CLINICAL STUDY

Prostate Artery Embolization in Patients with Prostate Volumes of 80 mL or More: A Single-Institution Retrospective Experience of 93 Patients

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ABSTRACT

Purpose: To evaluate the safety and efficacy of prostate artery embolization (PAE) for the treatment of benign prostatic hyperplasia for prostates $\geq$ 80 mL.

Patients and Methods: A retrospective review was conducted of 93 patients with prostate volumes (PVs) $\geq$ 80 mL treated with PAE from April 2014 through October 2017. Mean patient age was 68.5 years (range 52–88) and mean age-adjusted Charlson comorbidity index was 3.2 (range 1–8). Exclusion criteria included history of biopsy-proven prostate cancer or catheter dependency. Clinical and urodynamic outcomes were reviewed at 1, 3, 6, and 12 months. Adverse events were graded according to the Clavien-Dindo classification.

Results: Mean PV decreased significantly from 141.7 mL to 98.1 mL at 3 months ($P < .01$) and 82.2 mL at 12 months ($P < .01$). Significant improvements were seen in 3- and 12-month mean International Prostate Symptom Scores (IPSS) (22.3 vs 7.1 and 7.3, respectively; $P < .01$ for both), quality of life (QOL) (4.4 vs 1.2 and 1.3; $P < .01$ for both), and postvoid residual volume (196.7mL vs 92.1 and 61.2 mL; $P < .01$ and $P < .01$, respectively). Significant improvement was also seen in 3-month mean maximum urinary flow: 7.7 mL/s vs 12.8 mL/s ($P < .01$). One grade II complication of stroke occurred; all other complications were self-limited and grade I.

Conclusions: PAE achieved a clinically and statistically significant improvement in symptom burden and secondary outcome measures in patients with PVs $\geq$ 80 mL. PAE may be an alternate treatment for patients for whom conventional surgical options are limited or associated with significant morbidity.

ABBREVIATIONS

BPH = benign prostatic hyperplasia, LUTS = lower urinary symptoms, PAE = prostate artery embolization, PV = prostate volumes, QOL = quality of life

Men with larger prostate glands represent a challenging subset of patients when they require surgical management for benign prostatic hyperplasia (BPH). Most of the current minimally invasive and endoscopic approaches have limited efficacy and durability, as well as an increased risk of complications when used to treat patients with prostate glands that are larger than 80–100 mL (1). As a result, many patients with larger prostate glands are recommended to undergo subtotal prostatectomy, which is an invasive procedure that requires general anesthesia and may be associated with significant risks of perioperative blood loss, complications, and a prolonged period of postprocedural convalescence with an indwelling catheter (2,3).

Prostate artery embolization (PAE) is an evolving minimally invasive technique that has been performed to manage

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lower urinary symptoms (LUTS) in patients with prostate volumes up to 571 mL (4–10). It generally does not require administration of a general anesthetic, making it particularly suitable for managing those patients with significant comorbidities, who may carry a high risk for surgery (11–13).

Despite its promise in reducing the symptom burden in patients who have prostate volumes $\geq$ 80 mL, there remains a critical dearth of information, as well as a lack of standardization in reported data regarding the use of PAE in this cohort of patients. The purpose of the present study was to review the safety and efficacy of PAE at our center with the use of contemporary validated outcome measures that are widely used by the urologic community.

SUBJECTS AND METHODS

Patients

All patients with prostate volumes $\geq$ 80 mL as measured by computerized tomography (CT) or magnetic resonance (MR) who underwent PAE to treat LUTS secondary to BPH from January 2014 to October 2017 were selected from an ongoing Institutional Review Board–approved database. Patients with prostate volumes $<$ 80 mL and those who were catheter dependent were excluded from the review. Patients with a diagnosis of prostate cancer were excluded from the analysis. Those patients with PSA elevation or other features suggesting the diagnosis of prostate cancer were evaluated first by the urology department based on the current institutional protocol. A flow chart demonstrating exclusion and inclusion criteria is provided in Figure 1.

All patients undergoing PAE at our center undergo a baseline medical history and physical examination and complete several validated instruments, including the International Prostate Symptom Score (IPSS) and quality of life (QOL) index, as well as the International Index of Erectile Function 5 (IIEF-5). In addition patients undergo an assessment of their maximum urine flow rate (Q_{max}), and postvoid residual urine volume (PVR). Prostate volume was determined by means of a prostate MR or CT scan. The same imaging modality that was used for the pretreatment imaging was then used for all subsequent follow-ups.

Prostate Artery Embolization

All PAE procedures were performed under conscious sedation by a single operator (S.B.). During the procedure, all patients received antibiotic prophylaxis with the use of 400 mg intravenous ciprofloxacin and conscious sedation with the use of intravenous midazolam (Hospira, Lake Forest, Illinois) and fentanyl (West-Ward Pharmaceuticals, Eatontown, New Jersey). Patients were discharged home the same day (2–4 hours after the procedure) or were observed overnight and discharged home within 24 hours. The 23-hour admission was preferred in the early operator experience. The postprocedure medication regiment included oral phenazopyridine (Pyridium; Actavis Totowa) 100 mg 3 times a day for 5 days, oral ibuprofen 800 mg 3 times a day for 5 days, oral ciprofloxacin 500 mg twice a day for 5 days, and oral solifenacin succinate (Vesicare; Astellas Pharma) 5 mg once daily for 5 days. All embolization procedures were performed with either 100–300 μm or 300–500 μm Embosphere Microspheres (Merit Medical Systems, South Jordan, Utah) via radial or femoral arterial access. Transradial access was preferred route since February 2016. Transulnar access was used for 1 patient with a radial artery diameter $<$ 2 mm. The choice of embolic particle size was based on the operator's discretion. On selected patients, pelvic angiography was performed at the infrarenal abdominal aorta, again at operator discretion. Regardless of arterial access, all patients underwent hypogastric arteriography with a 5-F Berenstein diagnostic catheter (Merit Medical Systems). In all cases, the arteries feeding the prostate were super-selectively catheterized with a 1.8-F Finecross microcatheter (Terumo, Tokyo, Japan) or 2.1-F Maestro Microcatheter (Merit Medical Systems) and 0.014 Fathom guidewire (Boston Scientific, Marlborough, Massachusetts), and then embolized to stasis. Technical success was defined as bilateral embolization.

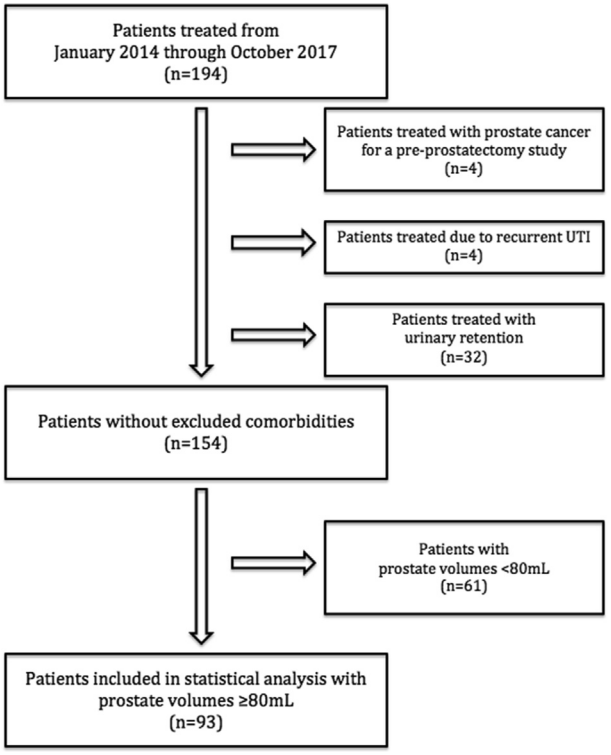

Figure 1. Flow chart demonstrating inclusion and exclusion of patients. UTI = urinary tract infection.

Patients returned for follow-up visits at 1, 3, 6, and 12 months after PAE. At each follow-up visit, patients were evaluated for IPSS, QOL, IIEF-5, and PVR. All of the patients underwent MR before PAE unless there was a contraindication to MR or they already had a baseline CT available. MR or CT was performed to measure prostate volume at 3 and 12 months after PAE, and Q_{max} was assessed at 3 months. Patients continued to take their