NYU Langone Health

Department of Urology
Case of the Month

Prostate Artery Embolization: What the Urologist Should Know

CASE PRESENTATION

Male in his late sixties with a history of hypertension, HIV disease, and a history of lower urinary tract symptoms (LUTS) including frequency, hesitancy, poor force of stream, sensation of incomplete bladder emptying, and nocturia x3 to 5. On a regimen of tamsulosin 0.8 mg HS. Referred to NYU Langone Health Urology for further workup and treatment.

MEDICAL HISTORY, SYMPTOM SCORES/PROCEDURES, AND LABORATORY VALUES

- Hypertension
- HIV disease
- Elevated PSA (s/p transrectal ultrasound guided biopsy in 2007 and 2011)
- International Prostate Symptom Score (IPSS): 26
- Quality of Life (QoL) score: 5/6
- Post void residual (PVR) volume: 187 mL
- PSA: 7.5 ng/mL (stable)
- Urinalysis (UA): negative
- Estimated glomerular filtration rate (EGFR): >60 mL/min/1.73 m^2

MANAGEMENT

Pelvic ultrasound showed the prostate to be 226 g. Renal ultrasound demonstrated no hydronephrosis. Videourodynamics revealed normal capacity bladder (565 mL), mildly impaired compliance at end-fill, no involuntary detrusor contractions, no detrusor overactive incontinence or stress incontinence. A voiding study showed high-pressure, low-flow void with incomplete emptying. On fluoroscopy, filling images were normal and voiding images showed no bladder neck funneling during voluntary void attempt. EMG activity was normal. The patient wished to continue tamsulosin and to start a 5-alpha reductase inhibitor rather than consider intervention.

One year later, the patient had acute urinary retention in the setting of constipation and he learned how to manage himself on clean intermittent catheterization (CIC). Repeat pelvic ultrasound now showed the prostate to be 192 g on dutasteride. IPSS was still high at 30. The patient was given the options of open simple prostatectomy, robotic simple prostatectomy, holmium laser enucleation of the prostate (HoLEP), or prostate artery embolization (PAE). He chose PAE and underwent a successful bilateral PAE by interventional radiology. He began voiding on his own 3 days after embolization, with PVRs under 140 mL. Six months post PAE, his IPSS had dropped to 14, his QoL had improved to 2 (indicating "mostly satisfied), and his prostate was now 148 g. He continued on dutasteride and tamsulosin, with a PVR of 76 mL. He reported that he was improved and that he preferred continuation of medical management over any surgical intervention.

COMMENT

Historically, transurethral resection of the prostate (TURP) has been the gold standard treatment for benign prostatic hyperplasia (BPH). A successful TURP has been demonstrated time and again to quickly relieve most men's urinary symptoms and to lead to significantly stronger urine flow within days. Over the past 2 decades, however, many minimally invasive procedures have been developed for treating LUTS associated with BPH. These interventions have 2 major goals: (1) to achieve clinical outcomes similar to the gold standard while reducing side effects such as urinary incontinence or sexual dysfunction and (2) to avoid general anesthesia for the increasingly elderly or polymorbid patient populations who are less likely to tolerate it.[1] Although the majority of these less invasive procedures have either been given a seal of approval (prostatic urethral lift, transurethral microwave therapy, water vapor thermal therapy) or been outright rejected (transurethral needle ablation) in the AUA guidelines, one of these procedures has been labeled indeterminate.[2] Per the most recently updated amendment from 2020, "PAE for the treatment of LUTS secondary to BPH is not supported by current data and trial designs, and benefit over risk remains unclear; therefore, PAE is not recommended outside the context of clinical trials."[2]

Embolization of the prostatic arteries was originally conceived as a potential treatment option for poorly controlled prostatic hematuria. It was first recognized to have a therapeutic benefit on BPH in 2000.[3,4] The procedure involves the delivery of microspheres into prostatic arteries, which stops local blood circulation and leads to infarction and necrosis of prostatic tissue and eventually prostate shrinkage.[1,3] PAE is an outpatient procedure performed by an interventional radiologist using only local anesthesia and mild sedation. Candidates for consideration of PAE tend to be surgery-averse or are not optimal candidates for surgery under general anesthesia. Optimal anatomic criteria tend to have larger prostate volumes (>80 g) and prostatic enlargement primarily occurring in the lateral rather than the median lobes.[5] In addition, PAE requires arterial patency in order to have maximal efficacy, and many centers obtain a CT scan or MR angiography prior to scheduling a patient for PAE so as to identify those with prostatic arterial occlusion that may prevent them from undergoing a successful procedure.[5]

Despite the AUA's assertion that data supporting PAE for BPH are scant, much has been published in recent years demonstrating the utility of the procedure. In 2016, Pisco et al. published the largest cohort of patients who underwent PAE with at least 6 months of subsequent follow-up.[6] They found that over the short-term (6 to 12 months), medium-term (1 to 3 years), and

long-term (3 to 6.5 years), patients experienced average IPSS improvements of –13.71, –14.5, and –16.94, respectively, average Q_{max} increases of 3.07 mL/sec, 4.12 mL/sec, and 7.98 mL/sec, respectively, and average PVR reductions of –43.89 mL, –47.92 mL, and –52.16 mL, respectively.[6] Similarly, a meta-analysis conducted by Kuang et al. in 2017 that included 788 patients from the literature up to that time showed an improvement in IPSS from a baseline mean of 23.75 to 10.94, 9.31, and 8.90 at 6, 12, and 24 months, respectively, and an increase in Q_{max} from a baseline mean of 8.34 mL/sec to 14.26 mL/sec, 15.91 mL/sec, and 16.91 mL/sec over those same time frames.[4]

The most severe complications that can arise from PAE are those of non-target embolization involving the rectum, bladder and penis which can present as symptoms of hematuria, hematochezia, bladder spasms, focal skin necrosis, pain with defecation or dysuria. More minor potential complications include urinary retention, hematospermia, and localized pain.[5] However, Pisco et al.[4] reported only 2 major complications (bladder ischemia requiring surgery and persistent perineal pain) and Kuang et al.[6] reported only 3 (vesicular artery dissection, persistent urinary infection requiring hospitalization, and focal bladder wall ischemia), thus lending support to PAE being an overall safe and low-risk intervention.

A specific criticism of PAE data in the AUA guidelines is the lack of published randomized controlled trials (RTCs). At the time of the AUA's 2020 amendment, only 3 RTCs had been identified that compared PAE to TURP.[2] More recently, Xiang et al. performed a meta-analysis examining the 2 procedures and found 10 studies meeting inclusion criteria.[7] No significant difference existed between the 2 procedures in IPSS improvement (p=0.1), QoL improvement (p=0.54), or PVR reduction (p=0.25).[7] Although TURP resulted in a greater increase in postoperative Q_{max}, PAE was associated with relatively fewer complications, lower cost, and shorter hospitalization.[7]

Although the existing evidence demonstrates PAE to be safe, effective, and non-inferior to TURP, 10 RTCs is clearly still not many, and more research will be required (particularly prospective research) before PAE might gain more acceptance by the general urology community. Analysis of longer-term outcomes, more than from just a handful of years of follow-up, will also be important in establishing PAE as a durable management option. Knowing which patient types are ideal—beyond their prostate size/shape or non-surgical candidacy—will help physicians choose the right candidates. If PAE is capable of improving voiding, will it significantly lower abnormally high voiding pressures as other outlet de-obstructive procedures can? And even if PAE shows inferiority to TURP, might it still play an adjunctive role in reducing the size of enormous prostate glands in order to make endoscopic treatment more safe/feasible or help make medical therapy more effective? Finally, the concern that a shift toward increased PAE use may lead to loss of primary operator status by the urologist should be addressed. We are in an age where multidisciplinary treatment teams are becoming the norm; urologists and interventional radiologists may need to work together on treating BPH in order to be of most benefit to and provide the best outcomes for their patients.

This case study was co-authored by Christopher E. Kelly, MD, assistant professor of urology at NYU Grossman School of Medicine, and Wilson Lin, MD, a PGY-3 urology resident at NYU Langone Health.

REFERENCES

1. Madersbacher S, Roehrborn CG, Oelke M. The role of novel minimally invasive treatments for lower urinary tract symptoms associated with benign prostatic hyperplasia. *BJU Int.* 2020;126(3):317-326.
2. Parsons JK, Dahm P, Kohler TS, Lerner LB, Wilt TJ. Surgical management of lower urinary tract symptoms attributed to benign prostatic hyperplasia: AUA guideline amendment 2020. *J Urol.* 2020;204(4):799-804.
3. Young S, Golzarian J. Prostatic artery embolization for benign prostatic hyperplasia: a review. *Curr Opin Urol.* 2018;28(3):284-287.
4. Kuang M, Vu A, Athreya S. A systematic review of prostatic artery embolization in the treatment of symptomatic benign prostatic hyperplasia. *Cardiovasc Intervent Radiol.* 2017;40(5):655-663.
5. Young S, Golzarian J. Prostate embolization: patient selection, clinical management and results. *CVIR Endovasc.* 2019;2(1):7.
6. Pisco JM, Bilhim T, Pinheiro LC, Fernandes L, Pereira J, Costa NV, Duarte M, Oliveira AG. Medium- and long-term outcome of prostate artery embolization for patients with benign prostatic hyperplasia: results in 630 patients. *J Vasc Interv Radiol.* 2016;27(8):1115-1122.
7. Xiang P, Guan D, Du Z, Hao Y, Yan W, Wang Y, Liu Y, Liu D, Ping H. Efficacy and safety of prostatic artery embolization for benign prostatic hyperplasia: a systematic review and meta-analysis of randomized controlled trials. *Eur Radiol.* 2021;31(7):4929-4946.

CHRISTOPHER E. KELLY, MD

Christopher E. Kelly, MD, is assistant professor of urology at NYU Grossman School of Medicine, specializing in male voiding dysfunction and neurogenic bladder. After completing his general surgery and urology training at Massachusetts General Hospital/ Harvard Medical School, he completed a fellowship in urodynamics, pelvic floor reconstruction, and neurourology at The University of Texas Southwestern Medical Center. An attending physician at NYU Langone Health, his area of clinical interest is the treatment of benign prostatic hyperplasia medically and with minimally invasive surgical techniques.

Department of Urology

NYU Langone Health

Our renowned urologic specialists have pioneered numerous advances in the surgical and pharmacological treatment of urologic disease.

For questions and/or patient referrals, please contact us by phone or by e-mail.

Faculty	Specialty	Phone Number/Email
James Borin, MD	Kidney stones, Kidney Cancer, Ureteral Stricture, UPJ obstruction, Endourology, Robotic Renal Surgery, Partial Nephrectomy, Ablation of Renal Tumors, PCNL	646-825-6387 james.borin@nyulangone.org
Benjamin Brucker, MD	Female Pelvic Medicine and Reconstructive Surgery, Pelvic Organ Prolapse-Vaginal and Robotic Surgery, Voiding Dysfunction, Male and Female Incontinence, Benign Prostate Surgery, Neurourology	646-754-2404 benjamin.brucker@nyulangone.org
Seth Cohen, MD	Female Sexual Dysfunction, Male Sexual Dysfunction, General Urology, Benign Disease Prostate, Post-Prostatectomy Incontinence, Erectile Dysfunction, Hypogonadism	646-825-6318 seth.cohen@nyulangone.org
Frederick Gulmi, MD*	Robotic and Minimally Invasive Urology, BPH and Prostatic Diseases, Male and Female Voiding Dysfunction, Kidney Stone Disease, Lasers in Urologic Surgery, and Male Sexual Dysfunction	718-630-8600 frederick.gulmi@nyulangone.org
Mohit Gupta, MD†	Urologic Oncology, Open, Laparoscopic, or Robot-Assisted Approaches to Surgery, Surgical Management of Genitourinary Malignancies including Kidney, Bladder, Prostate, Adrenal, Penile, and Testis Cancers	646-825-6325 Mohit.Gupta2@nyulangone.org
William Huang, MD	Urologic Oncology (Open and Robotic) – for Kidney Cancer (Partial and Complex Radical), Urothelial Cancers (Bladder and Upper Tract), Prostate and Testicular Cancer	646-744-1503 william.huang@nyulangone.org
Grace Hyun, MD	Pediatric Urology including Hydronephrosis, Hypospadias, Varicoceles, Undescended Testicles, Hernias, Vesicoureteral Reflux, Urinary Obstruction, Kidney Stones, Minimally Invasive Procedures, Congenital Anomalies	212-263-6420 grace.hyun@nyulangone.org
Christopher Kelly, MD	Male and Female Voiding Dysfunction, Neurourology, Incontinence, Pelvic Pain, Benign Prostate Disease	646-825-6322 chris.kelly@nyulangone.org
Herbert Lepor, MD	Prostate Cancer: Elevated PSA, 3D MRI/Ultrasound Co-registration Prostate Biopsy, Focal (Ablation) of Prostate Cancer, Open Radical Retropubic Prostatectomy	646-825-6327 herbert.lepor@nyulangone.org
Stacy Loeb, MD, MSc**	Urologic Oncology, Prostate Cancer, Benign Prostatic Disease, Men's Health, General Urology	718-261-9100 stacy.loeb@nyulangone.org
Danil Makarov, MD, MHS***	Benign Prostatic Hyperplasia, Erectile Dysfunction, Urinary Tract Infection, Elevated Prostate-specific Antigen, Testicular Cancer, Bladder Cancer, Prostate Cancer	718-376-1004 danil.makarov@nyulangone.org
Nnenaya Mmonu, MD, MS	Urethral Strictures, Robotic and Open Reconstructive Surgery for Ureteral Obstruction/Stricture, Fistulas, Bladder Neck Obstruction, Penile Prosthesis, Post Prostatectomy and Radiation Urinary Incontinence	646-754-2419 nnenaya.mmonu@nyulangone.org
Bobby Najari, MD	Male Infertility, Vasectomy Reversal, Varicocele, Post-Prostatectomy, Erectile Dysfunction, Male Sexual Health, Hypogonadism, Oncofertility	646-825-6348 bobby.najari@nyulangone.org
Nirit Rosenblum, MD	Female Pelvic Medicine and Reconstructive Surgery, Voiding Dysfunction, Neurourology, Incontinence, Female Sexual Dysfunction, Pelvic Organ Prolapse and Robotic Surgery	646-825-6311 nirit.rosenblum@nyulangone.org
Ellen Shapiro, MD	Pediatric Urology including: Urinary Tract Obstruction (ureteropelvic junction obstruction), Vesicoureteral Reflux, Hypospadias, Undescended Testis, Hernia, Varicocele, and Complex Genitourinary Reconstruction.	646-825-6326 ellen.shapiro@nyulangone.org
Mark Silva, MD*	Kidney stones, PCNL, Kidney Cancer, UPJ obstruction, Endourology, Robotic Renal Surgery, Ablation of Renal Tumors	718-630-8600 mark.silva@nyulangone.org
Gary D. Steinberg, MD	Muscle-Invasive Bladder Cancer, Non-Invasive Bladder Cancer, Radical Cystectomy, Urinary Tract Reconstruction After Bladder Removal Surgery	646-825-6327 gary.steinberg@nyulangone.org
Lauren Stewart, MD	Female Pelvic Medicine and Reconstructive Surgery, Pelvic Organ Prolapse, Incontinence in Women, Female Voiding Dysfunction	646-825-6324 lauren.stewart@nyulangone.org
Samir Taneja, MD	Urologic Oncology – Prostate Cancer (MRI-Guided Biopsy, Robotic Prostatectomy, Focal Therapy, Surveillance), Kidney Cancer (Robotic Partial Nephrectomy, Complex Open Surgery), Urothelial Cancers	646-825-6321 samir.taneja@nyulangone.org
James Wysock, MD, MS	Urologic Oncology – Prostate Cancer, MRI-Guided Biopsy, Kidney and Prostate Cancer Surgery, Robotic Urological Cancer Surgery, Prostate Cancer Image-guided Focal Therapy (Ablation, HIFU), and Testicular Cancer	646-754-2470 james.wysock@nyulangone.org
Lee Zhao, MD	Robotic and Open Reconstructive Surgery for Ureteral Obstruction, Fistulas, Urinary Diversions, Urethral Strictures, Peyronie's Disease, Penile Prosthesis, and Transgender Surgery	646-754-2419 lee.zhao@nyulangone.org
Philip Zhao, MD	Kidney Stone Disease, Upper Tract Urothelial Carcinoma, Ureteral Stricture Disease, and BPH/Benign Prostate Disease	646-754-2434 philip.zhao@nyulangone.org

*at NYU Langone Hospital – Brooklyn ** NYU Langone Ambulatory Care Rego Park ***NYU Langone Levit Medical †222 East 41st street; NYU Langone Ambulatory Care Bay Ridge, and NYU Langone Levit Medical