Intraoperative Management of an Incidentally Identified Ectopic Ureter Inserting Into the Prostate of a Patient Undergoing Radical Prostatectomy for Prostate Cancer

A Case Report

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Abstract: Congenital variations in urinary tract anatomy present unique surgical challenges when they present without prior knowledge. Ectopic ureters occur as a rare anatomic variation of the urinary tract and are often associated with duplicated renal collecting systems. While the condition is uncommon, even more atypical is its discovery and subsequent diagnosis during surgical intervention for treatment of localized prostate cancer.

We describe the intraoperative management of a unique case of bilateral ectopic ureters, with a right-sided ureter inserting into the prostate of a 54-year-old male undergoing robotic-assisted radical prostatectomy. While unknown at the time of surgery, this right-sided ureter was associated with a nonfunctioning right upper renal moiety of a duplex renal collecting system. This aberration was discovered intraoperatively and confirmed with imaging, and a robotic-assisted radical prostatectomy with right distal ureterectomy was performed.

Abbreviations: AUASS = American Urological Association Symptom Score, CT = computed tomography, PSA = prostate-specific antigen, PTSD = posttraumatic stress disorder, RRP = robotic radical prostatectomy, SHIM = Sexual Health Inventory for Men, TRUS = transrectal ultrasound, UTI = urinary tract infection, VUR = vesicoureteral reflux.

INTRODUCTION

Ureteral abnormalities represent a complex array of anatomic variations, of which disorders in ureteral number, diameter, and ureteral course are the most frequent. However, ectopic ureters are rare and occur in less than 1 out of 1900 live births. The definition of an ectopic ureter is a ureter that does not correctly terminate in the trigone of the bladder, but instead inserts in an alternative anatomic location, such as the urethra or vagina in females and the seminal vesicles, epididymis, vas deferens, ejaculatory duct, or posterior urethra in males. Ectopic ureters are 6 times more likely to occur in females than males, and 75–90% are associated with duplicated renal collecting systems. They are most commonly asymptomatic and found incidentally upon radiologic imaging; however, a subset present with symptoms at an early age due to hydronephrosis, incontinence, vesicoureteral reflux (VUR), and recurrent urinary tract infections (UTI).

While there have been a few reported cases of ectopic ureteral insertion into the prostatic urethra in men undergoing radical prostatectomy for prostate cancer in the literature, most were known to be present before surgery. Given the decreasing use of preoperative axial imaging before prostatectomy, the likelihood of encountering a previously unidentified anatomic anomaly during surgery has increased. Here, we describe a patient with bilaterally duplicated renal collecting systems, including an ectopic right-sided ureter inserting into the prostate, which was incidentally found during robotic radical prostatectomy (RRP) for localized prostate cancer. We discuss the intraoperative diagnosis and surgical approach for this patient, along with the anatomical and embryological principles that may help guide management of future cases.

CASE REPORT

A 54-year-old male was referred from his community physician to us for further evaluation and management of his newly diagnosed prostate cancer. He first presented in January 2015 with an elevated prostate-specific antigen (PSA) of 5.4 ng/mL and normal digital rectal examination. At that time, he underwent a transrectal ultrasound (TRUS)-guided prostate biopsy, which showed stage T1c Gleason score 7 (4 + 3) prostate cancer in 10/12 cores, with maximum 40% core volume, and perineural invasion present. Functionally, the patient reported minimal lower urinary tract symptoms, as evidenced by his low American Urological Association Symptom Score (AUASS) of 2. He noted only occasional urinary frequency and nocturia and felt he emptied his bladder well. He reported excellent erectile function, with a Sexual Health Inventory for Men (SHIM) score of 24.

His past medical history was significant for low testosterone, dyslipidemia, posttraumatic stress disorder (PTSD), degenerative disc disease, and gastroesophageal reflux. Relevant past surgical history included a vasectomy and medications included aspirin, atorvastatin, diazepam, ranitidine, and venlafaxine. He did report a family history of prostate cancer in his father, grandfather, and great-grandfather, as well as lung cancer in his grandmother. Social history was significant for one drink of alcohol per day, and he denied any history of smoking or other tobacco or drug use. On physical
examination, his abdomen was soft, nontender, nondistended, and without masses. External genitalia were normal with bilaterally descended testes and no scrotal masses or hernias. Rectal examination revealed a normal anus without masses, normal external anal sphincter tone, and an approximately 30 g smooth, nontender prostate without nodules or induration. After thoroughly discussing the treatment options with this patient, it was determined to proceed with robotic assisted laparoscopic radical prostatectomy for potentially curative treatment of his localized prostate cancer.

The patient was taken to the operating room, where he was induced with general anesthesia, and an RRP was initiated in a standard transperitoneal fashion. As the prostate was divided from the bladder at the bladder neck, there was a gush of clear fluid from the right side of the dissection plane. A lumen was identified just under the bladder neck on the right, and it was apparent we had entered an ectopic ureter most likely implanting into the prostate. At this point, we elected to cannulate the right ureter with a 5-French open-ended ureteral catheter and perform retrograde pyelography after undocking the robot and bringing a C-arm for fluoroscopy into the room. These images appeared to show dilated renal calyces, which we felt were consistent with an upper pole “nubbin” of a malformed kidney (Figure 1). We next performed renal ultrasonography, which demonstrated a normal appearing right kidney and again suggested the presence of an atrophied upper pole moiety. Taken together, these findings were consistent with a duplex collecting system that included an ectopic upper pole ureter entering the prostate.

FIGURE 1. (A) Intraoperative retrograde pyelography of right-sided collecting system showing opacification of malformed upper pole moiety of right kidney (red arrows), suggesting a distally obstructed ureter. (B) Noncontrast CT showing right-sided malformed upper renal moiety with retained intraoperative retrograde contrast (red arrow). (C) Noncontrast CT showing right-sided ectopic ureter (blue arrow) and kidney “nubbin” (red arrow) with retained retrograde pyelography contrast.

With an understanding of the likely anatomy, we resumed the surgical procedure. The robot was redocked and the bladder carefully inspected so that the trigone could be identified. The right orthotopic (lower pole) ureter was now easily identified. However, on the left, only a single orifice was identified just proximal to the bladder neck, and this was observed to be effluxing clear urine. We administered IV methylene blue to confirm these findings, and no blue was seen effluxing from the ectopic right ureter. Following this, the ectopic upper pole and the orthotopic lower pole ureters were identified at the pelvic brim. The ectopic ureter was clipped and divided at this level. The right ectopic ureter was fully transected at the bladder neck and the distal ectopic ureter was removed with the prostate specimen. The remainder of the prostatectomy was performed in a standard, nerve-sparing fashion. We then turned our attention to performing the urethrovesical anastomosis. Given its very close proximity to the bladder neck, the left ureter was cannulated with a ureteral catheter while the anastomosis was performed. The ureteral catheter was withdrawn before completion of the closure.

A computed tomography (CT) urogram was obtained postoperatively to delineate the patient’s anatomy (Figures 2–4). This confirmed the suspected right-sided anatomy, showing a duplex system with an atrophied, nonfunctional upper pole moiety. On the left, a complete duplex kidney was present, with a bifid ureter that united in the pelvis, implanting a single orifice just proximal to the bladder neck. Good drainage of all 3 systems was confirmed on the CT scan and no urine leak was present.
The patient’s postoperative course was uneventful. His Foley catheter was left in place for an extended period of time and was removed on postoperative day 13. His surgical incisions healed well, and he reported rare stress urinary incontinence (0–1 pads per day) and good erectile function without the need of his PDE5-inhibitor therapy as of his 6-week postoperative visit. Pathological examination showed stage pT3aN0 prostatic adenocarcinoma with mixed ductal and acinar features, Gleason score 7 (4 + 3) with tertiary Gleason pattern 5. His PSA at 6 weeks postsurgery was <0.1 ng/mL.

DISCUSSION
An ectopic ureter is a ureter that inserts at a location caudal to the trigone of the bladder. Embryologically, an ectopic ureter forms when ureteral bud separation from the mesonephric duct is delayed or absent. Duplication of the renal collecting system is commonly seen when 2 separate ureteric buds arise from a single mesonephric duct. Consistent with the Weigert–Meyer rule, and as was the case in this patient, the upper-cranial ureteric bud drains the lower renal pole, and the lower-caudal ureteric bud the upper pole (or, in this case, the “nubbin” of the malformed upper kidney).

Symptomology of ectopic ureters is driven by anatomy, as altered insertion sites cause disparate presentations. The most common sites of ectopic ureteral insertion in males are the posterior urethra (50%) and seminal vesicles (33%). Since ectopic ureters in males always insert proximal to the external urinary sphincter, symptoms of urinary incontinence are absent. Instead, some patients may present with hydronephrosis in utero or symptomatic UTI postnatally. Others, however, may be entirely asymptomatic. In contrast, females often present with urinary incontinence due to insertion into sites distal to the external urethral sphincter in two-thirds of cases (eg, vagina,
Ectopic ureters frequently present with other genitourinary anomalies, such as urethral duplication, hypospadias, renal hypoplasia, or dysplasia, and most ectopic ureters are associated with a subfunctioning renal moiety. While roughly 10% of ectopic ureters are bilateral, ectopic ureters associated with duplex collecting systems are 8 times more likely in females than males. In patients with a duplicated system and associated ectopic ureter, 80% have duplication of the contralateral system, an important consideration given the intraoperative findings in the present case. Due to the use of antenatal ultrasonography, it is relatively rare for the diagnosis of ectopic ureter to be made during adulthood.

Here, we present a unique instance in which a previously unidentified ectopic ureter, associated with an agenic upper pole renal moiety, inserted into the prostate of a patient undergoing robotic-assisted radical prostatectomy. While there are a few reported similar cases of this in the literature that we know of, this case is novel in that the anatomic aberration was not identified with imaging before surgery and additional morbidity was avoided. Given the current guidelines recommending axial imaging in only limited instances for patients with newly diagnosed prostate cancer, the present scenario could be encountered somewhat more commonly going forward. Another novel aspect of this case was the decision to clip and excise the distal ectopic ureter, rather than performing a ureteroureterostomy or reimplantation as previously reported. Our decision to clip the ectopic ureter was made based on embryological principles—specifically, that an ectopic ureter inserting into the prostate is likely associated with a nonfunctioning upper renal moiety.

In summary, this case describes our experience with a complex, unexpected anatomical variation during routine urologic oncologic surgery. Utilizing a combination of intraoperative imaging modalities and awareness of the embryological etiology of the variant anatomy, the operation was completed without additional morbidity. By describing the unique aspects of this case and providing a review of the literature on the topic, we provide a potential application for future similar cases and implicate a potential strategy in the intraoperative management of ectopic ureteral insertion into the prostate.

Informed consent for publication of this case was obtained.

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