Original Article

Comparison of the Efficacy of Transurethral Enucleation and Resection of the Prostate with Transurethral Resection of the Prostate for Medium Prostate Sizes

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Objective: To compare the efficacy of the transurethral enucleation of the prostate (TUERP) to transurethral resection of the prostate (TURP) through a prospective randomized controlled trial.

Materials and Methods: Between January 2016 and December 2019, 46 patients from a single center were divided into two groups, TURP and TUERP, using simple randomization. The perioperative and postoperative outcomes up to one year after surgery were evaluated.

Results: The mean estimated prostate volume (PV) in the TURP and TUERP group was 40±22 mL and 41±18 mL, respectively. There were no statistical differences in the baseline characteristics between the two groups. The mean operative time was significantly longer in the TUERP group (71.95±33.96 minutes versus 50.85±26.78 minutes; p=0.024). The average weight of prostate resected in the TUERP group was higher but not statistically significant (18.87±14.95 g versus 15.15±11.07 g; p=0.39). The volume of fluid irrigation collected postoperatively was significantly lower in the TUERP group (13.98±10.01 liter versus 24.73±21.90 liter; p=0.04). No statistically significant differences were noted between the two groups in terms of the postoperative IPSS, QoL, Q max, PSA, postoperative Hct, and the length of hospital stay.

Conclusion: The present study compared the surgical outcomes between the TUERP and the TURP techniques performed in medium prostate sizes. The authors concluded that TUERP resulted in a greater prostate tissue removal and, importantly, better intraoperative bleeding control.

Keywords: Benign Prostatic Hyperplasia, Transurethral enucleation of the prostate

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Transurethral resection of the prostate (TURP) is an established gold standard surgery for benign prostatic hyperplasia (BPH). However, TURP can result in major complications, such as bleeding and clot retention, especially in patients with a large prostate gland. Approximately 3% to 15% of patients require a repeated surgical intervention with close follow-up[1,2]. To reduce the incidence of perioperative morbidity, bipolar TURP modification has been proposed and recommended over traditional monopolar TURP[3,4].

Transurethral enucleation of the prostate using holmium laser enucleation of the prostate (HoLEP), as well as its bipolar enucleation variant, is currently considered an effective alternative to TURP and open simple prostatectomy (OP)[5]. The technique has demonstrated similar efficacy with a more favorable perioperative safety profile and lower re-operation rate at 10 years[6,7]. To date, endoscopic enucleation has been considered highly effective for BPH regardless of the size of the prostate gland[8,9]; however, its application has some limitations in practice, in particular due to the high cost of the holmium laser equipment and the required surgical

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learning curve[10]. Transurethral enucleation of the prostate gland was originally described by Hiraoka and Akimoto in 1989[11], and followed by Liu et al in 2006[12]. They proposed the use of a bipolar resectoscope in transurethral enucleation and resection of the prostate (TUERP). The benefit of this technique is it can potentially remove more prostatic tissue than the TURP without the need for additional devices.

Many studies into the efficacy of both procedures have shown the benefits of using the transurethral enucleation technique. However, some studies in the literature have not reported a consistent efficacy with favorable results, particularly among the patients with a relatively large prostate gland, i.e., weighing more than 60 mL, yet, a number of studies have suggested that the prostate volume (PV) in Asian populations is typically smaller than 60 mL[13,14]. Overall, few clinical studies have investigated the efficacy of transurethral enucleation of prostate glands weighing less than 60 mL. Therefore, the present study aimed to compare the efficacy of TUERP to TURP in patients with a relatively small to medium prostate gland through a prospective randomized control trial with a one-year follow-up.

Materials and Methods

The authors conducted a randomized controlled trial study with blinded participants between January 2016 and December 2019 at a single center. The primary endpoint was resected tissue weight. The sample size was calculated based on research by Zhao et al[15]. The sample size calculation by 2-side test with 80% power and alpha error of 0.05. Assuming a dropout rate of approximately 15%, total sample size require was 46 (23 in each group). Simple randomization by computer generated random number with concealment was employed to allocate 46 eligible patients into two groups, namely TURP and TUERP. The present study was approved by the Bangkok Metropolitan Administration Human Research Ethics Committee (S013h/58), and the registry trial number TCTR20180725006. All the participating patients provided written informed consents.

The study inclusion criteria were an IPSS score greater than 19 and age between 45 to 80 years old. All the included patients were identified as having at least one of the following conditions: 1) International Prostate Symptom Score (IPSS) greater than 19, 2) failure to respond to medication treatment (combination of alpha adrenoreceptor and 5 alpha reductase inhibitor), 3) recurrent urinary retention, or 4) renal insufficiency from bladder outlet obstruction. Patients with a neurogenic bladder, urethral stricture, bladder cancer, or prostate cancer were excluded. As for those with a prostate-specific antigen (PSA) level of more than 4 ng per mL, negative biopsy results before surgery were required for inclusion. All the patients were preoperatively evaluated by digital rectal examination, IPSS, Quality of life (QoL), serum PSA, uroflowmetry, and PV by transrectal ultrasound. The perioperative outcome was assessed based on the operative time, weight of the resected tissue, length of hospital stay, intraoperative and postoperative fluid irrigation, and the preoperative and postoperative hematocrit (Hct). All the surgeries were performed by a single surgeon. The postoperative follow-up assessment was performed based on IPSS, QoL, uroflowmetry Q max (mL/second), and PV by transrectal ultrasound at one year after surgery.

The TUERP procedure was performed using the TURP is bipolar resection system (Olympus). A 26-Fr Olympus continuous flow resectoscope was used. The enucleation procedure started from the prostatic apex, at the boundary with the adenoma. Blunt dissection was conducted clockwise and counterclockwise to separate the surgical capsule, starting from the 5 o'clock or the 7 o'clock position of the prostatic apex to the 12 o'clock position to the beak of the resectoscope sheath, and then the detachment area was extended laterally and forward to completely peel the adenomatous tissue off the surgical capsule lateral lobes along the surgical capsule. When the bilateral lobes were detached from the surgical capsule, the loop electrode was used to cut from the 11 o'clock to the 1 o'clock position. This left the lower half of the bilateral lobes and the mid lobe attached to the bladder neck. At this point, most of the blood supply to the lobes was blocked. The adenoma was resected rapidly and thoroughly from the 12 o'clock to the 6 o'clock position without serious hemorrhage. Prostatic chips were removed from the field. A triple lumen Foley catheter 24 Fr was inserted, and the balloon inflated with 15 to 20 mL normal saline, depending on the size of the prostate, upon which continuous urinary bladder irrigation was begun with normal saline until the wash became clear.

The TURP procedure was performed with the same instrument of TUERP. Resection begin at proximal portion of middle lobe at 6 o'clock and carried out with long cut toward the verumontanum up to surgical capsule. After resecting the middle lobe from 7 to 5 o'clock position, the resection was carried

Table 1. Baseline characteristics of included patient

Variables	TURP group (n=23) Mean±SD	TUERP group (n=23) Mean±SD
Age (years)	72±7	69±7
PV (mL)	40±22	41±18
PSA (ng/mL)	4.1±4.6	4.8±3.1
IPSS	23±9	27±8
QoL	5±1	5±1
Q max (mL/second)	4.8±4.3	4.3±5.4
Hct	39.60±4.9	39.2±5.6

TURP=transurethral resection of the prostate; TUERP=transurethral enucleation and resection of the prostate; SD=standard deviation; PV=prostate volume; PSA=prostate specific antigen; IPSS=international prostate symptom score; QoL=quality of life; Q max=maximum urinary flow rate; Hct=hematocrit

to both side of verumontanum in circular manner. The apical part of gland was resected last. After resection and removal all resected chips, a triple lumen Foley catheter 24 Fr was indwelled. Continuous urinary bladder irrigation begun with normal saline until the wash became clear.

Statistical analysis

The data were analyzed using IBM SPSS Statistics, version 22.0 (IBM Corp., Armonk, NY, USA). Baseline and clinical variables were analyzed using descriptive statistics. Kolmogorov-Smirnov's test was used to test for normality. The results were presented as the mean ± standard deviation (SD). The efficacy of the perioperative outcomes between the TURP and TUERP groups was compared via independent t-test. A p-value of less than 0.05 was considered statistically significant.

Results

The baseline characteristics of the present study patients are shown in Table 1. There were 46 patients, 23 patients in each group. The mean estimated PV in the TURP and the TUERP groups was 40±22 mL and 41±18 mL, respectively. There were no statistical differences in the baseline characteristics between the two groups. The mean IPSS and PSA levels in the TUERP group were slightly higher than the TURP group. All the cases were pathologically diagnosed postoperatively as BPH.

In Table 2, the mean operative time was significantly longer in the TUERP group than the TURP group (71.95±33.96 minutes versus 50.85±26.78 minutes; p=0.024). The intraoperative fluid was higher in the TUERP group than the TURP group. The average weight of prostate resected in the TUERP group was higher than the TURP group, but this difference was not statistically significant (18.48±14.72 g versus 15.15±11.07 g; p=0.39). The volume of fluid irrigation collected postoperatively was significantly lower for the patients that underwent TUERP compared to those that received TURP (13.98±10.01 liter versus 24.73±21.90 liter; p=0.04).

In Table 3, no statistically significant differences were noted between the two groups in terms of the postoperative IPSS, QoL, Q max, PSA, postoperative Hct, or the length of hospital stay. The postoperative residual PV was lower in the TUERP group (26.27±14.64 mL versus 30.82±23.81 mL; p=0.439).

The observed complications are listed in Table 4. Overall, the median follow-up was 12 months. Urethral strictures and clot retention were observed in both groups equally. All the patients showed clinical improvement after single urethral dilation.

Discussion

BPH is a common condition in urology. Its incidence increases with age where 50% of the men aged around 50 years old develop the condition,

Table 2. Perioperative data of patients who underwent TURP or TUERP

Variables	TURP group (n=23) Mean±SD	TUERP group (n=23) Mean±SD	p-value
Operative time (minutes)	50.85±26.78	71.95±33.96	0.024
Intraoperative irrigation fluid volume (L)	26.42±18.80	35.56±20.76	0.125
Postoperative irrigation fluid (L)	24.73±21.90	13.98±10.01	0.040
Weight of resected tissue (g)	15.15±11.07	18.48± 14.72	0.390
Hospital stay (days)	2.3±1.3	2.2±0.6	0.664
Postoperative Hct	36.73±5.56	36.48±4.47	0.864

TURP=transurethral resection of the prostate; TUERP=transurethral enucleation and resection of the prostate; SD=standard deviation; Hct=hematocrit

Table 3. Postoperative data after 12 months between TUERP or TURP

Variables	TURP group (n=23) Mean±SD	TUERP group (n=23) Mean±SD	p-value
Postoperative IPSS	6.78±4.11	6.91±3.01	0.903
Postoperative QoL	1.26±0.44	1.21±0.51	0.762
Postoperative Q max (mL/second)	12.68±7.91	10.66±5.76	0.327
Postoperative PSA (ng/mL)	3.48±4.15	3.5±3.77	0.933
Postoperative prostate volume (mL)	30.82±23.81	26.27±14.64	0.439
Difference in prostate volume (mL)	10.09±14.78	15.00±12.94	0.179

TURP=transurethral resection of the prostate; TUERP=transurethral enucleation and resection of the prostate; SD=standard deviation; IPSS=international prostate symptom score; QoL=quality of life; Q max=maximum urinary flow rate; PSA=prostate specific antigen

The difference in prostate volume (mL) is derived by the preoperative prostate volume minus postoperative prostate volume

Table 4. Complications of TUERP and TURP

	TURP group (n=23)	TUERP group (n=23)
Early complications		
Clot retention	1	1
Late complications		
Urethral stricture	2	2

TURP=transurethral resection of the prostate; TUERP=transurethral enucleation and resection of the prostate

rising to 80% at 80 years old and older[16]. The condition commonly presents with lower urinary tract symptoms. Monopolar transurethral resection of the prostate (M-TURP), which is a minimally invasive surgery, is considered the gold standard. However, TURP is sometimes associated with complications, such as bleeding, which may require blood transfusion. Up to 53% by volume of the prostate can be removed by TURP[17]; however, the rate of symptom recurrence requiring another intervention is 15%. This can be explained by the incomplete removal of the obstructing adenoma rather than a recurrence of the adenoma. This problem can be solved by performing enucleation of the prostate to achieve more tumor removal.

Endoscopic enucleation of the prostate has been known to remove the prostate adenoma as effectively as the traditional open surgery. The European Association of Urology (EAU) guideline recommends HoLEP as an alternative to transurethral resection because of its effectiveness and good safety profile[18]. In addition, the technique can be used regardless of the gland size. Unfortunately, this technique is not widely adopted in practice in some countries due to the expensive cost of equipment needed as well as the required surgical learning curve.

In the present study, the authors conducted a study on an Asian BPH cohort, with a mean PV of just above 40 mL. The results showed that the operative time for the transurethral enucleation technique (TUERP) was significantly longer than the non-enucleation technique (TURP). This finding is consistent with several previous studies[15,19-25]. Among others, Luo et al[20]. reported that the operative time of TUERP was shorter than that of TURP for patients with a larger PV (i.e., more than 60 mL), while it took longer for patients with a smaller PV (i.e., less than 60 mL). One possible explanation for this difference could be that it is technically more challenging to perform TUERP on smaller prostates, maybe due to more difficult enucleation plane. Furthermore, the longer operative time in TUERP is associated with increasing usage of perioperative fluid.

The authors found that the TUERP yielded much better homeostasis than the TURP. This is because the technique allows the surgeon to seal the bleeding vessels right after the adenoma is removed from the surgical capsule. Moreover, the vessels are cut open only once at the capsule in the TUERP, unlike in the TURP technique, where repeated bleeding episodes take place before the capsule is reached. In the present study, the authors also observed that significantly less postoperative fluid was used in the TUERP than in the TURP. The present study results are consistent with the findings reported by Mohamed et al[22], who demonstrated that there was less used postoperative fluid irrigation in the TUERP.

The present study also confirmed that the TUERP resulted in a greater prostate tissue removal, which was also reported in other studies[15,19-25]. However, the difference in the resected PV was not statistically significant, which is consistent with Luo et al[20]. However, this may have been due to the medium

size of the prostate or the small sample size of the present study cohort. The postoperative assessment confirmed the smaller residual PV in the TUERP group. The present study findings suggest that the TUERP technique is more effective in removing prostatic adenoma, and as a result, should be able to resolve the bladder outlet obstruction better.

At the one-year follow-up, the authors observed no significant differences in the following clinical parameters. IPSS, QoL, and Q max values, between the two patient groups. According to Zhu et al[25] and Zhao et al[15], the use of the TUERP versus the TURP resulted in no differences in most of these parameters during the first year of follow-up. However, the authors did report significant improvements in the TUERP group in these parameters after a longer follow-up time, i.e., 24 months or more.

The authors observed no difference in the surgical complications between the two groups. This finding was supported by that of Arcaniolo et al[5], who reported a low incidence rate of re-intervention for BPH in their patients underwent the TUERP. Also, none of the TUERP patients in their study needed a second procedure due to a relapse of the prostate adenoma.

Conclusion

The present study compared the surgical outcomes between the TUERP and the TURP techniques performed in patients with a PV smaller than 60 mL. The authors concluded that the TUERP resulted in greater prostate tissue removal and, importantly, better intraoperative bleeding control. However, the TUERP required a longer operative time than the TURP in the present study patient cohort. This was due to the more difficult enucleation plane and limited surgical field. A further study with a longer follow-up time is required to assess the long-term effectiveness between the two techniques.

What is already known on this topic?

The TUERP has better efficacy than the TURP, including a larger amount of tissue removal and less hematological changes, especially in patients with a large prostate size, which ultimately will require a longer operative time.

What this study adds?

With medium-sized prostates, the TUERP still offers good efficacy in perioperative outcomes, both in terms of more tissue removal and less bleeding.

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Conflicts of interest

The authors declare no conflict of interest.

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