Endorectal MRI of Prostatic and Periprostatic Cystic Lesions and Their Mimics

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Endorectal MRI of the prostate is a promising technique for the assessment of prostate cancer; it provides noninvasive depiction of the prostate gland with excellent anatomic detail. Although prostatic and periprostatic cystic lesions are uncommon entities, they are sometimes encountered on endorectal MRI, which is increasingly used for the pretreatment evaluation of prostate cancer and male infertility. This article describes the MRI appearances of cystic lesions of the prostate and adjacent structures and briefly reviews their clinical significance.

Anatomy
The prostate gland is composed of peripheral, central, and transition zones and a fibromuscular stroma (Fig. 1). The fibromuscular stroma is located anteriorly. The peripheral zone envelops the posterior, lateral, and apical portions of the prostate. The central zone is located posteriorly and superiorly between the peripheral zone and the proximal urethra. The transition zone is located anteriorly and laterally to the proximal urethra. The seminal vesicles and vasa deferentia are located just above the base of the prostate and behind the urinary bladder. The ducts of the seminal vesicles join the vasa deferentia to form the ejaculatory ducts, which open into the urethra at the level of the verumontanum. Knowledge of the embryology of the wolffian and müllerian duct systems in the male is important to understand normal anatomy and prostatic cyst location and their development. The wolffian duct gives rise not only to the vas deferens, the seminal vesicle, the ejaculatory duct, the epididymis, and the appendix of epididymis, but also to the renal collecting system and the ureter. The müllerian duct contributes to the appendix testis and the prostatic utricle. The urinary bladder, the prostate gland, and the prostatic utricle arise from the urogenital sinus.

Cysts in the region of the prostate seen on MRI may be described as either intraprostatic or periprostatic. Appendix 1 summarizes the most commonly seen cystic lesions of the prostate and adjacent structures and their mimics.

Intraprostatic Cystic Lesions
Müllerian Duct Cysts and Prostatic Utricle Cysts
Although these conditions are believed to be two different entities, it is difficult to differentiate them from one another on imaging and clinical studies [1–3]. Both occur in the midline. Müllerian duct cysts originate from the remnants of the müllerian duct. Prostatic utricle cysts result from the dilatation of the prostatic utricle.

Müllerian duct cysts may originate from the region of the verumontanum but usually extend above the prostate and may be slightly lateral to the midline. They do not communicate with the urethra. Prostatic utricle cysts always arise from the verumontanum and are always in the midline, and they communicate with the urethra (Figs. 2 and 3).

Müllerian duct cysts and prostatic utricle cysts may cause obstructive urinary symptoms, hematuria, and pelvic pain. They may also cause ejaculatory impairment by obstruction of the ejaculatory ducts in the midline. Because utricle cysts communicate with the urethra, they may result in postvoid dribbling. Prostatic utricle cysts are associated with some genitourinary abnormalities such as hypospadias, incomplete testicular descent, and unilateral renal agenesis. On aspiration, müllerian duct cysts (Fig. 4) never contain spermatozoa; whereas utricle duct cysts occasionally do. Both müllerian duct cysts and prostatic utricle cysts can become infected and may contain pus or hemorrhage, which can cause confusion on imaging because the appearances overlap those of abscess and cystic tumor of the prostate. Müllennian duct cysts commonly contain cal-
culi. There have been case reports of müllerian duct cysts and prostatic utricle cysts containing carcinoma [4, 5]. Not all cystic lesions located at the midline of the prostate are müllerian duct cysts or prostatic utricle cysts, and the possibility of other cystic lesions should also be considered [6].

**Ejaculatory Duct Cysts**

Ejaculatory duct cysts are rare. They are due to obstruction of the ejaculatory duct that may be congenital or acquired [7]. On imaging, these lesions 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 (Fig. 5).

On aspiration they contain fructose or spermatozoa. Ejaculatory duct cysts commonly contain calculi. Sometimes they may contain pus or hemorrhage. There may be associated cystic dilatation of the seminal vesicle on the same side. Patients often present with hematospermia or dysuria. Diverticula of the ejaculatory duct are probably even more rare than cysts of the ejaculatory duct.

**Prostatic Retention Cysts**

Retention cysts are acquired cysts that result from obstruction of the glandular ductules, causing dilatation of the acini. They may occur in any glandular zone of the prostate. They never contain spermatozoa on aspiration. Retention cysts usually appear as smooth-walled, unilocular simple cysts [1] (Fig. 6). They rarely cause symptoms.

**Cystic Degeneration of Benign Prostatic Hyperplasia (BPH)**

Cystic degeneration of BPH nodules is common and accounts for most prostatic cystic lesions. Cystic lesions resulting from cystic degeneration of BPH are located in the transition zone of the prostate along with BPH nodules (Fig. 7). They may be seen in irregular shapes and various sizes and may contain hemorrhage or calculi. Patients with these cysts usually have urinary obstructive symptoms due to BPH.

**Cysts Associated with Tumors**

Both benign and malignant prostate neoplasms may contain cystic components. Multilocular prostatic cystadenoma is a rare benign tumor that can grow to a large size [8]. Prostatic adenocarcinoma may show cystic features from time to time. Other tumors of the prostate gland that exhibit cystic components include papillary cystadenocarcinoma and combined transitional cell/adenoacarcinoma. Rarely, leiomyoma or liposarcoma in the prostate may have cystic elements. On MRI, the heterogeneity of signal intensity of the cystic components and the presence of soft-tissue elements in the lesion indicate a neoplastic cause (Fig. 8).

**Infectious, Inflammatory, and Parasitic Cysts**

A prostatic abscess may form secondary to acute bacterial infection, most often with *Escherichia coli*. Older diabetic patients are at increased risk. Patients usually have typical clinical signs and symptoms including fever, chills, dysuria, urinary frequency and urgency, hematuria, and pain. Although MRI is usually not performed for this condition, suspicion of an abscess is raised when a cystic lesion with thickened walls, septations, or heterogeneous contents is seen in a patient with appropriate clinical findings [9].

Chronic prostatitis may lead to a condition called prostatic urethritis, in which a combination of prolonged infections and fibrosis causes glandular ductal constriction and acinar dilatation. This results in a “Swiss cheese” appearance in the prostate, with multiple small cysts of various sizes scattered throughout the gland (Fig. 9). Correlation with clinical history is useful in these cases.

Parasitic (echinococcal and bilharzial) cysts in the prostate are rare and occur in the geographic regions where these parasites are endemic.

**Prominent Seminal Vesicles**

Cysts in the seminal vesicles are often discovered incidentally. However, if very large, they may be associated with voiding difficulties. They are commonly associated with adult polycystic kidney disease [10, 11]. Aspiration of seminal vesicle cysts yields spermatozoa and sometimes hemorrhage. Figure 10 provides an example of a seminal vesicle cyst depicted on MRI.

**Cysts of the Vas Deferens**

These cysts are located superior to the prostate gland along the course of the vas deferens. On MRI, vas deferens cysts are easily recognized and distinguished from other adjacent structures.

**Cowper’s Duct Cysts**

The Cowper’s (bulbourethral) glands are found in the urogenital diaphragm immediately inferior to the prostate. The Cowper’s gland ducts drain into the bulbous urethra, and obstruction of these ducts may cause retention cysts. Cowper’s duct cysts (Fig. 11) may be congenital or acquired, usually due to trauma or infection. Larger cysts may present with hematuria or urinary obstruction and, potentially, male infertility [12].

**Hydroureter and Ectopic Insertion of Ureter**

The tortuous course of a hydroureter can mimic a periprostatic cystic lesion. In addition, ectopic insertion of a ureter into the prostatic urethra can resemble a tubular cystic structure when dilated. Careful review of MR images in multiple planes helps identify the true nature of these conditions (Fig. 13).

**Bladder Diverticulum**

Bladder diverticula occur commonly. They may lie alongside the prostate or seminal vesicles when they extend posteriorly and may be confused with cysts of these structures. However, visualization of their communication with the urinary bladder helps clarify their true origin (Fig. 14).

**Summary**

The differential diagnosis of the various types of prostatic or periprostatic cystic lesions can be difficult, and it is complicated by the fact that cystic lesions originating from adjacent structures can mimic prostatic or periprostatic cystic lesions. Exact anatomic localization using MRI and appropriate clinical history are useful in narrowing the differential diagnosis and deciding whether to pursue further invasive diagnostic tests.
MRI of Prostatic and Periprostatic Cystic Lesions

References


Fig. 1—Schematic of prostate gland depicts zonal anatomy. PZ = peripheral zone, TZ = transition zone, CZ = central zone.

Fig. 2—51-year-old man with prostate cancer.
A–C, Transverse (A), coronal (B), and sagittal (C) T2-weighted MR images show prostatic utricle cyst (UC) that is located in midline, arising from verumontanum and communicating with urethra (U in C). Transverse image (A) shows focal low-signal-intensity area representing tumor (T in A).
Fig. 3—43-year-old man with infertility. T2-weighted coronal MR image shows small utricle cyst (UC) with ejaculatory duct (ED) calculus causing obstruction of right ejaculatory duct.

Fig. 4—65-year-old man with prostate cancer. A and B, Transverse (A) and sagittal (B) T2-weighted MR images show müllerian duct cyst (M) that is slightly lateral to midline and extends above prostate.

Fig. 5—35-year-old man with azoospermia. A and B, Coronal (A) and transverse (B) T2-weighted MR images show ejaculatory duct cyst (EDC) that extends from verumontanum to left of midline above prostate (P in A) along course of ejaculatory duct. Hemorrhage (arrow, B) layering at dependent aspect of cyst is also seen.

Fig. 6—66-year-old man with prostate cancer. A and B, Transverse (A) and coronal (B) T2-weighted MR images show unilocular, smooth, and thin-walled prostatic retention cyst (RC) in peripheral zone (PZ in B) of prostate.
Fig. 7—59-year-old man with prostate cancer. 
A and B, Sagittal (A) and transverse (B) T2-weighted images show hypertrophic transition zone (TZ) indenting urinary bladder (B in A). Note that one of benign prostatic hyperplasia nodules (N) has a cystic component (arrows).

Fig. 8—68-year-old man with mixed tumor of prostate containing high-grade ductal adenocarcinoma, with transitional cell and nonkeratinizing squamous cell differentiation. 
A and B, Transverse (A) and coronal (B) T2-weighted MR images show tumor (T) with cystic and solid components. Fluid–fluid level (arrow, A) is also seen at dependent portion of cystic component of tumor.

Fig. 9—68-year-old man with prostate cancer and chronic prostatitis. 
A and B, T2-weighted coronal MR image (A) shows multiple peripheral cystic areas (arrows, A) consistent with pathologically proven chronic prostatitis (arrows, B), as shown on step-section pathology image (B).
Fig. 10—35-year-old man with seminal vesicle cyst. A and B, Transverse (A) and sagittal (B) T2-weighted MR images show right seminal vesicle cyst (SVC) above prostate (P in B). Note that left seminal vesicle (arrow, A and C) is normal (A and C). C, Transverse T1-weighted MR image shows high signal intensity consistent with hemorrhage in right seminal vesicle cyst (SVC).

Fig. 11—53-year-old man with prostate cancer. A and B, Cowper’s duct cyst (arrows) is shown on transverse (A) and coronal (B) T2-weighted MR images.

Fig. 12—76-year-old man with previous transurethral resection of prostate gland and newly diagnosed prostate cancer. A and B, Transverse (A) and coronal (B) T2-weighted MR images show cystic space (arrows) in center of prostate (P). C, Sagittal T2-weighted MR image shows funnel-shaped defect (arrows) that communicates with urinary bladder (B). P = prostate.
MRI of Prostatic and Periprostatic Cystic Lesions

APPENDIX I: Most Commonly Seen Prostatic and Periprostatic Cystic Lesions and Their Mimics

A. Intraprostatic Cystic Lesions
1. Müllerian duct cysts and prostatic utricle cysts
2. Ejaculatory duct cysts
3. Prostatic retention cysts
4. Cystic degeneration of benign prostatic hypertrophy
5. Cysts associated with tumors
6. Infectious, inflammatory, and parasitic cysts
7. Ejaculatory duct diverticulum

B. Periprostatic Cystic Lesions
1. Seminal vesicle cysts
2. Cysts of the vas deferens
3. Cowper’s duct cysts

C. Entities That May Mimic Prostatic and Periprostatic Cystic Lesions
1. Defect from transurethral resection of the prostate
2. Hydroureter and ectopic insertion of the ureter
3. Bladder diverticulum
4. Prominent seminal vesicles

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