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The Clinical Effect of Bipolar Transurethral Resection in Saline of Benign Prostate Hyperplasia with Long Term Follow-Up

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Abstract

Transurethral resection of the prostate (TURP) is considered as the gold standard for the management of bladder outlet obstruction due to benign prostatic hyperplasia (BPH). Long-term follow-up of the clinical effect of bipolar transurethral resection of the prostate (B-TURP) in saline for BPH is required. **Objective:** To compare, with long term follow-up, the efficacy and safety of B-TURP in the treatment of BPH with prostate gland volumes of <45 ml, >45 ml, and larger than 60 ml. **Materials and Methods:** From January 2006 to December 2016, 318 patients with a mean age of 69.45 ± 8.37 years and a median prostate volume of 42 cm^3 (56.51 - 32.47) were treated with B-TURP by single urologist (SP) at the Division of Urology, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University. We retrospectively analyzed the perioperative status of patients' status follow-up for at least 6 months and up to 5 years. Post-void residual (PVR) and maximum flow rate (Qmax) were assessed preoperatively and postoperatively. Operative time, length of catheterization and hospitalization and complications were all reported. **Results:** The main indication for B-TURP was failure of medication (81.13%). Perioperative results showed no statistical significance among the groups in terms of catheterization days and the hospitalization length. During the follow-up, the improvement of postoperative parameters was compared with preoperative subscales, at different periods from baseline and after 24, 36, 48, and 60 months post treatment. PSA, Q max, PVR, and average flow rate were significantly different from pre-operation data ($p <$ 0.005). Regarding TURP complications, significant differences were observed in relation to transient incontinence (5.87%), urinary tract infection (2.5%), urinary retention/catheterization (1.57%), contracture of bladder neck (4.4%), urethral strictures (4.09%), recurrence of BPH (2.83%), hypotonic bladder (0.6%) and erectile dysfunction (7.8%). No TUR syndrome or secondary hemorrhage was recorded in the study. Interestingly, complications in patients

on ongoing oral anticoagulation were not found. **Conclusion:** With long-term follow-up, B-TURP is a safe and effective technique for BPH management with prostate gland < 45 ml, > 45 ml and larger than 60 ml.

Keywords

Lower Urinary Tract Symptoms (LUTS), Benign Prostatic Hyperplasia (BPH), Transurethral Resection of Prostate (TURP), Bipolar TURP (B-TURP)

1. Introduction

Despite the rise of new minimally invasive technologies, transurethral resection of prostate (TURP) is the gold standard of surgical treatment for bothersome moderate severe lower urinary tract symptoms (LUTS) secondary to BPH [1] [2] [3]. The three main reasons for the continued popularity of TURP are a robust, simple technique; and, until now, unsurpassed efficacy; and, with regard to the risk-benefit ratio, a low morbidity [4].

Monopolar (M-TURP) and bipolar (B-TURP) are safe, effective techniques and both are equally widely used in surgical treatment for BPH management [5]. Although M-TURP efficacy in prostate resection is established, potential perioperative complications and associated costs remain a concern [6]. In contrast, bipolar TURP is considered more efficacious and has a better clinical outcome in comparison with M-TURP [7]. In this study, B-TURP reported a significant reduction of related complications [3] [8] [9]. B-TURP coupled with 0.9% sodium chloride has minimal effects on serum sodium levels, compared with M-TURP [5]. Interestingly, Madduri *et al.* concluded that B-TURP is the new gold standard, since urologists prefer to operate on larger prostates using B-TURP, which definitely reduces the incidence of bleeding and hyponatremia [10]. However, many studies are conflicting regarding the merits of B-TURP over M-TURP. [10] B-TURP is associated with high complication rates, especially secondary hemorrhage [11] [12], and M-TURP should be used if surgeons want to save time [7].

Moreover, present practice demonstrates the majority of a representative group of the Endourological Society members perform TURP in patients on ongoing oral anticoagulation (OA) [13]. To our knowledge, no report related to B-TURP in patients on ongoing oral anticoagulation (OA) in a long-term follow-up has been published. Therefore, in this study, we evaluated and compared the efficacy and safety of B-TURP in the treatment of BPH with prostate gland < 45 ml, > 45 ml and larger than 60 ml and with long term follow-up. We also evaluated the factors associated with complications especially secondary hemorrhage after B-TURP in patients on ongoing OA.

2. Material and Methods

From January 2006 to December 2016, 318 Patients with LUTS due to BPH un-

derwent B-TURP by single urologist (SP) at the Division of Urology, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University. Patients were evaluated preoperatively by full detailed history, routine preoperative investigation, digital rectal examination (DRE), serum prostate-specific antigen (PSA), transrectal ultrasonography (TRUS), maximum flow rates (Qmax) and Post-void residual (PVR). The exclusion criteria included urethral stricture disease, known history of neurogenic bladder dysfunction, active urinary tract infection, previous prostate, bladder and/or urethral surgery or bladder cancer.

Patients underwent standard B-TURP (Olympus Medical, Tokyo, Japan) performed by single urologist (SP) using the same surgical technique [14]. A 26 Fr Karl Storz (Tuttlingen, Germany) resectoscope was used with pre-warmed normal saline solution as an irrigant with a continuous-flow setup for clear vision during the procedure. The middle lobe was first resected and an excavation up to the surgical capsule was formed. After that, the side lobes and ventral parts of the gland were resected. Finally, the apical parts of the gland were resected. At the end of the B-TURP, a three-way 22-F Foley catheter was inserted for postoperative continuous bladder irrigation with saline until the urine became clear. Then, the Foley catheter was removed and the patients were discharged when voiding was satisfactory.

We retrospectively analyzed the perioperative status of patients by follow-up for at least 6 months and up to 5 years. Postoperative parameters were evaluated and the patients were reassessed at 24, 36, 48 and 60-month follow-ups with the same examinations. PVR and Qmax were assessed preoperatively and postoperatively. Operative time, length of catheterization and hospitalization and complications were all reported. All data were entered in SPSS-17.0 software. A *p*-value less than 0.05 was considered as significant.

3. Results

At the beginning of the study, there were 318 patients. The mean age of the patients was 69.45 ± 8.37 years. Table 1 shows the baseline characteristics of patients who underwent B-TURP. Hypertension (57.86%) was the most common underlying disease of the patients. Indications for B-TURP included failure of medication (81.13%), acute urinary retention (11.95%) recurrence of UTI (3.77%), recurrence of hematuria (1.57%) and bladder stones (1.57%). B-TURP was performed in 27 patients (8.49%) on ongoing OA. The major anesthesia technique was spinal block (70.44%).

Table 2 shows the evaluation of preoperative parameters. The mean postoperative irrigation volume was 15,000 ml. The median duration of resection in bipolar TURP was 80 minutes (102.5 - 65.0). Median hospital stay was 3 days (4 - 3) and median indwelling catheterization time was 3 days (4 - 3). The median prostate volume and the median amount of resected tissue were 46 ml (56.51 - 32.47), and 8.5 gm (13 - 5), respectively. Median blood loss was 50 ml (100 - 10)

Table 1. Baseline characteristic of patients underwent B-TURP (N = 318).

Variable	Mean ± SD	Range
Age (Years)	69.45 ± 8.37	36 - 88
BMI	24.38 ± 3.42	13.35 - 35.76
Underlying	N	(%)
Hypertension	184	57.86
Dyslipidemia	126	39.62
Diabetic Mellitus	82	25.79
Inguinal Hernia	8	2.5
CAD	6	1.886
Parkinsonism	3	0.943
Erectile dysfunction	58	18.24
Indication for TURP		
Failure of medication	258	81.13
Acute Urinary Retention	38	11.95
Recurrence of UTI	12	3.774
Recurrence of hematuria	5	1.572
Bladder stones	5	1.572
On ASA	27	8.491
Anesthesia technique		
Spinal Block	224	70.44
General Anesthesia	11	3.459

B-TURP = Bipolar Transurethral resection of prostate; BMI = Body Mass Index; CAD = Cardiovascular disease; UTI = Urinary tract infection; ASA = acetylsalicylic acid.

Table 2. Preoperative data.

Variables	Median	IQR (Q3 – Q1)
Irrigation Volume (ml)	15,000	12,500 (22,000 – 9500)
Operative time (min)	80	37.50 (102.50 – 65.00)
Duration of catheter (days)	3	1 (4 – 3)
Hospital stay (days) range	3	1 (4 – 3)

Postoperative comparisons of non-normally and normally distributed variables in three groups (prostate gland < 45 ml, > 45 ml and larger than 60 ml) are displayed in Table 3 and Table 4, respectively. Perioperative results showed no statistical significance among the groups in terms of catheterization days (median 3 days; $p = 0.37$), the hospitalization length (median 3 days; $p = 0.269$), estimated blood loss or complications. However, the greater the prostate volume, the greater the volume of irrigation fluid, the amount of resected prostate and operative times. Most of the cases underwent spinal block before operation. During the follow-up, PSA, Qmax, PVR, and average flow rate were significantly different

Table 3. Postoperative comparison of non-normally distributed variables in three groups.

Variables	Prostate volume ≤ 45 ml (n = 89)		Prostate volume > 45 ml (n = 39)		Prostate volume ≥ 60 ml (n = 34)		*p*-value
	Median	IQR (Q3 – Q1)	Median	IQR (Q3 – Q1)	Median	IQR (Q3 – Q1)	
Hospital stay	3	1 (4.0 – 3.0)	3	0 (3.0 – 3.0)	3	1 (4.0 – 3.0)	0.269
Irrigate vol (ml): In	11,900	8000 (16,000 – 8000)	18,400	18400 (23,500 – 13,250)	23,000	12750 (31,750 – 19,000)	0.000*
Irrigate vol (ml): Out	11,200	7600 (15,600 – 8000)	17,700	10600 (23,300 – 12,700)	22,450	13650 (31,950 – 18,300)	0.000*
Prostate resected (g)	6.00	5.5 (10 – 4.5)	10.00	9.0 (15 – 6)	20.00	20.0 (30 – 10)	0.000*
BUN	14	6.0 (17 – 11)	14	6.0 (17 – 11)	14	4.0 (16 – 12)	0.754
Creatinine	1.05	0.29 (1.19 – 0.9)	1.08	0.32 (1.32 – 1.00)	1.085	0.36 (1.24 – 0.88)	0.498
Albumin	40.45	3.40 (41.9 – 38.5)	39.45	4.20 (42.3 – 38.1)	35.6	5.10 (39.6 – 34.5)	0.061
Operative time	75	30 (90 – 60)	90	25 (100 – 75)	95	50 (130 – 80)	0.008*
Indwelling catheterization time (days)	3	1 (4 – 3)	3	0.5 (3.0 – 2.5)	3	1.5 (3.5 – 2.0)	0.371
Estimated blood loss	30	90 (95 – 10)	50	100 (120 – 20)	100	175 (200 – 25)	0.071

Table 4. Postoperative comparison of normally distributed variables in three groups.

Variables	**Prostate volume ≤ 45 ml (n = 89)**		**Prostate volume > 45 ml (n = 39)**		**Prostate volume ≥ 60 ml (n = 34)**		***p*-value**
	N	**Percent**	**N**	**Percent**	**N**	**Percent**	
Anesthesia technique							0.291
SB	70	22.013	30	9.434	25	7.862	
GA	2	0.629	2	0.629	2	0.629	
Late complication							0.723
Stricture urethra	3	0.943	2	0.629	1	0.314	
CBN	6	1.887	0	0.000	0	0.000	
Hypotonic bladder	0	0.000	0	0.000	1	0.314	
UTI	0	0.000	1	0.314	0	0.000	
Surgical risk							0.312
Unknown surgical risk	4	1.258	1	0.314	0	0.000	
Intermediate risk	1	0.314	0	0.000	0	0.000	
Long term	4	1.258	2	0.629	0	0.000	
Incontinence	5	1.572	0	0.000	1	0.314	0.207
On ASA	9	2.830	3	0.943	4	1.258	0.997
Pathological report: prostate cancer	14	4.403	2	0.629	3	0.943	0.084

SB = Spinal block; GS = General Anesthesia; CBN = Contracture bladder neck; UTI = Urinary tract infection; ASA = Aspirin.

from pre-operation data ($p < 0.005$). Prostate volume measured by TRUS was not significantly reduced from a median of 42 ml preoperatively to 38.9 ml postoperatively. Table 5 demonstrated the improvement of postoperative parameters at different periods compared with preoperative subscales in five subgroups at baseline and at 24, 36, 48, and 60 months after treatment. Median of PSA, Qmax, PVR and average flow rate before operation were 4.6 ng/ml, 11 ml/s, 60 ml and 5.6 ml/s, respectively. Median of PSA, Qmax, PVR and average flow rate at 60 months after the operation were 0.884 ng/ml, 18.8 ml/s, 25 ml and 9.85 ml/s, respectively.

Regarding TURP complications (Table 6), transient incontinence (5.87%),

Table 5. Improvement of Postoperative Parameters at Different Periods Compared with Preoperative subscales in five subgroups at baseline and after 24, 36, 48, and 60 months of treatment (Wilcoxon signed-rank test).

Variables	Median	IQR (Q3 – Q1)	*p*-value
PSA (ng/ml)			
Pre-op; n = 231	4.600	6.370 (7.94 – 1.57)	
Post-op 24 month; n = 190	1.315	1.710 (2.30 – 0.59)	0.000
Post-op 36 months; n = 123	1.120	2.168 (2.21 – 0.042)	0.000
Post-op 48 months; n = 61	0.688	2.717 (2.72 – 0.003)	0.000
Post-op 60 months; n = 20	0.884	3.020 (3.15 – 0.13)	0.006
Prostate volume (ml)			
Pre-op; n = 162	42.00	24.04 (56.51 – 32.47)	
Post-op 24 month; n = 212	41.745	26.53 (56.18 – 29.65)	0.197
Post-op 36 months; n = 137	39.30	20.57 (50.57 – 30.00)	0.140
Post-op 48 months; n = 81	36.80	20.99 (49.62 – 28.63)	0.062
Post-op 60 months; n = 38	38.920	19.64 (46.97 – 27.33)	0.036
Qmax (ml/s)			
Pre-op; n = 228	11.00	9.10 (16.70 – 7.60)	
Post-op 24 month; n = 94	12.90	9.20 (17.80 – 8.60)	0.080
Post-op 36 months; n = 98	17.10	13.90 (25.30 – 11.40)	0.000
Post-op 48 months; n = 71	16.50	13.10 (22.50 – 9.40)	0.004
Post-op 60 months; n = 190	18.80	12.60 (26.10 – 13.50)	0.000
Residual volume (ml)			
Pre-op; n = 228	60.00	104.50 (132.50 – 28.00)	
Post op 24 month; n = 94	35.00	60.00 (75.00 – 15.00)	0.004
Post op 36 months; n = 98	35.00	55.00 (70.00 – 15.00)	0.000
Post op 48 months; n = 71	20.00	41.00 (51.00 – 10.00)	0.000
Post op 60 months; n = 190	25.00	38.00 (53.00 – 15.00)	0.000
Average flow (ml/s)			
Pre-op; n = 228	5.600	4.80 (8.40 – 3.60)	
Post op 24 month; n = 94	6.500	3.70 (8.20 – 4.50)	0.927
Post op 36 months; n = 98	8.950	6.50 (12.10 – 5.60)	0.000
Post op 48 months; n = 71	7.90	7.40 (12.50 – 5.10)	0.010
Post op 60 months; n = 190	9.85	6.40 (13.50 – 7.10)	0.000

Table 6. Postoperative Adverse Events (N = 318).

	N	%
Early postoperative complication		
Transient Incontinence	19	5.87
Urinary tract infection	8	2.5
Urinary retention/catheterization	5	1.57
Late postoperative complication		
Contracture of Bladder neck	14	4.40
Urethral stricture	13	4.09
Recurrence BPH	9	2.83
Hypotonic bladder	2	0.62
Erectile dysfunction	25	7.8

urinary tract infection (2.5%), urinary retention/catheterization (1.57%), contracture of bladder neck (4.4%), urethral strictures (4.09%), recurrence of BPH (2.83%), hypotonic bladder (0.6%) and erectile dysfunction (7.8%) were observed. Neither suffering from TUR syndrome nor receiving blood transfusion were reported during bipolar TURP in this study. Interestingly, no complications for patients on ongoing OA were reported.

4. Discussion

Endoscopic management of BPH is based on resection, vaporization, or enucleation [15]. M-TURP was considered the gold standard for the management of bladder outlet obstruction due to BPH [10]. Later, B-TURP showed similar effect and safety in patients with BPH compared with those who underwent M-TURP. In BPH larger than 60 ml, a significant difference between the M-TURP and B-TURP groups was the greater decrease in serum sodium levels in the M-TURP group [16].

However many studies demonstrated that the issue of the benefit of B-TURP was, to some extent, controversial [7] [17]. Ahmad *et al.* reported that the duration of the resection and operating time was shorter in M-TURP than B-TURP and suggested urologists save time by using M-TURP [7]. Transurethral plasmakinetic enucleation and resection of the prostate (TUERP) is superior to B-TURP in the management of large volume BPH in terms of efficacy and safety, but needs to be validated in further prospective, randomized, controlled studies [18]. A steep operative learning curve may be the main obstacle to the widespread use of TUERP [19].

In the present study, a significant constant and gradual improvement over time after B-TURP was observed in the post-operative PSA, average flow rate, Qmax and PVR in all groups with significant difference ($p < 0.005$) at base line and after 24, 36, 48 and 60 months of follow-up. These results were statistically significant compared to the baseline values, when compared with one another,

and were maintained throughout the whole follow-up period, which is similar to other published data [5] [10].

For complications, secondary bladder neck sclerosis represents one of the more frequent complications following endoscopic, open, and other forms of minimally invasive prostate surgery (e.g., radical prostatectomy, TURP, HoLEP, radiotherapy, HIFU) [20]. Most of the urethral strictures after B-TURP occurred at the bulbar urethra and may be linked to a slow resection rate [21]. In our study, the urethral stricture rate of 4.0% after B-TURP in this long term study of 60 months is comparable to previous series [21].

In the contemporary B-TURP series, no TUR syndrome was found which confirmed that TUR syndrome is nowadays a clinical rarity [4]. Moreover, secondary hemorrhage after B-TURP and complications of patients on ongoing oral anticoagulation were not found in our study. We believe that many complications can be avoided by a proper resection technique. The main limitation of this study was that it was a retrospective review and small sample size.

The prevalence of erectile dysfunction in Thai males aged 40 - 70 years old is 42.18% [22]. In our series with the mean age 69.45 years, the incidence of erectile dysfunction was 7.8%. It seems that B-TURP did not increase erectile dysfunction.

5. Conclusion

Our study confirms that B-TURP in patients' LUTS/BPH provides durable and comparable efficacy at 60 months follow up and is suitable for any prostate size.

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