Original Article

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Comparison of Outcomes Between S-TUAEP and M-TUAEP in Benign Prostatic Hyperplasia at Rajavithi Hospital

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Abstract:

Objective: This study aimed to measure the outcomes in 100 patients who underwent the transurethral anatomical enucleation of the prostate (TUAEP), comparing the results between the standard TUAEP (S-TUAEP) and modified TUAEP (M-TUAEP) procedures in patients with benign prostatic hyperplasia.

Material and Methods: Fifty cases were performed in S-TUAEP, and the other 50 were performed in M-TUAEP. Each group recorded demographic data, PSA, IPSS (International Prostate Symptom Score), QOL (Quality of Life score), Uroflowmetry (UFM), Maximum Flow Rate (Qmax), operative time, blood loss, length of hospital stay, and complications.

Results: The mean operative time was 114.50±54.30 minutes in the S-TUAEP and 120.26±42.64 minutes in the M-TUAEP (p-value=0.55). The length of stay was 3.12±1.13 days in the S-TUAEP group and 2.50±0.58 days in the M-TUAEP group (p-value<0.001). The mean Qmax at 24 months showed that S-TUAEP was 21.87±7.03 and M-TUAEP was 22.24±6.97 (p-value<0.001). The median comparison of QOL at 24 months between the S-TAUEP and the M-TUAEP was 1 (0.2) and 0 (0.2), respectively (p-value=0.01).

Conclusion: The present study reported no statistically significant differences in perioperative outcomes between the two groups. However, a better functional outcome was observed in the M-TUAEP group. More TUAEP cases are required to observe the long-term consequences.

Keywords: Anatomical Enucleation, BPH, BipolEP, prostate gland, TUAEP

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Introduction

The transurethral resection of the prostate (TUR-P) was first reported in 1926 by Maximilian S[1]. For decades, this surgical technique has remained the standard treatment for patients with a prostate gland size of less than 80 grams. However, TURP still has complications related to abnormal electrolyte and volume overload (TUR-P syndrome)[2-3] that can be life-threatening. Since the bipolar TURP (B-TURP) was developed, the incidence of TUR-P syndrome has been reduced due to the use of saline irrigating systems. The technique of B-TURP is still similar to the traditional method, which is still limited by the size of the prostate gland and postoperative blood loss. The transurethral anatomical enucleation of the prostate (TUAEP) is a technique that enucleates the prostate tissue following the surgical capsule, and it is the first report in Thailand since 2019[4]. The TUAEP was a concept that integrated new surgical skills and techniques with bipolar system instruments for better outcomes. The S-TUAEP has some problems during enucleation in identifying the connection to the bladder, which can be solved by the early release of the mucosa at the bladder neck. This approach may reduce operative time and improve outcomes. This study aimed to report the surgical technique and measure the treatment outcomes in 100 patients who underwent TUAEP, comparing the results between the standard TUAEP (S-TUAEP) and modified TUAEP (M-TUAEP) procedures in patients with benign prostatic hyperplasia (BPH) at Rajavithi Hospital.

Material and Methods

The study design was a retrospective cohort study, approved by the Research Ethics Committee of Rajavithi Hospital (protocol number: 66004).

Patient selection and data collection

The author reviewed a total of 100 BPH patients who were indicated to undergo TUAEP (with the same indication as TURP) by a single surgeon from May 2015 to August 2022 at Rajavithi Hospital. The indications for TURP were urinary retention, recurrent urinary tract infection, and hematuria. The exclusion criteria were patients with prostate cancer, urethral stricture, and neurogenic bladder. Cases 1-50 were performed in S-TUAEP, and cases 51-100 were performed in M-TUAEP. Each group recorded demographic data, prostate-specific antigen (PSA), International Prostate Symptoms Score (IPSS), Quality of Life score (QOL), Uroflowmetry (UFM), Maximum Flow Rate (Qmax), Post-Void Residual urine (PVR), operative time, blood loss, pathological outcome, length of hospital stays, the catheter time, and complications. All data were compared between groups using statistical analyses performed with IBM SPSS, version 20. Statistical analysis was conducted for categorical data using the Chi-square test, and for continuous data using the independent t-test to compare the two groups; p-value significance was $p\text{-value}<0.05$. The Rajavithi Hospital Ethics Committee approved this study.

Surgical technique

The S-TUAEP procedure used a 27Fr resectoscope with a standard bipolar loop and normal saline as the irrigation fluid. Under general or regional anesthesia, the patient was placed in the lithotomy position. The enucleation began close to the verumontanum from the 5 to the 3 o'clock position to identify the plane of the surgical capsule, and the prostate adenoma was separated from all circumferential areas of the surgical capsule. At this point of enucleation, only 3 points remained at which the prostate was attached to the prostatic fossa: the bladder neck at the 5 and 7 o'clock positions and the urethral mucosa at 12 o'clock, close to the external sphincter. In the final step, the bipolar loop cuts 3 points of attachment on the urethral mucosa at 12 o'clock on the urethral mucosa and both points of attachment on the bladder neck to completely free the prostate adenoma, as shown in Figure 1. In the final step,

a morcellator was used to remove the floating adenoma from the bladder and insert a 3-way Foley catheter with continuous bladder irrigation by normal saline. The surgical technique of M-TUAEP utilizes early mucosa release at 5, 7, and 12 o'clock on the bladder neck in a median lobe enlarged prostate; however, prostatic hyperplasia without median lobe enlargement utilizes early mucosa release at 6 and 12 o'clock on the bladder neck, which improves the identification of the end of the enucleation, as shown in Figure 2. The other step is the same as in the S-TUAEP technique.

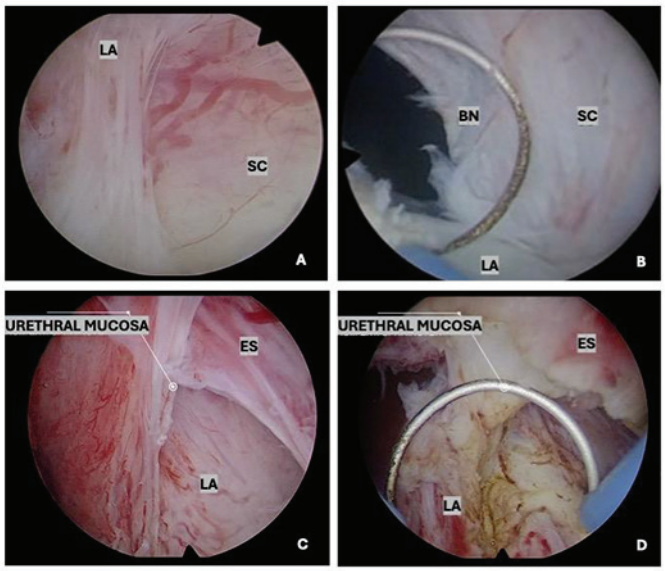

Figure 1 Standard TUAEP. A: Identified the plane of the surgical capsule. B: Enucleated left adenoma (LA) until bladder neck (BN). C: Identified the plane of the external sphincter (ES), urethral mucosa (UM). D: Identified the plane of the external sphincter (ES) and cut the urethral mucosa (UM)

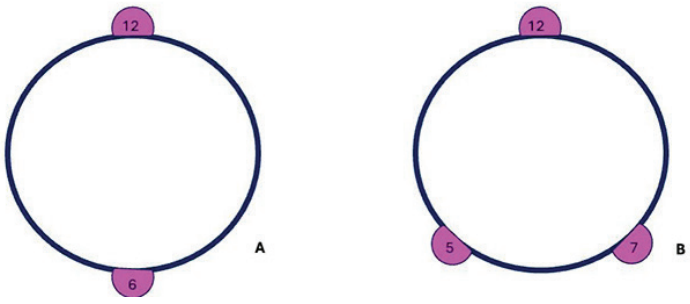

Figure 2 The modified TUAEP shows early release of the mucosa at the bladder neck. A: Prostatic without median lobe enlargement: the bladder neck incision was made at 6 o'clock and 12 o'clock. B: Prostate with median lobe enlargement: the bladder neck incision was made at 5 o'clock, 7 o'clock, and 12 o'clock

Results

Preoperative clinical data

The mean age was 70.22±6.24 years in the S-TUAEP group and 69.04±6.37 years in the M-TUAEP group (p-value=0.35), and the median preoperative IPSS (min, max) was 18 (6, 35) in the S-TUAEP group and 22 (9, 35) in the M-TUAEP group (p-value =0.02), which were clinically significant. The preoperative QOL (min, max) was 4 (2, 6) in the S-TUAEP group and 5 (3, 6) in the M-TUAEP group (p-value<0.001), which was clinically significant. The pre-operative maximum flow rate (Mean±S.D.) was 8.29±3.30 in the S-TUAEP group and 7.27±4.91 in the M-TUAEP group (p-value=0.23). The pre-operative post-void residual urine (Mean±S.D.) was 93.30±74.66 ml in the S-TUAEP group and 168.46±156.56 ml in the M-TUAEP group (p-value<0.001), which was clinically significant, as shown in Table 1.

Perioperative clinical data

The mean operative time was 114.50±54.30 minutes in the S-TUAEP group and 120.26±42.64 minutes in the M-TUAEP group (p-value=0.55). The postoperative hemoglobin (Hb) was 12.46±1.44 gm/dl in the S-TUAEP group and 12.29±1.35 gm/dL in the M-TUAEP group (p-value=0.54). Blood transfusion was indicated by a hematocrit level of less than 30 percent. The mean blood transfusion in the S-TUAEP group was 0.12±0.38 units, with no blood transfusions in the M-TUAEP group (p-value=0.03), which was not clinically significant, as shown in Table 2.

Postoperative clinical data

The mean resection weight was 44.10±24.85 g in the S-TUAEP group and 50.45±21.61 g in the M-TUAEP group (p-value=0.17). The catheter was removed when the urine in the catheter was clear, on the same day of discharge. The length of stay was 3.12±1.13 days in the S-TUAEP group and 2.50±0.58 days in the M-TUAEP group (p-value<0.001), which was clinically significant. The mean postoperative PSA after 24 months of follow-up was not statistically significantly different between the two groups, except at the 3rd and 24th months, as shown in Table 2. The comparison of IPSS was better in the M-TUAEP group at 3 and 6 months post-operation, as shown in Table 3. The comparison of QOL results between the two groups revealed better outcomes in the M-TUAEP group at 1, 2, 12, 18, and 24 months, as shown in Table 3. The comparison of Qmax showed no statistically significant difference between the two groups, as shown in Table 3. Comparing the PVR of the two groups, it was found to be better in the S-TUAEP group at 1-month post-operation, as shown in Table 3. A comparison of the outcomes between 100 preoperative and postoperative cases of TUAEP showed statistically significant differences in IPSS, QOL, Qmax, and PVR outcomes from 1 to 24 months of clinical follow-up, as shown in Table 4. The early complications in 100 cases of TUAEP included acute urinary retention (5.0%), urinary tract infection (3.0%), and bleeding (3.0%), but there was no statistically significant difference between the two groups. Late complications for 100 cases of TUAEP included stricture of the urethra (4.0%) and incontinence (4.0%). The statistically significant late complications included stricture of the urethra (8.0%) in S-TURP, but no stricture of the urethra in M-TUAEP. Incontinence was 2.0% in S-TUAEP but 6.0% in M-TUAEP, as shown in Table 2.

Discussion

Since 2006, bipolar transurethral enucleation of prostate (BipolEP) systems have been reported, and the incidence of TURP syndrome has decreased because the irrigating fluid has been changed to normal saline. An alternative to HoLEP, such as BipolEP, yields similar results;

Table 1 Comparison of pre-operative data between Standard TUAEP and Modified TUAEP

Data	Total TUAEP (n=100)	Standard TUAEP (n=50)	Modifed TUAEP (n=50)	p-value
Mean age (year)	69.63±6.30	70.22±6.24	69.04±6.37	0.35
Mean Pre-operative Hb (gm/dl)	13.11±1.32	13.22±1.45	13.00±1.18	0.41
Mean Pre-operative Hct (gm%)	39.95±3.96	40.41±4.10	39.49±3.81	0.24
Median Pre-operative IPSS (min, max)	20 (6, 20)	18 (6, 35)	22 (9, 35)	0.02
Median Pre-operative QOL (min, max)	4 (2, 6)	4 (2, 6)	5 (3, 6)	<0.001
Mean Pre-operative Qmax (mean±S.D.)	7.77±4.20	8.29±3.30	7.27±4.91	0.23
Mean Pre-operative residual urine (ml.)	130.88±127.74	93.30±74.66	168.46±156.56	0.00
Mean Pre-operative PSA (ng/ml)	6.02±5.68	7.15±6.91	4.86±3.81	0.04
LUTS				
Irritative symptoms n (%)	19 (19.0)	9 (18.0)	12 (20.0)	
Obstructive symptoms n (%)	63 (63.0)	38 (76.0)	26 (50.0)	0.01
Urinary retention n (%)	15 (15.0)	3 (6.0)	12 (24.0)	

TUAEP=transurethral anatomical enucleation of prostate, Hb=hemoglobin, Hct=hematocrit, IPSS=international prostate symptoms score, QOL=quality of life, Q max=maximum flow rate, PSA=prostate specific antigen, LUTS=lower urinary tract symptoms, S.D.=standard deviation, gm=gram, ml=milliliter, ng/ml=nanogram per milliliter

Table 2 Comparison of postoperative data between Standard TUAEP and Modified TUAEP

Data	Total TUAEP (n=100)	Standard TUAEP (n=50)	Modifed TUAEP (n=50)	p-value
Mean postoperative Hb (gm/dl)	12.38±1.39	12.46±1.44	12.29±1.35	0.54
Mean postoperative Hct (gm%)	37.57±4.36	37.88±4.61	37.26±4.13	0.49
Mean blood transfusion (units)	0.06±0.27	0.12±0.38	0.00±0.00	0.03
Mean operation time (mins)	117.38±48.66	114.50±54.30	120.26±42.64	0.55
Mean resection weight (gms)	47.27±23.39	44.10±24.85	50.45±21.61	0.17
Mean catheter time (days)	2.81±0.95	3.12±1.13	2.50±0.58	<0.001
Mean continuous bladder irrigation (days)	1.56±0.68	1.62±0.78	1.50±0.58	0.38
Mean length of stay (days)	2.81±0.95	3.12±1.13	2.50±0.58	<0.001
Mean postoperative PSA (ng/ml)				
3rd month	0.89±0.58	1.00±0.66	0.78±0.46	0.05
12th month	0.96±0.73	1.09±0.83	0.83±0.60	0.08
24th month	1.01±0.70	1.20±0.78	0.85±0.57	0.01
Postoperative pathology				
prostate hyperplasia n (%)	97 (96.0)	48 (96.0)	47 (97.0)	1.0
Prostate cancer n (%)	3 (3.0)	2 (4.0)	1 (3.0)	
Early complication				0.53
Acute urinary retention n (%)	5 (5.0)	2 (4.0)	3 (6.0)	
Urinary tract infection n (%)	4 (3.0)	3 (6.0)	1 (2.0)	
Bleeding n (%)	4 (3.0)	1 (2.0)	3 (6.0)	
Late complication				<0.001
Stricture urethra n (%)	4 (4.0)	4 (8.0)	0 (0.0)	
incontinence n (%)	4 (4.0)	1 (2.0)	3 (6.0)	

TUAEP=transurethral anatomical enucleation of prostate, Hb=hemoglobin, Hct=hematocrit, PSA=prostate specific antigen, S.D.=standard deviation, gm=gram, ml=milliliter, ng/ml=nanogram per milliliter

however, the straightforward conversion to standard bipolar TURP enables surgeons to learn the technique step-by-step, without compromising patient outcomes[5]. Thanyarat, et al. compared the irrigating fluid absorption between B-TURP and TUAEP. The author concluded that the absorption of irrigating fluid was not related to the surgical technique but was associated with the operative time[6]. Thaidumrong, et al. reported the first TUAEP in Thailand. The pilot study reported a 6-month follow-up of IPSS scores, QOL, Qmax, and PVR, which showed significant improvement compared to the pre-operative period[4]. The present study compared the outcomes of S-TUAEP and M-TUAEP, revealing no significant difference in operative time. However, some functional outcomes showed statistically significant differences, including the IPSS, which was better in the M-TUAEP group at 3 and 6 months post-operation. Notably, there were no clinical differences in post-operative management, as shown in Table 3. The comparison of QOL between the two groups revealed better results in the M-TUAEP group, which may be attributed to the high pre-operative QOL and IPSS scores, as shown in Table 3. Comparing the two groups of PVR, it was found to be better in the S-TUAEP group at 1 month post-operation, because M-TUAEP had higher preoperative post-void residual urine, as shown in Table 3. The present study, comparing pre-operative and post-operative outcomes in 100 TUAEP cases, demonstrated statistically significant improvements in postoperative outcomes up to 24 months, as well as enhancements in IPSS score, QOL, Qmax, and PVR, as shown in Table 4. A retrospective study comparing B-TURP and transurethral enucleation resection of the prostate (TUERP) in 270 patients showed better postoperative IPSS, higher Qmax, and fewer reoperations in TUERP[7]. Chunxiao Liu et al. reported the use of TUERP in 1,100 patients with BPH, based on plasma kinetics. They reported no significant blood loss or TURP syndrome. The mean enucleation time was 15.5 minutes (range, 10-38 minutes), and the mean resection time was 46 minutes (range, 20-65 minutes). The mean catheter time was 1.80±0.40 days, and the mean length of stay (LOS) was 5.30±2.30 days[8]. The present study (100 patients with TUAEP) showed that the mean operation time was 117.38±48.66 minutes. The mean catheter time was 2.81±0.95 days, and the mean LOS was 2.81±0.95 days. Gosrisirikul reported a comparison of HoLEP versus B-TUEP outcomes (using the same technique as TUAEP) in BPH. The outcomes show that HoLEP requires longer operative time, catheterization time, and LOS. Several studies have shown TUERP to be a safe and feasible treatment for BPH with few complications[7-10]. The present study did not reveal a statistically significant difference in early complications between the two groups. Still, late complications, including the urethral stricture, were shown to occur in 8.0% of S-TUAEP, which may be caused by more traction during enucleation when compared with M-TUAEP, which has early mucosal release at the bladder neck. All patients had correct urethral stricture by urethral dilatation. Urinary incontinence was significant in M-TUAEP (6.0%), possibly due to more extensive resection at the bladder neck in the early step. Still, all cases experienced spontaneous recovery of continence within 1 to 3 months. Sa-nguancharoenpong studied the association of pyuria post-TUAEP. The risk factors for urinary tract infection after TUAEP include postoperative pyuria greater than 100/HPF, diabetes mellitus, and preoperative bacteriuria[11].

Conclusion

The present study reported no statistically significant difference in perioperative outcomes between S-TUAEP and M-TUAEP However, the TUAEP technique in the present study is one option for the surgical treatment of prostate hyperplasia because of less blood loss, shorter

Table 3 Comparison of functional outcomes between Standard TUAEP and Modified TUAEP

Data	IPSS S-TUAEP (n=50) Median (min, max)	IPSS M-TUAEP (n=50) Median (min, max)	p-value	QOL S-TUAEP (n=50) Median (min, max)	QOL M-TUAEP (n=50) Median (min, max)	p-value	Qmax S-TUAEP (n=50) Mean± S.D.	Qmax M-TUAEP (n=50) Mean± S.D.	p-value	PVR S-TUAEP (n=50) Mean± S.D.	PVR M- TUAEP (n=50) Mean± S.D.	p-value
Pre-operative day	18 (6, 35)	22 (9, 35)	0.02	4 (2, 6)	5 (3, 6)	0.00	8.29± 3.30	7.27± 4.91	0.23	93.30± 74.66	168.46± 156.56	0.00
Postoperative 1 month	5.5 (1, 16)	5 (1, 17)	0.99	2 (0, 3)	1 (0, 4)	0.02	20.48± 8.23	20.15± 8.92	0.84	37.20± 33.76	52.10± 38.79	0.04
Postoperative 2 month	5 (1, 12)	3 (1, 12)	0.26	1 (0, 4)	1 (0, 3)	0.00	21.25± 8.21	20.88± 8.67	0.83	30.88± 24.34	43.60± 42.09	0.06
Postoperative 3 month	4 (1, 19)	3 (1, 14)	0.03	1 (0, 4)	0 (0, 3)	0.52	20.33± 7.88	19.93± 7.85	0.80	33.04± 29.81	36.42± 32.79	0.59
Postoperative 6 month	4 (1, 13)	2 (0, 9)	0.01	1 (0, 3)	0 (0, 2)	0.14	22.15± 7.18	20.16± 7.46	0.17	36.74± 46.97	32.48± 32.65	0.60
Postoperative 12 month	2 (0, 12)	2 (0, 22)	0.69	1 (0, 4)	0 (0, 3)	0.00	21.03± 6.33	23.68± 15.86	0.28	23.64± 32.34	26.30± 29.83	0.67
Postoperative 18 month	2 (1, 11)	2 (1, 8)	0.35	1 (0, 2)	0 (0, 2)	0.04	22.30± 6.33	22.44± 6.25	0.91	16.12± 17.75	24.10± 28.03	0.09
Postoperative 24 month	2 (1, 6)	2 (1, 5)	0.26	1 (0, 2)	0 (0, 2)	0.01	21.87± 7.03	22.24± 6.97	0.78	17.72± 20.51	22.84± 25.94	0.27

TUAEP=Transurethral Anatomical Enucleation of Prostate, Hb=Hemoglobin, Hct=Hematocrit, IPSS=International Prostate Symptoms Score. QOL=Quality of Life, Q max=Maximum Flow Rate, PSA=Prostate Specific Antigen, LUTS=Lower Urinary Tract Symptoms. S.D.=standard deviation, gm=gram, ml=milliliter, ng/ml=nanogram per milliliter

Table 4 Comparison of pre-operative and post-operative outcomes of 100 TUAEP cases

Data	IPSS (n=100) Median (min, max)	QOL (n=100) Median (min, max)	Qmax (n=100) Mean±S.D.	PVR (n=100) Mean±S.D.	p-value
Pre-operative day	20 (6, 20)	4 (2, 6)	7.77±4.20	130.88±127.74	
Postoperative 1 month	5 (1, 17)	1 (0, 4)	20.32±8.54	44.65±36.94	0.00*
Postoperative 2 month	4 (1, 12)	1 (0, 4)	21.06±8.40	37.24±34.80	<0.01*
Postoperative 3 month	4 (1, 19)	1 (0, 4)	20.13±7.83	34.73±31.22	<0.01*
Postoperative 6 month	3 (0, 13)	1 (0, 3)	21.15±7.35	34.61±40.30	<0.01*
Postoperative 12 month	2 (0, 22)	1 (0, 2)	22.37±12.18	24.97±30.98	<0.01*
Postoperative 18 month	2 (1, 11)	1 (0, 1)	22.37±6.26	20.11±23.68	<0.01*
Postoperative 24 month	2 (1, 6)	0 (0, 1)	22.05±6.97	20.28±23.41	<0.01*

TUAEP=transurethral anatomical enucleation of prostate, Hb=hemoglobin, Hct=hematocrit, IPSS=international prostate symptoms score, QOL=quality of life, Q max=maximum flow rate, PSA=prostate specific antigen, LUTS=lower urinary tract symptoms, S.D.=standard deviation, gm=gram, ml=milliliter ng/ml=nanogram per milliliter, *Comparison with preoperative data

hospital stays, improved symptoms, enhanced quality of life, and fewer complications, as evidenced by 2-year follow-up outcomes when compared with the preoperative data. However, the TUAEP technique requires a larger amount of data with randomized controlled trials for comparison with standard TURP and HoLEP, as well as to observe the long-term consequences.

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Conflict of interest

The authors declare no conflicts of interest.

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