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Original Research Article

Prostatic artery embolisation versus bipolar transurethral resection of prostate in large prostatomegaly: a prospective comparative pilot study

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ABSTRACT

Background: Prostatic artery embolisation (PAE) has emerged as a minimally invasive alternative to Bipolar Transurethral Resection of the Prostate (B-TURP) for managing large benign prostatic hyperplasia (BPH). However, comparative evidence in prostates >80 mL remains limited. This study compared the efficacy, safety, and functional outcomes of PAE and B-TURP in patients with large BPH.

Methods: In this prospective comparative pilot study, 40 patients with symptomatic BPH and prostate volume >80 mL were randomized to undergo PAE (n=20) or B-TURP (n=20). Patients were evaluated at baseline and 3, 6, and 12 months using the International Prostate Symptom Score (IPSS), quality-of-life (QoL) score, maximum urinary flow rate (Qmax), post-void residual urine (PVR), prostate volume, prostate-specific antigen (PSA), International Index of Erectile Function-5 (IIEF-5), and procedure-related complications.

Results: Both procedures significantly improved LUTS and QoL at 12 months. Symptom improvement was comparable between groups (IPSS: 9.0±5.0 vs. 7.0±4.5; p=0.21), whereas B-TURP achieved superior improvement in Qmax (19.0±4.0 vs. 14.0±3.5 ml/s; p=0.003), PVR (p=0.04), and prostate volume reduction (55.0% vs. 30.0%; p<0.005). PAE resulted in shorter hospital stay (1.0 vs. 2.5 days; p=0.032), fewer major complications, and better preservation of erectile (80% vs. 50%; p=0.036) and ejaculatory function (p<0.001). Clinical success was achieved in 80% and 90% of patients following PAE and B-TURP, respectively.

Conclusions: Both PAE and B-TURP effectively improve LUTS in patients with large BPH. While B-TURP provides superior objective functional outcomes, PAE offers comparable symptomatic relief with lower perioperative morbidity, shorter hospitalization, and significantly better preservation of sexual function, making it an attractive minimally invasive option for appropriately selected patients.

Keywords: Benign prostatic hyperplasia, Prostatic artery embolization, Bipolar TURP, Lower urinary tract symptoms, Large prostate, Sexual function.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a prevalent age-related condition, affecting approximately 50% of men beyond the fifth decade and over 80% by the ninth decade.[1] It commonly causes lower urinary tract symptoms (LUTS), comprising storage and voiding symptoms, with substantial impact on quality of life.[2] Management ranges from watchful waiting and lifestyle modification to pharmacotherapy with alpha-blockers and 5-alpha-reductase inhibitors.[3] Failure or intolerance of medical therapy may necessitate surgical treatment for bladder outlet obstruction. Transurethral resection of the prostate (TURP) remains the established standard for prostates of 30–80 ml; however, large prostatomegaly (>80 g) is associated with prolonged operative time and greater haemostatic challenges with conventional TURP.

Open simple prostatectomy, laser enucleation and bipolar TURP (B-TURP) are established alternatives for large glands, with B-TURP offering advantages over monopolar TURP.[4]

Despite its efficacy, B-TURP carries postoperative morbidity, including retrograde ejaculation, urinary incontinence, sepsis and urethral stricture, creating a need for less invasive alternatives, particularly in elderly patients with substantial comorbidity.[5] Prostatic artery embolisation (PAE) is a minimally invasive endovascular procedure performed under local anaesthesia, in which selective prostatic arterial embolisation induces ischaemia and subsequent reduction of hyperplastic tissue. PAE has demonstrated clinical efficacy and durability in selected patients with severe LUTS and large prostate volumes.[6]

Comparative studies suggest that PAE offers advantages in safety and sexual-function preservation, whereas TURP generally provides greater improvement in maximum urinary flow rate and prostate-volume reduction, particularly in the short term.[6–8] However, evidence specifically comparing PAE with B-TURP in large glands remains limited. The Society of Interventional Radiology multisociety consensus supports PAE for moderate-to-severe refractory LUTS, including selected patients with large prostates, catheter-dependent urinary retention, significant comorbidity limiting surgical options, and those prioritising preservation of sexual function.[9,10]

The primary objective of the study was to compare the efficacy of prostatic artery embolisation (PAE) and bipolar transurethral resection of the prostate (B-TURP) in achieving symptomatic and objective functional improvement in patients with large-volume benign prostatic hyperplasia (BPH), assessed using prostate volume (PV), International Prostate Symptom Score (IPSS), and maximum urinary flow rate (Qmax). The secondary objectives included comparing the safety and perioperative outcomes of both procedures in terms of procedure-related morbidity, complication profiles, and duration of hospitalisation; evaluating their impact on erectile and ejaculatory function; and assessing clinical durability over 12 months based on treatment success, catheter independence, and the need for retreatment.

METHODS

Study design and setting

This research was structured as a prospective comparative analysis conducted within the Departments of Urology and Radiology at Medical College & Hospital, Kolkata. The study design aimed to compare the clinical and safety outcomes of two distinct treatment modalities—PAE and B-TURP—in patients presenting with considerable prostatic enlargement.

Informed consent was obtained, and the study protocol was approved by the institutional ethical committee (Ref No. MC/KOL/IEC/NON-SPON/2302/03/2024 dated 18/03/2024)

Study period

The study duration was between June, 2025 to May, 2026.

Study population and sample size

The target population comprised male patients presenting with LUTS attributed to BPH who attended the Urology Outpatient Department of Medical College, Kolkata. The core inclusion criterion was large prostatomegaly, defined as a Prostate Volume (PV) exceeding 80 gm/ml, as measured by ultrasonography.

As per the operational mandate of this inquiry, a total sample size of n=20 patients were stipulated. These patients were randomized into two equal treatment arms: First the prostatic artery embolisation (PAE) Group**:** n=20 patients and second the Bipolar Transurethral Resection of Prostate (B-TURP) Group: n=20 patients.

Inclusion criteria

Patients aged ≥ 18 years presenting with prostatomegaly exceeding 80 gm.

Exclusion criteria

Patients younger than 18 years, history of prior BPH operation, urinary tract malignancy, bleeding diathesis, active UTI, aortoiliac aneurysm/claudication, or poor performance status.

Interventional procedures

PAE

Performed by the interventional radiology team in the DSA unit under local anaesthesia. Pre-procedural planning utilized CT Angiography of the bilateral iliac vessels to map the complex pelvic arterial anatomy. The procedure aimed for bilateral embolization, which is known to reduce the risk of re-intervention compared to unilateral PAE. Techniques employed Microcatheter super-selective catheterization, guided by Digital Subtraction Angiography (DSA). Embolic agents typically consisted of calibrated microspheres (e.g., 300-500 µm range is common), injected slowly until true flow stasis was achieved. The PErFecTED technique (proximal embolization first, then embolize distal) is known to produce greater prostate ischemia.

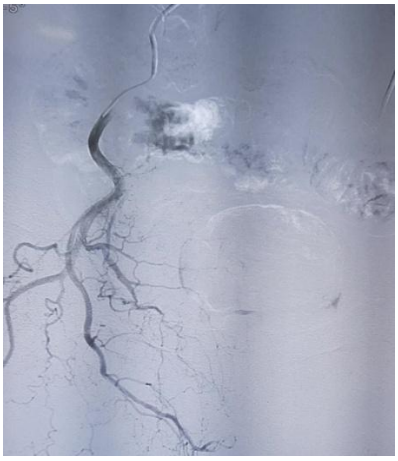

Figure 1: Digital subtraction angiography image during prostatic artery embolization.

Bipolar transurethral resection of prostate (B-TURP)

Defined as the standard surgical comparator, B-TURP involves endoscopic resection of the obstructing prostatic tissue. TURP is known to offer immediate symptomatic relief and superior objective outcomes compared to PAE, but carries inherent risks associated with tissue resection.

Outcome measures and follow-up

Patients were observed post-procedure until stable discharge. Follow-up assessments were conducted at 3, 6, and 12 months in the Urology OPD.

Primary outcomes (efficacy)

Change in IPSS (International Prostate Symptom Score) and change in Qmax (Maximum Urinary Flow Rate, measured by Uroflowmetry) from baseline to 12 months. Clinical success was generally defined as IPSS <18 with a reduction of 25%, and QoL with 1-point decrease.

Secondary outcomes

Secondary outcomes evaluated using the IIEF-5/DAN-PSSsex questionnaires. The incidence and severity of adverse events (AEs) were also assessed and categorized according to the modified Clavien–Dindo Classification, along with the need for any surgical or medical re-intervention.

Statistical analysis

Comparative analyses of continuous varia bles (IPSS, Qmax, PV, IIEF) between the PAE and B-TURP cohorts at 3, 6, and 12 months relied on inferential statistical methods (e.g., ANOVA, independent t-tests, or appropriate non-parametric equivalents, depending on data distribution). Treatment effects were expressed as the Mean Difference (MD) with 95% Confidence Intervals (Cis).

Categorical data (AE rates, re-intervention rates) were compared using chi-square tests. A p-value **<0.05** was considered indicative of statistical significance. All analyses were carried out by using SPSS version 22.0 (Armonk, NY: IBM Corp.)

RESULTS

Prostate volume and PSA dynamics

B-TURP achieved a significantly greater proportional reduction in PV compared to PAE, reflecting its resective mechanism. However, PAE demonstrated a sustained, albeit gradual, volume reduction over 12 months, correlated with effective embolization.

Both treatment modalities resulted in progressive reductions in prostate volume and serum PSA levels during follow-up.

At 12 months, the PAE group demonstrated a 30.0% reduction in prostate volume (105.0±15.0 to 73.5±10.5 ml), whereas the B-TURP group achieved a significantly greater reduction of 55.0% (108.0±16.0 to 48.6±8.0 ml; $p<0.005$).

Serum PSA levels also declined in both groups, decreasing by 30.8% following PAE (6.5±1.5 to 4.5±1.0 ng/ml) and by 38.2% following B-TURP (6.8±1.4 to 4.2±0.9 ng/ml). However, the between-group difference in PSA reduction was not statistically significant ($p=0.07$).

Safety profile and adverse events (AEs)

The safety profile overwhelmingly favored PAE, with significantly fewer major adverse events reported in the embolisation group. Postembolisation Syndrome (PES) remained the most frequent event in the PAE arm.

Table 1: Baseline characteristics.

Characteristic	PAE Group (n=20)	B-TURP Group (n=20)	P value
Median age (years)	71.5 (IQR 66-77)	72.5 (IQR 67-76)	0.78
Median prostate volume (ml/gm)	105.0 (IQR 85-135)	108.0 (IQR 88-140)	0.64
Median IPSS (points)	29.5 (IQR 23-42)	30.0 (IQR 24-44)	0.87
Catheter dependent patients (N)	5 (25.0%)	6 (30.0%)	1.0
Median QoL Score (points)	4.8 (IQR 4-5)	4.9 (IQR 4-6)	0.74

Table 2: Comparison of key functional outcomes (mean reduction/improvement from baseline at 12 months).

Outcome measures	Baseline	PAE Group (n=20)	B-TURP Group (n=20)	P value
IPSS (points)	30.0	9.0 ± 5.0 (−21.0)	7.0 ± 4.5 (−23.0)	0.21
Quality of life (QoL) Score	4.8	2.0 ± 1.4 (−2.8)	1.5 ± 1.2 (−3.3)	0.41
Qmax (ml/s)	9.0	14.0 ± 3.5 (+5.0)	19.0 ± 4.0 (+10.0)	0.003
Post-void Residual (PVR, ml)	90.0	50.0 ± 25.0 (−40.0)	25.0 ± 15.0 (−65.0)	0.04
IIEF-5 Score (Median, IQR)	15 (10-20)	16 (12–21)	13 (8–18)	0.04
Ejaculatory function (DAN-PSSsex, Median, IQR)	3 (0-6)	2 (0–6)	5 (3–7)	<0.001

Table 3: Incidence of adverse events classified by modified Clavien-Dindo grade (n=40).

Adverse events	Clavien–Dindo Grade	PAE Group (n=20)	B-TURP Group (n=20)	P value†
Post-embolisation syndrome (PES)	I–II	8 (40%)	0 (0%)	0.001
Urinary tract infection	II	2 (10%)	3 (15%)	1.000
Macroscopic haematuria	I	1 (5%)	4 (20%)	0.342
Acute urinary retention	II	1 (5%)	2 (10%)	1.000
Access-site haematoma	I	2 (10%)	0 (0%)	0.487
Urethral stricture	IIIa/IIIb	0 (0%)	1 (5%)	1.000
Overall Grade I complications	I	12 (60%)	10 (50%)	0.752
Overall Grade II complications	II	5 (25%)	8 (40%)	0.501
Overall Grade IIIa complications	IIIa	0 (0%)	1 (5%)	1.000
Overall Grade IIIb/IV complications	IIIb–IV	1 (5%)	3 (15%)	0.605

Table 4: Clinical outcomes and disposition at 12 months post-procedure (n=40).

Metrics	PAE Group (n=20)	B-TURP Group (n=20)	P value
Clinical success (IPSS <18, 25% reduction)	16 patients (80%)	18 patients (90%)	0.661
Catheter removal (of 11 catheter-dependent patients)	3/5 achieved removal (60%)	5/6 achieved removal (83%)	0.545
Surgical re-intervention required (within 12 months)	2 patients (10%)	0 patients (0%)	0.487
Medical retreatment required (within 12 months)	1 patient (5%)	3 patients (15%)	0.045
Median hospital stay (days)	1.0 (0-1)	2.5 (2-4)	0.032
Complications (Clavien III/IV) (N)	1 patient	3 patients	0.605
Preservation of erectile function (IIEF-5)	80% maintained/improved status	50% maintained/improved status	0.036

DISCUSSION

The present prospective comparative study evaluated the efficacy, functional outcomes, safety profile, and impact on sexual function of Prostatic Artery Embolisation (PAE) and Bipolar Transurethral Resection of the Prostate (B-TURP) in patients with large benign prostatic hyperplasia (prostate volume >80 ml). Both modalities produced significant improvement in lower urinary tract symptoms (LUTS) and quality of life over 12 months. However, B-TURP achieved superior objective outcomes, including greater improvement in maximum urinary flow rate (Qmax), post-void residual urine (PVR), and prostate-volume reduction, whereas PAE was associated with fewer major complications, shorter hospitalization, and better preservation of erectile and ejaculatory function. Thus, PAE represents an effective minimally invasive alternative for appropriately selected patients, particularly those with large prostates and increased surgical risk.[11–14]

These findings are consistent with the randomized controlled trial by Gao et al (2014), which demonstrated that PAE improves LUTS, urinary flow, and quality of life in symptomatic BPH, although TURP provides superior objective urodynamic outcomes. Similarly, we

observed comparable improvements in IPSS and QoL at 12 months, while Qmax and PVR improved more after B-TURP. Gao et al. also reported lower perioperative morbidity and shorter recovery with PAE, consistent with the findings of this study fewer major complications and shorter hospital stay. These findings support the complementary roles of the two modalities: B-TURP provides more effective anatomical and functional relief of obstruction, whereas PAE offers substantial symptomatic benefit with lower procedural morbidity.[5]

The study results also corroborate the randomized study by Abt et al. (2021), which compared PAE and TURP over two years. TURP produced greater improvements in urinary flow and residual urine, while PAE had a more favourable perioperative safety profile. Likewise, our cohort demonstrated significantly greater improvements in Qmax, PVR, and prostate volume following B-TURP, with comparable symptom relief between groups. The lower incidence of Clavien–Dindo grade III/IV complications following PAE further supports its potential role in elderly patients and those with significant comorbidity.[4]

The multicentre PARTEM trial, although comparing PAE with optimized medical therapy rather than TURP, established PAE as an effective minimally invasive treatment producing clinically meaningful improvements in LUTS and quality of life with an acceptable safety profile. Our findings extend this evidence by demonstrating favourable outcomes with PAE against an established surgical intervention in patients with large prostate glands. Preservation of erectile function and better ejaculatory outcomes are particularly relevant for sexually active men who prioritize sexual function alongside symptom relief.[2,15,16]

Clinically, B-TURP remains appropriate when maximal improvement in urinary flow and anatomical relief of obstruction are the principal objectives. PAE provides an important alternative for patients at increased anaesthetic or surgical risk, elderly patients with multiple comorbidities, those receiving anticoagulant therapy, and men wishing to preserve erectile and ejaculatory function. Its shorter hospital stay and lower major-complication rate may also reduce healthcare resource utilization. Successful implementation requires careful patient selection, close collaboration between urologists and interventional radiologists, and standardized embolisation techniques.

This study has several strengths. It is one of the few prospective comparative studies from the Indian subcontinent specifically evaluating PAE in patients with prostate volumes >80 mL. Standardized preoperative assessment, follow-up, and objective measures including IPSS, Qmax, PVR, prostate volume, PSA, QoL, and IIEF-5 strengthened outcome assessment. Prospective recording of complications using the modified Clavien–Dindo classification enabled systematic safety comparison. By focusing exclusively on large prostates, the study addresses a clinically important subgroup that is underrepresented in comparative literature.

Limitations

This study has several limitations. First, its single-centre design may limit generalizability. Second, the modest sample size may have reduced statistical power for secondary outcomes, particularly uncommon complications and re-interventions. Third, the 12-month follow-up limits assessment of long-term durability, retreatment rates, and sustained functional outcomes. Finally, cost-effectiveness and patient-reported satisfaction beyond validated symptom questionnaires were not assessed. Larger multicentre studies with longer follow-up and economic evaluation are warranted to better define the role of PAE and B-TURP in large BPH.

CONCLUSIONS

This prospective comparative study in patients with large prostatomegaly confirms that Prostatic Artery Embolisation (PAE) is a safe, effective, and durable option. While Bipolar Transurethral Resection of the Prostate (B-TURP) provides superior improvements in Qmax and prostate-volume reduction, PAE offers lower major perioperative morbidity, shorter hospitalisation, and better preservation of erectile and ejaculatory function.

For patients with large prostatomegaly (>80 ml), particularly those with comorbidities or prioritising sexual function, PAE is a valid minimally invasive alternative. Its continued refinement requires multidisciplinary collaboration, while future studies with >5-year follow-up should establish long-term durability and identify biomarkers predictive of PAE success or failure.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kristensen-Alvarez A, Lund-Frank C, Stroomberg HV, Fode M, Lönn L, Taudorf M, et al. Long-term outcomes of prostatic artery embolisation: a nationwide prospective cohort study. Eur Urol Focus. 2025.
2. Sapoval M, Thiounn N, Descazeaud A, Déan C, Ruffion A, Pagnoux G, et al. Prostatic artery embolisation versus medical treatment in patients with benign prostatic hyperplasia (PARTEM): a randomised, multicentre, open-label, phase 3, superiority trial. Lancet Reg Health Eur. 2023;31:100672.

3. Altman R, Ferreira R, Barragan C, Bhojani N, Lajkosz K, Zorn KC, et al. Comparing prostatic artery embolization to surgical and minimally invasive procedures for the treatment of benign prostatic hyperplasia: a systematic review and meta-analysis. BMC Urol. 2024;24:22.
4. Abt D, Müllhaupt G, Hechelhammer L, Markart S, Güsewell S, Schmid HP, et al. Prostatic artery embolisation versus transurethral resection of the prostate for benign prostatic hyperplasia: 2-year outcomes of a randomised open-label single-centre trial. Eur Urol. 2021;80(1):34-42.
5. Gao YA, Huang Y, Zhang R, Yang YD, Zhang Q, Hou M, et al. Benign prostatic hyperplasia: prostatic arterial embolization versus transurethral resection of the prostate—a prospective, randomized, and controlled clinical trial. Radiology. 2014;270(3):920-8.
6. Carnevale FC, Iscaife A, Yoshinaga EM, Moreira AM, Antunes AA, Srougi M. Transurethral resection of the prostate (TURP) versus original and PErFecTED prostate artery embolization (PAE) due to benign prostatic hyperplasia (BPH): preliminary results of a single center, prospective, urodynamic-controlled analysis. Cardiovasc Intervent Radiol. 2016;39(1):44-52.
7. Insausti I, Sáez de Ocáriz A, Galbete A, Capdevila F, Solchaga S, Giral P. Randomized comparison of prostatic artery embolization versus transurethral resection of the prostate for treatment of benign prostatic hyperplasia. J Vasc Interv Radiol. 2020;31(6):882-90.
8. Ray AF, Powell J, Speakman MJ, Longford NT, DasGupta R, Bryant T, et al. Efficacy and safety of prostate artery embolization for benign prostatic hyperplasia: an observational study and propensity-matched comparison with transurethral resection of the prostate (the UK-ROPE study). BJU Int. 2018;122(2):270-82.
9. Russo GI, Kurbatov D, Sansalone S, Lepetukhin A, Dubsky S, Sitkin I, et al. Prostatic arterial embolization vs open prostatectomy: a 1-year matched-pair analysis of functional outcomes and morbidities. Urology. 2015;86(2):343-8.
10. McWilliams JP, Bilhim TA, Carnevale FC, Bhatia S, Isaacson AJ, Bagla S, et al. Society of Interventional Radiology multisociety consensus position statement on prostatic artery embolization for treatment of lower urinary tract symptoms attributed to benign prostatic hyperplasia. J Vasc Interv Radiol. 2019;30(5):627-37.e1.
11. Bilhim T, Costa NV, Torres D, Pinheiro LC, Spaepen E. Long-term outcome of prostatic artery embolization for patients with benign prostatic hyperplasia: single-centre retrospective study in 1072 patients over a 10-year period. Cardiovasc Intervent Radiol. 2022;45(9):1324-36.
12. Moreira AM, de Assis AM, Carnevale FC, Antunes AA, Srougi M, Cerri GG. A review of adverse events related to prostatic artery embolization for treatment of bladder outlet obstruction due to BPH. Cardiovasc Intervent Radiol. 2017;40(10):1490-500.
13. Dias Júnior US, de Moura MRL, Viana PCC, de Assis AM, Marcelino ASZ, Moreira AM, et al. Prostatic artery embolization: indications, preparation, techniques, imaging evaluation, reporting, and complications. Radiographics. 2021;41(5):1509-30.
14. Carnevale FC, Moreira AM, Antunes AA. The "PErFecTED technique": proximal embolization first, then embolize distal for benign prostatic hyperplasia. Cardiovasc Intervent Radiol. 2014;37(6):1602-5.
15. Mouli S, Salem R, McClure TD. Prostate artery embolization for benign prostatic hyperplasia. J Urol. 2024;212:216-9.
16. Bilhim T. Prostatic artery embolization: an update. Korean J Radiol. 2023;24(4):313-23.

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