Benign prostatic hyperplasia (BPH), a nonmalignant enlargement of the prostate gland commonly occurring in men after the age of 50 and sometimes leading to compression of the urethra and obstruction of the flow of urine, occurs in about 25% of men over the age of 50 years in Canada. There are various treatment options for BPH, from watchful waiting, to drug therapies, to phytotherapy, to minimally invasive therapies. Minimally invasive therapy includes techniques such as transurethral resection of the prostate (monopolar or standard TURP), transurethral vaporization of the prostate (TUVP), laser therapies, transurethral microwave thermotherapy (TUMT), high intensity focused ultrasound (HIFU), transurethral needle ablation (TUNA), photoselective vaporization of the prostate (Greenlight Laser), prostatic stents, intraprostatic ethanol injections, and botulinum toxin A injections.

The introduction of bipolar technology has led to better outcomes than with monopolar technology, with techniques such as bipolar transurethral resection in saline (TURis or bipolar TURP) and, most recently, bipolar plasma vaporization of the prostate (BPVP). In BPVP, vaporization of the irrigation fluid causes a thin layer of gas (called plasma) to form around the electrode that will remove the upper layers of prostatic tissue without subjecting surrounding tissue to thermal load. Recently, to prevent generator overheating problems that standard BPVP (S-BPVP, Olympus PlasmaButton, Olympus, MA, USA) may cause, continuous BPVP techniques (C-BPVP, Olympus Europe, Hamburg, Germany) have been developed with the use of a second generation energy source to produce a continuous plasma activation phenomenon.

This review aims to review the clinical efficacy, safety and cost-effectiveness of BPVP for the treatment of BPH as compared to TURP.
RESEARCH QUESTIONS

1. What is the evidence for the clinical efficacy and safety of plasma vaporization of the prostate compared with transurethral resection of the prostate, for patients with benign prostatic hypertrophy?

2. What is the evidence for the cost-effectiveness of plasma vaporization of the prostate compared with transurethral resection of the prostate, for patients with benign prostatic hypertrophy?

KEY FINDINGS

Findings from six RCTs and one retrospective study support BPVP as a reliable alternative to TURP, with better efficacy outcomes and similar complication rates in short and medium term follow-up periods. For follow-up period up to 100 months, limited evidence showed that BPVP reduced BPH symptoms and reoperation rates compared to TURP. There was no evidence found on the cost-effectiveness of BPVP compared to TURP, for patients with BPH.

METHODS

Literature Search Strategy

A limited literature search was conducted on key resources including PubMed, The Cochrane Library (2014, Issue 2), University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2009 and February 4, 2014. Internet links were provided, where available.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed for relevance. Full texts of any relevant titles or abstracts were retrieved, and assessed for inclusion. The final article selection was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

<table>
<thead>
<tr>
<th>Population</th>
<th>Adult patients with BPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>Plasma vaporization of the prostate (may also be referred to as BPVP or plasma kinetic vaporization)</td>
</tr>
<tr>
<td>Comparator</td>
<td>TURP</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Clinical benefits, safety and harm, improved patient outcomes Cost effectiveness</td>
</tr>
<tr>
<td>Study Designs</td>
<td>Health technology assessments (HTA), systematic reviews (SRs), meta-analyses (MAs), randomized controlled trials (RCTs), non-RCTs, and economic evaluations.</td>
</tr>
</tbody>
</table>
Exclusion Criteria

Articles were excluded if they did not meet the selection criteria in Table 1, if they were published prior to January 2009, if they were duplicate publications of the same study, or if they were referenced in a selected systematic review.

Critical Appraisal of Individual Studies

The quality of the included trials was assessed using the Downs and Black checklist. Numeric scores were not calculated. Instead, the strengths and limitations of the study are summarized and presented.

SUMMARY OF EVIDENCE

Quantity of Research Available

The literature search yielded 97 citations. After screening of abstracts from the literature search and from other sources, 15 potentially relevant studies were selected for full-text review. Seven studies met the inclusion criteria and were included in the review. The PRISMA flowchart in Appendix 1 details the process of the study selection.

Summary of Study Characteristics

A detailed summary of the included study is provided in Appendix 2.

Study design

Six RCTs8-13 and one retrospective study14 were included in the report. Outcomes were measured at 1, 3, 6 months,8,9,13,14 at 1, 3, and 12 months,12 at 1, 3, 6, 12, and 18 months,10 or at 60, 100 months.11 Five studies were conducted in Europe,8,10-13 and two in Asia.9,14

Population

The included studies enrolled men with BPH and moderate to severe lower urinary tract symptoms, with an overall age range of 51 to 85 years old.

Interventions and comparators

Interventions were C-BPVP,8 or S-BPVP,9-14 Comparators were S-BPVP and monopolar TURP,8 monopolar TURP,9,11-13 or monopolar TURP and bipolar TURP.10,14

Outcomes

The most frequent reported efficacy outcomes were operation time, catheterization time, hospital stay, Qmax (maximum flow rate), PVR or PVUR (post-void residual urine volume), PSA (prostate specific antigen) level, IPSS (international prostate symptom score), and HRQL (health-related quality of life). Safety/complication outcomes such as re-catheterization, bladder neck sclerosis, capsular perforation rate, blood loss, hemoglobin level, post-operative hematuria, and clot retention were also reported.
Summary of Critical Appraisal

Six of the included trials were randomized controlled trials. and one study was a retrospective study. All included studies had hypotheses, method of population selection, main outcomes, interventions, patient characteristics, and main findings clearly described. The findings from each study were generalizable to the patients with the condition in the context of European and Asian health care systems where the trials were conducted. It is unclear in all included studies whether patients were blinded of the procedure. The team in charge of post-operative care and follow-up was unaware of the treatment method in three trials. Losses to follow-up were described in one study. Five studies did not indicate whether the study had sufficient power to detect a clinically important effect. One study indicated that the first author received honoraria from the manufacturer at company sponsored symposia, four studies mentioned there was no conflict of interest declared by the authors, and two studies did not report conflict of interest.

Details of the strengths and limitations of the included studies are summarized in Appendix 3.

Summary of Findings

Main findings of included studies are summarized in detail in Appendix 4.

1. What is the evidence for the clinical efficacy and safety of plasma vaporization of the prostate compared with transurethral resection of the prostate, for patients with benign prostatic hypertrophy?

Six RCTs and one retrospective study compared the clinical effectiveness and safety of BPVP to TURP, for patients with BPH. In general, BPVP represents a reliable alternative to TURP, with better efficacy outcomes and similar complication rates in short and medium term follow-up periods. For long term follow-up periods, limited evidence showed that BPVP reduced BPH symptoms and reoperation rates compared to TURP.

One controlled trial randomized 180 men with BPH to C-BPVP, S-BPVP or monopolar TURP (i.e., standard TURP) and followed-up at 1, 3 and 6 months post operatively. Findings showed that C-BPVP performed better than S-BPVP, and that both C-BPVP and S-BPVP provided statistically better efficacy (e.g., operation time, catheterization time, hospital stay, IPSS and Qmax), and safety outcomes (e.g., hemoglobin level decrease, capsular perforation rate, post-operative hematuria rate) at 1, 3 and 6 months follow-up compared with TURP. There was no statistically significant difference in HRQL, PVR, PSA levels and prostate volumes in three study arms.

Five RCTs which included a total of 852 men with BPH, compared S-BPVP to monopolar TURP or to monopolar TURP and bipolar TURP. Short and medium term efficacy, safety outcomes and HRQL were assessed at 1, 3, 6 months, at 1, 3, and 12 months, at 1, 3, 6, 12, and 18 months, and longer term outcomes were assessed at 60, and 100 months. Among trials with short and medium term follow-up, one trial reported no statistical difference in IPSS, PVR, Qmax and prostate volumes between the S-BPVP and monopolar TURP groups up to 12 months follow-up. The remaining trials found better efficacy (e.g., operation time, catheterization time, hospital stay, IPSS, Qmax) and safety outcomes (e.g., blood loss, hemoglobin level decrease, capsular perforation rate, post-operative hematuria rate, bladder neck sclerosis, clot retention rate) in patients with S-BPVP compared to monopolar TURP, or...
compared to monopolar and bipolar TURP. HRQL which was measured in one trial, and no statistical difference was observed between S-BPVP and monopolar TURP up to 6 months post-surgery. For the trial with long term follow-up, S-BPVP statistically improved IPSS compared with monopolar TURP but no statistical difference between the two techniques was found for Qmax at 60 months and at 100 months follow-up. Reoperation due to persistent obstructive symptoms was performed in six patients in the S-BPVP group and four patients in the monopolar TURP group at 100 months follow-up.

One observational study retrospectively analyzed 73 men with BPH who underwent S-BPVP, monopolar TURP, or bipolar TURP. There was no statistical difference in operative time in the three groups. S-BPVP lead to a statistically significant improvement in efficacy outcomes (e.g., procedural irrigation fluid volume, postoperative irrigation duration, catheter duration, and hospital stay) compared with monopolar TURP and bipolar TURP. The S-BPVP group had no complications; three transfusions and four clot retentions occurred in the monopolar TURP group; one transfusion and one clot retention occurred in the bipolar TURP group.

2. What is the evidence for the cost-effectiveness of plasma vaporization of the prostate compared with transurethral resection of the prostate, for patients with benign prostatic hypertrophy?

There was no evidence found on the cost-effectiveness of BPVP compared with TURP for patients with BPH.

Limitations

The main limitation of the included studies was the limited sample size (five out of six studies had a sample size < 200 patients) and short term follow-up (only one study had follow up > 18 months). Additionally, the clinical significance of potentially small but statistically significant difference in some outcomes is unclear. Only one study examined the comparative effect of BPVP. Most studies compared S-BPVP to monopolar (i.e., standard) TURP, with limited evidence on the comparison to bipolar TURP. Findings are therefore mainly based on the comparison between S-BPVP to monopolar TURP while bipolar technologies are emerging. Because all included studies were conducted in Europe or Asia, generalizability of the findings to a Canadian context is limited. There is no evidence found on the cost-effectiveness of BPVP compared with TURP for patients with BPH.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING

Findings from six RCTs and one retrospective study support BPVP as a reliable alternative to TURP, with better efficacy outcomes and similar complication rates in short and medium term follow-up periods. For longer follow-up periods, limited evidence showed that BPVP reduced BPH symptoms and reoperation rates compared to TURP. The comparative findings between BPVP and TURP from this review need to be interpreted with caution, partly because of the recent advances in bipolar technology. Bipolar TURP can potentially offer advantages over monopolar (or standard) TURP. Meta-analyses have shown that bipolar and standard TURP may have similar short term efficacy but bipolar TURP may lead to a better safety profile. Similarly, limited evidence suggested B-BPVP offered shorter operative time than S-BPVP. Decision makers may need to balance the potential benefits and costs of bipolar technology.
compared with monopolar or standard technology. There was no evidence found on the cost-effectiveness of BPVP compared with TURP for patients with BPH.

PREPARED BY:
Canadian Agency for Drugs and Technologies in Health
Tel: 1-866-898-8439
www.cadth.ca
REFERENCES


Appendix 1: Selection of Included Studies

97 citations identified from electronic literature search and screened

84 citations excluded

13 potentially relevant articles retrieved for scrutiny (full text, if available)

2 relevant reports retrieved from other sources (grey literature, hand search)

15 potentially relevant reports

8 reports excluded (irrelevant designs, population, interventions or outcomes)

7 reports included in review
Appendix 2: Characteristics of Included Studies

<table>
<thead>
<tr>
<th>First Author, Year, Country</th>
<th>Sample Size, Patient Characteristics, Length of Follow-up</th>
<th>Conflict of interest</th>
<th>Intervention</th>
<th>Comparator(s)</th>
<th>Main Study Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Randomized controlled trials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geavlete, 2014, Romania</td>
<td>180 men with BPH, equally randomized to C-BPVP, S-BPVP or monopolar TURP Follow up at 1, 3 and 6 months after surgery First author received honoraria from Olympus at company sponsored symposia</td>
<td></td>
<td>C-BPVP</td>
<td>S-BPVP, monopolar TURP</td>
<td>Operation time Hemoglobin level Capsular perforation rate Post-operative hematuria rate Catheterization time Hospital stay Q max (maximum flow rate) Post-void residual urine volume Prostate volume PSA level IPSS Health-related quality of life</td>
</tr>
<tr>
<td>Zhang, 2012, China</td>
<td>30 men with BPH, equally randomized to BPVP or monopolar TURP Follow up at 1, 3 and 6 months after surgery Conflict of interest not stated</td>
<td></td>
<td>S-BPVP</td>
<td>Monopolar TURP</td>
<td>Operation time Blood loss Hemoglobin level Na level Catheterization time Prostate volume Hospital stay Q max IPSS</td>
</tr>
<tr>
<td>Geavlete, 2011, Romania</td>
<td>510 men with BPH, equally randomized to S-BPVP, monopolar TURP, or bipolar TURP (TURis) Follow-up at 1, 3, 6, 12, and 18 months after surgery Conflict of interest not stated</td>
<td></td>
<td>S-BPVP</td>
<td>Monopolar TURP Bipolar TURP (TURis)</td>
<td>Operation time Hemoglobin level Capsular perforation rate Post-operative hematuria rate Catheterization time Hospital stay Q max IPSS</td>
</tr>
<tr>
<td>Muslumanoglu, 2011, Turkey</td>
<td>67 men with BPH, randomized to S-BPVP (PlasmaKinetic) (n = 34) or monopolar TURP (n = 33) Follow-up at 60 and 100 months</td>
<td></td>
<td>S-BPVP</td>
<td>Monopolar TURP</td>
<td>Operation time Catheterization time Post-operative complications Qmax IPSS Reoperation rate</td>
</tr>
</tbody>
</table>
### Table A1: Characteristics of Included studies

<table>
<thead>
<tr>
<th>First Author, Year, Country</th>
<th>Sample Size, Patient Characteristics, Length of Follow-up Conflict of interest</th>
<th>Intervention</th>
<th>Comparator(s)</th>
<th>Main Study Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuhoglu, 2011, Turkey</td>
<td>90 men with BPH, equally randomized to S-BPVP or monopolar TURP Follow-up at 1, 3, and 12 months No conflict of interest declared by authors</td>
<td>S-BPVP</td>
<td>Monopolar TURP</td>
<td>Q max (maximum flow rate) Post-void residual urine volume Prostate volume IPSS</td>
</tr>
<tr>
<td>Geavlete, 2010, Romania</td>
<td>155 men with BPH, randomized to S-BPVP, or monopolar TURP Follow-up at 1,3, and 6 months No conflict of interest declared by authors</td>
<td>S-BPVP</td>
<td>Monopolar TURP</td>
<td>Operation time Hemoglobin level Capsular perforation rate Post-operative hematuria rate Catheterization time Hospital stay Q max (maximum flow rate) Post-void residual urine volume Prostate volume PSA level IPSS HRQL: health-related quality of life</td>
</tr>
<tr>
<td>Lee, 2011, Korea</td>
<td>73 consecutive men with BPH who underwent monopolar TURP, bipolar TURP(TURis), or S-BPVP were retrospectively analyzed. Follow-up at 1, 3, and 6 months No conflict of interest declared by authors</td>
<td>S-BPVP</td>
<td>Monopolar TURP Bipolar TURP (TURis)</td>
<td>Operation time Hemoglobin level Transfusion rate Catheterization time Hospital stay Q max (maximum flow rate) Post-void residual urine volume Prostate volume PSA level IPSS HRQL: health-related quality of life</td>
</tr>
</tbody>
</table>

**Observational studies**

**Lee, 2011, Korea**

- 73 consecutive men with BPH who underwent monopolar TURP, bipolar TURP(TURis), or S-BPVP were retrospectively analyzed.
- Follow-up at 1, 3, and 6 months
- No conflict of interest declared by authors

**Conflict of interest**

- No conflict of interest declared by authors

**Intervention**

- S-BPVP
- Monopolar TURP
- Bipolar TURP (TURis)

**Comparator(s)**

- Monopolar TURP

**Main Study Outcomes**

- Q max (maximum flow rate)
- Post-void residual urine volume
- Prostate volume
- IPSS

**HRQL: health-related quality of life**

**BPH:** benign prostatic hypertrophy; **C-BPVP:** continuous bipolar plasma vaporization of the prostate; **HRQL:** health-related quality of life; **IPSS:** international prostate symptom score; **PSA:** prostate specific antigen; **PVP:** plasma vaporization of the prostate; **S-BPVP:** standard bipolar plasma vaporization of the prostate; **TURP:** transurethral resection of the prostate.
### Table A2: Summary of Critical Appraisal of Included Studies (Downs and Black’)

<table>
<thead>
<tr>
<th>First Author, Publication Year</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geavlete, 2014</td>
<td>• hypothesis clearly described • patients randomized • method of selection from source population and representation described • main outcomes, interventions, patient characteristics, and main findings clearly described • estimates of random variability and actual probability values provided • study had sufficient power to detect a clinically important effect</td>
<td>• unclear whether patients were blinded • losses to follow-up not described</td>
</tr>
<tr>
<td>Zhang, 2012</td>
<td>• hypothesis clearly described • patients randomized • method of selection from source population and representation described • main outcomes, interventions, patient characteristics, and main findings clearly described • estimates of random variability and actual probability values provided</td>
<td>• unclear whether patients were blinded • losses to follow-up not described • unclear whether study had sufficient power to detect a clinically important effect</td>
</tr>
<tr>
<td>Geavlete, 2011</td>
<td>• hypothesis clearly described • patients randomized • method of selection from source population and representation described • main outcomes, interventions, patient characteristics, and main findings clearly described • estimates of random variability and actual probability values provided • study had sufficient power to detect a clinically important effect</td>
<td>• unclear whether patients were blinded • losses to follow-up not described</td>
</tr>
<tr>
<td>Muslimanoglu, 2011</td>
<td>• hypothesis clearly described • patients randomized • method of selection from source population and representation described • main outcomes, interventions, patient characteristics, and main findings clearly described • estimates of random variability and actual probability values provided</td>
<td>• unclear whether patients were blinded • losses to follow-up not described • unclear whether study had sufficient power to detect a clinically important effect</td>
</tr>
<tr>
<td>Nuhoglu, 2011</td>
<td>• hypothesis clearly described • patients randomized • method of selection from source population and representation described • losses to follow-up described • main outcomes, interventions, patient characteristics, and main findings clearly described</td>
<td>• unclear whether patients were blinded • unclear whether study had sufficient power to detect a clinically important effect</td>
</tr>
<tr>
<td>First Author, Publication Year</td>
<td>Strengths</td>
<td>Limitations</td>
</tr>
<tr>
<td>-------------------------------</td>
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<td>-------------</td>
</tr>
</tbody>
</table>
| Geavlete, 2010                | • hypothesis clearly described  
• patients randomized  
• method of selection from source population and representation described  
• main outcomes, interventions, patient characteristics, and main findings clearly described  
• estimates of random variability and actual probability values provided | • unclear whether patients were blinded  
• losses to follow-up not described  
• unclear whether study had sufficient power to detect a clinically important effect |
| Lee, 2011                     | • hypothesis clearly described  
• patients not randomized  
• method of selection from source population and representation described  
• main outcomes, interventions, patient characteristics, and main findings clearly described  
• estimates of random variability and actual probability values provided | • patients not blinded  
• losses to follow-up not described  
• unclear whether study had sufficient power to detect a clinically important effect |
### Table A3: Main Study Findings and Authors’ Conclusions

<table>
<thead>
<tr>
<th>First Author, Publication Year</th>
<th>Main Study Findings</th>
<th>Authors’ Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gea vlete, 2014</strong></td>
<td>Operation time: statistically significantly shorter for C-BPVP (31.5 min) than for S-BPVP (40.6 min) and monopolar TURP (49.8 min), with a 22.4% and 39.1% decrease in duration for C-BPVP when compared with S-BPVP and TURP, respectively ($P &lt; 0.001$). For C-BPVP and S-BPVP compared with TURP, hemoglobin level decrease (0.4 and 0.6 vs 1.4 g/dL), capsular perforation rate (1.7% and 3.3% vs 10%), postoperative hematuria rate (1.7% and 1.7% vs 13.3%), catheterisation period (24.1 and 23.9 vs. 73.6 hours), and hospital stay (2.1 and 2.2 vs. 4.5 days) were statistically significantly lower. ($P &lt; 0.001$).</td>
<td>“The operation time for C-BPVP was on average 20% and 40% quicker than S-BPVP and TURP, respectively. Both C-BPVP and S-BPVP had better perioperative safety and improved follow-up voiding and symptom scores than TURP” ($p$ 288)</td>
</tr>
<tr>
<td><strong>Zhang, 2012</strong></td>
<td>BPVP statistically significantly superior to TURP in terms of: indwelling catheter time (4.1 vs. 6.8 days, $P=0.000$), blood loss (64.7 vs. 254.7 mL, $P=0.040$), hospital stay (8.7 vs. 11.7 days, $P=0.000$), IPSS (4.2 vs. 9.3, $P=0.049$), QOL ($P=0.027$), Qmax ($P=0.038$), hemoglobin (130.7 vs. 122.1, g/L, $P=0.047$), Na+ level ($P=0.046$) and operation time (39.0 vs. 69.3 min, $P=0.004$).</td>
<td>“Compared with TURP, BPVP with “button-type” electrode shows superior efficacy and safety. Therefore, BPVP with “button-type” electrode represents a valuable endoscopic treatment alternative for BPH patients” ($p$ 3811)</td>
</tr>
<tr>
<td><strong>Gea vlete, 2011</strong></td>
<td>Capsular perforation rate (1.2% vs. 7.1% vs. 9.4%), intraoperative bleeding rate (1.8% vs. 8.2% vs. 13.5%), mean hemoglobin drop (0.5 g/dL vs. 1.2 g/dL vs. 1.6 g/dL): statistically significantly decreased for BPVP compared to bipolar or monopolar TURP. ($P = 0.004$) Postoperative hematuria (2.9% vs. 4.7% vs. 15.3%), blood transfusion (1.2% vs. 1.8% vs. 6.5%), and clot retention rates (0.6% vs. 1.2% vs. 4.1%): statistically significantly lower in the BPVP and bipolar TURP groups compared to the monopolar TURP group. ($P = 0.0001$) Operation time: shorter for BPVP patients (39.7 min) compared to monopolar (55.6 min) and bipolar TURP (52.1 min) groups ($P = 0.0001$) Catheterization period significantly reduced for BPVP (23.5 h), followed by bipolar TURP (46.3 h) compared with monopolar TURP (72.8 h). ($P = 0.0001$) Hospital stay significantly reduced for BPVP (1.9 days), followed by bipolar TURP (3.1 days) compared with monopolar TURP (4.2 days). ($P = 0.0001$)</td>
<td>“BPVP represents a valuable endoscopic treatment alternative for BPH patients, with superior efficacy and satisfactory complication rate. The long-term follow-up emphasized durable improvements of the postoperative parameters for BPVP” ($p$ 930)</td>
</tr>
</tbody>
</table>
Table A3: Main Study Findings and Authors’ Conclusions

<table>
<thead>
<tr>
<th>First Author, Publication Year</th>
<th>Main Study Findings</th>
<th>Authors’ Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muslumanoglu, 11 2011</td>
<td>Operation time: shorter in the Plasmakinetics group (40.3 min) than in the TURP group (57.8 min, P &lt;0.001)</td>
<td>“Our 100 months results suggest that Plasmakinetic technology can be used as a first-line treatment instead of monopolar TURP.” (p 546)</td>
</tr>
<tr>
<td>Nuhoglu, 12 2011</td>
<td>IPSS, PVRU, Qmax, and prostatic volumes: no significant differences between the two groups at 1, 3, and 12 months follow-up</td>
<td>“We detected similar effectiveness and morbidity rates in both groups. Bipolar TUVP has advantages such as shorter catheter indwelling times and hospital stays, and fewer bleeding episodes without any risk of transurethral resection syndrome. We believe that TUVP might be an alternative to TURP which is currently the ‘gold standard’ treatment in BPH.” (p 400)</td>
</tr>
<tr>
<td>Geavlete, 13 2010</td>
<td>Operative time (35.1 vs. 50.4 min), catheterization period (23.8 vs. 71.2 hours) and hospital stay (47.6 vs. 93.1 hours): statistically significantly shorter for TURis-PVP (S-BPVP) patients compared to monopolar TURP (P &lt; 0.05)</td>
<td>“TURis-PVP represents a valuable endoscopic treatment alternative for patients with BPE, with superior efficacy, short-term results and complication rates compared with monopolar TURP.” (p 1695)</td>
</tr>
<tr>
<td>Lee, 14 2011</td>
<td>Operation time: no statistically significant differences between the 3 groups (P = 0.211). Procedural irrigation fluid volume, postoperative irrigation duration, catheter duration (2.80 vs. 4.26 vs. 4.05 days), and hospital stay (4.86 vs. 6.66 vs. 6.00 days); statistically</td>
<td>“TURIS and TURIS-V were effective for the surgical treatment of BPH in addition to conventional TUR-P. TURIS-V was not inferior to conventional TUR-P or TURIS in terms of safety.” (p 763)</td>
</tr>
</tbody>
</table>

Irritative symptoms and urethral strictures rates: similar in the 3 series.

Re-catheterization, bladder neck sclerosis, and retreatment rates: significantly lower in the BPVP group. (P < 0.05)

IPSS, Qmax: at 1, 3, 6, 12, and 18 months’ follow-up, BPVP showed significantly superior parameters compared to monopolar or bipolar TURP. (P = 0.0001)
### Table A3: Main Study Findings and Authors’ Conclusions

<table>
<thead>
<tr>
<th>First Author, Publication Year</th>
<th>Main Study Findings</th>
<th>Authors’ Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>significantly less for TURIS-V (S-BPVP) compared with conventional TUR-P (monopolar TURP) and TURIS (bipolar TURP) ($P &lt; 0.05$)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IPSS, HRQL, Qmax, PVR: improved compared to baseline for all techniques (no figures on comparison between techniques)</td>
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<tr>
<td></td>
<td>Hemoglobin levels: no statistically significant differences between the groups before and after the operations. ($P &gt; 0.05$)</td>
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<tr>
<td></td>
<td>Transfusions and clot retentions: 3 transfusions and 4 clot retentions in the TUR-P group (monopolar TURP); 1 transfusion and 1 clot retention in the TURIS group (bipolar TURP). The TURIS-V group (S-BPVP) had no complications.</td>
<td></td>
</tr>
</tbody>
</table>

**Research question 2 (evidence for the cost-effectiveness of plasma vaporization of the prostate compared with transurethral resection of the prostate, for patients with benign prostatic hypertrophy)**

No evidence found on the cost-effectiveness of plasma vaporization of the prostate compared with transurethral resection of the prostate, for patients with benign prostatic hypertrophy

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BPH: benign prostatic hypertrophy; C-BPVP: continuous bipolar plasma vaporization of the prostate; HRQL: health-related quality of life; IPSS: international prostate symptom score; PVR or PVRU: post-void residual urine volume; PSA: prostate specific antigen; PVP: plasma vaporization of the prostate; Qmax: maximum flow rate; S-BPVP: standard bipolar plasma vaporization of the prostate; TURP: transurethral resection of the prostate; TUVP: transurethral vaporization of the prostate