



Prostate artery embolization for the treatment of urinary retention caused by large (>80 mL) benign prostatic hyperplasia: Results of 21 patients

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ABSTRACT

Objective: A large prostate size (>80 mL) of benign prostatic hyperplasia (BPH) is technically challenging to treat surgically. This study aimed to investigate the safety and efficacy of super-selective prostatic artery embolization (PAE) for the treatment of urinary retention caused by large BPH.

Methods: A total of 21 patients with urinary retention, indwelling urinary catheter, or suprapubic cystostomy as a consequence of giant BPH (prostate volume [PV] > 80 mL) who sought treatment between January 2013 and December 2017 were enrolled. A microcatheter (1.9–2.7 Fr) and a “two-step embolization” combining 50- μ m and 100- μ m polyvinyl alcohol embolization particles were used in all patients. International Prostate Symptom Score (IPSS), quality of life (QoL), PV, and prostate-specific antigen (PSA) were evaluated at 3, 6, and 12 months post-PAE. Clinical success was defined as removal of urinary catheter or suprapubic cystostomy and ability to void spontaneously.

Results: The clinical success rate was 95.2% (20/21). Compared with pre-procedural values, IPSS, QoL, PV, and PSA showed statistically significant differences at 3, 6, and 12 months post-PAE ($P < 0.05$). There were no serious complications after PAE.

Conclusions: PAE was safe and effective for the treatment of urinary retention caused by large BPH in patients without surgical treatment options.

Introduction

Lower urinary tract symptoms is often associated with benign prostatic hyperplasia (BPH), a highly prevalent and age-related disease estimated to affect 6% of the male population worldwide.¹ If patients develop urinary retention due to BPH but radical surgery is not indicated, they can be treated only with an indwelling urinary catheter or suprapubic cystostomy, both of which significantly negatively impact quality of life.² Transcatheter super-selective prostatic artery embolization (PAE) is a recently developed endovascular interventional technique for the treatment of BPH.^{3,4} However, there are few reports in the literature on PAE for the treatment of urinary retention, indwelling urinary catheter, or suprapubic cystostomy resulting from large BPH (>80 mL). This article reports on the safety and efficacy of PAE in catheter-dependent patients with a large prostate volume (PV; >80 mL) who are unfit for surgical treatment.

Materials and methods

Ethical approval

The study was approved by the ethics committee of Chinese PLA General Hospital. All clinical practices and observations were conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from each patient before the study was conducted.

Patient selection

A total of 21 patients who presented with acute urinary retention, an indwelling urinary catheter, or a suprapubic cystostomy resulting from giant BPH between January 2013 and December 2017 were retrospectively analyzed. Written informed consent was obtained from all patients. Inclusion criteria for this study were as follows: (1) confirmed diagnosis

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of BPH and receipt of indwelling urinary catheter or suprapubic cystostomy due to acute urinary retention; (2) PV > 80 mL; and (3) inoperable due to cardiac or pulmonary dysfunction and other underlying diseases. The exclusion criteria were as follows: (1) detrusor failure; (2) neurogenic bladder; (3) allergy to iodinated contrast agents; (4) severe renal dysfunction; and (5) active infection in the urinary system.

PAE procedures

Patients underwent angiography and PAE in a therapeutic angiography unit equipped with a digital flat-panel detector system (INNOVA 4100 IQ; GE Healthcare, Milwaukee, WI, USA) with nonionic contrast medium (Visipaque 320 mgI/mL; GE Healthcare).

Angiography of the prostatic artery (PA): The indwelling 4.0 Fr vascular sheath (Cordis, USA) was placed under local anesthesia. PA angiography was performed after super-selective catheterization of the PA using a microcatheter with a 1.9–2.7 Fr tip (Terumo, Japan). A C-arm computed tomography scan (X-ray tube rotation, 180°; rotation speed, 10°/s) was also performed to further define the PA and surrounding communicating branches.⁵ PAE was performed using a “two-step embolization” method with 50- μ m and 100- μ m polyvinyl alcohol (PVA) particles (Cook, USA). The embolic agent was slowly infused until the contrast agent filled the proximal end of the PA and a cast was formed.

Follow-up

The first attempt to remove the urinary catheter was 1 week after surgery. If the patient was unable to void voluntarily, another attempt was performed 1 week later. For patients with a suprapubic cystostomy, the cystostomy could be removed if the patient voided voluntarily when the drainage tube was clamped. IPSS, QoL, PSA, and PV were recorded before surgery and at 3, 6, and 12 months after surgery. Postoperative reactions and complications were monitored and recorded. Minor complications included pain in the pubic area and a urinary tract burning sensation, while serious complications included thromboembolism in the bladder or seminal vesicles.⁶

Efficacy evaluation

PAE clinical success was defined as successful removal of the urinary catheter or cystostomy and the recovery of voluntary voiding with a PV > 80 mL.⁷

Statistical analysis

Quantitative variables are expressed as mean and standard deviation or minimum and maximum values, whereas qualitative variables are expressed as number and percentage. A paired-sample *t*-test was used to compare the differences in efficacy parameters between pre- and postoperative values at each postoperative time point. Differences of $P < 0.05$ were deemed statistically significant. Statistical software (SPSS ver. 24.0; SPSS Inc., Chicago, IL, USA) was used for the data analyses.

Results

Patient characteristics

A total of 21 patients aged 68–91 years (mean age, 76.8 ± 5.8 years) were included. Among them, 15 had an indwelling urinary catheter with a mean duration of 1.7 ± 1.1 (range, 1–4) weeks, while the other 6 had an indwelling suprapubic cystostomy with a mean duration of 2.5 ± 1.9 (range, 1–6) weeks (Table 1).

Efficacy evaluation

Bilateral PAE was successfully performed in 19 patients (90.5%),

Table 1

Baseline data before PAE (N = 21).

Characteristic	Value
Age (years)	76.8 ± 5.8 (68–91)*
Indwelling urinary catheter (cases)	15
Indwelling urinary catheter (weeks)	1.7 ± 1.1 (1–4)*
Suprapubic cystostomy (cases)	6
Suprapubic cystostomy (weeks)	2.5 ± 1.9 (1–6)*
IPSS (points)	9
QoL score	6
PV (mL)	5
PSA (ng/mL)	4

IPSS, International Prostate Symptom Score; PAE, prostatic artery embolization; PSA, prostate-specific antigen; PV, prostate volume; QoL, quality of life.

*Data are expressed as mean \pm standard deviation with range in parentheses.

while unilateral PAE was performed in 2 (9.5%) (atherosclerosis led to severely tortuous internal iliac artery and PA, resulting in catheterization failure). Catheters were successfully removed in 20 patients (95.2%), and the average duration to removal was 1.8 ± 0.8 weeks (successfully removed at postoperative week 1 in 8 patients, postoperative week 2 in 10 patients, and postoperative week 3 in 2 patients). Urinary catheter removal failed in 1 patient (who underwent unilateral PAE due to atherosclerosis) despite several attempts and ultimately remained in place (Fig. 1A and B).

Postoperative follow-up

The patients were followed up for a mean 31 ± 10 (range, 12–48) months post-PAE. Compared with preoperative values, the IPSS, QoL, PV, and PSA showed statistically significant differences at 3, 6, and 12 months post-PAE ($P < 0.05$) (Table 2). MRI scans performed 3 months after PAE showed significant infarction that constituted a mean $64 \pm 13\%$ (range, 50–85%) of the central zone of the prostate. The PV continued to shrink during the follow-up period, with an average reduction of 42%.

Complications

No serious complications occurred after PAE. The following minor complications occurred: 6 patients (28.6%) reported urinary tract burning, 1 patient (4.8%) reported transient hematuria, 10 patients (47.6%) reported mild pain in the pubic area, and 7 patients (33.3%) had a low-grade fever. All complications resolved spontaneously at 1 week after surgery without specific treatment.

Discussion

As BPH progresses, the probability of developing acute urinary retention in patients with BPH can reach 53%.⁸ Current treatment approaches for BPH mainly include drug therapy, open surgical resection, and transurethral resection of the prostate.⁹ However, alternative therapies remain limited for elderly patients with underlying diseases such as cardiac and pulmonary dysfunction and poor tolerance of surgical treatment.^{10,11} PAE has appealing potential as a new treatment option for patients with large prostates in whom other therapies fail.

This study further confirms that PAE for the treatment of acute urinary retention caused by large BPH in elderly patients is safe and effective. There were no serious complications among the enrolled patients. The clinical success rate was 95.2%, and no cases of recurrence were observed up to the longest follow-up period of 48 months; these results are better than those of previous reports.^{12,13}

Several points are worth noting in this study. First, according to severe prostatic arterial tortuosity, a moderately firm microcatheter (1.9–2.7 Fr) and guidewire should be used, and nitroglycerin injection (300–500 μ g) should be used to dilate the blood vessels before

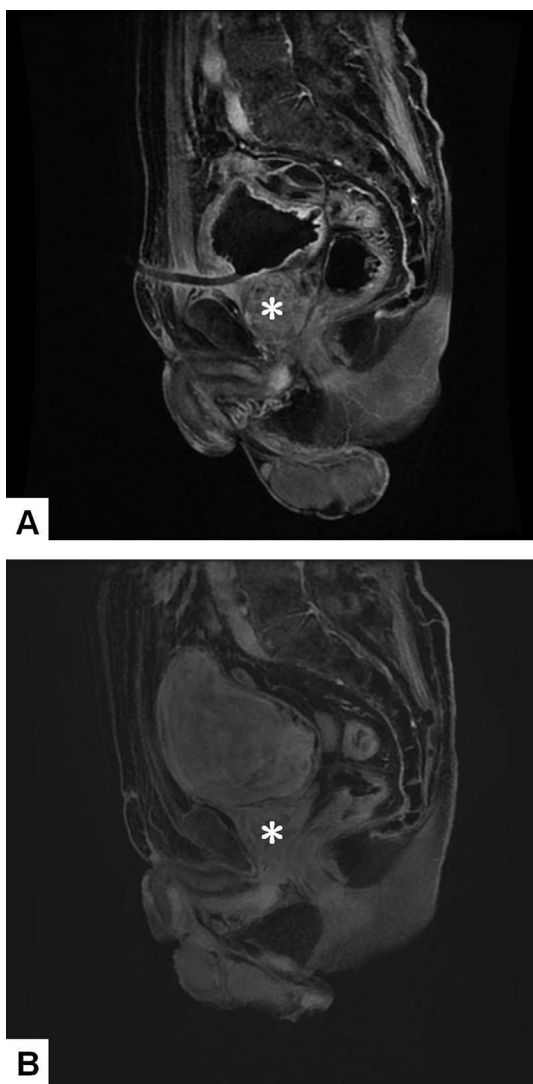


Fig. 1. A. Post-PAE follow-up MR image of an elderly patient with suprapubic cystostomy. A. MR image of the pelvis taken before PAE shows the urinary catheter (↘). B. MR image taken 12 months after PAE showing that the catheter was successfully removed and the prostate volume (*) was reduced by 31%. MRI, magnetic resonance; PAE, prostatic artery embolization.

Table 2
Clinical values of response variables before and at 3, 6, and 12 months after PAE.

Variable	Before PAE	3 months	6 months	12 months	P value*
IPSS (points)	30.2 ± 4.5	12.1 ± 5.8	6.5 ± 3.2	6.1 ± 4.3	<0.01
QoL score	6.2 ± 1.5	2.7 ± 1.3	2.5 ± 1.0	2.4 ± 1.2	<0.01
PV (mL)	123.5 ± 40.2	65.0 ± 14.0	48.0 ± 22.0	45.0 ± 10.6	<0.01
PSA (ng/mL)	3.3 ± 2.5	3.2 ± 1.7	3.2 ± 1.5	3.0 ± 1.4	<0.05

IPSS, International Prostate Symptom Score; PAE, prostatic artery embolization; PSA, prostate-specific antigen; PV, prostate volume; QoL, quality of life.

*P values compared with baseline.

embolization to avoid vasospasm and dissection. Second, embolization should focus on the central zone of the prostate, the area that is known to lead to lower urinary tract obstruction.¹⁴ Third, “two-step embolization,” which combines 50 and 100 μm diameter PVA particles, should be used.⁴ Finally, early treatment is critical. Our study found that the long indwelling duration and detrusor injury caused by acute urinary

retention might have also affected the successful removal of catheter after PAE, as did the time required for its removal. All patients who underwent catheter removal within 2 weeks post-PAE had an indwelling duration of ≤2 months and had previously developed acute urinary retention only once.

This study had the following limitations. First, a relatively small number of patients were enrolled. Second, PAE was not compared with other BPH treatments in a randomized controlled manner. And third, the long-term efficacy of PAE (>5 years) is a topic that warrants further attention.

In summary, PAE is a safe and effective treatment for urinary retention caused by large BPH (>80 mL), particularly in elderly patients with multiple underlying diseases, such as cardiac and pulmonary dysfunction, who are not surgical candidates.

Patient consent

Written informed consent was obtained from patients for publication of these case reports and any accompanying images.

Author contributions

Conception and design: B.Y., M.Q.W.,
Analysis and interpretation: B.Y., Y.W., H.N.X.,
Data collection: J.L.Z., X.Q.W., J.X.F.,
Writing the article: B.Y.
Statistical analysis: J.L.Z., J.Y.Y., Y.W., J.X.F.,
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Overall responsibility: B.Y.

Declaration of competing interest

The authors declare that they have no conflicts of interests to this work. We declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the work submitted.

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