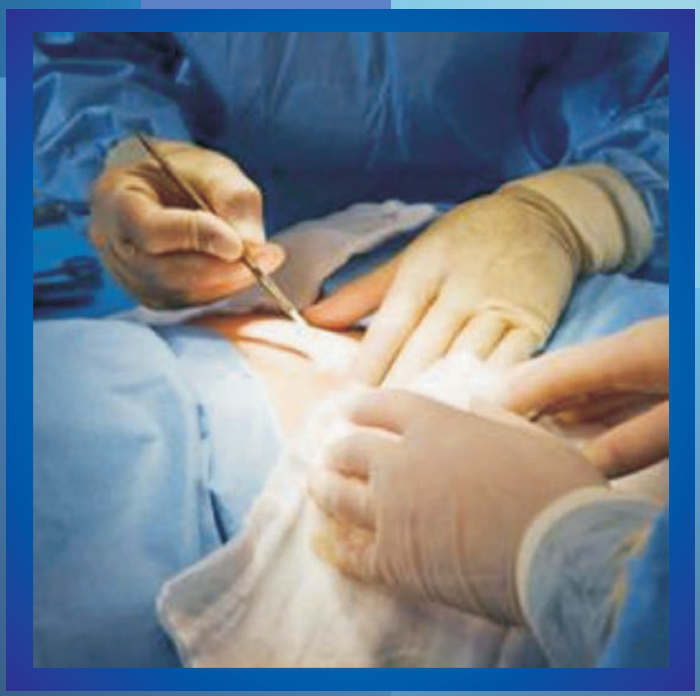
Issue 1



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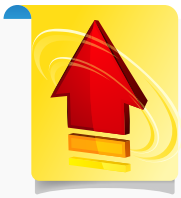
In Patients with LUTS due to BPH,

℞ **CONTIFLO ICON™**

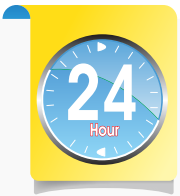
Tamsulosin Hydrochloride 0.4mg **Prolonged Release Tablets**

Tamsulosin with Innovative CONtrolled absorption technology



Delivers consistent drug levels over 24hrs[1,2]

- Better control of bothersome night-time symptoms of LUTS/ BPH, including nocturia
- Better QoS and QoL



Offers 24-hr symptom control[1,2]

- OD dose sufficient

Lower C-max & Drug intake independent of food consumption[1,2]

- Better cardiovascular safety profile
- Patient compliance

LUTS- Lower Urinary Tract Symptoms , BPH-Benign Prostate Hyperplasia, QoL- Quality of Life, QoS- Quality of Sleep, C-max- Maximum concentration of drug in the plasma

Ref: 1.Christopher R. Chapple And Emmanuel Chartier-Kastler. Pharmacokinetic profile of tamsulosin OCAS. Journal Compilation BJU International, 2006;98(2):9-12
2.Phillip K. Introduction and Summary. Journal Compilation BJU International, 2006;98 (2):1-2

Abbreviated Prescribing Information. CONTIFLOTM ICON.

GENERIC NAME: Tamsuosin Hydrochloride Prolonged Release Tablets. COMPOSITION:Each film-coated tablet contains: Tamsulosin HCl IP…0.4 mg (prolonged release.DOSAGE Form: Tablets for oral use. Description: CONTIFLO ICON contains tamsulosin hydrochloride, which is an antagonist of alphaIA adrenoceptors in the prostate. Indications: For the treatment of sign and symptoms of benign prostatic hyperplasia (BPH). DOSE AND METHOD OF ADMINISTRATION: The recommended dose of CONTIFLO ICON (Tamsulosin HCl Prolonged Release Tablet) is 0.4mg once daily. It should be administered approximately one-half hour following the same meal each day. For those patients who fail to respond to the 0.4mg dose after 2 to 4 weeks of dosing, the dose of tamsulosin HCl prolonged release tablet can be increased to 0.8mg once daily. If discontinued or interrupted for several days at either the 0.4mg or 0.8mg dose, therapy should be started again with the 0.4mg once daily doseThe tablet should be swallowed whole and should not be crunched or chewed as this will interfere with the prolonged release of the active ingredient. Pregnancy: Pregnancy category B: Tamsulosin is not indicated for use in women. CONTRAINDICATIONS: Patients with known hypersensitivity to tamsulosin or any other component of this product. Reactions have included skin rash, urticaria, pruritus, angioedema and respiratory symptoms. WARNINGS AND PRECAUTIONS: Possibility of postural hypotension. Patients should be cautioned to avoid situations where injury could result should syncope occur. Tamsulosin should not be used in combination with other alpha adrenergic blocking agents. Caution is advised when alpha adrenergic blocking agents including tamsulosin are co-administered with PDE5 inhibitors. Alpha adrenergic blockers and PDE5 inhibitors are both vasodilators that can lower blood pressure. Concomitant use of these two drug classes can potentially cause symptomatic hypotension. Caution should be exercised with concomitant administration of warfarin and tamsulosin. Patients must be advised about the possibility & seriousness of Priapism. Intraoperative floppy iris syndromehas been observed during cataract surgery in some patients treated with alpha1 blockers, including tamsulosin. Advice patients considering cataract surgery to tell their ophthalmologist about use of contiflo Icon. DRUG INTERACTIONS: Tamsulosin 0.4mg should not be used in combination with strong inhibitors of CYP3A4 (e.g., ketoconazole). Tamsulosin should be used with caution in combination with moderate inhibitors of CYP3A4 (e.g., erythromycin), in combination with strong (e.g., paroxetine) or moderate (e.g., terbinafine) inhibitors of CYP2D6, in patients known to be CYP2D6 poor metabolizers particularly at a dose higher than 0.4mg (e.g., 0.8mg).. SHELF-LIFE: Please see Mfg. Date. Expiry date printed on pack. Do not use product after expiry date which is stated on packaging. Expiry date refers to last day of that month. STORAGE AND HANDLING INSTRUCTIONS: Store below 25□C, protected from light and moisture. Keep all medicines out of reach of children. For more information kindle write to : SUN HOUSE, 201 B/1,WESTERN EXPRESS HIGHWAY, GOREGAON EAST, MUMBAI-400063

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Contents

Technical Innovations to Optimize Early Return of Urinary Continence

Usama Khater, Sanjay Razdan

Introduction

Post-prostatectomy incontinence (PPI) represents a time-dependent devastating iatrogenic complication after surgery. A 12-month continence rate is reported in 48–91 % after laparoscopic prostatectomy (LP), in 89–97 % after robot-assisted laparoscopic prostatectomy (RALP) and 77.7–93.7 % of cases after open retropubic radical prostatectomy (RRP) [1]. Although the continence rate 1 year after RALP is excellent, achievement of an earlier continence at 3 and 6 months postoperatively is still a challenge. Several surgical techniques to optimize the early return of continence have been described. Most of these techniques emphasize the importance of restoring the normal pelvic anatomy after removal of the prostate.

Anatomical Background and Techniques

In men, urinary continence is thought to be controlled by five main structures: the detrusor muscle, the internal sphincter, the ureterotrigonal muscles, the levator muscles, and the rhabdosphincter [2, 3]. Maintaining these structures and maintaining the normal anatomy of the pelvis are the cornerstone to achieve better post-RALP results. This can be achieved through three different steps of techniques: preservation, reconstruction, and reinforcement of the sphincter structures.

Electronic supplementary material The online version of this chapter (doi:10.1007/978-3319-39448-0_5) contains supplementary material, which is available to authorized users.

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Preservation

Bladder Neck Preservation

Anatomically, the bladder neck serves as an internal sphincter and it is intuitive that bladder neck preservation may contribute to early return of urinary continence.

Maintaining circular fibers of the bladder neck during dissection of the prostatovesical junction can accelerate the return of postoperative urinary continence. Anterocephalic tension of the bladder using the fourth arm will create a landmark that facilitates dissection of the bladder neck. Precise incision of the posterior bladder neck will maintain clean detrusor margins for subsequent urethrovesical anastomosis, anastomosis (Figs. 1, 2, and 3) [4].

Friedlander *et al*. compared cancer control outcomes and continence in bladder neck sparing vs. non sparing technique during RALP. No difference in cancer control outcome was detected in both groups. However, bladder neck sparing is associated with fewer urinary leakage complication and better post-prostatectomy continence outcome [4].

Nerve Preservation

The rhabdosphincter receives nerve fibers from the pelvic nerve, intrapelvic branch and perineal branch from pudendal nerve. Preservation of intrapelvic branch of the pudendal nerve has been shown to maintain rhabdosphincter function after RALP [5].

Though it is clear that neurovascular bundle preservation during RALP will preserve postoperative potency, it is still controversial whether preservation of nerves around the bladder, prostate, and urethra results in continence after RALP. Choi *et al*. reported that continence rate and EPIC urinary function score were better for bilateral nerve-sparing vs. non-nerve-sparing technique after 4 months [6]. On the other hand, Pick *et al*. have found no significant difference

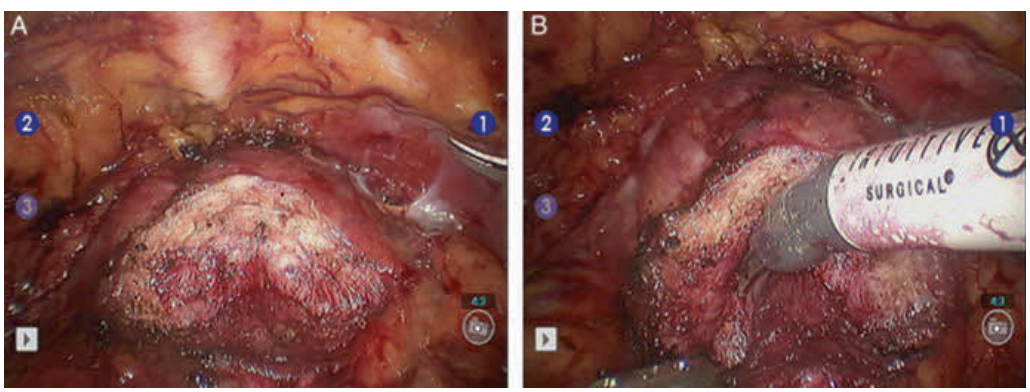

Fig. 1: Bladder neck dissection is initiated in midline at prostate mid/base anterior until reaching depth of vertically oriented bladder neck fibers (**A**). Bladder neck incision is arced cephalad with lateral extension until anterior portion of bladder neck is defined. Blunt dissection is performed anterior, and on right and left (**B**) of bladder neck to define its funneled contour as it transitions to prostatic urethra [4].

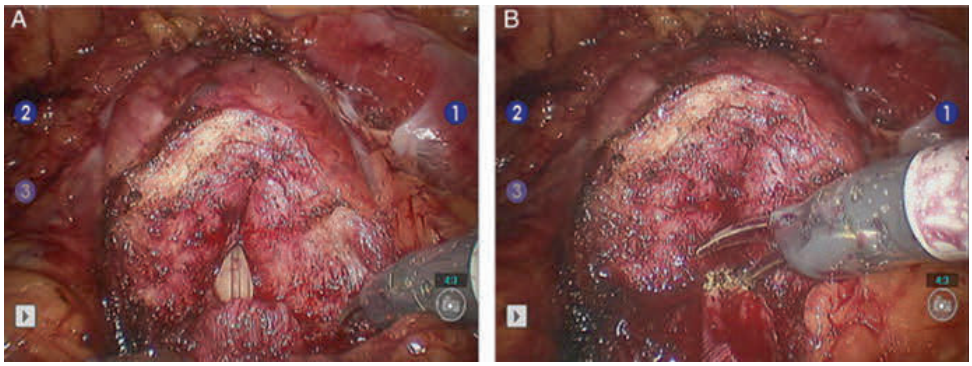

Fig. 2: Bladder neck is opened anterior to expose catheter (**A**), which is withdrawn before scoring posterior bladder neck mucosa with monopolar current (**B**) [4].

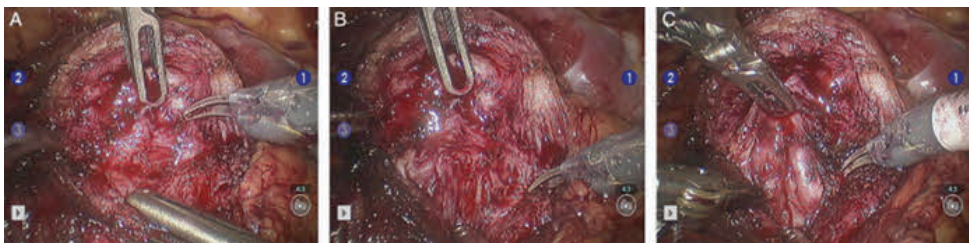

Fig. 3: Fourth arm ProGrasp elevates prostate base to create tension for posterior bladder neck dissection (**A**). Assistant laparoscopic grasper counter traction is applied during posterior bladder neck dissection. Bladder neck dissection proceeds laterally to adipose tissue, which serves as lateral border of dissection bilaterally (**B**). Downward traction of assistant suction tip aids exposure. Note suction tip on posterior longitudinal detrusor layer. Posterior longitudinal detrusor layer is opened as low as possible, revealing vas deferens (**C**) [4].

in continence rate at 12 months after RALP between unilateral, bilateral, and non-nerve-sparing RALP (88.9, 89.2, and 84.8 % respectively), concluding that preservation of cavernous nerve does not predict over all return of continence [7].

Pubovesical Complex Sparing and Puboprostatic Ligament Preservation

Different studies have shown that puboprostatic ligament preservation improves continence results after RALP [8, 9]. Astimakopoulos *et al.* developed a pubovesical complex sparing technique, in which the prostate is dissected from underneath the spared pubovesical complex and urethrovesical anastomosis is performed under the spared complex. Twenty percent of patients needed one security pad after catheter removal. Preservation of periprostatic anatomy may enhance early functional outcome [10].

Preservation of Urethral Length

Male sphincteric mechanism is composed of striated urogenital sphincter muscle and an inner smooth muscle layer. The internal component of the distal sphincter mechanism extends to the

verumontanum while the striated sphincter is functional from prostate apex to the bulb [11]. Early urinary continence can be achieved through maximum preservation of the striated sphincter and intraprostatic portion of the membranous urethra [12]. It is important not to compromise apical margin during maximal urethral length preservation, this can be achieved by accurate identification of the junction between prostatic apex and urethra. Nguyen *et al.* stated that shorter urethral sphincter length on pre operative endorectal MRI is associated with higher risk of post-prostatectomy incontinence. However, technical modification to restore the continence mechanism intraoperatively could improve continence outcome in patients with shorter urethral sphincter [13].

Modified Maximal Urethral Length Preservation (MULP) Technique

At the International Robotic Prostatectomy Institute, the senior author and editor of this text, Razdan S., modified and pioneered maximal urethral length preservation (MULP) in RALP. In this technique the previously ligated deep venous complex (DVC) is divided using shears. The correct plane between the anterior prostatic capsule and the ligated DVC is achieved by the "apical pinch" which affords proper orientation as well as avoids a positive anterior margin. Following division of the deep venous complex, the apex is dissected carefully along the retropubic plane using the robotic endoshear, starting at the prostatic–rhabdosphincter junction, by dividing the striated and smooth muscle fibers sweeping from the apex toward the membranous urethra. Twisting the prostate from side to side with the fourth robot arm enables clear visualization of the prostatic apex. Subsequently, division of the flimsy posterior fibrous connections at the apex of the prostate allows release of the posterior lip of the prostate, thereby exposing an additional length of intraprostatic urethra, which adds to the MULP (Fig. 4). Division of the urethra at the new prostate urethral junction is then carried out with a birds eye view thereby, reducing positive apical margins (see Video 1). The authors have been able to preserve an additional 1–2 cm of intraprostatic and membranous urethra by this modified MULP procedure which in turn facilitates an easier vesicourethral anastomosis and earlier return of continence. Urethrovesical anastomosis is then performed using the classic Van Velthoven technique (see Video 2).

The continence rate following the modified MULP technique in RALP was in 50–70 % of patients at one month, in 90–96.66 % at 3 months and 100 % of patients 6 months after catheter removal [14].

A considerable proportion of the external urethral sphincter is located between the verumontanum and distal edge of the prostatic apex, and this plays a significant role in continence. Through MULP technique we were able to get an extra length of urethral stump that improved the overall continence mechanism. The longer urethral stump also facilitates faster and easily accessible vesicourethral anastomosis without the need for perineal compression and provides support to the bladder. By dissecting the urethra more proximally in MULP, we keep the autonomic branches that innervate the external sphincter away from the anastomosis. Furthermore, by working more proximally away from the external sphincter, the latter is less likely to be compromised by the inflammatory process that takes place due to intraoperative maneuvers at the site

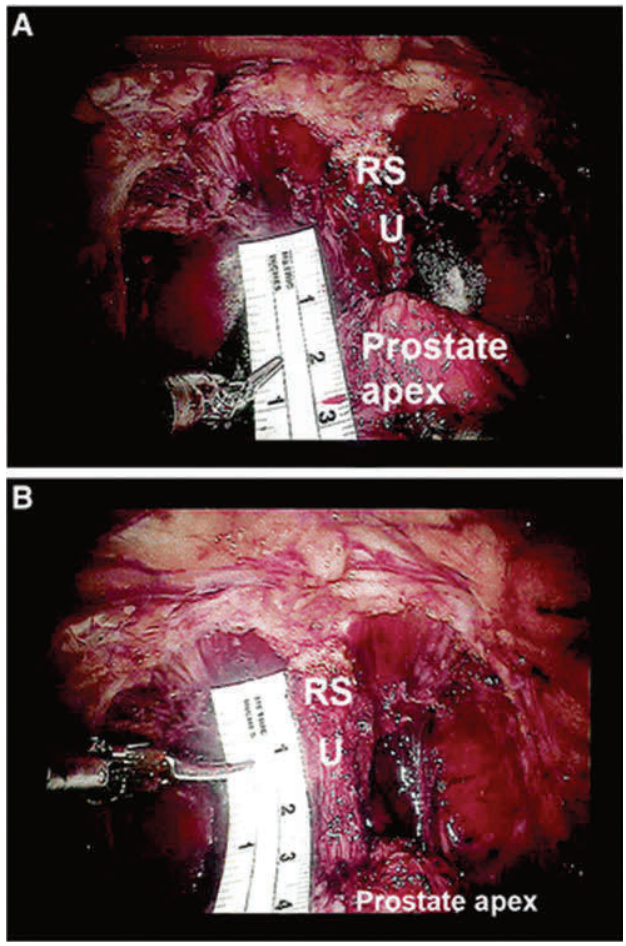

Fig. 4: (**A**) The posterior urethral junction and the membranous urethra after dissecting the endopelvic fascia and the dorsal vein complex. (**B**) The maximal urethral length preservation after performing the retro-apical dissection. *RS* rhabdosphincter, *U* membranous urethra [14]

of the anastomosis. Other studies have also reiterated that MULP has a very significant role in early continence recovery [15].

Reconstruction

Posterior Rhabdosphincter Reconstruction

Posterior reconstruction aims at restoring the anatomical and functional defect through reapproximating the posterior semi-circumference of the rhabdosphincter to the residual cut edge of the Denonvilliers' fascia. This will allow a firm support to the posterior aspect of the urethral sphincter complex [16–18]. Nguyen *et al*. investigated the relation between posterior reconstruction and early return of continence after RALP and LRP, 3 days after catheter removal, 34 % of patients who underwent posterior reconstruction were continent, in comparison to patients who underwent standard technique where only 3 % were continent ($P = 0.007$) [19]. Brien *et al*.

have reported a significant improvement in terms of return of baseline score for urinary bother in posterior reconstruction group in comparison to control group (72 % vs. 53 %; $P = 0.0083$) [20]. Gondo *et al*. have reported that posterior reconstruction has better early recovery of urinary continence results after 1 month of catheter removal in univariate analysis [21]. Fecarra *et al*. have reported 95 % recovery of urinary continence at a mean follow-up of 9 months [22] He also concluded that posterior reconstruction procedure is simple, with minimal increase in operative time, and provides a good support of the urethrovesical anastomosis. On the other hand, Menon *et al*. have found no significant difference in continence rate with posterior reconstruction compared to control group [23].

Anterior Retropubic Suspension

Anterior retropubic suspension aims at providing anatomical support of the urethra and stabilizing urethra and striated sphincter in anatomical position [24]. Anterior suspension is done through a monofilament suture that pass from the right to the left between the urethra and dorsal venous complex and then through the periosteum of the pubic bone. Patel *et al*. have reported significant improvement in continence rate after 3 months of RALP, in patients who had anterior suspension technique in comparison to non suspension technique (92.8 % vs. 83 %, $P = 0.02$) [25].

At our institution we compared the continence rates at 1, 3, and 6 months after RALP in three group of patients; the first group had posterior urethral reconstruction and anterior bladder suspension, second group had MULP combined with posterior urethral reconstruction and anterior bladder suspension and the third group had only MULP. Each group included 30 matched patients. The second and third groups showed significantly higher and earlier continence rate than the first group who had posterior urethral reconstruction and anterior bladder suspension without MULP. There was no significant difference in the continence rate between the patients who had only MULP and the group who had MULP combined with posterior urethral reconstruction and anterior bladder suspension (Fig. 5). No significant differences were noticed in the rates of overall and apical positive margins between the three groups. No significant variations were detected in terms of biochemical recurrence at 12 month follow-up [14].

Total Reconstruction of Vesicourethral Junction

Tewari *et al*. evaluated continence rate in patients who underwent anterior reconstruction alone versus anterior and posterior reconstruction during RALP versus a historical control group, he found that at 3 months, the continence rate for the control group was 50 %, while in the anterior reconstruction group and combined anterior and posterior reconstruction groups continence rate was 77 and 91 % respectively at 3 months [15]. A much more reconstruction techniques were used including: preservation of archus tendentious and puboprostatic ligament, creation of muscular flap behind the sphincter, control of dorsal venous complex using a puboprostatic ligament sparing suture, preparation of a long urethral sump, usage of Pagano principle reinforcement of

the flap behind the bladder neck, usage of Rocco principle suturing of the flap to the distal end of the Denonvillier's fascia close to the urethral stump. Finally, reattachment of Arcus tendentious and puboprostatic plate to the bladder neck after the anastomosis is created [2] (Fig. 6).

Reinforcement

Bladder Neck Plication

Bladder neck plication is done through a plication stitch placed 2 cm proximal to the vesicourethral anastomosis at 3 o'clock and 9 o'clock, after tying this stitch, this will create a funneling of distal bladder neck. Mean time to total continence was ± 3.8 weeks in stitch technique group, vs. 8.49 ± 6.32 weeks in non stitch group ($P = 0.002$) [26].

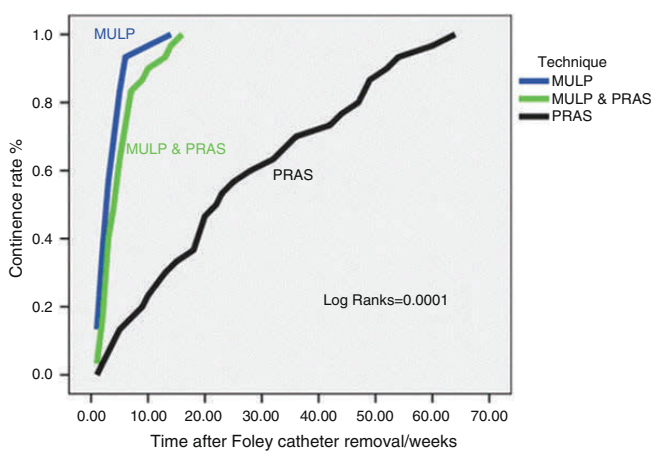

Fig. 5: Kaplan–Meier plot for the improvement in continence rates among the three study groups. *MULP* maximal urethral length preservation, *PRAS* posterior urethral reconstruction and anterior bladder suspension

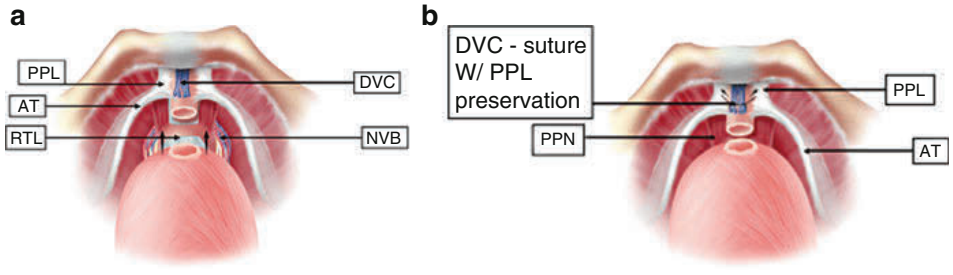

Fig. 6: (**a**) Creation of muscle flap behind the bladder. (**b**) Control of dorsal venous complex using a puboprostatic ligament sparing suture [15]. *PPL* puboprostatic ligament, *NVB* neurovascular bundle. *AT* arcus tendentious, *DVC* deep venous complex, *RTLL* retroperitoneal layer

Bladder Neck Sling Suspension

Bladder neck sling suspension can support proximal urethra and bladder neck and increase the functional length of the urethral sphincteric complex after RALP. This subsequently improves the early return of continence after RALP [27].

Conclusions

- Surgical modifications that preserve the natural urinary continence mechanisms seem to promote early recovery of continence.
- Maximal urethral length preservation (MULP) in the authors' experience is the single most important factor determining early return of continence after RALP.
- Neurovascular bundle preservation and bladder neck preservation may have a positive impact in overall recovery of urinary continence, though the results of studies are mixed.
- In the authors' experience, anterior suspension and total vesicourethral reconstruction have no impact on recovery of continence and in fact may have a detrimental effect on early return of continence.

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Flexible Ureteroscopy: Wireless and Sheathless

Jacob H. Cohen, Seth D. Cohen, Michael Grasso III

Introduction

No-touch ureteroscopy, also termed "wireless and sheathless" ureteroscopy, was first introduced as means of mapping the upper urinary tract urothelium in those who had undergone prior endoscopic therapy of an urothelial malignancy. Minimizing incidental trauma from a guidewire or dilator was found to be particularly helpful in performing a meticulous endoscopic evaluation in this select patient population. Bagley was the first to describe a no touch or atraumatic diagnostic technique [1, 2]. A small diameter semi rigid ureteroscope was first employed under direct vision inspecting the distal ureter, and then over a guidewire passed only into the distal ureter, the flexible ureteroscope was placed to complete the more proximal ureteral and intrarenal inspection. Improvements in the mechanics of flexible ureteroscopes, including smaller tip diameter, exaggerated tip deflection, and a larger deflecting radius allow for the intubation of the ureteral orifice and the complete upper urinary tract inspection to be performed solely with a flexible endoscope, commonly without the assistance of a potentially traumatic guidewire.

Direct flexible ureteroscope access to the upper urinary tract involves identifying, intubating, and traversing the intramural ureter under direct vision without the use of a guidewire or an access sheath which might obscure a distal ureteral lesion. Achieving upper tract urinary access with this technique was described in 2004 by Johnson *et al.* [3]. Atraumatic evaluation of the upper urinary tract is particularly useful in those undergoing diagnostic ureteroscopy with a history of upper tract urothelial malignancies. In this setting, use of a ureteral access sheath may obscure small ureteral tumors, and a guidewire may cause mucosal trauma and erythema, rendering a diagnostic evaluation difficult. With the safety and efficacy of this technique in diagnostic

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applications, the indications for no-touch ureteroscopy have expanded to include a variety of therapeutic indications including tumor therapy and endoscopic lithotripsy. Herein, a review of the current techniques and results associated with wireless and sheathless flexible ureteroscopy will be presented.

Instrumentation

The early 1990s saw the advent of the two-way, actively deflectable, flexible ureteroscope, ushering in the era of modern, flexible ureteroscopy. New generation flexible ureteroscopes possess many design advantages that facilitate no-touch ureteroscopy, such as smaller tip diameter, increased primary active deflection, and greater shaft durometer (stiffness).

No-touch ureteroscopy requires the smallest tip diameter fiberoptic flexible ureteroscopes, typically having a 7.5 Fr tip diameter and a shaft diameter of 8.1–8.5 Fr (Fig. 1). Digital ureteroscopes tend to be of a larger diameter and less deflectable making intramural intubation more challenging. The smallest diameter endoscopes also help facilitate irrigant drainage around the instrument, minimizing over-distension of the renal collecting system. The standard 3.6 Fr working channel allows placement of accessory instruments with adequate simultaneous irrigation. Increased ureteroscope shaft stiffness prevents buckling in the bladder and distal ureter, thus facilitating greater control of the ureteroscope tip.

One-to-one torquability (rotating the flexible ureteroscope at the handle facilitates the same degree of tip rotation) and logical active deflection (lever down leads to tip down) of up to 270° facilitate accurate placement of the flexible ureteroscope throughout the upper urinary tract (Fig. 2). Active tip deflection by depressing the endoscope lever is enhanced by passive distal shaft deflection, often required to access the lower pole. With the instrument hand lever maximally depressed, the instrument is advanced causing buckling at a predetermined shaft segment. This maneuver, termed passive deflection, is useful in placing endoscope accessories into a particularly

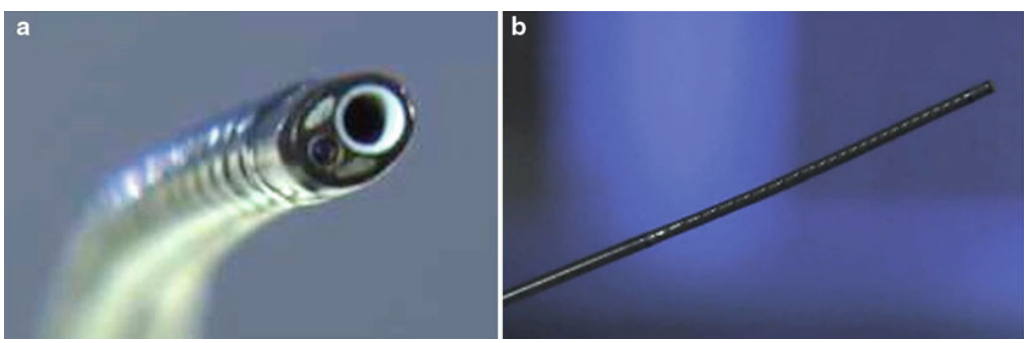

Fig. 1: Cross-section view of a flexible ureteroscope showing the optical system and 3.6 Fr working channel (**a**). Figure 23.1a from Cohen JH, Grasso III, M. Ureteroscopy for Upper Ureteric and Renal Stones: Overcoming Difficulties with the Flexible Approach. In: Difficult Cases in Endourology Al-Kandari A, Desai M, Shokeir AA, Shoma AM, Smith AD, editors. New York. Springer Science + Business Media; 2013. Reprinted with permission. Modern fiberoptic flexible ureteroscopes typically have a 7.5 Fr tip diameter, a shaft diameter of 8.1–8.5 Fr (**b**).

Fig. 2: A 270° tip deflection is demonstrated. Figure 23.1b from Cohen JH, Grasso III, M. Ureteroscopy for Upper Ureteric and Renal Stones: Overcoming Difficulties with the Flexible Approach. In: Difficult Cases in Endourology Al-Kandari A, Desai M, Shokeir AA, Shoma AM, Smith AD, editors. New York. Springer Science + Business Media; 2013. Reprinted with permission.

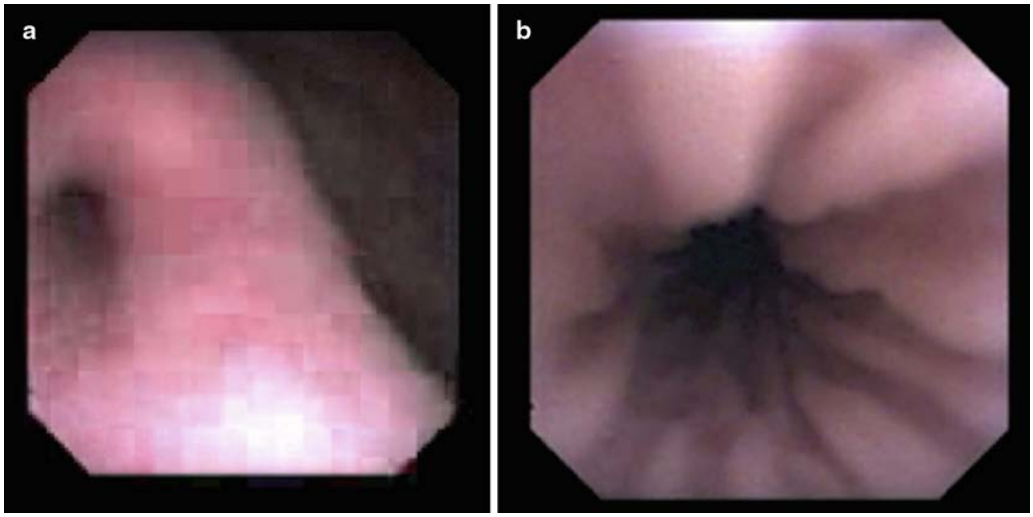

Fig. 3: View of the right ureteral orifice through the ureteroscope (**a**). A peristaltic wave is encountered in the mid ureter (**b**).

dependant lower pole calyx. Accessory equipment, such as a 365-mm laser fiber and a 2.4 Fr Nitinol basket decrease tip deflectability, but their application is enhanced with this maneuver.

Technique

Ureteroscopy begins with cystoscopic evaluation of the bladder to both evaluate the lower urinary tract urothelium and define the location and caliber of the ureteral orifices. A 5-Fr open-ended ureteral catheter and real-time fluoroscopy are employed for a contrast-based retrograde

pyelogram, defining ureteral and calyceal anatomy. The bladder is then drained completely, and the flexible ureteroscope passed into the bladder. Sufficient irrigant (typically 50–60 cc) is instilled to lift the back wall of the bladder off of the trigone, which aids in identifying the ureteral orifice. If the bladder is over distended, the intramural tunnel is compressed, making ureteral cannulation with the endoscope challenging.

The ureteral orifice is gently cannulated with the flexible ureteroscope under direct vision and then directed proximally (Fig. 3). If a ureteral peristaltic wave is encountered, retrograde passage is transiently paused until the wave has passed. Once in the kidney, a complete mapping of the collecting system is routinely performed. Instillation of dilute radio-opaque contrast through the working channel of the ureteroscope can be employed as a map for subsequent endoscopic inspection. Lower pole calyces can be challenging to visualize, particularly if associated with a narrow or angled infundibulum. The combination of maximal active tip deflection with passive proximal shaft buckling (i.e., secondary deflection) will often help facilitate endoscope placement in this setting (Fig. 4).

Irrigant is employed through the working channel of the endoscope to clear the optical lens of debris and to distend the collecting sufficiently for inspection. A simple irrigation system commonly employed is based on two refillable 60 cc syringes joined to a 3-way stopcock attached to the endoscope with standard Luer-lock ended tubing (Fig. 5). The assistant instills sufficient irrigant to clear the optical field, varying the pressure and flow as needed based on the clinical presentation. Normal saline is the most common irrigant employed for diagnostic ureteroscopy and endoscopic lithotripsy. If electrocautery is to be employed for fulguration, sorbitol is the preferred irrigant. Small aliquots of sterile water can also be used in this setting and is particularly useful when encountering a bloody endoscopic field of view.

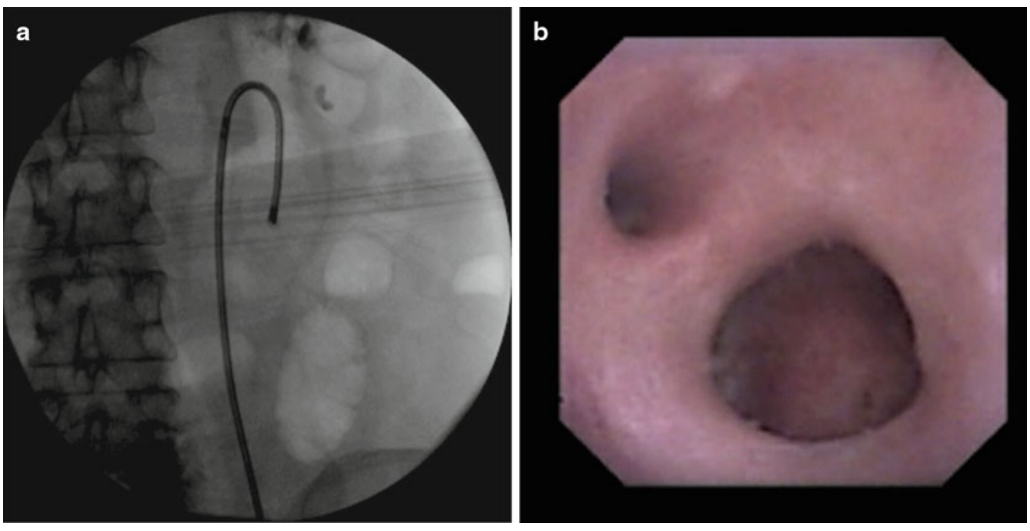

Fig. 4: Secondary active and passive deflection is required to achieve access to this right, lower-pole calyx (**a**). Endoscopic view of anterior and posterior mid-pole calyxes from the renal pelvis (**b**).

Difficult Endoscope Access: Broadening the Algorithm

No-touch flexible ureteroscopic access is employed when technically feasible for the reasons previously defined. Commonly, a tight ureteral orifice or a tortuous intramural ureter will prohibit endoscope placement. In this setting a flexible tipped guidewire is passed through the working channel of the endoscope and the distal ureter is intubated under direct vision. This maneuver

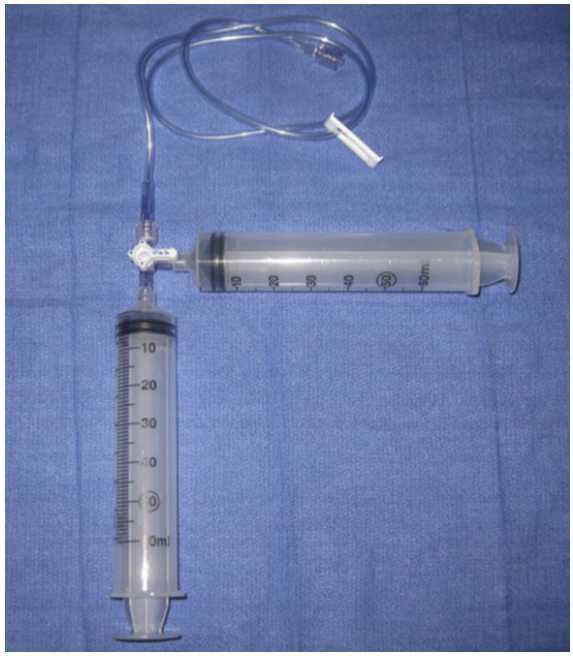

Fig. 5: Two 60 cc syringes connected through a 3-way stopcock to Luer-lock extension tubing allows variation in pressure and flow while irrigating.

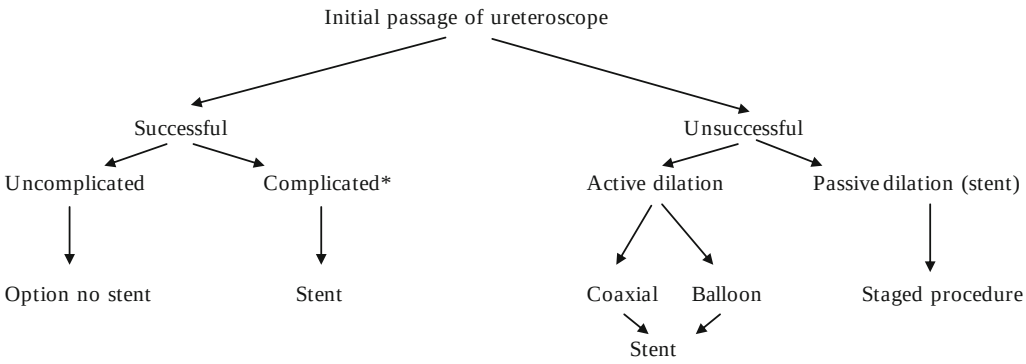

Fig. 6: Procedural algorithm. *Asterisk*: Complicated defined by prolonged procedure, infection, ureteral edema/trauma, congenital obstructive anomaly, or significant residual stone burden. Figure 23.2 from Cohen JH, Grasso III, M. Ureteroscopy for Upper Ureteric and Renal Stones: Overcoming Difficulties with the Flexible Approach. In: Difficult Cases in Endourology Al-Kandari A, Desai M, Shokeir AA, Shoma AM, Smith AD, editors. New York. Springer Science + Business Media; 2013. Reprinted with permission.

frequently facilitates endoscope passage through a tortuous or kinked segment of the ureter, straightening the ureter while providing increased shaft rigidity. Once the narrowed or tortuous segment is traversed, the guidewire is removed and the remainder of the ureter and collecting system inspected without a wire in place.

If the intramural ureter is narrowed, a common finding in young males, and a guidewire alone will not facilitate access, intramural dilation is required (Fig. 6). Dilators with the smallest caliber outer diameter cause the least ureteral trauma and are preferred. The intramural ureter is actively dilated with either a 6–12 Fr graduated dilator (i.e., Nottingham dilator, Boston Scientific, Natick Mass.), or a balloon dilator (5 Fr delivery sheath, 12 Fr inflated outer diameter, 4–10 cm long balloon). Dilation is performed over a teflon sheathed kink-resistant, nickel-titanium guidewire (Zebra wire, Boston Scientific, Natick, MA). The more costly balloon dilation can be less traumatic with only circumferential dilating force, as compared to gradual dilators which have the added shearing force. After active intramural dilation, the flexible ureteroscope is then passed over the guidewire to begin the endoscopy.

If the flexible ureteroscope cannot traverse the ureteral orifice after active dilation, a mucosal lip or fold may be inhibiting progress. In that setting a small caliber semirigid ureteroscope is employed to inspect this segment. The passage of the graduated semirigid endoscope will also facilitate ureteral dilation in this setting. There are certain clinical presentations where after the aforementioned maneuvers, the endoscope will not pass proximally. Patients with prior retroperitoneal surgery or radiotherapy causing marked ureteral fibrosis may prohibit diagnostic ureteroscopy.

In this setting, performing a staged procedure by first placing an ureteral stent to facilitate passive dilatation of the ureter over time is a useful technique.

Management of Upper Urinary Tract Urothelial Tumors

Atraumatic ureteroscopic examination of the upper urinary tract is crucial in the setting of diagnosing and treating upper urinary tract tumors. No-touch flexible ureteroscopy, if technically feasible, facilitates a pristine inspection of the urothelium, minimizing bleeding and inadvertent urothelial trauma. In addition, the application of an access sheath in this setting may disrupt a papillary lesion or obscure distal ureteral tumors and thus are infrequently employed, particularly during diagnostic endoscopic mapping (Fig. 7).

Cystoscopic mapping of the lower urinary tract urothelium, bladder barbotage for cytological evaluation, and retrograde pyelograms are performed prior to diagnostic ureteroscopy. A small aliquot of dilute contrast is instilled through a 5 Fr angiographic ureteral catheter under real-time fluoroscopic guidance to opacify the collecting system. Over distension of the collecting system may cause extravasation and mucosal changes, potentially obscuring small or flat lesions.

Obtaining an adequate biopsy specimen is paramount to accurately diagnosing upper urinary tract tumors and crafting a treatment plan. Papillary tumors are best biopsied with a flatwire 2.4 Fr stainless steel Segura basket (Boston Scientific, Natick, MA). The flexible ureteroscope is withdrawn with the engaged specimen under vision, as extracting the basket through the working

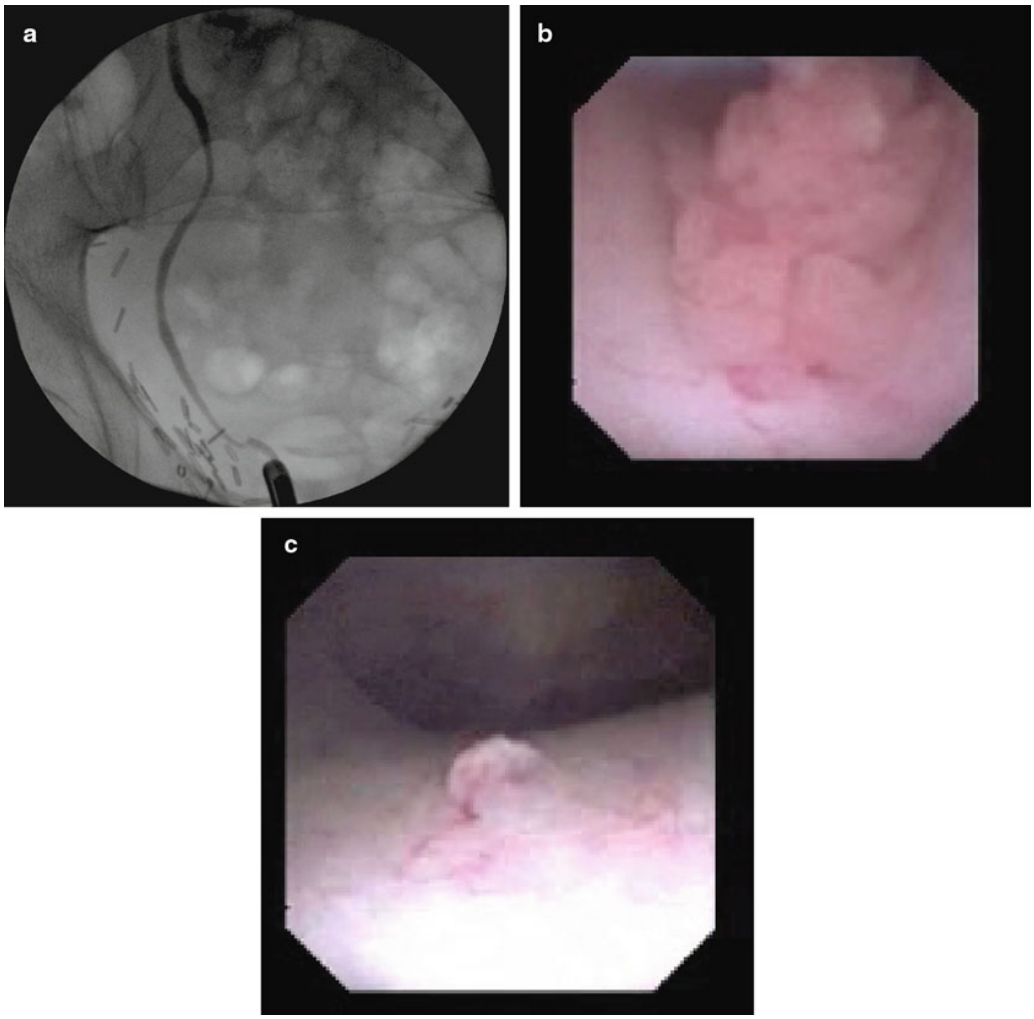

Fig. 7: Normal retrograde pyelogram in a patient with a history of prior pelvic surgery and upper tract urothelial cancer (**a**). No-touch ureteroscopy was performed, revealing a 5-mm right distal ureteral tumor that did not manifest as a filling defect on the retrograde pyelogram (**b**). A 1-mm tumor in the renal pelvis easily appreciated with atruamatic inspection of the upper urinary tract without prior sheath or wire placement (**c**).

channel of the ureteroscope will shear off specimen (Fig. 8). For large and vascular lesions, it is often helpful to first coagulate the tumor base with laser energy or electrocautery to minimize hematuria associated with the biopsy. Flat lesions are biopsied with a cup biopsy forceps (Piranha biopsy forceps, Boston Scientific, Natick, MA) with the small specimens prepared and evaluated using cytologic cell block technique [4]. Obtaining a barbotage specimen of saline obtained through the working channel of the endoscope after biopsy will increase the sensitivity of the cytologic evaluation [5].

Once an ureteroscopic biopsy has been performed, tumor therapy can proceed in the appropriate setting. The indications for ureteroscopic therapy have broadened with the best results in

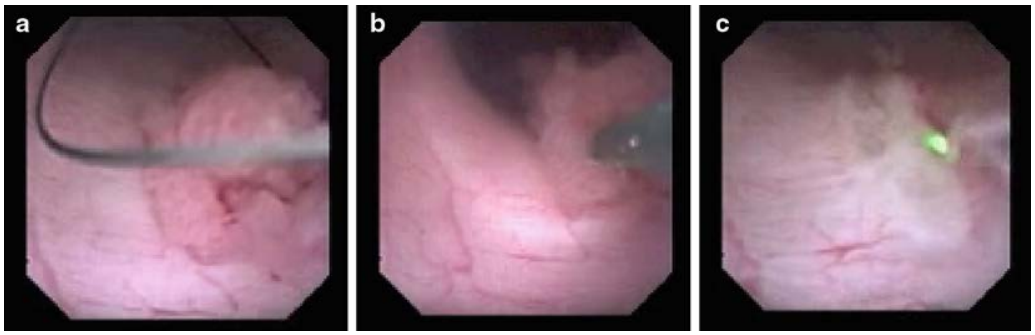

Fig. 8: A 2.4-Fr basket is placed around the tumor (**a**). The tumor is pulled free and the tumor, basket, and ureteroscope are withdrawn down the ureter as a unit (**b**). The tumor base is then coagulated using holmium laser energy (**c**).

those with modest-sized, lower grade lesions [6, 7]. Ureteroscopic resection of an upper urinary tract urothelial lesion is performed with either electrocautery or laser energy, with the intent to remove all visible tumor. Small caliber 2 Fr electrocautery electrodes are employed to both resect and coagulate lesions. Holmium laser energy is an efficient means of clearing papillary tumor fronds, employing low power setting of 0.6 J and frequency of pulsation of 5 Hz to coagulate small bleeding sites as tumor is ablated. ND:YAG (neodymium) laser energy can be employed simultaneously with holmium to obtain deeper tissue coagulation. Twenty watts of Nd:YAG power for 15–20 s will both coagulate and also cause deeper tissue necrosis as compared to holmium, and as such should be used with caution in the ureter in light of a relatively high risk of subsequent structure [8]. Staged ureteroscopic resection is employed commonly for large tumors, and to help facilitate topical therapies.

Postoperative ureteral stenting is employed after ureteroscopic tumor therapy based in part on the complexity of the procedure and the volume of tumor treated. In cases where active dilation was employed for access, or when an intrarenal chemotherapy is planned, a ureteral catheter is placed at the termination of ureteroscopic therapy.

Ureteroscopic Lithotripsy

Flexible ureteroscopic lithotripsy is a common therapy for upper urinary tract calculi, and is particularly useful for extracorporeal shock wave (ESWL) failures and in those patients who are not candidates for the more invasive percutaneous nephrostolithotomy (PCNL). Ureteroscopic lithotripsy can be employed for various stone compositions, often irrespective of size. Ureteroscopic lithotripsy is useful in treating complex presentations including the morbidly obese, those with uncorrectable bleeding diathesis or on chronic anticoagulation, or patients with other comorbidities limiting their ability to tolerate more invasive procedures. A relative contraindication to flexible ureteroscopic lithotripsy is active pyelonephritis, potentially with pyonephrosis, where primary drainage and staged endoscopic lithotripsy are the best course.

The holmium laser is the most common lithotrite employed through the flexible ureteroscope, delivering laser energy in a pulsatile fashion through flexible, low water density quartz

fibers. Holmium laser energy fragments all stones irrespective of composition, with higher power required for the more dense calcium oxalate monohydrate and brushite calculi. Laser fibers of 365 or 200-mm diameter are commonly used. Larger fibers have an exponentially larger spot size and efficiency in fragmentation, while smaller diameter fibers maximize irrigant flow and endoscope deflectability, which is particularly useful when treating dependant lower pole calculi. Laser settings for lithotripsy often begin at 1 J and 5 Hz frequency of pulsation. For particularly dense calcium oxalate monohydrate stones, higher settings may be used, with the caveat that increased kinetic energy will be transmitted to the stone, making it more difficult to pin and fragment smaller pieces. Once primary fragmentation is complete, lowering the laser settings will help efficiently pulverize residual. Laser fiber strippers should be available to optimize the fiber tip as it is degraded during active lithotripsy.

Small caliber (1.3–2.4 Fr) nitinol baskets are employed to extract representative fragments for stone analysis after ureteroscopic lithotripsy. The nitinol basket's soft and moldable spherical shape is useful in both extracting and disengaging stone fragments (Fig. 9). Nitinol graspers (1.9 Fr Graspit, Boston Scientific, Natick, MA or 1.7 Fr Engage, Cook Urology, Spencer, IN) can disengage calculi more easily and are particularly useful in relocating calculi from a lower pole location to a more easily accessible cephalad calyx where a larger laser fiber can be employed to maximize efficient lithotripsy.

Continuous bladder drainage during ureteroscopic lithotripsy is commonly performed by placing a small diameter 14 Fr foley catheter to gravity drainage beside the ureteroscope. Decompressing the bladder will help clear the optic field and minimize intramural ureteral pressure which can limit ureteroscopic maneuverability.

At the conclusion of endoscopic lithotripsy, an ureteral stent is placed if intramural ureteral dilation was required for endoscope access, significant edema from impacted stones was

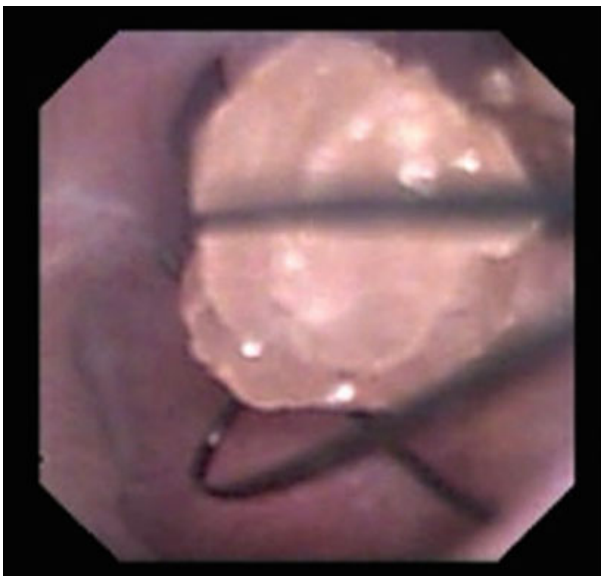

Fig. 9: A zero-tipped nitinol basket is used to grap a cystine stone fragment. The basket's helical shape conforms to the shape of the ureter. The operating surgeon must ensure that stone fragments are small enough to be withdrawn atraumatically.

encountered, infectious debris was noted endoscopically, or if significant stone debris remains requiring passive ureteral dilation to help facilitate subsequent clearance. Routine ureteral stenting is not otherwise performed, especially if no-touch ureteroscopic access is employed.

Special Stone Situations: Impacted Ureteral Stones, Lower Pole Stones, and Large Calculi

The application of the actively deflectable, flexible ureteroscope for an impacted, proximal ureteral stone is a common but clinically challenging presentation. Significant mucosal edema may surround the calculus, limiting visualization (Fig. 10). In this setting, it is paramount to place the laser fiber centrally on the stone to limit ureteral wall trauma. Rather than completely fragmenting the stone in situ, the preferred technique is to centrally fragment and disimpact the calculus, moving it to a more cephalad intrarenal location to complete the lithotripsy. This will help minimize fragments remaining in the inflamed ureteral segment, which can become submucosal and can be associated with ureteral fibrosis [9]. Placing the patient in a head-down position with the ipsilateral side raised will help direct disimpacted stone fragments cephalad, away from a dependant lower pole calyx.

For lower pole stones, the endoscopist must chose to either fragment in situ in the lower pole and remove fragments, or to move the stone (if it is small enough) to the upper pole where fragmentation can proceed more efficiently. It can be challenging to place a relatively stiff laser fiber into a dependant, medial lower pole calyx associated with a long, narrow infundibulum. Small nitinol baskets and graspers inhibit endoscope deflection less and are easier to manipulate through a maximally deflected ureteroscope. They are particularly useful in moving lower pole stones to a more cephalad location where they can be fragmented more easily with larger diameter caliber laser fibers. If the lower pole stone is too large to extract, in situ lithotripsy is employed to create moveable fragments which are promptly relocated and then treated to completion.

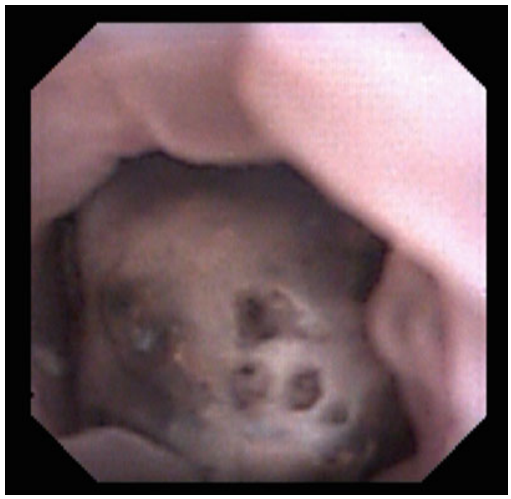

Fig. 10: A 1.8-cm, impacted proximal ureteral stone with a characteristic appearance of calcium oxalate monohydrate. There is significant ureteral edema. Figure 23.4a from Cohen JH, Grasso III, M. Ureteroscopy for Upper Ureteric and Renal Stones: Overcoming Difficulties with the Flexible Approach. In: Difficult Cases in Endourology Al-Kandari A, Desai M, Shokeir AA, Shoma AM, Smith AD, editors. New York. Springer Science + Business Media; 2013. Reprinted with permission.

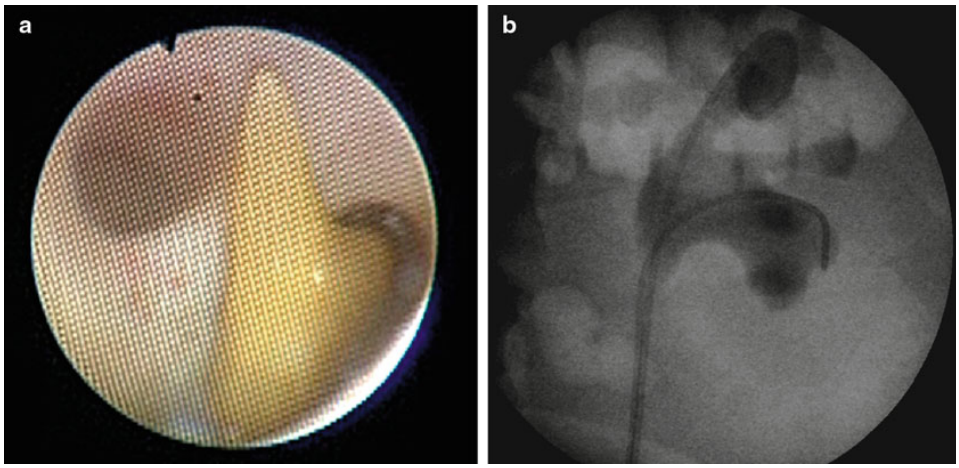

Fig. 11: A 2.5-cm lower pole partial staghorn calculus in a patient with cystinuria (**a**). Between stated ureteroscopic lithotripsy sessions, retrograde catheters are employed for topical therapy to clear stone dust. Inflow is performed through a 6 Fr Cobra catheter with its tip in a dependant lower pole location, where debris tends to collect. Outflow is obtained through a 6 or 8 Fr single pigtail catheter positioned in a superior calyx (**b**). Figure 23.5 from Cohen JH, Grasso III, M. Ureteroscopy for Upper Ureteric and Renal Stones: Overcoming Difficulties with the Flexible Approach. In: Difficult Cases in Endourology Al-Kandari A, Desai M, Shokeir AA, Shoma AM, Smith AD, editors. New York. Springer Science + Business Media; 2013. Reprinted with permission.

Flexible ureteroscopy lithotripsy can be employed for large, noninfectious branching stone burdens (>2 cm). Ureteroscopic lithotripsy in this setting creates stone dust that coats the urothelium, eventually limiting visualization and often necessitating staged therapy. Keys to success when treating large calculi ureteroscopically include moving fragments cephalad to maximize laser parameters, while maintaining continuous bladder drainage during ureteroscopic lithotripsy. Between staged ureteroscopic lithotripsy sessions, and in particular for stone compositions like cystine or uric acid that are in part dissolvable, retrograde catheters are employed for topical therapy to clear stone dust (Fig. 11). Inflow is performed through a 6 Fr Cobra catheter positioned with it tip in a dependant lower pole location where debris tends to collect. Outflow is obtained with a 6 or 8 Fr single pigtail catheter positioned in a superior calyx. Both catheters are secured to a urethral foley, and are irrigated by hand if blocked by debris.

Irrigant choice depends on stone composition (Table 1), and the rate is adjusted from 50 to 100 cc/h based on patient tolerance. Irrigation is promptly stopped and the patient reassessed if

Table 1: Irrigant choice for intrarenal irrigation.

Stone type	Irrigant choice	Effect
Cystine	THAM-E and Mucomyst[a]	Clear dust and debris
Uric acid	THAM-E	Dissolve fragments, clear dust and debris
Calcium-based	Saline and gentamicin	Clear dust and debris

[a]THAM-E is pH-10 trometamol tris-hydroxymethyl aminomethane, Mucomyst is N-acetylcysteine

symptoms of obstruction are noted or if the patient has a significant rise in temperature. After an interval of irrigation, most frequently 36–48 h, a second stage of endoscopic lithotripsy is employed to treat residual. Interval irrigation improves visualization during the second session. In addition, the passive ureteral dilation from the irrigation catheters helps facilitate passage of remaining debris, with many patients being rendered stent-free thereafter.

Results and Complications

In 2006, Johnson *et al*. reviewed 460 consecutive upper urinary-tract procedures performed by a single surgeon using a 7.5 Fr actively deflectable, flexible ureteroscope [3]. Procedures were performed for a variety of therapeutic indications, including evaluation and treatment of essential gross hematuria, upper-tract urothelial tumors, ureteral strictures, endoscopic lithotripsy, and ureteropelvic junction (UPJ) obstruction. A stent was in place or had been previously placed in 108 of the procedures (24 %). Only 52 of the remaining 352 procedures (11 %) required any form of ureteral dilation to facilitate ureteral access. Two hundred and twenty-seven (48 %) wireless

Table 2: Comparison of ureteroscopic complications.

Study	Blute *et al*. [14]	Abdel-Razzak and Bagley [15]	Harmon *et al*. [16]	Grasso *et al*. [17]
Year	1988	1992	1997	2000
Procedures	346	290	209	1,000
Minor complications	(%)	(%)	(%)	(%)
Colic/pain	–	9	3.5	4.2
Fever	6.2	6.9	2	1.3
False passage	0.9	–	–	0.4
Hematuria minor	0.5	2.1	0	0.8
Prolonged	0.3	1.0	0	0.8
Extravasation	0.6	1.0	–	–
UTI	–	1.0	–	1.7
Pyelonephritis	–	–	–	1.0
Major complications	(%)	(%)	(%)	(%)
Major perforation	4.6	1.7	1.0	0
Stricture	1.4	0.7	0.5	0.4
Avulsion	0.6	0	0	0
Urinoma	0.6	–	0	0
Urosepsis	0.3	0	0	0
CVA	–	–	0.5	0.1
DVT	–	–	–	0.1
MI	–	–	–	0.1

UTI urinary tract infection, *CVA* cerebrovascular accident, *DVT* deep venous thrombosis, *MI* myocardial infarction
From [17], reprinted with permission from Elsevier Limited

and sheathless procedures were performed, identifying and intubating the ureteral orifice under direct vision in atraumatic fashion. Inability to access the lower pole was rare, observed in only 1.5 % of procedures.

Grasso *et al*. published a multi-institutional study of retrograde ureteropyeloscopic lithotripsy of large upper tract stones, including many partial staghorn calculi, treating these stones with direct ureteral access without an access sheath. Stone clearance was 95 % with a 5 % complication rate [10]. Other series of flexible ureteroscopic lithotripsy for large upper urinary tract stone burdens (>2 cm) describe stone clearance rates of 90 % or greater, yet all utilized ureteral access sheaths to facilitate repeated access up and down the ureter [11–13]. The complication rates in these series ranged from 0 to 20 %. Therefore, even with the most complex stone burdens, Grasso *et al*. showed a ureteral access sheath was not necessary to achieve an excellent stone clearance rate with minimal complications.

Improvements in instrumentation and refinement in technique have decreased complications from flexible ureteroscopy. Reported complication rates are low, ranging from 1 to 5 %. Infectious events, such as pyelonephritis, are the most commonly reported complication, and are minimized by ensuring a sterile, preoperative urine and appropriate antibiotic prophylaxis. Gross hematuria is infrequent, and may be treated with mild supportive measures.

If small diameter endoscopes are employed and contemporary described technique is used, major complications such as ureteral perforation, avulsion, and stricture are infrequent (Table 2). In a published series of 1,000 consecutive ureteroscopies by a single urologist, of which 491 were endoscopic lithotripsies, there were no perforations or avulsions, and the ureteral stricture rate was 0.4 % [14].

Conclusion

Newer generation flexible ureteroscopes, with their greater deflectability, miniaturization, and improved tip control are key to the atraumatic inspection of the entire urothelium. Flexible ureteroscopy without use of an access sheath or guidewire is a feasible and safe technique for diagnostic and also therapeutic procedures. When practiced with the described technique, no-touch flexible ureteroscopy allows the least traumatic intervention for upper tract urinary pathology possible.

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Instruments for Upper Tract Biopsy and Treatment

Ariel Schulman, Majid Eshghi

Clinical Evaluation

Upper tract urothelial carcinoma (UTUC) accounts for 4% of urothelial malignancies and 7% of tumors found in the kidney [1]. It occurs most commonly in males in the sixth and seventh decades and most often presents with hematuria [2, 3]. Tumors are also detected during the evaluation of flank pain or abnormal imaging findings. Since the 1970s, the incidence of UTUC has risen with the increased use of abdominal imaging and more rigorous bladder cancer follow-up [4].

Standard clinical evaluation of the upper urinary tract includes cross-sectional imaging of the abdomen and pelvis with urographic follow-through, selective urine tumor markers and endoscopic inspection and biopsy of abnormal lesions [5]. Most important is a complete visual examination of all lesions and procurement of sufficient tissue for pathologic diagnosis, grading, and staging. The identification of one lesion should not preclude complete inspection of the entire urothelium as multifocal disease is common [6].

Despite advances in endoscopic techniques, undergrading and understaging of upper tract tumors remains a significant concern [7]. Small volume tissue samples and the technical difficulty of obtaining adequate specimen from beyond the mucosal surface limit the accuracy of upper tract biopsy. It is prudent to submit multiple specimens with more than one type of instrument to improve the diagnostic yield [8]. One may consider intraoperative pathology examination at the time of ureteroscopy to confirm adequate tissue collection. A nondiagnostic biopsy should prompt further investigation, particularly in the presence of positive cytology or visualized mucosal abnormality.

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The Retrograde Approach

Examination of the Lower Urinary Tract

The retrograde approach is preferred for the initial endoscopic inspection of the upper urinary tract [9]. It is familiar to the urologists and well-tolerated and provides access to all areas of the collecting system. Evaluation begins with a bimanual examination under anesthesia to identify any palpable abnormalities of the urethra or bladder. A 30° rigid cystoscope is then used for visualization of the urethra and systematic circumferential inspection of the bladder. Dedicated bladder washings for cytology are submitted. For complete visualization, a 70° lens and flexible cystoscope can be used adjunctively for inspection of the anterior wall and bladder neck [10]. Abnormal lesions of the bladder and urethra are completely resected and sent for pathologic analysis. We typically use a 26 French bipolar resectoscope with saline irrigation for bladder tumors. Dedicated samples are sent from the base of the tumor to define depth of invasion.

Ureteral Access

Following examination and treatment of lesions of the bladder, the ureters are approached. A six-French open-ended or cone-tipped catheter is placed at the ureteral orifice and contrast is injected to opacify the ureter to identify filling defects (Fig. 1). Abnormal regions are correlated to bony landmarks for anatomic localization. We consider ureteral lesions above the iliac crest as proximal, below the pelvic brim as distal, and those in between as mid ureter. If there is pre-operative suspicion of tumor in the intramural ureter, a small diameter, semi-rigid ureteroscope can be used for direct inspection and pyelography before the passage of wires or catheters (Fig. 2).

In the absence of disease in the distal ureter, the ureteral orifice is cannulated with a guidewire that is advanced several centimeters proximally to allow for atraumatic delivery of an open-ended catheter into the distal ureter. We typically use a Sensor™ wire (Boston Scientific, Natick, MA) for initial entry. The proximal floppy tip is ideal for initial access to gently navigate the ureteral lumen while the nitinol shaft provides rigidity for advancement [11]. Selective cytology is obtained and

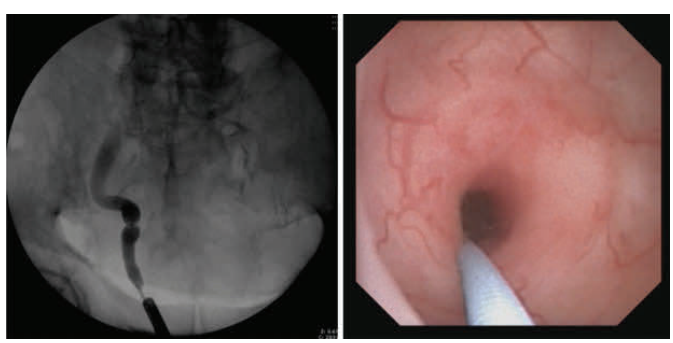


Fig. 1: Right retrograde pyelography with an annular, constrictive defect of the distal ureter. Inspection revealed a sessile, hyperemic structured region, and biopsy was consistent with high-grade urothelial carcinoma.

submitted for dedicated examination and additional contrast is injected with continuous, gentle pressure to opacify the length of the ureter (Fig. 3).

Following pyelography, the ureter is accessed with an ureteroscope. We prefer to visually inspect the upper tract mucosa before the passage of instruments for undisturbed native inspection and to avoid specimen dislodgement. This "no-touch" technique is particularly important to identify carcinoma-in situ or sessile lesions and has proven safe in large series [12]. Current

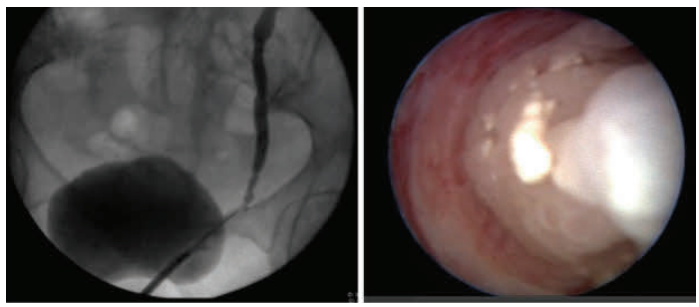


Fig. 2: Direct inspection of the left distal ureter with a semi-rigid ureteroscope of an obstructive, papillary tumor of the intramural and distal ureter. Pyelography through the scope noted a long filling defect with proximal hydronephrosis.

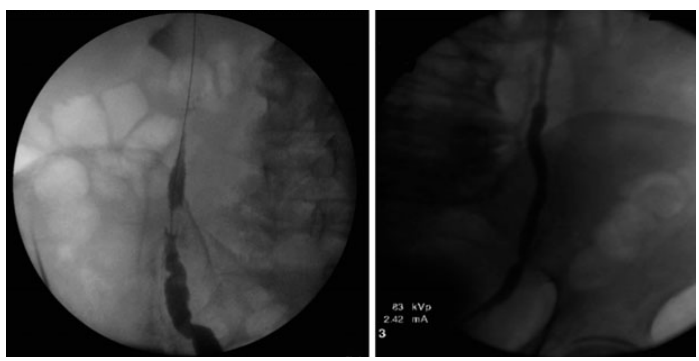


Fig. 3: Pyelography of the proximal and mid ureter. *(Left)* An obstructive 3 cm defect is noted in the mid ureter. *(Right)* A long region of multifocal, irregular is noted in the proximal ureter.

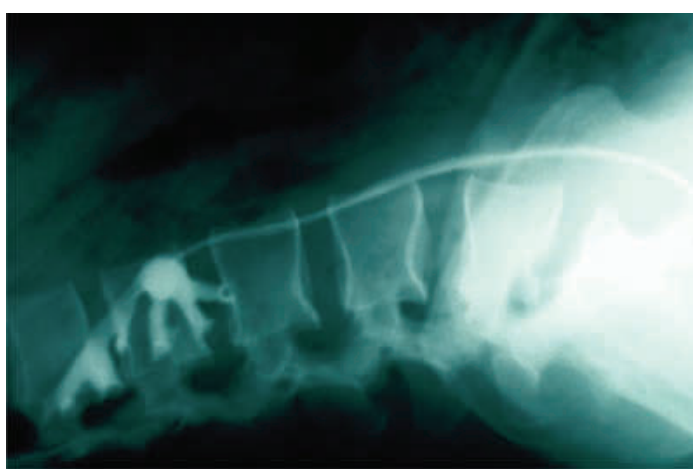


Fig. 4: Cross-table fluoroscopy accentuates the normal arc taken by the native ureter across the bony pelvis.

generation flexible scopes offer improved flexible tip control to accommodate the natural curvature of the ureter with the requisite stiffness to advance without a traveling wire (Figs. 4 and 5) [13]. Lesions of the distal and mid ureter may initially be inspected with a semi-rigid ureteroscope while lesions of the proximal ureter and renal pelvis typically require flexible ureteroscopy.

The most significant update to ureteroscope technology has been the transition from fiberoptic image transmission to digital, "chip on the tip" technology with improved quality, magnification, and self-focus [14]. While digital scopes weigh less and do not require an external light source, they have a larger shaft diameter that may limit scope passage in some cases [15].

Difficult Ureteral Access

Primary entry into the ureteral orifice with an ureteroscope is usually well tolerated but up to 10% of patients do not accommodate initial scope passage [16]. Complicating patient factors to consider include a history of pelvic radiation or previous ureteral reimplantation. Patients with an indwelling stent, previous ipsilateral manipulation, and older age seem to better tolerate initial entry [17]. If the scope cannot enter the ureter, adjunctive techniques to gain entry include the use of angled or glide wires, titration of bladder volume, and digital manipulation of the trigone from the rectum.

If a wire can be passed into the ureter but the scope cannot be advanced across the orifice, balloon dilation, or sequential dilators can be used under fluoroscopic guidance to gain ease entry. Additionally, a small diameter semi-rigid scope can be advanced dorsal to the guidewire while circumferentially rotating to move the beak of the spoke beyond the ventral lip of the orifice (Fig. 6). In the absence of disease in the distal ureter, a ureteral access sheath may be used in select cases [18].

In rare instances where the ureter cannot be accessed despite adjunctive techniques, a small-bore (4.8–5.0 Fr) stent is placed to allow for passive ureteral dilation and a second attempt at ureteroscopy is performed several weeks later [19]. Stent placement can impact endoscopic findings

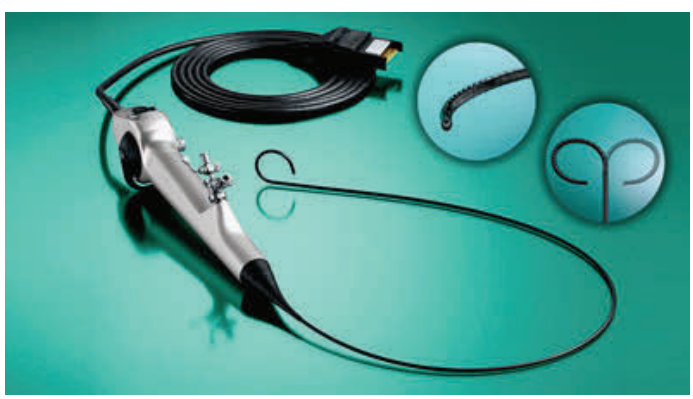


Fig. 5: The flexible Video-Uretero-Renoscope Flex-Xc (KARL STORZ, Tuttlingen, Germany) utilizes a digital CMOS chip for excellent image quality with built in LED illumination which ensures homogenous illumination. The distal tip circumference is 8.4 Fr and the scope has a 270° distal tip deflection in either direction. The handle is lightweight and ergonomically designed with no camera head or external light source required. ©KARL STORZ GmbH & Co. KG, Germany; used with permission.

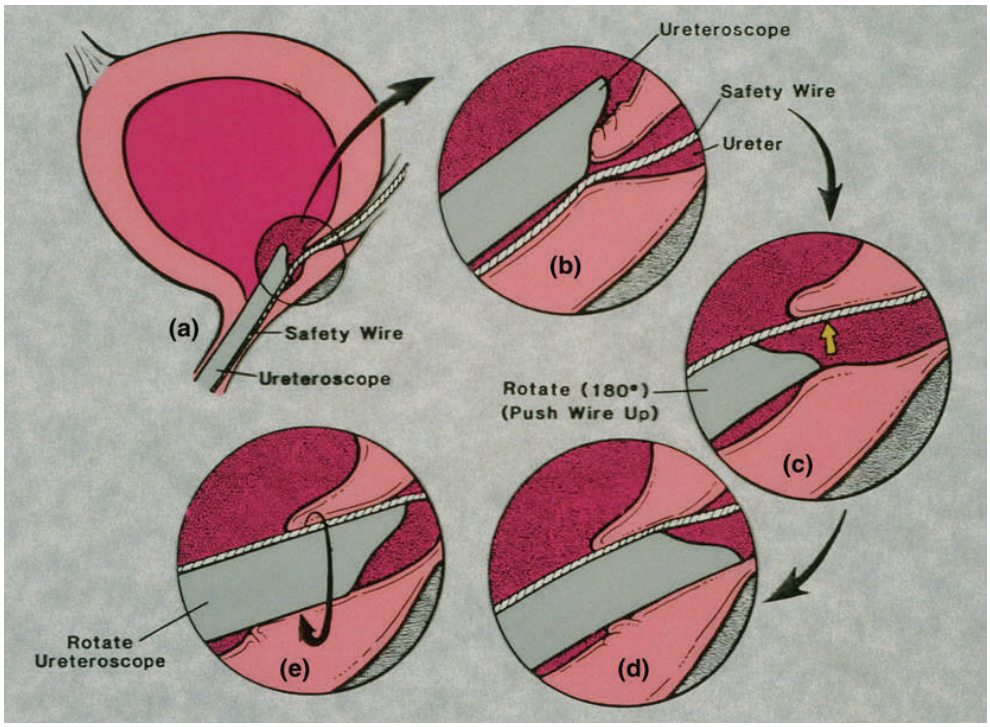


Fig. 6: When advancing anterior to the wire, the superior beak of a semi-rigid scope is limited by the ventral lip of the orifice (**a+b**). To enter the ureter, the scope is positioned "under the wire" and circumferentially rotated (**c**) while advancing proximally to allow the beak to bypass the orifice (**d+e**).

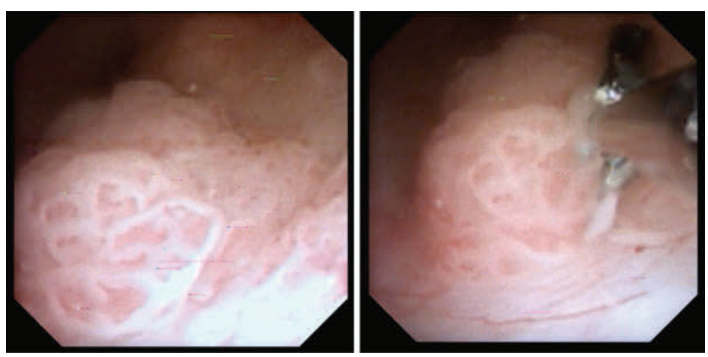


Fig. 7: A flexible, ureteroscopic cold-cup forceps is directed at the base of a papillary lesion for biopsy.

and this can be tempered with pre-operative removal of the stent several days prior to the second attempt at ureteroscopy.

Ureteroscopic Biopsy

Once access to the ureter is obtained, the scope is advanced proximally. Mucosal lesions are evaluated and biopsied as they are encountered to prevent dislodgement and traumatic bleeding from

the advancing scope. The lesion is visually inspected and correlated with filling defects seen on imaging. For obstructive lesions, gentle proximal pyelography can help to define the length and intraluminal volume of the tumor.

Following visual inspection, specimen collection is initiated. Initial biopsies are performed with a flexible, cold-cup ureteral biopsy forceps. The forceps are opened, advanced into the tumor, and the tissue is grasped (Fig. 7). The forceps are withdrawn with a brisk snapping motion to sharply avulse specimen from the surrounding tissue.

For complete specimen retrieval, the biopsy forceps are held in a fixed position at the tip of the scope and forceps are removed in tandem from the patient. The specimen is then submitted for pathologic analysis. In this manner, the specimen is never drawn through the narrow working channel of the scope. Directed biopsies from the base of the tumor should be performed for identification of mucosal invasion and additional washings are sent for cytologic analysis.

Alternative commercial forceps include the Piranha ureteroscopic biopsy forceps (Boston Scientific, Natick, MA) and 2.4 French BIGopsy biopsy forceps (Cook Medical, Bloomington, IN). Ureteroscopic baskets are particularly useful for debulking papillary tumor and removing larger volumes of tissue. We commonly use the ZeroTip™ and Segura™ stone retrieval baskets (Boston Scientific, Natick, MA) for larger tumors (Fig. 8). In some cases, a semi-rigid ureteral resectoscopes can be advanced to an upper tract tumor for complete removal with deep intramural resection (Fig. 9).

Comparative performance features of biopsy instruments include the size and depth of specimen collected, tissue fragmentation, and most importantly feasibility of pathologic grading and staging [20, 21]. We advocate submitting multiple samples with several instruments to optimize diagnostic yield.

After biopsy and debulking, the base of the tumor is fulgurated with a ureteral cautery electrode or laser fiber. The holmium (Ho:YAG) laser is used with direct tissue contact and creates ablation up to 0.5 mm of tissue depth. The shallow penetration makes it the preferred laser energy source to minimize ureteral stricture and nearby organ injury. Typical settings are 0.5 kJ of energy with a rate of 10–15 Hz (Fig. 10).

Assessment of the Pelvicalyceal System

After examination and treatment of ureteral lesions, the scope is advanced to the renal pelvis. Cytology washings are submitted for examination and a pyelogram is performed to outline a roadmap for inspection and to identify filling defects (Figs. 11 and 12). Complete pyeloscopy is performed in systematic fashion with inspection of both anterior and posteriorly directed calyces. Lower pole lesions pose the greatest challenge for inspection and biopsy due to the required scope angulation. The placement of instruments through the working channel can further limit maximal deflection. If complete visualization and treatment of a lower pole lesion is not feasible ureteroscopically, an antegrade approach should be considered.

Biopsy and fulguration of pelvicalyceal tumors is approached in similar fashion to ureteral tumors with the use of forceps and baskets for biopsy. The capacious nature of the renal col-

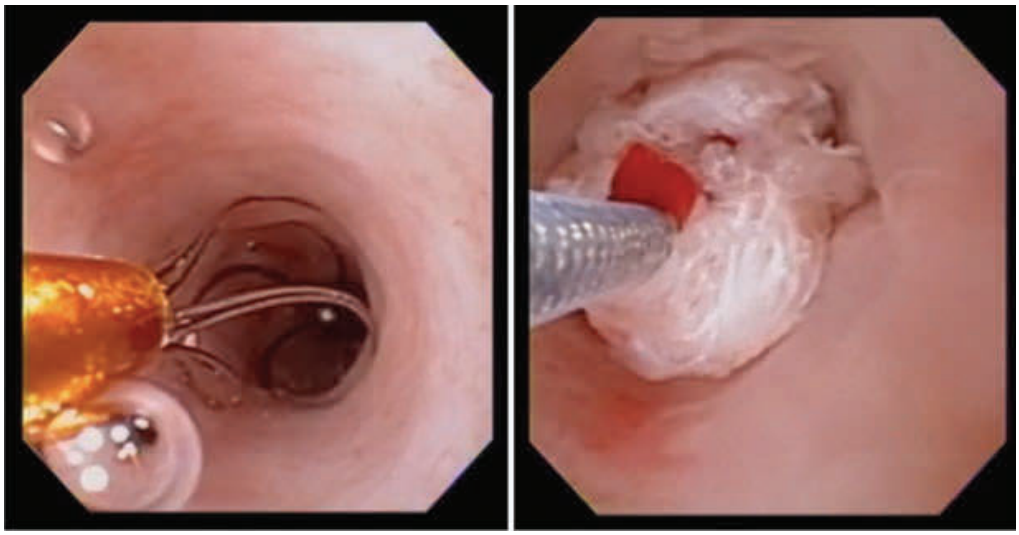
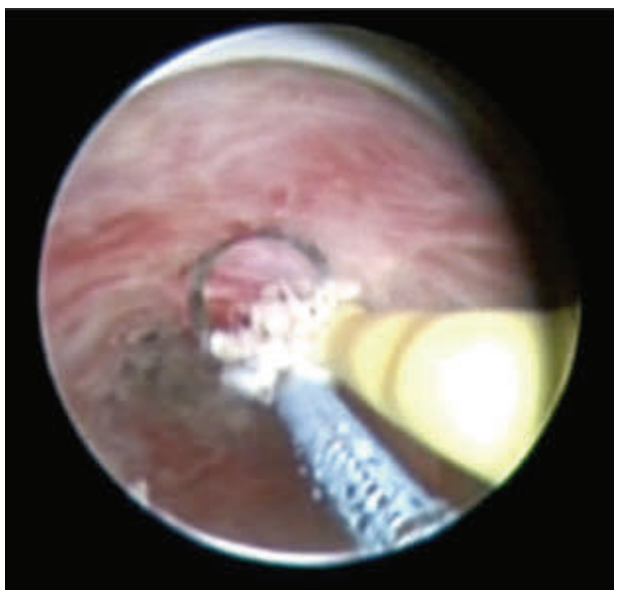


Fig. 8: A Segura™ flatwire basket (Boston Scientific) can collect large volumes of intraluminal tissue for pathologic review and debulking.

Fig. 9: A monopolar ureteral resectoscope resects deeply into the wall of the distal ureter for complete tumor removal and accurate staging.



lecting system may produce larger volume tumors compared to the ureter and more debulking is sometimes required. Within the renal pelvis and calyces, the Neodymium (Nd:YAG) laser is used to safely ablate intraluminal tumor efficiently [22]. The laser is positioned 2–3 mm away from the tumor and delivers energy to 5–10 mm of tissue depth. Efficacy is visually monitored

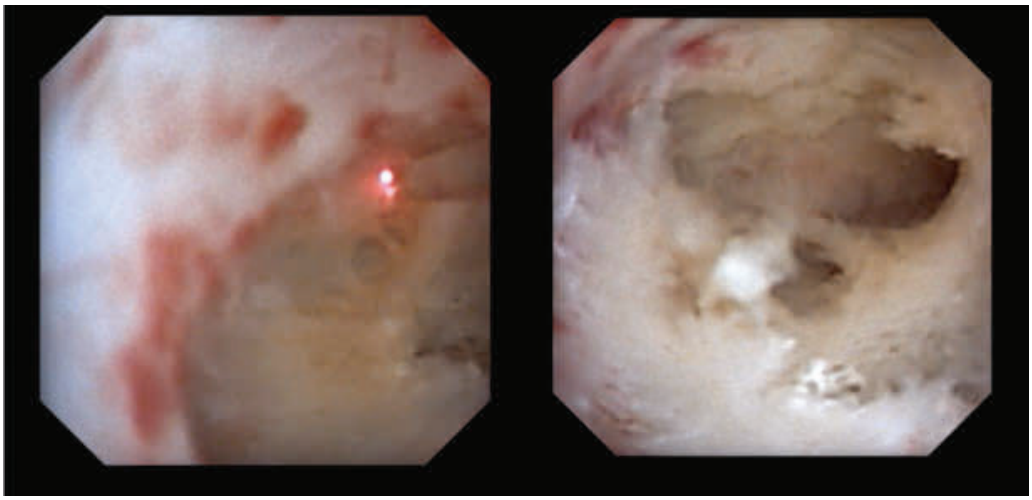
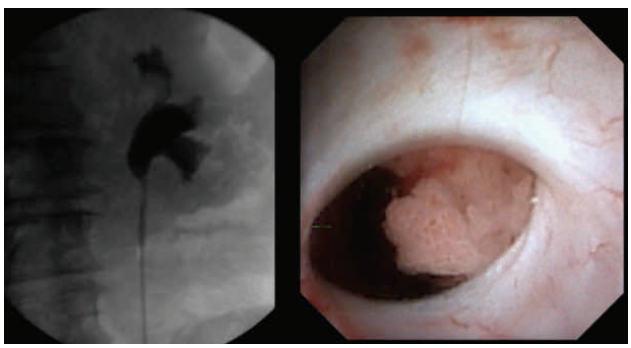


Fig. 10: A 200 μm holmium laser fiber is used to completely fulgurate the base of a urothelial tumor.

Fig. 11: Retrograde pyelography shows irregular narrowing of the upper pole infundibulum. Inspection revealed a stenotic infundibulum and multiple papillary tumors located circumferentially around the entry to the calyx.



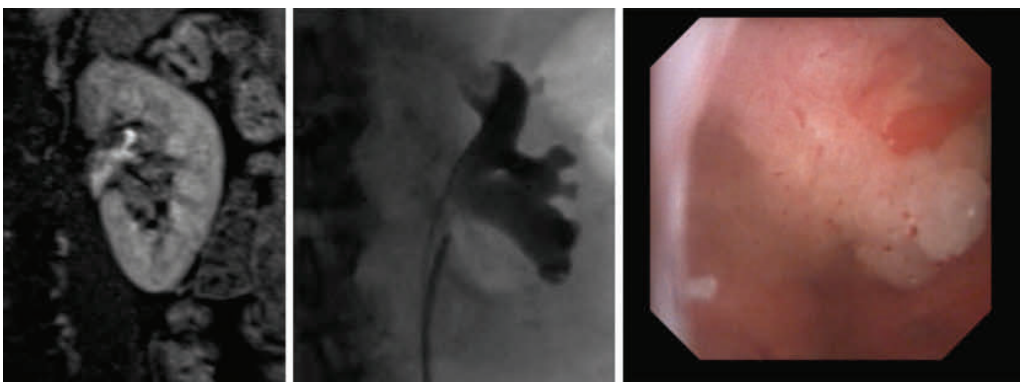


Fig. 12: A broad-based sessile lesion is noted in the upper pole papilla on MRI and pyelogram. Inspection revealed a bulky, papillary tumor.

by progressive white blanching of the tumor. We typically use a 30 W continuous power setting. Following debulking, additional biopsies are taken from the base of the tumor and the holmium laser is used for fulguration and hemostasis (Videos 1 and 2).

The Antegrade, Percutaneous Approach

While retrograde ureteroscopy is the initial approach, some patients benefit from an antegrade, percutaneous approach for biopsy and treatment. Indications include lesions not amenable to a retrograde treatment and anatomic variation such as a urinary diversion that prevents retrograde access. The percutaneous approach offers a larger working sheath for irrigation of clots and removal of a larger volume of disease. A 26 Fr transurethral resectoscope is used for deep specimen collection (Fig. 13). One disadvantage of percutaneous access is the risk of retroperitoneal and tract seeding, although this is limited to select case reports [23].

Percutaneous renal access is obtained in standard fashion, with preferred entry through the papilla of a posterior calyx. The selection of polar entry into the kidney is dependent on the location of the lesion, with an upper pole puncture providing the best access to the ureteropelvic junction and lower pole. In addition to the standard 30 Fr percutaneous access sheath (Boston Scientific, Natick, MA), a "mini-perc" technique (Mini-PERC) can be used for insertion of a 13 Fr sheath into the collecting system for passage of a flexible cystoscope for inspection and biopsy.

Summary Box

- The clinical evaluation of suspected urothelial carcinoma of the upper urinary tract includes cross-sectional imaging of the abdomen and pelvis with urographic follow-through, urine tumor markers and endoscopic inspection, and biopsy of suspicious lesions.
- Ideally, the upper tract urothelium is inspected before the passage of guidewires or instruments to obtain a true native inspection of the mucosal surface.

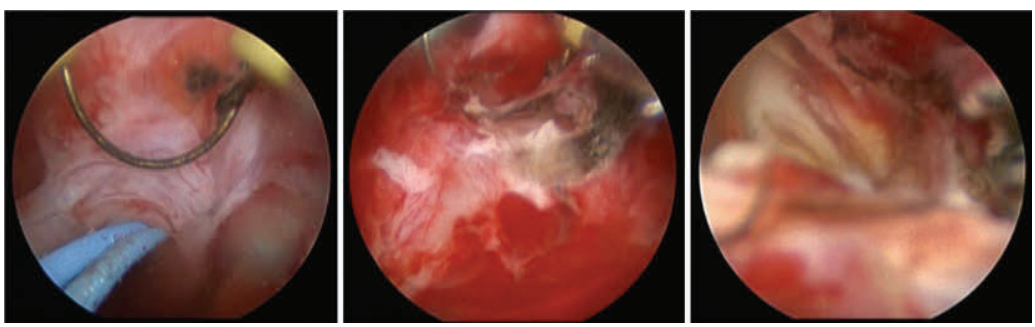


Fig. 13: Percutaneous access for re-resection of multiple papillary tumors of the upper pole. A 24 Fr transurethral resectoscope is used through a 30 Fr clear access sheath to obtain deep specimens. *Yellow* sinus fat is visible at the base of the resection. The tumor was upgraded and upstaged following pathologic examination of percutaneous specimens.

- Clinical history may suggest a ureteral orifice that is difficult to identify or cannulate and adjunctive endoscopic techniques are sometimes required for ureteral access.
- Despite technical improvements, undergrading and understaging remains a significant concern. Multiple samples with forceps and baskets should be obtained to improve the diagnostic yield and selective cytology at various stages of examination and biopsy should be submitted.
- While retrograde access is the preferred first line approach, percutaneous antegrade access may be required in some cases.

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Deep Vein Thrombosis and Pulmonary Embolism Secondary To Urinary Retention: A Case Report

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Abstract

Pulmonary embolism occurs when a blood thrombus forms and travels from a vein in the body to an artery in the lung. Thrombi often develop in one of the deep veins of the legs, thighs, or pelvis, a condition known as deep vein thrombosis. In this report, we describe a rare instance of a patient who developed deep vein thrombosis and pulmonary embolism secondary to urinary retention, and we also review some of the literature. A 75-year-old Japanese man visited our hospital with the complaint of lower extremity weakness. A physical examination revealed bilateral leg edema. Contrast-enhanced computed tomography showed thrombi in both the bilateral intrapelvic veins and the right pulmonary artery, with an extremely distended bladder. We diagnosed deep vein thrombosis and pulmonary embolism due to urinary retention, which was attributed to detrusor insufficiency owing to both taking an anticholinergic drug and neurogenic bladder. The patient was immediately started on both management of voiding dysfunction and anticoagulant therapy. We encountered a patient with deep vein thrombosis and pulmonary embolism secondary to urinary retention that could have been fatal. In such cases, clinicians should always take into account appropriate management of voiding dysfunction.

Keywords: Deep vein thrombosis, Pulmonary embolism, Urinary retention, Neurogenic bladder

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Background

Pulmonary embolism (PE) induced by deep vein thrombosis (DVT) can be fatal; therefore, it should be considered when examining a patient with lower extremity edema. DVT is commonly seen in the lower limbs and pelvic veins. The common causes of thrombus formation are stasis of blood flow, endothelial injury, and hypercoagulability [1]. Stasis of blood flow is often caused by long-term bed rest, general anesthesia, lower limb paralysis, or varicose veins of the lower limb [2]. In this report, we describe a rare case of a patient with DVT and PE, which were caused by venous compression by an extremely distended bladder due to urinary retention. The characteristic computed tomo graphic (CT) image led to appropriate management.

Case presentation

A 75-year-old Japanese man visited our hospital complaining of lower extremity weakness for a duration of 3 days. He had a past history of laminectomy for spinal canal stenosis and transurethral resection of the prostate for benign prostatic hyperplasia (BPH) and had been prescribed an

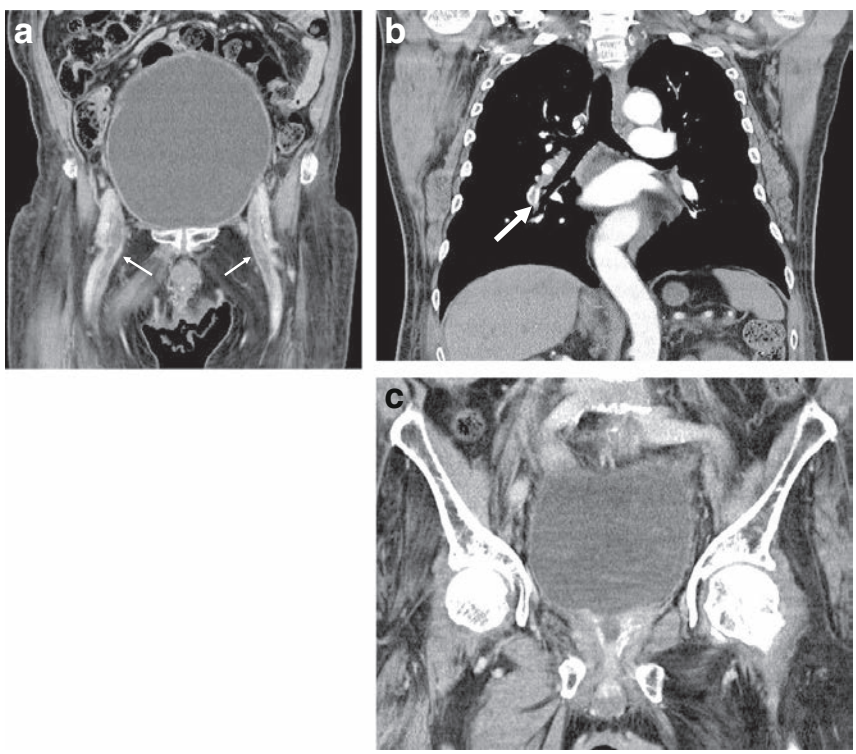

Fig. 1: (**a, b**) Contrast-enhanced computed tomographic scan shows thrombi in both the bilateral intrapelvic veins (*small arrows*) and the right pulmonary artery (*large arrow*), with an extremely distended bladder. **c**; Computed tomographic scan shows a postoperative change of transurethral resection of the prostate. The estimated prostate volume was 15-ml, which indicated that the patient did not have benign prostatic hyperplasia.

anticholinergic agent, propiverine 20 mg/day, and a β3 adrenergic receptor agonist, mirabegron 50 mg/day, for treatment of urinary urgency by his family doctor.

A physical examination revealed bilateral leg edema. Laboratory examination showed that the patient's D-dimer level was 7.7 μg/ml. Other laboratory test results were within normal limits. Chest radiography showed no sign of pleural effusion. Echocardiography showed no sign of left ventricular motor abnormality, but it revealed a mild hypertrophy of the left atrium that indicated increased right heart load. Contrast-enhanced computed tomography (CECT) showed thrombi in both the bilateral intrapelvic veins and the right pulmonary artery, with an extremely distended bladder. According to the CT scan, BPH was not present (Fig. 1).

We diagnosed DVT and PE due to urinary retention, which was attributed to detrusor insufficiency owing to both taking an anticholinergic drug and neurogenic bladder. The patient was hospitalized, a urethral catheter was inserted, and propiverine and mirabegron were discontinued. He was started on anticoagulant therapy with rivaroxaban 30 mg/day. On the second day of hospitalization, his lower extremity edema and lower limb muscle strength had improved bilaterally. On the ninth day, the urethral catheter was removed, and he was started on silodosin 8 mg/day and intermittent self-catheterization. On the 15th day, CECT showed that most of the thrombi had resolved (Fig. 2). On the 19th day, the patient was discharged. Anticoagulant therapy was maintained for 3 months, and the patient has reported no other events since the beginning of the treatment.

Discussion

Our patient presented with DVT and PE secondary to urinary retention, which is a common symptom seen not only by urologists but also by general physicians and family practitioners. In the United States, DVT occurs in 50 per 100,000 people per year, and about 20% to 40% of DVTs

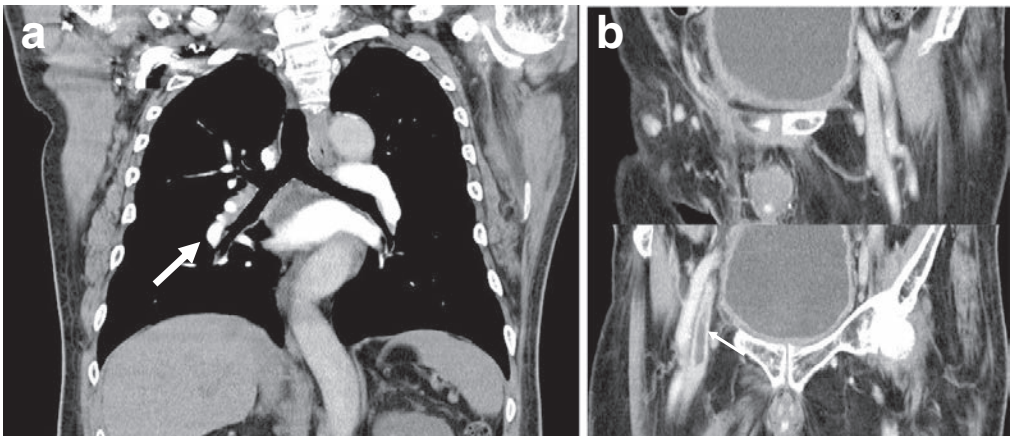

Fig. 2. (**a, b**) On the 15th day of the patient's hospitalization, contrast-enhanced computed tomography showed that most thrombi (the bilateral intrapelvic veins; *small arrow*, the right pulmonary vein; *large arrow*) had resolved.

are associated with PE [3]. A previous study identified mortality rates for PE of 4% at 1 month and 13% at 1 year [4]. Hence, DVT and PE require a rapid diagnosis and adequate treatment. Causes of DVT include venous stasis, endothelial injury, and hypercoagulability. DVT often occurs in the pelvic or lower limb veins and is commonly caused by increased venous pressure resulting from a congenital iliac band, iliac vein compression by the iliac artery, or an indwelling catheter from the thigh or long-term bed rest [2]. A site of predilection of DVT is the lower limb veins, and the initial site is commonly the soleus muscle vein [5]. In this case, thrombi were found in the femoral vein and external iliac vein, and no thrombi were observed below the popliteal vein. Imaging findings indicated that the cause of DVT was venous return failure caused by compression by an extremely distended bladder, in turn caused by urinary retention.

Urinary retention is a common urologic emergency in general practice [6]. Common causes of urinary retention are an outflow obstruction, a neurologic impairment, and an inefficient detrusor muscle [7]. The cause of urinary retention in this case was thought to be the patient's inefficient detrusor muscle accompanying his taking an anticholinergic drug and a β3 adrenergic receptor agonist, as well as his neurogenic bladder accompanying lumbar spinal canal stenosis, because he did not have BPH, which is a common cause of urinary retention [7]. Drug-induced urinary retention is frequently observed in clinical practice, but anticholinergic drugs and β3 adrenergic receptor agonists can promote difficult urination associated with neurogenic bladder, which can be a cause of chronic urinary retention [8].

Venous obstruction by a distended urinary bladder was first described in 1960 by Carlsson and Garsten [9]. Since then, there have been several case reports describing an enlarged bladder compressing vascular structures in the pelvis [10–12], but few reports of cases that resulted in DVT and PE. Most of these were caused by BPH [13–17], whereas cases caused by neurogenic bladder are rare. Ito *et al.* [18] reported that clomipramine, prescribed for severely depressed and immobilized patients, caused DVT and PE as a result of urinary retention resulting from neurogenic bladder. Our patient's case carries a significant clinical implication, namely that DVT and PE secondary to urinary retention caused by detrusor insufficiency due to both taking an anticholinergic drug and neurogenic bladder can occur even in patients who are not immobilized. Therefore, both physicians and urologists should pay attention to appropriate management of urinary dysfunction and prevent patients from developing chronic urinary retention, which can induce fatal complications.

Conclusions

We treated a rare case of a patient with DVT and PE due to urinary retention. Although urinary retention is a relatively common disease condition, it should be noted that inappropriate management of urinary dysfunction may lead to fatal complications.

Abbreviations
BPH: Benign prostatic hyperplasia; CECT: Contrast-enhanced computed tomography; CT: Computed tomographic; DVT: Deep vein thrombosis; PE: Pulmonary embolism

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Availability of data and materials
Owing to ethical restrictions, the raw data underlying this study are available upon request from the corresponding author.

Authors' contributions
TK, TY, TO, MA, and HN wrote the paper. All authors read and approved the final manuscript.

Ethics approval and consent to participate
This study was performed in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of Onomichi Municipal Hospital.

Consent for publication
Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests
The authors declare that they have no competing interests.

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Urinary Schistosomiasis: Report of Case Diagnosed in Bladder Biopsy

Hafsa Chahdi*, Amal Damiri, Mohamed Reda El Ochi, Mohamed Allaoui, Abderrahmane Al Bouzidi, Mohamed Oukabli

Abstract

Urinary schistosomiasis is a common parasitic disease in endemic countries. We report the case of a patient who was on a working trip to Mauritania. This parasitosis, suspected in the presence of hematuria and the notion of stay in an endemic zone, was confirmed by the presence of Schistosoma haematobium eggs during the histological examination of the bladder biopsy performed after cystoscopy, highlighting a bilharzial granuloma and of course, the diagnosis was confirmed by the presence of eggs during the direct examination of the freshly collected urine. It should be pointed out that the diagnosis of schistosomiasis must be evoked with the association of hematuria and the particular inflammatory aspect of the vesical mucosa and, of course, the notion of stay in an endemic zone.

Keywords: Schistosoma haematobium, Hematuria, Bladder diseases

Background

Urinary schistosomiasis was discovered by Bilharz in Cairo and it is caused by the parasite *Schistosoma haematobium*. This endemic disease in 53 African countries, in the eastern Mediterranean and in India is suspected in the face of gross hematuria and confirmed by the detection of *S. haematobium* eggs. Cystoscopy, when performed, most often reveals diffuse bladder involvement that has been compared to "sugar grains" or "acne seeds" [1].

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In Morocco, this pathology of importation is less well known. However, the diagnosis of bilharziasis must be mentioned and initial hematuria chart revealing a bladder tumor.

We report here an observation of a young patient who presented a pseudotumoral form of bladder schistosomiasis.

Case Presentation

A 25-year-old man from Morocco worked in Mauritania as an engineer in a water dam for 1 year. One month after his return to Morocco, he has suffered abdominal pain and hematuria wrongly diagnosed in a local clinic as kidney stones.

He was admitted to a central hospital with progressive hematuria, he has benefited from a cystoscopy with biopsies. Histological examination of the biopsies revealed a granulomatous inflammatory reaction made of epithelioid and gigantocellular granulomas punctuated by eosinophilic polynuclear cells. These granulomas contain in their centers bilharzia eggs (Fig. 1).

The diagnosis was confirmed by the presence of *Schistosoma heamatobium* eggs in direct examination of fresh urine collected (Fig. 2).

Discussion

Schistosoma is a subtype of trematodes, comprising multiple species. Of these, only five infect the human being, that is *Schistosoma mansoni*, *Schistosoma japonicum* [2–5], *S. haematobium*, *Schistosoma mekongi* and *Schistosoma intercalatum.* The first three are the most frequent. The only one that

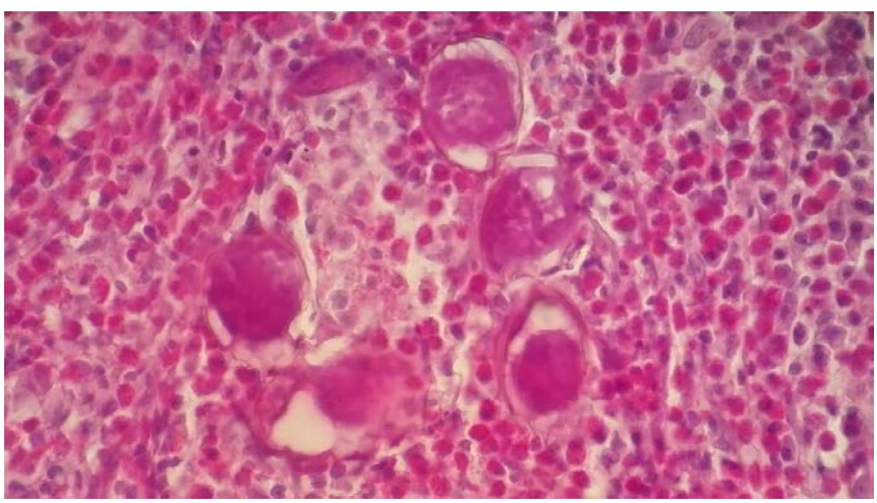

Fig. 1: Histopathology of bladder mucosa shows the eggs of S haematobium surrounded by intense inflammatory infiltration in granuloma (hematoxylin and eosin stain, × 100).

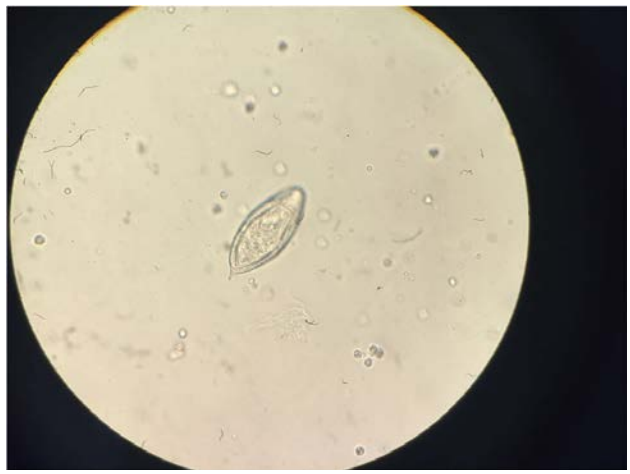

Fig. 2: Sediment examination of a 24-h urine sample from case 1 demonstrates the diagnostic terminal spine of egg of Schistosoma haematobium (original magnification, × 400; no stain used).

primarily infects the urinary tract is *S. haematobium*, causing urinary *schistosomiasis*. *S. haematobium* was discovered by a German physician, Theodor Bilharz, during an autopsy in Egypt in 1851 [5, 6]. To date, *S.haematobium* infection is still prevalent in sub-Saharan Africa and parts of the Middle East [2]. Our patient was in Mauritania which is a contact point between north Africa and sub-Saharan Africa. The life cycle of *S. haematobium* begins with the presence of eggs in the urine of affected patients; miracidia hatch and penetrate into intermediate hosts snails; the development of cercariae and the release of snails into the water; the cercariae enter the human skin and migrate through the venous circulation into the liver, where the moat reaches maturity; adult flukes move to the venous plexus of the bladder, where female worms lay eggs; finally, the eggs migrate to the lining of the bladder and complete the life cycle [2, 7]. Our patient contracted the parasite through contact with contaminated water. The definite test for the diagnosis of urinary schistosomiasis is the identification of *S. haematobium* eggs in the urine.

Biopsy of an alleged bladder injury is another diagnostic tool. Eggs of *S. haematobium* have characteristic "terminal spines", as has been demonstrated in our clinical case where a granulomatous inflammatory reaction has been observed around bilharzia eggs [8, 9]. The most important long-term complication of urinary schistosomiasis is the predisposition to bladder cancer [2]. The most common histological type of schistosomal bladder cancer is squamous cell carcinoma [8]. As a result, *S. haematobium* infection has been classified as a Group 1 carcinogen by the International Agency for Research on Cancer [5, 10].

Conclusion

We reported a case of urinary schistosomiasis with typical histopathological features. Despite the limited prevalence of areas in sub-Saharan Africa and parts of the Middle East, the disease can still be seen in developed countries where the population is displaced.

Abbreviation
S. haematobium: Schistosoma haematobium

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HC, AD and MRE performed the histological examination of the tumor and were major contributors to writing the manuscript. All authors read and approved the final version of the manuscript.

Ethics approval and consent to participate
Not applicable.

Consent for publication
Written informed consent was obtained from the patient for publication of this case report. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests
The authors declare that they have no competing interests.

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*Konstantinos Dimitropoulos and Stavros Gravas , Fixed-dose combination therapy with dutasteride and tamsulosin in the management of benign prostatic hyperplasia Ther Adv Urol. 2016 Feb; 8(1): 19–28.
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