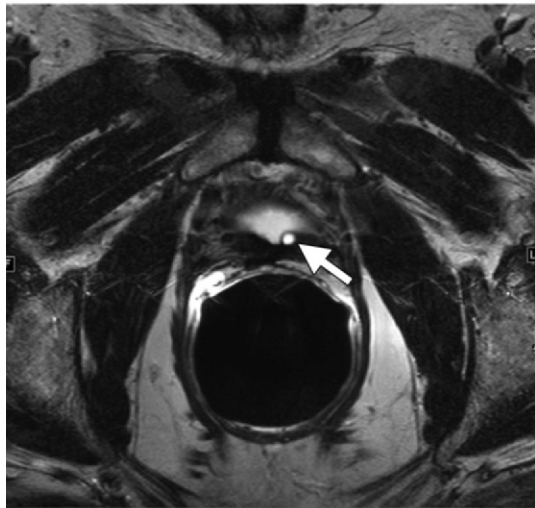
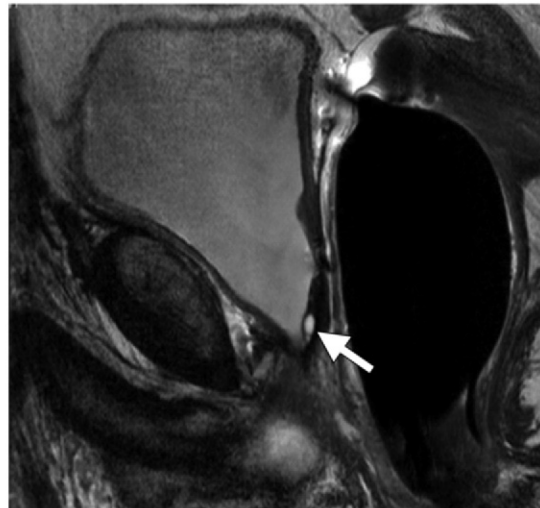


Figure 10. Ejaculatory duct cyst in a 30-year-old man with oligospermia. **(a)** Axial two-dimensional (2D) transrectal US image shows a small anechoic cyst (arrow) just lateral to the midline. **(b, c)** Axial **(b)** and sagittal **(c)** 3.0-T T2-weighted MR images obtained with an endorectal coil show a small, high-signal-intensity oval lesion (arrow) just lateral to the midline along the course of the left ejaculatory duct just posterior to the bladder neck, a finding that is consistent with cyst.

a.



b.



c.

contain fructose or spermatozoa, commonly contain calculi, and sometimes contain pus or blood. There may be associated cystic dilatation of the ipsilateral seminal vesicle (7).

Imaging Findings.—At imaging, ejaculatory duct obstructions appear to be cystic structures along the ejaculatory duct just lateral to the midline in the central zone of the prostate. However, when they are large, they may extend cephalad to the prostate and appear to arise centrally. MR imaging can clearly demonstrate the level and cause of ejaculatory duct obstruction. However, MR imaging performed with an endorectal coil is expensive and is not as widely available as transrectal US, and it should be reserved for selected patients in whom the results of transrectal US are inconclusive (15). The obstructed ejaculatory duct manifests at transrectal US as a hypoechoic cystic structure that is best seen in the sagittal plane just lateral to the midline (Fig 10). The transrectal US features of ejaculatory duct obstruction include ejaculatory duct cyst, calci-

fication, and dilatation, as well as seminal vesicle dilatation (15).

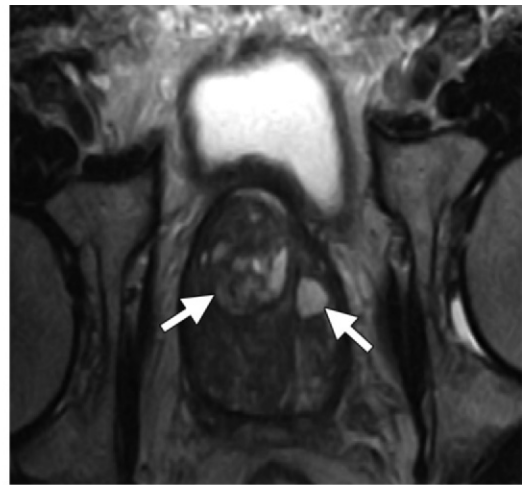
Lateral Cysts

Lateral cysts (prostatic retention cysts, cystic degeneration of BPH, cysts associated with tumors, prostatic abscesses) are located at some distance from the midline and may involve any zone of the prostate.

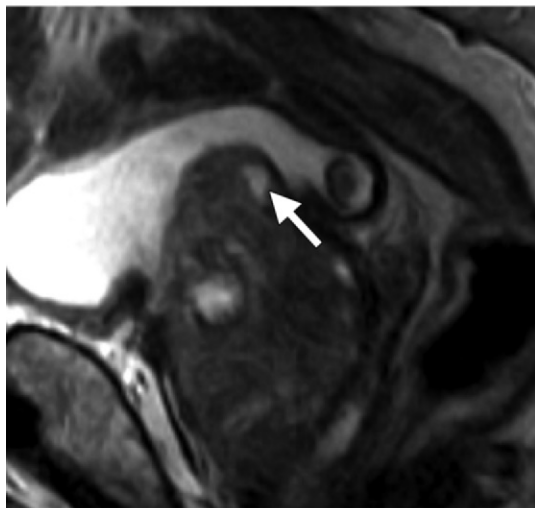
Prostatic Retention Cysts.—The pathogenesis of prostatic retention cysts is unknown; however, they occur more frequently with increasing age and are seen in patients with BPH. Infertile patients have been found to have a higher prevalence of retention cysts than fertile control patients (4).

Prostatic retention cysts result from dilatation of glandular acini due to an acquired obstruction of the ductuli, producing cysts 1–2 cm in diameter that contain clear fluid. These cysts are common,

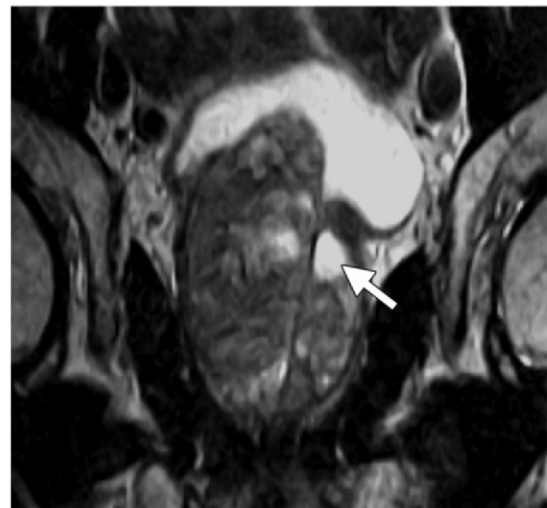
Figure 11. Prostatic retention cyst in a 53-year-old man with symptoms of BPH. Axial (a), sagittal (b), and coronal (c) T2-weighted MR images obtained with a torso array coil show enlargement of the central gland of the prostate causing elevation of the bladder neck. Variable-sized high-signal-intensity lesions (arrows) are seen within the gland, findings that are consistent with cysts.



a.



b.



c.

arise in the 5th or 6th decade of life, and are rarely symptomatic, but symptoms of BPH are always present (9).

Retention cysts are smooth-walled, usually round, unilocular cysts that can occur in any zone of the prostate. They are identical in appearance to cysts associated with BPH. The diagnosis rests on their location in the peripheral zone or on lack of other evidence of BPH (9).

Cystic Degeneration of BPH.—Cystic degeneration of BPH is common and accounts for most prostatic cystic lesions. Cystic lesions resulting from degeneration of BPH are located in the transitional zone of the prostate, along with BPH nodules. These lesions may have irregular shapes and various sizes and may contain hemorrhage or calculi. Patients with these cysts usually have symptoms of urinary obstruction due to BPH (Fig 11) (6).

Cysts Associated with Tumors.—Both benign and malignant prostatic neoplasms may contain cystic components. Multilocular prostatic cystadenoma is a rare benign tumor that can become quite large. Cystic carcinoma of the prostate occurs as a predominantly cystic mass with wall nodularity, with the solid wall components representing the neoplasm (16,17).

MR imaging can depict the cystic contents and extent of the lesions. The pathogenesis of cystic prostatic carcinoma may be associated with either (a) a pseudocyst due to central necrosis or hemorrhage in the malignant focus, or (b) malignant degeneration of a retention cyst. Most of the reported cystic carcinomas have been pseudocysts with hemorrhage; only 17% arose from degeneration of a retention cyst. In cystic lesions of the prostate, the presence of blood should raise suspicion for malignancy (17).

Other tumors of the prostate that exhibit cystic components include papillary cyst adenocarci-

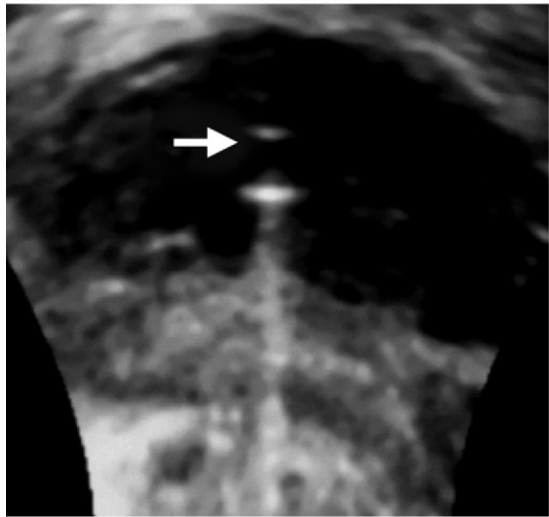
Teaching
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a.



b.



c.

Figure 12. Prostatic abscess in a 45-year-old diabetic man. Axial (a), sagittal (b), and coronal (c) 3D transrectal US images show a large, multilocular cystic lesion that occupies most of the prostate. Note the thick septa in a and b. Arrow in c = tip of needle used for aspiration, which revealed thick pus.

noma and combined transitional cell adenocarcinoma. Rarely, leiomyoma or liposarcoma of the prostate may have cystic elements (18). At MR imaging, the heterogeneous signal intensity of the cystic components and the presence of soft-tissue elements indicate a neoplastic cause (18).

Prostatic Abscess.—Prostatic abscesses are uncommon and can produce a cystic lesion anywhere in the prostate. They usually result from acute bacterial infection; the diagnosis is made on the basis of clinical findings (9).

Escherichia coli is the main causative organism. Elderly diabetic patients are at increased risk. Typical clinical signs and symptoms include fever, chills, dysuria, urinary frequency and urgency, hematuria, and pain.

Although MR imaging is usually not performed for this condition, an abscess should be

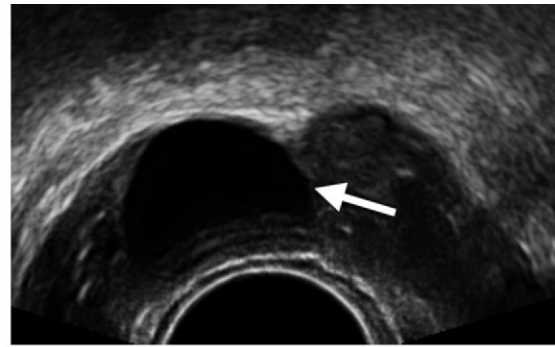
suspected when a cystic lesion with thickened walls, septa, or heterogeneous contents is seen in a patient with typical clinical findings (5).

Chronic prostatitis may lead to cavitory prostatitis, in which fibrosis causes glandular ductal constriction and acinar dilatation. This results in multiple small cysts of various sizes scattered throughout the gland, creating a “Swiss cheese” appearance. Knowledge of the patient’s clinical history is useful in these cases (6).

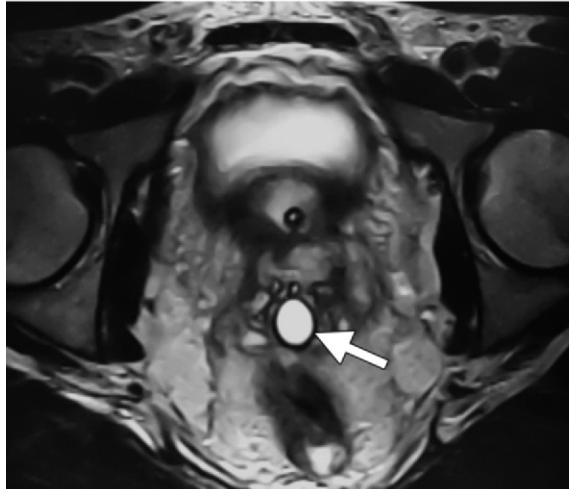
Although (as mentioned earlier) MR imaging is usually not performed for prostatic abscess, it typically demonstrates uni- or multiloculated fluid collections with thickened walls, septa, or heterogeneous contents with low T1 signal intensity, high T2 signal intensity, and marginal enhancement after intravenous administration of contrast material (5).

Transrectal US typically demonstrates hypo- or anechoic areas with thin or thick walls due to surrounding edema. Transrectal US is the imaging modality of choice for a prostatic abscess, since it is the most cost-effective modality, has better contrast resolution than computed tomography or MR imaging, and is easily accessible. In addition to its diagnostic value in prostatic abscesses, transrectal US is an essential tool for guiding drainage procedures (Fig 12) (19).

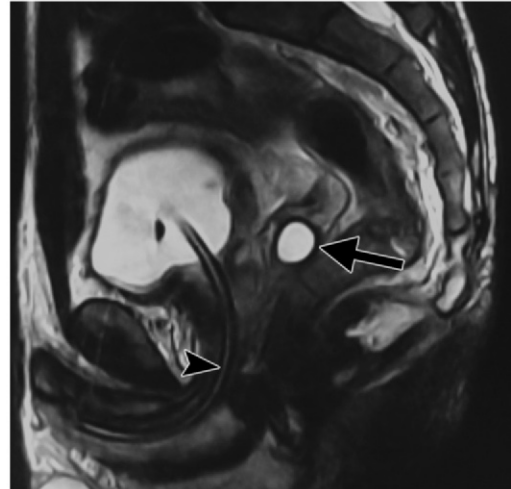
Figure 13. Seminal vesicle cyst in a 44-year-old man with hematuria. (a) Axial 2D transrectal US image shows an anechoic cyst (arrow) within the seminal vesicle. (b, c) Axial (b) and sagittal (c) T2-weighted MR images show a high-signal-intensity lesion consistent with a cyst (arrow) within the seminal vesicle (cf a). Arrowhead in c = urethral catheter.



a.



b.



c.

Extraprostatic Cysts

Extraprostatic cysts arise outside the prostate from nearby structures such as the seminal vesicles, vas deferens, and Cowper ducts.

Seminal Vesicle Cysts

Seminal vesicle cysts can be congenital or acquired. They are usually found in patients between 10 and 40 years of age (20,21).

Congenital cysts of the seminal vesicles can be subcategorized as isolated cysts, cysts associated with upper urinary tract anomalies, and cysts associated with autosomal dominant polycystic kidney disease (21). There have been several reports of seminal vesicle cysts, many with associated ipsilateral renal agenesis (18,22).

Symptoms.—Symptoms develop during the years of sexual activity, when secretions are at their peak or drainage is inadequate owing to a malformed or secondarily stenosed duct system (21).

The majority of seminal vesicle cysts are small (<5 cm) and are either asymptomatic or manifest with infective or irritative urinary symptoms. Large cysts (>8–10 cm) may manifest with symptomatic obstruction of the bladder or bowel and occur less frequently (21,22).

Patients with seminal vesicle cysts may also present with symptoms of chronic recurrent prostatitis and recurrent epididymitis, painful ejaculation, urethral discharge, urgency, hesitancy, hematuria, acute urinary retention, pain upon defecation, tenesmus, constipation, pelvic discomfort, perineal or testicular pain, an abdominal or pelvic mass, infertility, or hematospermia (23).

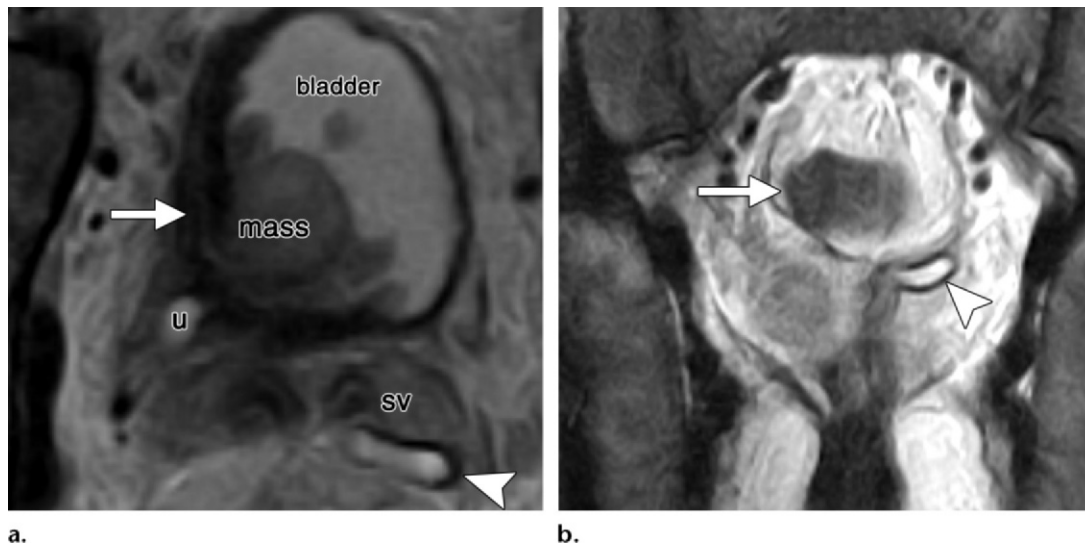


Figure 14. Bladder tumor in a 65-year-old man. Axial (**a**) and coronal (**b**) T2-weighted MR images obtained with a torso array coil show a mass (arrow) arising from the lateral bladder wall, along with incidentally discovered dilatation of the left vas deferens (arrowhead) as it courses toward the seminal vesicle (SV). *u* = right pelvic ureter.

Imaging Findings.—At MR imaging, seminal vesicle cysts are seen as well-defined, intraseminal, unilocular round or oval cystic lesions posterior to the urinary bladder, with variable signal intensity on T1-weighted images and, most often, fluid signal intensity on T2-weighted images. Increased T1 signal intensity is thought to reflect hemorrhage or an increased concentration of proteinaceous fluid (21). At transrectal US, seminal vesicle cysts manifest as (*a*) anechoic masses within the seminal vesicle, or (*b*) larger anechoic saccular lesions, which may arise from the pelvis and displace the bladder and other pelvic structures. US can be used to guide needle placement for drainage or in combination with contrast agents to more fully delineate the lesion (Fig 13) (23,24).

Cysts of the Vas Deferens

Vas deferens cysts are located along the course of the vas deferens and superior to the prostate. Congenital abnormalities of the vas deferens are the most common finding in men with azoospermia and low ejaculation volume (7). Infection, obstruction, and neoplasia are possible acquired causes of vas deferens cysts.

The spatial relationship between a cystic lesion and the vas deferens is most likely to be deter-

mined at MR imaging. Hyperintensity along the vas deferens on T2-weighted images, combined with nonenhancement after contrast material administration, confirm the cystic nature of these abnormalities (Fig 14).

Cowper Duct Cysts

The Cowper gland ducts drain into the bulbous urethra; obstruction of these ducts may cause retention cysts. Cowper duct cysts may be congenital or acquired. Most of these cysts are asymptomatic; however, larger cysts may result in hematuria or urinary obstruction and, potentially, male infertility (5).

Several cases of prenatal and early postnatal death secondary to urinary obstruction from large Cowper duct cysts have been reported. In adults, acquired Cowper duct cysts occur due to infection or trauma (4). Sagittal and coronal images may be helpful in identifying the origin of these cysts (4).

Typically, a Cowper duct cyst appears at MR imaging and transrectal US as a unilocular cystic lesion at the posterior or posterolateral aspect of the posterior urethra (Fig 15) (5).

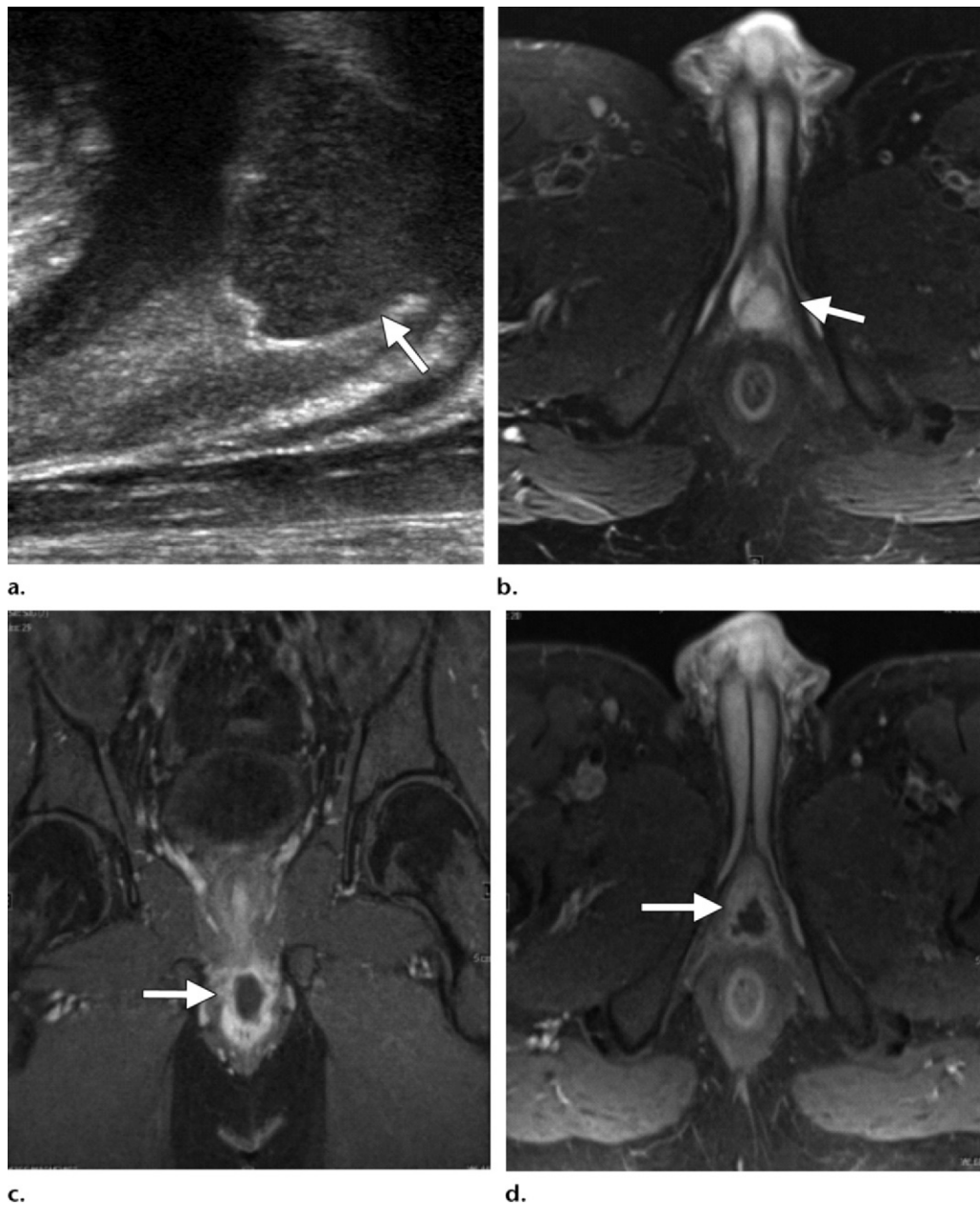


Figure 15. Cowper duct cysts. (a) Sagittal 2D perineal US image shows a unilocular cystic lesion with low-level internal echoes (arrow) located at the root of the penis. (b–d) Axial fat-suppressed short inversion time inversion-recovery T2-weighted MR image (b) and coronal (c) and axial (d) fat-suppressed T1-weighted MR images obtained with a torso array coil after the intravenous administration of contrast material show a cyst with strong peripheral enhancement (arrow) located at the root of the penis. The cyst demonstrates high signal intensity on the short inversion time inversion-recovery image.

Mimics of Prostatic and Periprostatic Cysts

Mimics of prostatic and periprostatic cysts are not true cysts but dilatations of nearby structures. They include ureterocele, dilatation of the prostatic urethra after transurethral resection of the prostate (TURP), bladder diverticula, and

hydroureter and ectopic insertion of the ureter (Fig 16). It is important to be aware of and consider alternative diagnoses when assessing possible prostatic and periprostatic cysts, such as bladder diverticulum, dilated ectopic ureter, and ureterocele. These lesions may be incidentally found at imaging or may manifest as lower urinary tract symptoms such as hematuria, dysuria, hematospermia, or urinary incontinence. Differentiation can be made on the basis of charac-

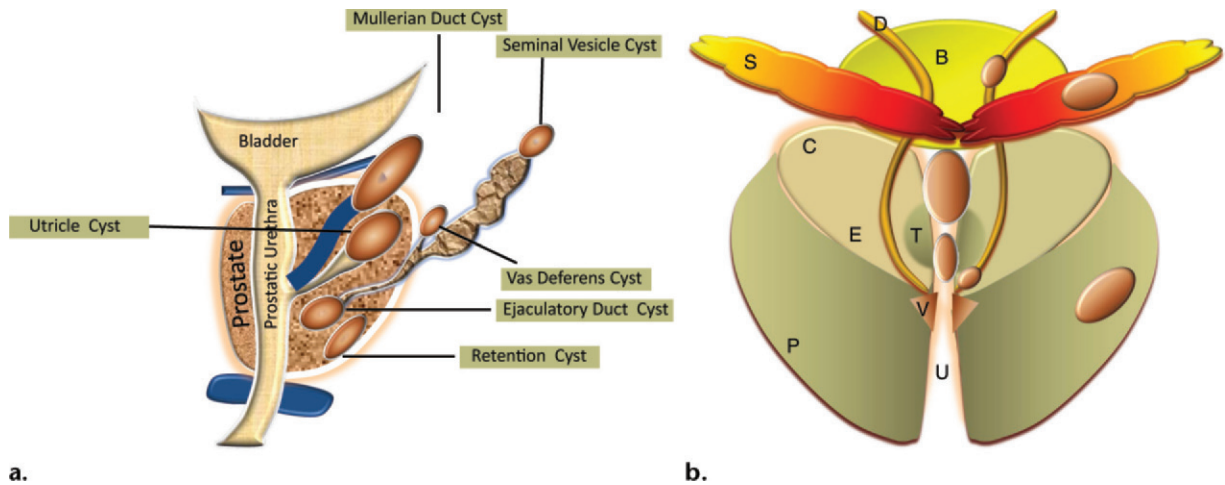


Figure 16. Sagittal (a) and coronal (b) diagrams illustrate the distribution of intra- and extraprostatic cysts. *B* = bladder, *C* = central zone, *D* = vas deferens, *E* = ejaculatory ducts, *P* = peripheral zone, *S* = seminal vesicles, *T* = transitional zone, *U* = urethra, *V* = verumontanum.

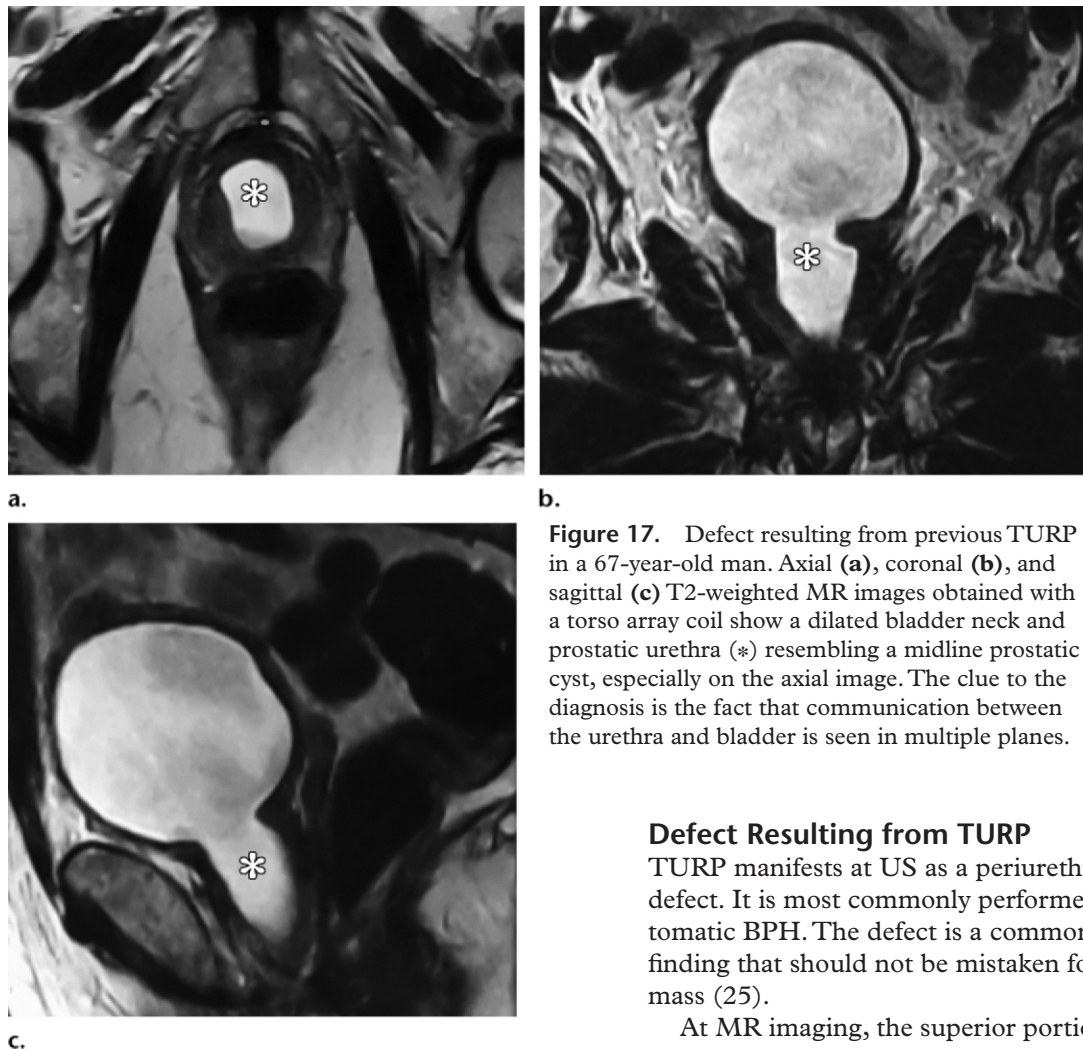


Figure 17. Defect resulting from previous TURP in a 67-year-old man. Axial (a), coronal (b), and sagittal (c) T2-weighted MR images obtained with a torso array coil show a dilated bladder neck and prostatic urethra (*) resembling a midline prostatic cyst, especially on the axial image. The clue to the diagnosis is the fact that communication between the urethra and bladder is seen in multiple planes.

Defect Resulting from TURP

TURP manifests at US as a periurethral central defect. It is most commonly performed for symptomatic BPH. The defect is a commonly observed finding that should not be mistaken for a cystic mass (25).

At MR imaging, the superior portion of this defect communicates with the bladder and appears as an irregular funnel-shaped defect in the midline (Fig 17) (5).

teristic location, contents, and association with renal or genital anomalies, but such differentiation may be difficult (9,21).

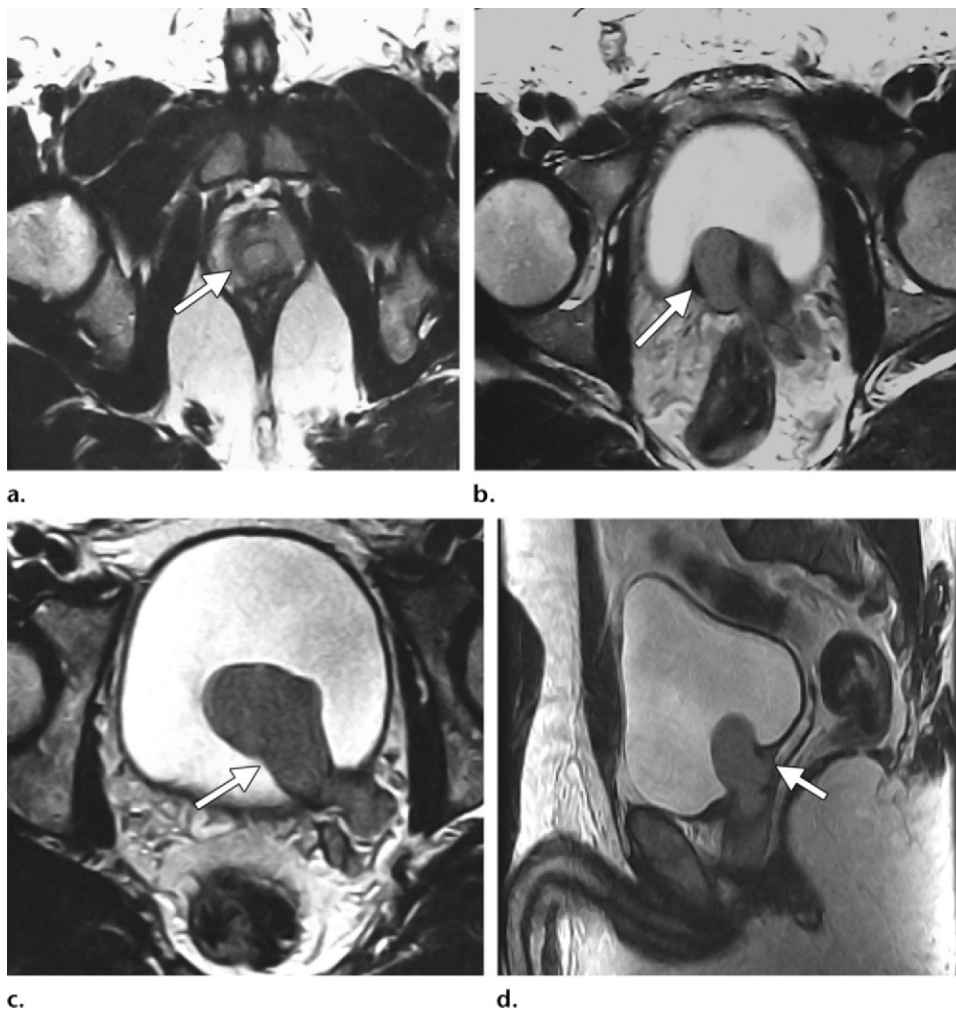


Figure 18. Ureterocele with hydroureter mimicking a prostatic cyst in a 23-year-old man. (a) Axial T2-weighted MR image obtained in the inferosuperior direction with a torso array coil shows an apparent midline prostatic cyst (arrow). (b–d) Axial (b, c) and sagittal (d) T2-weighted images reveal that the lesion (arrow) is a ureterocele on the patient's left side.

Bladder Diverticula

Bladder diverticula are very common. When they extend posteriorly, they may lie alongside the prostate or seminal vesicles and may be confused with cysts of these structures. However, visualization of their communication with the urinary bladder is diagnostic, clarifying the organ of origin (5).

Hydroureter and Ectopic Insertion of Ureter

With its tortuous course, a hydroureter can mimic a periprostatic cystic lesion. In addition, when dilated, ectopic insertion of a ureter into the prostatic urethra can resemble a tubular cystic structure. Careful review of MR images obtained in multiple planes helps identify the true nature of these conditions (Fig 18) (5).

Summary

Various types of cysts can affect the lower male genitourinary tract and may lead to serious complications. Despite their rarity, it is essential to be familiar with these cysts in terms of their patterns, associations, and complications. Two main groups of cysts can affect the lower male genitourinary tract: intra- and extraprostatic cysts. MR imaging and transrectal US are the modalities of choice for proper diagnosis and management of these cysts.

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Cysts of the Lower Male Genitourinary Tract: Embryologic and Anatomic Considerations and Differential Diagnosis

Haytham M. Shebel, MD • Hashim M. Farg, MSc • Orpheus Kolokythas, MD • Tarek El-Diasty, MD

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Initially, both male and female embryos have two pairs of genital ducts: mesonephric (wolffian) ducts and paramesonephric (müllerian) ducts. The normal development of the male genital tract is the result of the differentiation of wolffian derivatives and the involution of müllerian derivatives. However, wolffian and müllerian remnants sometimes persist in adult males.

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At MR imaging, the central and transitional zones together are referred to as the central gland and cannot be differentiated. The peripheral zone is typically hypointense on T1-weighted images and homogeneously hyperintense on T2-weighted images. The central gland appears heterogeneously hyperintense on T2-weighted images.

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The seminal vesicles are seen as elongated fluid-containing structures with thin septa. The seminal fluid demonstrates low signal intensity on T1-weighted images and high signal intensity on T2-weighted images. The intraabdominal portions of the vas deferens are seen as bilateral symmetric tubular structures with low signal intensity on both T1- and T2-weighted images.

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Utricle cysts are pear-shaped structures that, unlike müllerian duct cysts, do not extend above the base of the prostate. They communicate freely with the prostatic urethra.

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MR imaging can depict the cystic contents and extent of the lesions. The pathogenesis of cystic prostatic carcinoma may be associated with either (a) a pseudocyst due to central necrosis or hemorrhage in the malignant focus, or (b) malignant degeneration of a retention cyst. Most of the reported cystic carcinomas have been pseudocysts with hemorrhage; only 17% arose from degeneration of a retention cyst. In cystic lesions of the prostate, the presence of blood should raise suspicion for malignancy.