Bipolar transurethral enucleation and resection of the prostate versus bipolar resection of the prostate for prostates larger than 60gr: A retrospective study at a single academic tertiary care center

Yong Wei 1, Ning Xu 1, Shao-Hao Chen 1, Xiao-Dong Li 1, Qing-Shui Zheng 1, Yun-Zhi Lin 1, Xue-Yi Xue 1

1 Department of Urology, the First Affiliated Hospital of Fujian Medical University, Fuzhou, China

ABSTRACT

Objective: To evaluate the efficacy and safety of bipolar transurethral enucleation and resection of the prostate (B-TUERP) versus bipolar transurethral resection of the prostate (B-TURP) in the treatment of prostates larger than 60g.

Material and Methods: Clinical data for 270 BPH patients who underwent B-TUERP and 204 patients who underwent B-TURP for BPH from May 2007 to May 2013 at our center were retrospectively analyzed. Outcome measures included operative time, decreased hemoglobin level, total prostate specific antigen (TPSA), International Prostate Symptom Score (IPSS), maximal urinary flow rate (Qmax), quality of life (QoL) score, post void residual urine volume (RUV), bladder irrigation duration, hospital stay, and the weight of resected prostatic tissue. Other measures included perioperative complications including transurethral resection syndrome (TURS), hyponatremia, blood transfusion, bleeding requiring surgery, postoperative acute urinary retention, urine incontinence and urinary sepsis. Patients in both groups were followed for two years.

Results: Compared with the B-TURP group, the B-TUERP group had shorter operative time, postoperative bladder irrigation duration and hospital stay, a greater amount of resected prostatic tissue, less postoperative hemoglobin decrease, better postoperative IPSS and Qmax, as well as lower incidences of hyponatremia, urinary sepsis, blood transfusion requirement, urine incontinence and reoperation (P<0.05 for all).

Conclusions: B-TUERP is superior to B-TURP in the management of large volume BPH in terms of efficacy and safety, but this finding needs to be validated in further prospective, randomized, controlled studies.

INTRODUCTION

Transurethral resection of the prostate (TURP) has long been considered the gold standard for treatment of symptomatic benign prostatic hyperplasia (BPH) when medical therapy fails (1, 2). Conventional TURP uses a monopolar electrocautery system in which distilled water or a variety of solutions other than normal saline are used as an irrigant (3). Although monopolar TURP has a high success rate (90%-95%), it is associated with a morbidity rate of 15% to 18% and a mortality rate of 0.001% (4). Bipolar TURP (B-TURP), with the use of normal saline as irrigant, significantly eliminates the risk of transurethral resection syndrome (TURS) (3-5). B-TURP is asso-
associated with significantly less fluid absorption than monopolar TURP, but the operative duration and the weight of resected prostatic tissue are similar between the two procedures (6). In addition, postoperative bleeding, blood transfusion requirements, early and late complications such as clot retention, urinary retention, bladder neck stenosis and urethral stricture did not significantly differ between the two procedures (7-10). There is still a need to upgrade this technique to improve its efficacy and safety.

Transurethral enucleation and resection of the prostate (TUERP) is a recently developed procedure created by Liu et al. (11), in which the prostate is transurethrally enucleated and resected using a bipolar plasma kinetic resectoscope (12). Studies have suggested that TUERP is a safe and feasible treatment for BPH with few complications (12-15). Although several studies have demonstrated better clinical benefits for TUERP than for other treatments (13, 16), this procedure has not been widely accepted. This study aimed to compare the efficacy and safety of B-TUERP versus B-TURP in the management of prostates larger than 60g.

**MATERIAL AND METHODS**

**Patients and study protocol**

The study was approved by the Medical Ethics Committee of the First Affiliated Hospital of Fujian Medical University. All patients provided written informed consent. The clinical data for 298 consecutive patients who underwent B-TUERP and 225 consecutive patients who underwent B-TURP for BPH from May 2007 to May 2013 at our center were retrospectively analyzed. All operations were performed mainly by one surgeon (Xue X-Y), who has more than twenty years of experience with these procedures. The type of operation was selected according to the patient’s preference after detailed explanation by the surgeon regarding the procedures, outcomes, and complications of each option. All the patients had histologically proved BPH and only those with prostate volume larger than 60g on transrectal ultrasound were included (9, 17). Any patient with a previous history of prostatic or urethral surgery, urethral stricture, neurovesical dysfunction and/or prostate cancer was excluded. Indications for surgery were a preoperative International Prostate Symptom Score (IPSS) ≥12 points, a maximal urinary flow rate (Qmax) <15mL/s, urine retention, upper tract dilatation, renal insufficiency and recurrent urinary tract infection. B-TUERP or B-TURP was done according to patient’s preference. Age, IPSS, quality of life (QoL) score, prostate specific antigen (PSA), prostatic volume (PV) and post-void residual urine volume (RUV) were compared preoperatively between the two groups. A total of 474 (90.6%) of 523 patients were followed for two years, and the others were lost to follow-up.

**Operative techniques**

Both bipolar resection procedures were performed using the Gyrus bipolar plasmakinetic resection system, with the power set at 200W for cutting and at 100W for coagulation. Normal saline was used as irrigant, and the irrigation pressure ranged from 80 to 100mH2O. Cystostomy was not performed in all cases. Under general or spinal anesthesia, the patient was placed in the lithotomy position. A 27-Fr resectoscope was placed in the bladder under video assisted endoscopic system guidance.

B-TURP was performed as previously described (18). Transurethral resection of prostatic hyperplasia tissue was performed along the direction from the mouth of the urethra to the prostate apex and from the urethra to the prostatic capsule.

B-TUERP was conducted also as previously described (12). Briefly, an incision was created close to the verumontanum in order to incise the urethral mucosa deep to the level of the surgical capsule. After dissecting the distal mid lobe and mucosa in a retrograde fashion toward the bladder neck and detaching adenoma of the distal mid lobe from the surgical capsule, the denuded supply vessels and hemorrhage spots on the capsule surface were identified and coagulated to block the lobe blood supply. The bilateral lobes along the surgical capsule were then detached and all supply vessels were coagulated. The adenoma was finally resected. When resec-
tion was completed, all adenoma fragments were extracted using an Ellik evacuator, and a 20-F 3-way Foley catheter was placed and connected to straight drainage until hematuria sufficiently resolved.

Outcome measures
Operative time, pre-and postoperative hemoglobin levels (on the first postoperative day), weight of resected prostatic tissue, bladder irrigation duration, hospital stay, IPSS, Qmax, QoL score, RUV, and TPSA were calculated. Perioperative complications such as TURS, hyponatremia (at the end of operation, defined as serum sodium less than 135mmol/L), blood transfusion, bleeding requiring surgery to stop bleeding, postoperative acute urinary retention, urine incontinence and urinary sepsis were observed.

Follow-up
Patients in both groups were followed for two years. One independent investigator performed the follow-up at 1, 6, 12, and 24 months. Postoperative outcome measures, including Qmax, PSA, IPSS, RUV, and QoL score, were recorded at each follow-up visit. Urethral stricture, bladder neck stenosis, urine incontinence and postoperative acute urinary retention, as well as postoperative recurrence requiring reoperation were also recorded during the follow-up period.

Statistical analysis
Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA). Data following a normal distribution are presented as mean±standard deviation and were compared using the t-test, while data not following a normal distribution are presented as median (range) and were compared using the Wilcoxon rank-sum test for two independent samples. Categorical data (percentages) were compared using the chi-square test or the Fisher’s exact probability test. P-values <0.05 were considered statistically significant.

RESULTS
Baseline patient characteristics
The baseline characteristics of the included patients are shown in Table-1. There were 270 patients in the B-TUERP group and 204 patients in the B-TURP group. Preoperatively, the two groups had comparable mean age, IPSS, QoL score, TPSA, PV and RUV (P>0.05 for all).

Table 1 - Baseline characteristics of the included patients.

<table>
<thead>
<tr>
<th></th>
<th>B-TUERP</th>
<th>B-TURP</th>
<th>P</th>
</tr>
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<tbody>
<tr>
<td>No. of cases</td>
<td>270</td>
<td>204</td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>68.0±8.6</td>
<td>68.4±7.9</td>
<td>0.588</td>
</tr>
<tr>
<td>IPSS</td>
<td>25.4±5.2</td>
<td>25.0±5.7</td>
<td>0.431</td>
</tr>
<tr>
<td>QoL score</td>
<td>3.5±1.4</td>
<td>3.5±1.6</td>
<td>0.806</td>
</tr>
<tr>
<td>Median preoperative TPSA</td>
<td>3.70</td>
<td>3.67</td>
<td></td>
</tr>
<tr>
<td>(interquartile range)</td>
<td>(2.52-6.25)</td>
<td>(2.39-6.19)</td>
<td>0.748*</td>
</tr>
<tr>
<td>PV (mL)</td>
<td>80.1±11.1</td>
<td>80.7±12.5</td>
<td>0.578</td>
</tr>
<tr>
<td>Qmax (mL/s)</td>
<td>5.7±2.6</td>
<td>5.3±2.3</td>
<td>0.089</td>
</tr>
<tr>
<td>RUV (mL)</td>
<td>140.1±43.4</td>
<td>136.5±41.0</td>
<td>0.369</td>
</tr>
</tbody>
</table>

*B-TUERP = bipolar transurethral enucleation and resection of the prostate; B-TURP = bipolar transurethral resection of the prostate; IPSS = International Prostate Symptom Score; Qmax = maximal urinary flow rate; QoL = quality of life; TPSA = total prostate specific antigen; PV = prostatic volume; RUV = residual urine volume. *Mann-Whitney test.
Perioperative and postoperative outcomes

All procedures were successful, and no conversion to open surgery was required. There were no perioperative cardiovascular or cerebrovascular accidents following the two procedures. Perioperative outcomes in the two groups are summarized in Table-2. The B-TUERP procedure required significantly shorter operative time than the B-TURP procedure (P<0.05). Postoperative hemoglobin decrease was more significant in the B-TURP group compared with the B-TUERP group (P<0.05). The weight of resected prostatic tissue was greater in the B-TUERP group (P<0.05). In addition, postoperative bladder irrigation duration and hospital stay were significantly shorter in the B-TUERP group than in the B-TURP group (P<0.05 for both).

Perioperative and postoperative complications

Perioperative and postoperative complications in the two groups are presented in Table-3. No TURS occurred in either group. Six patients in the B-TURP group developed hyponatremia, while only two patients developed hyponatremia in the B-TUERP group (P<0.05). The number of patients requiring blood transfusion was significantly lower in the B-TUERP group than in the B-TURP group (P<0.05). At one month, urinary incontinence rate was significantly lower in the B-TUERP group than in the B-TURP group (P<0.05), but this resolved within three months. However, there were no significant differences in the incidence of urethral stricture, bladder neck stenosis, bleeding requiring surgery or postoperative acute urinary retention.

DISCUSSION

In recent years, B-TURP has been advocated as an alternative to monopolar TURP—the gold standard for the surgical treatment of BPH (19).

Table 2 - Perioperative outcomes in the two groups.

<table>
<thead>
<tr>
<th></th>
<th>B-TUERP</th>
<th>B-TURP</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time (min)</td>
<td>73.37 ± 19.99</td>
<td>83.77 ± 20.89</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hospital stay (d)</td>
<td>4.0</td>
<td>5.0</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>(interquartile range)</td>
<td>(4.0-5.0)</td>
<td>(5.0-6.0)</td>
<td></td>
</tr>
<tr>
<td>Decreased hemoglobin (g/L)</td>
<td>1.79 ± 0.51</td>
<td>2.35 ± 0.63</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Postoperative bladder irrigation duration (h)</td>
<td>32.56 ± 8.97</td>
<td>58.92 ± 12.93</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Weight of resected prostatic tissue (g)</td>
<td>43.2±12.9</td>
<td>40.4±11.6</td>
<td>0.013</td>
</tr>
</tbody>
</table>

B-TUERP = bipolar transurethral enucleation and resection of the prostate; B-TURP = bipolar transurethral resection of the prostate.*Mann-Whitney test.
Figure 1 - Mean IPSS scores before and after treatment.

* $P<0.05$, IPSS=Internacional Prostate Symptom Score

Figure 2 - Mean QoL scores before and after treatment.

* $P>0.05$, QoL=Quality of Life
Figure 3 - Mean Qmax scores before and after treatment.

Figure 4 - Mean RUV scores before and after treatment.

* $P<0.05$, Qmax=Maxima Urinary Flow Rate

* $P>0.05$, RUV=Residual Urine Volume
more complete adenoma removal. We therefore in
the present study compared the efficacy and safety
of B-TUERP versus B-TURP in the management of
prostates larger than 60g. Unsurprisingly, we found
that when compared with the B-TURP procedure, B-
TUERP was associated with shorter operative time,
postoperative bladder irrigation duration and hospi-
tal stay. Furthermore, there was a greater weight of
resected prostatic tissue, less postoperative hemoglo-
bin decrease, better postoperative IPSS and Qmax,
and lower incidences of hyponatremia, urinary sepsis,
blood transfusion requirement and reoperation.
All these suggest that B-TUERP is safe and feasible
in the treatment of prostates larger than 60g.

After the adenoma was detached from the
surgical capsule during TUERP, the blood supply to
the adenoma was cut off and hemostasis was per-
formed by coagulation under endoscopic monitor-
ing (12). Therefore, the resection of the detached ad-
enoma is virtually bloodless (15). In contrast, during
TURP the vessels are repeatedly cut until the surgi-
cal capsule is reached (16). Therefore, intraoperative
blood loss will be less in the B-TUERP procedure
than in the B-TURP procedure (12, 16). Consistent
with this previous observation, we found that post-
operative hemoglobin decrease and the numbers of
patients requiring blood transfusion and those de-
veloping bleeding requiring surgery differed signifi-
cantly in favor of the TUERP procedure. Due to im-
proved operative field visibility, decreased capsular
perforation and more rapid, complete tissue removal
(16), the operative time, postoperative bladder irri-
tigation duration and hospital stay were significantly
shortened in the TUERP procedure compared with
the TURP procedure.

Excessive intraoperative absorption of irri-
tigation fluid may lead to the occurrence of TURS,
and the use of saline for irrigation can reduce the
fluid absorption-associated morbidity and eliminate
the risk of TURS (22, 23). In the current study, no
TURS occurred in either the B-TURP group or the B-
TUERP group, because both procedures used normal
saline as irrigant. However, we found that the inci-
dence of hyponatremia was significantly higher in
the B-TURP group than in the B-TUERP group. This
discrepancy may be explained by longer operative

Table 3 - Complications of B-TUERP and B-TURP classified according to the modified Clavien system.

<table>
<thead>
<tr>
<th>Complications</th>
<th>B-TUERP</th>
<th>B-TURP</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td>Grade I, n(%)</td>
<td>19(7.0%)</td>
<td>34(16.7%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Hyponatremia, n(%)</td>
<td>2(0.7%)</td>
<td>6(2.9%)</td>
<td>0.139</td>
</tr>
<tr>
<td>Postoperative urinary sepsis, n(%)</td>
<td>0(0%)</td>
<td>4(2.0%)</td>
<td>0.071*</td>
</tr>
<tr>
<td>Postoperative acute urinary retention, n(%)</td>
<td>2(0.7%)</td>
<td>2(1.0%)</td>
<td>1.000*</td>
</tr>
<tr>
<td>Bladder neck stenosis, n(%)</td>
<td>1(0.4%)</td>
<td>1(0.5%)</td>
<td>1.000*</td>
</tr>
<tr>
<td>Incontinence at 1 month, n(%)</td>
<td>14(5.0%)</td>
<td>21(10.3%)</td>
<td>0.035</td>
</tr>
<tr>
<td>Grade II, n(%)</td>
<td>0(0%)</td>
<td>3(1.5%)</td>
<td>0.079*</td>
</tr>
<tr>
<td>Blood transfusion requirement, n(%)</td>
<td>0(0%)</td>
<td>3(1.5%)</td>
<td>0.079*</td>
</tr>
<tr>
<td>Grade III, n(%)</td>
<td>0(0%)</td>
<td>7(3.4%)</td>
<td>0.003*</td>
</tr>
<tr>
<td>Bleeding requiring surgery, n(%)</td>
<td>0(0%)</td>
<td>3(1.5%)</td>
<td>0.079*</td>
</tr>
<tr>
<td>Urethral stricture, n(%)</td>
<td>0(0%)</td>
<td>1(0.5%)</td>
<td>0.430*</td>
</tr>
<tr>
<td>Postoperative recurrence requiring reoperation#, n(%)</td>
<td>0(0%)</td>
<td>3(1.5%)</td>
<td>0.079*</td>
</tr>
<tr>
<td>Grade IV, n(%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td></td>
</tr>
<tr>
<td>Grade V, n(%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td></td>
</tr>
<tr>
<td>Total, n(%)</td>
<td>19(7.0%)</td>
<td>44(21.6%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

B-TUERP = bipolar transurethral enucleation and resection of the prostate; B-TURP = bipolar transurethral resection of the prostate; TURS = transurethral resection syndrome.*Fisher’s exact test; #due to inadequate resection in the first procedure,
time and greater intraoperative blood loss associated with the B-TURP procedure.

Since BPH patients often develop urinary retention and urinary tract infections, bacteria in urine can spread via blood vessels or perforated prostatic capsule and induce urinary sepsis (24). When the adenoma is enucleated during B-TUERP, hemostasis is performed by coagulation. Thus, the chance of prostatic capsular perforation and the incidence of urinary sepsis are greatly reduced. In the present study, four patients in the B-TURP group developed urinary sepsis, whereas no patients in the B-TUERP group developed this complication.

Studies have shown that the incidences of urethral stricture and bladder neck stenosis are not different significantly between the bipolar and monopolar TURP procedures (7). In this study, we found that the incidences of urethral stricture, postoperative acute urinary retention and bladder neck stenosis did not differ significantly between the bipolar TUERP and TURP procedures, suggesting that resection type is not a significant predictor of the risk of these complications.

Ideal TURP should involve accurate, complete removal of the adenoma. However, when performing traditional TURP, it is difficult to accurately judge the boundary between outer and inner glands and the depth of excision. This often results in excessive resection which may induce capsular perforation, or results in insufficient removal of the adenoma (18). Particularly, when the volume of the prostate gland is large, e.g., significantly above the level of the verumontanum, the surgeon often does not cut enough prostatic tissue at the apex due to serious concern about damaging the urethral sphincter and causing incontinence (12). As a result, recurrence often develops. Since the B-TUERP allows the removal of the adenoma accurately and completely (12, 15, 16), there is often little residual hyperplasia tissue. Unsurprisingly, although four patients in the B-TURP group needed reoperation during the 2-year follow-up period, no patients in the B-TUERP group required reoperation because of recurrence.

Our study has several limitations. The non-randomized retrospective nature of the study is associated with a high risk of bias and may influence the interpretation of our data. In this single-center study, the relatively small sample size and short follow-up duration might lead to low statistical power and limit the strength of our conclusions. Furthermore, the inability to measure intraoperative blood loss and postoperative PV is another limitation of our study. Due to the resected cavity, the size of the residual adenoma cannot be exactly measured. Larger studies conducted in multiple centers will be required in future to confirm the findings of the present study.

In conclusion, our findings suggest that B-TUERP is superior to B-TURP in the management of prostates larger than 60g in terms of shorter operative time, postoperative bladder irrigation duration and hospital stay. There is also a greater weight of resected prostatic tissue, less postoperative hemoglobin decrease, better postoperative IPSS and Qmax. There are lower incidences of hyponatremia, bleeding, urinary sepsis, blood transfusion requirement, transitory incontinence and reoperation. However, longer-term and larger studies are needed to validate these results.

**ABBREVIATIONS**

BPH = benign prostatic hyperplasia  
B-TUERP = bipolar transurethral enucleation and resection of the prostate  
B-TURP = bipolar transurethral resection of the prostate  
IPSS = International Prostate Symptom Score  
PV = prostatic volume  
Qmax = maximal urinary flow rate  
QoL = quality of life  
RUV = residual urine volume  
TPSA = total prostate specific antigen  
TUERP = transurethral enucleation and resection of the prostate  
TURP = transurethral resection of the prostate  
TURS = transurethral resection syndrome
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Yong Wei, Ning Xu, Shao-Hao Chen
These authors contributed equally to this work.

CONFLICT OF INTEREST

None declared.

REFERENCES


Correspondence address:
Xue-Yi Xue, MD
Department of Urology
the First Affiliated Hospital of Fujian Medical University
No. 20 Chazhong Road, Fuzhou 350001, China
Email: drxun@163.com