Comparison of prostatic artery embolisation (PAE) versus transurethral resection of the prostate (TURP) for benign prostatic hyperplasia: randomised, open label, non-inferiority trial

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Learning objectives

1. Learn indications for surgical treatment options for LUTS secondary to BPH
2. Learn various surgical treatment options for LUTS secondary to BPH
3. Learn the factors to consider when picking a treatment option
Module Outline

I. Case

II. Background

III. Article Overview

IV. Clinical Questions

V. Key Points
Case presentation

77 yo male

• Chief complaint: BPH and urinary retention

• Daily intermittent catheterization, unable to tolerate Flomax

• Hx of bladder and kidney stones, MI s/p CABG/aortic aneurysm repair in 2010
Case imaging
Case presentation cont.

• Patient presenting with obstruction due to BPH in which medical management failed

• Surgical treatment options
  • TURP
  • Water vaporization
  • Urolift
  • PAE
  • Robotic simple prostatectomy
  • HoLEP
Case presentation cont.

• Patient presenting with obstruction due to BPH in which medical management failed

• Surgical treatment options
  • TURP
  • Water vaporization
  • Urolift
  • PAE
  • Robotic simple prostatectomy
  • HoLEP
Case imaging
Case questions

Was PAE the right choice for this patient?
Module Outline

I. Case
II. **Background**
III. Article Overview
IV. Clinical Questions
V. Key Points
Enlarged prostate

Excessive need to urinate worsens at night
<table>
<thead>
<tr>
<th>In the past month:</th>
<th>Not at All</th>
<th>Less than 1 in 5 Times</th>
<th>Less than Half the Time</th>
<th>About Half the Time</th>
<th>More than Half the Time</th>
<th>Almost Always</th>
<th>Your score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Incomplete Emptying</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>How often have you had the sensation of not emptying your bladder?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Frequency</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>How often have you had to urinate less than every two hours?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Intermittency</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>How often have you found you stopped and started again several times when you urinated?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Urgency</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>How often have you found it difficult to postpone urination?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Weak Stream</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>How often have you had a weak urinary stream?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Straining</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>How often have you had to strain to start urination?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Nocturia</td>
<td>None</td>
<td>1 Time</td>
<td>2 Times</td>
<td>3 Times</td>
<td>4 Times</td>
<td>5 Times</td>
<td></td>
</tr>
<tr>
<td>How many times did you typically get up at night to urinate?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total I-PSS Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Score:**
- 1-7: Mild
- 8-19: Moderate
- 20-35: Severe

**Quality of Life Due to Urinary Symptoms**

If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that?

<table>
<thead>
<tr>
<th>Delighted</th>
<th>Pleased</th>
<th>Mostly Satisfied</th>
<th>Mixed</th>
<th>Mostly Dissatisfied</th>
<th>Unhappy</th>
<th>Terrible</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
Module Outline

I. Case
II. Background
III. Article Overview
IV. Clinical Questions
V. Key Points
Benign prostatic hyperplasia: PAE versus TURP

103 Men with refractory lower urinary tract symptoms secondary to benign prostatic hyperplasia
Age 40+

Randomisation

48 PAE
Prostate artery embolisation, performed with 250–400 μm microspheres under local anaesthesia

51 TURP
Transurethral resection of the prostate, performed under spinal or general anaesthesia

Primary outcome
International prostate symptoms score (IPSS)
0–35, low scores better
Non-inferiority defined as difference of 3 points or less between trial arms

IPSS at baseline
Mean 19.38
17.59

Change in IPSS at 12 weeks
-9.23 points
Difference = 1.54
-10.77 points

Despite similar mean differences, non-inferiority of PAE could not be established owing to large variation between individuals (P=0.17). PAE is associated with fewer complications but has disadvantages regarding functional outcomes, which should be considered when selecting patients.
Fig 1 | Study enrolment and randomisation (CONSORT flow diagram)
Materials and Methods

I. Randomization

II. Interventions
   I. PAE
   II. TURP

III. Outcomes
   I. IPSS
   II. Secondary outcomes
   III. Adverse Events
Results: Baseline characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>PAE (n=48)</th>
<th>TURP (n=51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>65.7 (9.3)</td>
<td>66.1 (9.8)</td>
</tr>
<tr>
<td>Body mass index†</td>
<td>26.5 (4.2)</td>
<td>27.0 (3.9)</td>
</tr>
<tr>
<td>Charlson comorbidity index</td>
<td>3.6 (1.6)</td>
<td>4.3 (2.1)</td>
</tr>
<tr>
<td>IPSS</td>
<td>19.38 (6.37)</td>
<td>17.59 (6.17)</td>
</tr>
<tr>
<td>Prostate specific antigen concentration (μg/L)</td>
<td>4.2 (5.4)</td>
<td>4.5 (5.6)</td>
</tr>
<tr>
<td>Prostate volume (mL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measured by transabdominal ultrasound</td>
<td>51.2 (16.5)</td>
<td>52.1 (18.6)</td>
</tr>
<tr>
<td>Measured by magnetic resonance imaging</td>
<td>52.8 (32.0)</td>
<td>56.5 (31.1)</td>
</tr>
<tr>
<td>Medical treatment of lower urinary tract symptoms before surgery (No (%) of patients)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5α-reductase inhibitors</td>
<td>0</td>
<td>1 (2.0)</td>
</tr>
<tr>
<td>α1-adrenergic receptor antagonists</td>
<td>26 (54.2)</td>
<td>22 (43.1)</td>
</tr>
<tr>
<td>Combination of both drugs mentioned above</td>
<td>14 (29.2)</td>
<td>13 (25.5)</td>
</tr>
<tr>
<td>Antimuscarinic drugs</td>
<td>8 (16.7)</td>
<td>9 (17.6)</td>
</tr>
<tr>
<td>Total No receiving drug treatment</td>
<td>41 (85.4)</td>
<td>44 (86.3)</td>
</tr>
<tr>
<td>Indwelling urethral catheter at baseline (No (%) of patients)</td>
<td>9 (18.8)</td>
<td>12 (24.5)</td>
</tr>
</tbody>
</table>

Data are mean (standard deviation) unless indicated otherwise. IPSS=International prostate symptoms score; PAE=prostatic artery embolisation; TURP=transurethral resection of the prostate.

*Baseline symptom scores other than IPSS, micturition parameters, and urodynamic findings are reported in figure 2 and figure 3.
†Body mass index calculated as weight in kilograms divided by height squared in metres.
Results: Primary outcome

![Graph showing IPSS change from baseline to 12 weeks for PAE and TURP.]

- **PAE**
  - Preop: 19.38
  - 1 week: 14.93
  - 6 weeks: 10.64
  - 12 weeks: 10.15
  - Mean change: -9.23 points

- **TURP**
  - Preop: 17.59
  - 1 week: 9.31
  - 6 weeks: 8.25
  - 12 weeks: 6.82
  - Mean change: -10.77 points

**Difference**

PAE - TURP = 1.5 points

(95% CI -1.45 to 4.52), P=0.17
Results: Secondary outcomes

<table>
<thead>
<tr>
<th>Measure</th>
<th>PAE (n=48)</th>
<th>TURP (n=51)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaesthesia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General (No. %) of patients</td>
<td>—</td>
<td>26 (51)</td>
<td>—</td>
</tr>
<tr>
<td>Spinal (No. %) of patients</td>
<td>—</td>
<td>25 (49)</td>
<td>—</td>
</tr>
<tr>
<td>Local (No. %) of patients</td>
<td>48 (100)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Procedure time (min)</td>
<td>122.2 (25.8)</td>
<td>69.5 (22.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PAE procedure details</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilateral (No. %) of patients</td>
<td>36 (75.0)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Unilateral (No. %) of patients</td>
<td>12 (25.0)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Fluoroscopy time (min)</td>
<td>50.8 (17.5)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Dose area product (Gy/cm²)</td>
<td>176.5 (101.2)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pain during intervention (visual analogue scale)</td>
<td>0.1 (0.6)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Additional analgiesics needed (No. %) of patients</td>
<td>2 (4.2)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Amount of embolisation particles used (mL)</td>
<td>1.0 (0.4)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>TURP procedure details</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time of resection (min)</td>
<td>—</td>
<td>58.25 (24.33)</td>
<td>—</td>
</tr>
<tr>
<td>Weight of resected tissue (g)</td>
<td>—</td>
<td>25.20 (15.16)</td>
<td>—</td>
</tr>
<tr>
<td>Retrieval rate (g/min)</td>
<td>—</td>
<td>0.43 (0.20)</td>
<td>—</td>
</tr>
<tr>
<td>Recovery parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative haemoglobin (g/L)</td>
<td>147.4 (12.2)</td>
<td>145.2 (12.7)</td>
<td>0.38</td>
</tr>
<tr>
<td>Haemoglobin decrease 24h (g/L)</td>
<td>—4.3 (7.0)</td>
<td>−13.8 (11.0)</td>
<td>0.001</td>
</tr>
<tr>
<td>Bladder catheter indwelling time (days)</td>
<td>1.3 (1.4)</td>
<td>3.3 (3.4)</td>
<td>0.001</td>
</tr>
<tr>
<td>Duration of hospital stay (days)</td>
<td>2.2 (0.6)</td>
<td>4.2 (1.7)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Data are mean (standard deviation) unless stated otherwise.
*1 g of paracetamol given as premedication.
Results: Secondary outcomes
Results: Adverse events

Fig 4 | Frequency of treatment related adverse events, postoperative pain, and ejaculatory disorders in patients with lower urinary tract symptoms secondary to benign prostatic hyperplasia receiving prostatic artery embolisation (PAE) or transurethral resection of the prostate (TURP). VAS=visual analogue scale (≥6 points=severe pain). Postoperative pain during hospital stay and ejaculatory disorders were not defined as deviation from the normal postoperative course\(^{26}\); therefore, these events were not included in the total number of adverse events but assessed separately
Discussion

I. Results indicate there are similar degrees of improvement in symptoms achieved by PAE and TURP in the short term.

II. There are clear advantages of TURP over PAE regarding pure obstructive effect, reflected in improved urodynamic parameters and reduction in bladder outlet obstruction.

III. Considerably fewer and less adverse events were found under PAE.
But wait . . . (Limitations)

I. Sample size was not high enough to establish non-inferiority or inferiority of PAE versus TURP

II. Blinding of patients and physicians was not feasible
Future research. . .

I. Larger scale trials and long term follow-up data are needed before PAE is implemented as a routine treatment for BPH-LUTS

II. Future research should also focus on the technical aspects of PAE

III. Future trials can focus on comparing PAE to less invasive treatments such as α-blockers and 5α-reductase inhibitors)
Module Outline

I. Case
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V. Key Points
Back to our case

• Was PAE the right choice for this patient?
  
  • According to the study?
  
  • Was the study generalizable to our patient?
  
  • Why might PAE have been a good first line surgical treatment? (hint to the right)
Key points

I. Surgical treatment should be considered when a patient has LUTS refractory to medical management

II. PAE is a valuable alternative to TURP in the treatment of BPH associated symptoms

III. Patient satisfaction and functional data do not always align
References


