Prostate Embolization as an Alternative to Open Surgery in Patients with Large Prostate and Moderate to Severe Lower Urinary Tract Symptoms

João Pisco, MD, PhD, Tiago Bilhim, MD, PhD, EBIR, Luis C. Pinheiro, MD, PhD, Lúcia Fernandes, MD, José Pereira, MD, Nuno V. Costa, MD, Marisa Duarte, MD, and António G. Oliveira, MD, PhD

ABSTRACT

Purpose: To evaluate efficacy of prostate artery embolization (PAE) in patients with benign prostatic hyperplasia (BPH), prostate volume (PV) $>$ 100 cm^3.

Materials and Methods: This was a single-center retrospective cohort study. Between March 2009 and September 2014, PAE was performed in patients with a diagnosis of BPH, PV $>$ 100 cm^3, and moderate to severe lower urinary tract symptoms (LUTS) refractory to medical treatment for at least 6 months or who had acute urinary retention. Success was defined as improved symptoms (International Prostate Symptom Score $\leq$ 15 and decrease of $\geq$ 25% from baseline score), improved quality of life (measured as score of $\leq$ 3 points or decrease of $\geq$ 1 point from baseline), and no need for additional treatment.

Results: PAE was performed in 152 patients 48–87 years old (mean ± SD 67.4 y ± 7.5) with mean PV of 134.2 cm^3 ± 41.8 (range, 101–383 cm^3). PAE was technically successful in 149 patients (98.0%). Symptomatic control was achieved for a median of 18 months ± 15.5 (range, 3–66 mo). There were 33 clinical failures (23.6%); 23 occurred in the short-term ($\leq$ 6 mo), and 10 occurred in the medium-term (6–24 mo); there were no long-term failures ($>$ 36 mo). Cumulative clinical success rates were 90%, 87.9%, 83.5%, 81.1%, and 77.8% at 1, 3, 6, 12, and 18 months and 72.4% thereafter to 66 months (5.5 y).

Conclusions: PAE provides sustained short-, medium-, and long-term control for LUTS in patients with BPH and PV $>$ 100 cm^3.

ABBREVIATIONS

AUR = acute urinary retention, BPH = benign prostatic hyperplasia, CI = confidence interval, HoLEP = holmium laser enucleation of the prostate, IIEF = International Index of Erectile Function, IPSS = International Prostate Symptom Score, LUTS = lower urinary tract symptoms, PAE = prostate artery embolization, PSA = prostate-specific antigen, PV = prostate volume, PVA = polyvinyl alcohol, PVR = postvoid residual urine volume, Q_{max} = peak urinary flow rate, QoL = quality of life

Benign prostatic hyperplasia (BPH) is the most frequent benign tumor in men, affecting $>$ 50% by the age of 60 years (1,2). Treatment options should be oriented to treat lower urinary tract symptoms (LUTS) related to BPH (3). Numerous treatment options now exist, and medical therapy is usually the first-line treatment for men with moderate to severe LUTS (4,5). In men with moderate to severe LUTS refractory to medical therapy (and when medical therapy is refused), the treatment options are minimally invasive therapy or surgery (6). Surgery is also indicated for acute urinary retention (AUR) or when there are other BPH-related complications, including renal insufficiency, recurrent urinary tract infections, gross hematuria, large bladder stones, large bladder diverticula, or progressive bladder dysfunction. Transurethral resection of the prostate is the gold standard treatment for patients with BPH and prostate volume (PV) $<$ 80–100 cm^3, and open

From the Interventional Radiology Department (J.Pi., T.B., L.F., J.Pe., N.V.C., M.D.) and Urology Department (L.C.P.), Hospital Saint Louis, R. Luz Soriano, Lisbon 1200-249, Portugal; Radiology Department (T.B., L.F., J.Pe., N.V.C.), Medicine Faculty, Universidade Nova de Lisboa, Lisbon, Portugal; and Biostatistics Department and Department of Pharmacy (A.G.O.), Universidade Federal do Rio Grande do Norte, Natal, Rio Grande do Norte, Brasil. Received July 9, 2015; final revision received January 11, 2016; accepted January 12, 2016. **Address correspondence to** J.Pi.; E-mail: martinspisco@hslouis.pt

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prostatectomy is generally indicated for men with very large prostates (PV > 80–100 cm^3) (7,8).

Prostate artery embolization (PAE) is a minimally invasive therapy that has been shown to be safe and efficient for LUTS caused by BPH (9–30), with good evidence of short-term and medium-term outcomes among patients with PV > 80 cm^3 (25,28–30). However, the long-term efficacy outcomes are unclear in patients with PV > 100 cm^3 and moderate to severe LUTS refractory to medical therapy.

MATERIALS AND METHODS

Study Population

This single-center retrospective study was conducted between March 2009 and September 2014 after receiving approval from the institutional review board. We used the following inclusion criteria: male patients with age > 45 years, diagnosis of BPH, moderate to severe LUTS with an International Prostate Symptom Score (IPSS) > 18 or a quality of life subscore (QoL) of at least 3 points, a peak urinary flow rate (Q_{max}) of ≤ 12 mL/s or current AUR, PV > 100 cm^3, and LUTS refractory to medical treatment for at least 6 months. The IPSS QoL subscore ranged from 0 (delighted) to 6 (terrible) (2). Informed consent for PAE as an alternative treatment to surgery was signed by all participants.

Patients were excluded if they had any of the following conditions: malignancy, advanced atherosclerosis and tortuosity of iliac or prostatic arteries on computed tomography (CT) angiography performed before the procedure, secondary renal insufficiency as a result of prostatic obstruction, large bladder diverticula or stones (> 5 cm), a neurogenic bladder, detrusor failure, active urinary infection, and uncontrolled coagulopathy (12,13). A prostatic biopsy was performed in all patients with suspected prostatic malignancy and a prostate-specific antigen (PSA) level > 4 ng/mL or suspicious focal lesions either by digital rectal examination or by transrectal ultrasound or magnetic resonance imaging. If bladder outlet obstruction was doubtful based on Q_{max} > 12 mL/s or if bladder dysfunction was suspected based on high (> 150 mL) postvoid residual urine volume (PVR), invasive urodynamic tests were performed. Part of the reported cohort has been previously published (11–14,16).

Medication

Patients were given an acid-suppressing drug (omeprazole 20 mg once daily), an antiinflammatory (naproxen 1,000 mg twice daily), and an antibiotic (ciprofloxacin 750 mg, twice daily) 2 days before PAE, and these were continued for 7 days after PAE. On the day of the procedure, patients received the same medications at breakfast and at dinner; the dinner was 8 hours after PAE. Patients were admitted to the hospital 2 hours before the intervention on the day of the procedure. During embolization, an antiallergic and sedative medication (hydroxyzine 25 mg) was given orally, and an analgesic (metamizole 2 g) and an antiinflammatory (ketorolac tromethamine 30 mg) were given intravenously. Patients receiving BPH-related medical therapy stopped alpha blockers until 5 days after PAE and 5α-reductase inhibitors during the following 3 weeks after PAE.

PAE Technique

All patients underwent CT angiography before the procedure to study the anatomy of the pelvic and prostate arteries (21,22). Embolization was performed under local anesthesia by a unilateral femoral approach whenever feasible, usually through the right femoral artery. For this purpose, a 5-F 11-cm-long or 23-cm-long sheath (Terumo Corporation, Tokyo, Japan) was introduced into the right femoral artery. To catheterize the left internal iliac artery and its anterior division, a Roberts Uterine Catheter (Cook, Inc, Bloomington, Indiana) and a 0.035-inch hydrophilic guide wire (Terumo Corporation) were used; after placing the catheter, we performed digital subtraction angiography (6 mL contrast medium, 3 mL/s in ipsilateral anterior oblique projection [35°], and caudal-cranial angulation [−10%]). The prostate arteries were selectively catheterized with a 2.0-F to 2.7-F Cantata (Cook, Inc) or Progreat (Terumo Corporation) microcatheter and 0.016-inch hydrophilic guide wire (GLIDEWIRE GT; Terumo Corporation).

After catheterization of the prostate artery, a power injection of contrast medium (4 mL, 2 mL/s) was performed in ipsilateral anterior oblique and posteroanterior views (Fig 1a–f). In the case of bifurcation of the prostate arteries, the microcatheter was placed just proximal to the bifurcation for embolization. If there was no bifurcation, the microcatheter was placed as distally as possible, preferably in the anterolateral prostate branch (central gland). If there was risk of untargeted embolization because of anastomoses with other important pelvic arteries (internal pudendal, accessory internal pudendal, vesical, and middle rectal arteries), embolization was performed with coils to avoid complication (this was performed according to the specific anatomy of a patient's prostate artery) (Fig 2a–c). The potential risks regarding PAE-related erectile dysfunction were discussed with right patients who had large anastomoses to the penile artery.

For embolization, we use nonspherical polyvinyl alcohol (PVA) particles (100 and 200 μm; Cook, Inc), spherical PVA particles (300–500 μm; Bead Block; Biocompatibles UK Ltd, Farnham, United Kingdom), Embosphere (300–500 μm; Merit Medical Systems, Inc, South Jordan, Utah), and Embozene (400 μm; CeloNova BioSciences, Inc, San Antonio, Texas). The chosen endpoints were occlusion of the arterial branches