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Comparison between bipolar transurethral enucleation versus bipolar transurethral resection of the prostate from 60 to 100 gm: A prospective randomized study

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Abstract

Background: Recent technological advancements have resulted in the development of enucleation methods for benign prostatic hyperplasia (BPH), which use several laser and plasma techniques. The objective of this study was to evaluate and contrast the effectiveness and safety of bipolar transurethral resection (B-TURP) and bipolar transurethral enucleation (B-TUEP) procedures for prostates ranging in size from 60 to 100 grams.

Methods: This prospective randomized study was carried out on 40 patients with benign prostatic enlargement ranged from 60 to 100 gm and indicated for surgical intervention. This study included unsatisfied patients with the quality of life (QoL) because of the lower urinary tract symptoms (LUTS) despite pharmacological treatments, patients with recurrent urinary tract infection (UTI), refractory urinary retention, recurrent attacks of hematuria or significant post-void residual urine (PVR) above 200 ml. These patients were randomly divided into two equal groups; the odd numbers were for patients in Group A who were candidate for B-TURP, while the even numbers were for patients in Group B who were candidate for B-TUEP.

Results: In the B-TURP group, the duration of the operation was considerably reduced, and the amount of irrigation fluid used during the surgery was much lower, with a high level of statistical significance ($p<0.001$). The decrease in hemoglobin levels after surgery was more pronounced in the B-TURP group, and this difference was statistically significant ($p<0.001$). The duration of catheterization and the length of hospitalization were significantly shorter in the B-TUEP group ($p<0.001$). There were no significant statistical differences seen between the two groups in terms of the improvement in postoperative IPSS and QOL ratings at 1, 3, and 6 months. The maximum flow rate (Qmax) measured at 3 months after the surgical procedure was considerably higher in the B-TUEP group (P=0.033).

Conclusions: B-TUEP is an effective procedure with significant improvement in postoperative Qmax and a safe theraputic option of prostatic enlargement between 60 to 100 gm as it was associated with shorter catheterization time and hospital stay with less hemoglobin drop postoperatively. Both B-TURP and B-TUEP had statically significant improvement in IPSS and QoL scores in patients with prostatic enlargement between 60 to 100 gm.

Keywords: Bipolar transurethral enucleation, B-TURP, BHP, LUTS

Introduction

Benign prostatic hyperplasia (BPH) is a prevalent condition that affects about 50% and 90% of males aged 60 and 85 years, respectively [1]. Lower urinary tract symptoms (LUTS) are a common clinical complaint in males that is often related with BPH [2]. LUTS often have a detrimental influence on the overall QoL and may impede the performance of everyday tasks [3].

The medical management of LUTS related to BPH may fail and the need for the surgical management is occasionally needed [4]. Determining the most suitable surgical treatment depends on numerous factors including patient history, the proficiency of the surgeon present and the accessible technologies. The size of the prostate has also been a crucial factor in deciding the appropriate surgical procedure for the patient [5].

The only method of treating BPH was open prostatectomy until the introduction of transurethral resection of the prostate (TURP) in the 1930s [6]. Monopolar transurethral resection of the prostate (TURP) is the most accepted and most effective therapy for BPH [7].

Currently, B-TURP of the prostate (TURP) is considered more advantageous than monopolar TURP because it offers a safer peri-operative experience, with benefits such as the removal of TUR-syndrome and decreased rates of clot retention and blood transfusion. Furthermore, bipolar TURP was linked to reduced irrigation and catheterization duration, resulting in a shorter hospital stay [8].

Bipolar Transurethral Enucleation of the Prostate (B-TUEP) is a suggested procedure that aims to combine the benefits of bipolar electrocautery with the higher effectiveness of enucleation compared to resection [9].

It has been demonstrated that the bipolar enucleation is easier and more efficient for the large prostate [10, 11]. However, many studies up till now didn't prove a significant difference between the two techniques in management of the small size prostate [12, 13].

The process of enucleation is more complex, requiring a longer learning curve and the need for morcellation after enucleation may be considered as a limitation because of the increased overall operative time and the associated risk of the injury of the bladder mucosa which may occur during morcellation of enucleated tissue by incidental aspiration of the bladder wall [14].

The objective of this study was to evaluate and compare the effectiveness and safety of B-TURP (B-TURP of the prostate) and B-TUEP (Bipolar transurethral enucleation of the prostate) procedures in patients with prostatic enlargement ranging from 60 to 100 grams.

Patients and Methods

This prospective randomized study was carried out on 40 patients aged from 53 to 74 years old, males, who had prostate size ranged from 60 to 100 gm and indicated for surgical intervention. This study included unsatisfied patients with QoL because of LUTS despite pharmacological treatments, patients with recurrent urinary tract infection (UTI), refractory urinary retention, recurrent hematuria or significant PVR (above 200 ml).

The study was done from March 2022 to March 2023 after approval from the Ethical Committee of Tanta University Hospitals, Tanta, Egypt with institutional review board approval (Number: 33961/7/20). An informed written consent was obtained from the patients.

Exclusion criteria were patients with abnormal digital rectal examination, suspected prostate cancer like elevated PSA above the normal for age adjusted range, prostatic volume less than 60 or more than 100 gm, presence of prostatic hypoechoic lesion by transrectal ultrasound, associated urethral and/or urinary bladder pathology.

Randomization

These patients were randomly divided into two equal groups; the odd numbers were for patients in Group A who were candidate for B-TURP, while the even numbers were for patients in Group B who were candidate for B-TUEP. (Block randomization).

All patients underwent a comprehensive assessment, which included: obtaining their medical history, conducting a thorough physical examination, and performing various laboratory tests. These tests encompassed urine analysis with culture and sensitivity as needed, complete blood count (CBC), prothrombin time and activity (PT and PA), international normalized ratio (INR), partial thromblastin time (PTT), liver and renal function tests, prostate-specific antigen (PSA) level measurement, as well as fasting and postprandial blood sugar tests (FBS and PPBS). Radiological evaluation included abdominal-pelvic ultrasound for assessment of the kidneys and the bladder and for estimation of the PVR urine.

The transrectal ultrasound (TRUS) was used for more accurate estimation of the prostate size and full scanning of prostate. Uroflowmetry study was done to determine the pattern of voiding, voided volume and flow time for cases not in retention.

Prophylactic antibiotic (third generation cephalosporin) was given at time of anesthesia induction).

Equipment

Fig 1: Cystoscope-Urethroscope Sheath, 22 Fr (Karl Storz 27026B) with Karl Storz HOPKINS® Forward-Oblique Telescope 30° and Karl Storz Telescope bridge

Fig 2: Karl Storz resectoscope Sheath, 26 Fr, rotating inner sheath with ceramic insulation, with Obturator, STEMA One-Stem Working element.

Fig 3: LUMENIS VersaCut™ Tissue Morcellator System (Tissue morcellator Control box and sterile tubing) and reusable handpiece and blade set

Fig 4: Nephroscope (Karl Storz HOPKINS® wide-angle straight forwards telescope with Endoscope adapter) and Karl Storz resectoscope Sheath, 26 Fr

Electrocautery device (Karl Storz Autocon II 400 Tuttlingen, Germany), normal Saline 0.9%), bipolar one-stem resection loop and mushroom-like electrode and Ellik`s Evacuator were used.

The patient received spinal anesthesia and was positioned in the lithotomy position. Both methods were executed using 0.9% normal saline as the irrigating solution. The bipolar processes were executed using a power setting of 200W for cutting and 100W for coagulation.

Group A (B-TURP)

A bipolar resectoscope is a medical instrument used for surgical procedures. The sheath may be inserted into the bladder using either the blunt tip or the visualizing obturator. The resectoscope was introduced into the bladder with the use of video-assisted guiding. The bipolar resection loop was used to do prostate resection. The first step was resecting the median lobe till reaching the surgical capsule. Subsequently, the resection began at the bladder neck and extended towards the proximal region of the verumontanum.

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Group B (B-TUEP)

Longitudinal incisions were performed at the 5 and 7 o'clock locations, as well as the 12 o'clock position, extending from the bladder neck to the proximal part of the verumontanum using a loop instrument resembling a mushroom. Two longitudinal deep grooves served as the boundaries between the median lobe and the two lateral lobes.

Subsequently, the mucosa around the apical adenoma was cut all the way around, and the grooves were made deeper until they reached the surgical capsule. The surgical capsule was dissected in a retrograde manner from the apex of the prostate towards the bladder using the resectoscope beak and loop. Both the lateral lobes and central lobes were removed during the dissection.

The loop was used to effectively separate the adenoma from the surgical capsule by cutting off the adhesive fibers between the lobe and the capsule as needed. The exposed supply veins and areas of bleeding on the surface of the capsule were detected and cauterized. This operation advanced towards the bladder neck to fully separate each lobe from the capsule, and to push the bladder neck into the urine bladder. The excised tissue was extracted using tissue morcellation.

Prior to commencing morcellation, hemostasis was performed due to the crucial need of a distinct endoscopic field. The cutting blades of tissue morcellator were inserted into the working channel of an offset nephroscope. The nephroscope was effortlessly attached to the outside sheath of the current resectoscope utilizing the endoscope adapter. The bladder was enlarged during the process of morcellation, which included passing fluid through both the inflow ports of the resectoscope and nephroscope. Depressing the morcellator pedal first triggers the suction mechanism of the morcellator, followed by the activation of the morcellator blades, which should be seen through the scope's end. Consistent suction maintained sufficient visibility throughout the process of morcellation and helped in effectively capturing the removed tissue. To ensure safety during morcellation, the blades were not activated while in close proximity to the bladder mucosa. Additionally, the morcellator was directed upwards towards the center of the bladder when engaging the tissue. The fragmented tissue was gathered in a container designed for collecting samples. The sample was sent for histopathology analysis.

The whole of the obtained tissue was gathered for histological analysis. Following the removal of all adenoma pieces, a conventional 22 Fr 3-way Foley catheter was placed and attached to a straight drainage system. Bladder irrigation was required until the hematuria was well treated. The catheters were extracted within a period of three to five days after the surgical procedure.

Postoperative follow up

The vital signs, oxygen saturation, degree of hematuria and irrigation outflow and inflow volumes were monitored. Irrigation continued till the catheter drainage became clear. The catheter was removed after 3 - 5 days of the operation. The patients were re-evaluated 1 week after removing the urethral catheter in outpatient clinic to check result of histopathological examination and the relief of symptoms. Additional follow up visits were scheduled at 1, 3 and 6 months for recording IPSS, Qol assessment index and for detection of any complications. Uroflowmetry was done 3 months after the operation.

Statistical analysis

Statistical analysis was done by SPSS v26 (IBM Inc., Chicago, IL, USA). Quantitative variables were presented as mean and standard deviation (SD) and compared between the two groups utilizing unpaired Student's t-test. Qualitative variables were presented as frequency and percentage (%) and analyzed using the Chi-square or Fisher's exact test when appropriate. A two-tailed P value < 0.05 was considered statistically significant.

Results

Regarding the patient's age, complaint, medical history & associated comorbidities and the preoperative data there were no significant differences between the two groups. Table 1

Table 1: Comparison between the two groups as regard to patient's age, complaint, medical history

	Group (A) (n = 20)	Group (B) (n = 20)	P
Age	64.90 ± 4.855	65.20 ± 5.845	0.861
Patient's complaint			
Storage and voiding LUTS	11(55.0%)	9(45.0%)	0.654
Storage and voiding LUTS with Hematuria	1(5.0%)	0(0%)	
RUR ± hematuria	8(40.0%)	10(50.0%)	
Chronic urine retention	0(0%)	1(5.0%)	
Medical history			
DM	5(25.0%)	2(10.0%)	0.407
HTN	6(30.0%)	4(20.0%)	0.716
Ischaemic heart disease	2(10.0%)	2(10.0%)	1.000
Mild to moderate liver cirrhosis	2(10.0%)	2(10.0%)	1.000
Chest Diseases	1(5.0%)	1(5.0%)	1.000
Hypothyroidism	0(0.0%)	1(5.0%)	1.000
Preoperative data			
Preoperative HB	13.27±1.148	13.45±0.942	0.591
Serum creatinine	1.22±0.169	1.12±0.216	0.128
PSA	3.28±1.605	3.59±2.091	0.534
Prostate size	76.05±9.806	78.80±11.413	0.420
Preoperative Q max	9.2 ± 1.49	9.67 ± 1.67	0.507

Data are presented as mean ± SD or frequency (%). *: significant P value <0.05, LUTS: Lower Urinary Tract Symptoms, RUR: Robotic ureteral reconstruction, TWOC: Trial without catheter, DM: diabetes mellitus, HTN: hypertension, PSA: Prostate-specific antigen, Hb: hemoglobin.

Intraoperatively, Group (A) showed shorter operative time (p<0.001) and lower volume of irrigation fluid compared to group (B) (p<0.001). Capsular perforation, superficial mucosal bladder injury and intra-operative bleeding were distributed randomly in both groups with no statistically significant differences (p=0.33). Table 2

Table 2: Comparison between the two groups as regard to the intraoperative data and complications.

	Group (A) (n = 20)	Group (B) (n = 20)	P
Intraoperative data & complications			
Operative time (min)	66.25±7.900	101.25±10.336	<0.001*
Volume of irrigation fluid (L)	20.58±2.7	33.02±3.31	<0.001*
Capsular perforation	1(5.0%)	2(10.0%)	0.33
Urinary bladder injury	0(0.0%)	1(5.0%)	
Intra-operative bleeding not requiring blood transfusion (No.)	1(5.0%)	0(.0%)	

Data are presented as mean ± SD or frequency (%). *: significant P value <0.05.

Regarding postoperative hematuria, blood transfusion (in patients with more than 1 g/dl Hb drop) and postoperative first week follow up; there was no significant difference between two groups. Table 3

The enucleation group had significantly lower postoperative Hb decline, shorter hospital stays, and reduced time of catheterization compared to the other group (p<0.001). Table 3

Table 3: Comparison between the two groups as regard to postoperative data

		Group (A) (n = 20)	Group (B) (n = 20)	P
Hematuria				
Clear		12(60.0%)	17(85.0%)	0.145
Significant Hematuria		2(10.0%)	0(0.0%)	
Insignificant Hematuria		6(30.0%)	3(15.0%)	
Hb	Preoperative	13.27±1.148	13.45±0.942	0.591
	Postoperative	11.87±1.207	12.57±0.961	0.048*
	Change	-1.40±0.149	-0.88±0.145	<0.001*
		<0.001*	<0.001*	
Blood transfusion (in patients with more than 1 g/dl Hb drop)		2(10.0%)	0(0.0%)	0.487
Length of hospital stays		3.20±0.616	2.05±0.224	<0.001*
Duration of catheterization		4.85±0.587	3.15±0.489	<0.001*
First week follow up				
Improved symptoms		16(80.0%)	11(55.0%)	0.136
Transient urinary incontinence		2(10.0%)	5(25.0%)	
Post-micturition dribble		2(10.0%)	4(20.0%)	

Data are presented as mean ± SD or frequency (%). *: significant P value <0.05, Hb: hemoglobin.

The IPSS & QoL scores were postoperatively significantly improved in both groups compared to the preoperative ones but both groups showed no difference between each other. While the Q-max improvement was a significantly higher in B-TUEP group (P=0.033). Table 4

Table 4: Comparison between the two groups as regard to patient's IPSS

	Group (A) (n = 20)	Group (B) (n = 20)	P
IPSS			
Preoperative	27.30±3.614	28.00±3.866	0.558
After 1 month	4.80±1.240	4.25±0.967	0.146
Change	-21.20±1.240	-21.75±0.967	
	<0.001*	<0.001*	
After 3 months	3.90±0.968	3.60±0.754	0.217
Change	-22.10±0.968	-22.40±0.754	
	<0.001*	<0.001*	
After 6 months	3.70±1.031	3.55±1.050	0.507
Change	-22.30±1.031	-22.45±1.050	
	<0.001*	<0.001*	
QOL			
Preoperative	4.45±0.510	4.50±0.688	0.560
After 1 month	1.35±0.489	1.25±0.639	0.683
Change	-2.65±0.489	-2.75±0.639	
	<0.001*	<0.001*	
After 3 months	1.25±0.444	0.95±0.510	0.061
Change	-2.75±0.444	-3.05±0.510	
	<0.001*	<0.001*	
After 6 months	0.90±0.447	0.90±0.553	0.971
Change	-3.10±0.447	-3.10±0.553	
	<0.001*	<0.001*	
Q max			
After 3 months	19.08±2.248	23.40±9.407	0.033*

Data are presented as mean ± SD or frequency (%). *: significant P value <0.05, IPSS: the International Prostatic Symptoms Score, QOL: quality of life.

The postoperative complications were comparable between the two groups.

Discussion

EAU guideline considered B-TURP and B-PKEP are valid options for surgical treatment of the enlarged prostate in patients with moderate-to-severe LUTS [15]. Up till now, controversies still present whether B-TURP or B-TUEP should be the standard surgical treatment of BPH [12, 13]. Therefore we did this study to try to find our recommendations.

In this study, the operative time in B-TUEP (101.2 min) group was significantly longer than B-TURP (66.2 min) group (p<0.001). This finding was also detected by Yucong Zhang *et al*. [14] as they reported that the enucleation procedure had longer mean operative time when compared with bipolar resection time with p=0.0001 as the enucleation required additional time for morcellation of the enucleated tissue and it needs a longer learning curve. On the other hand, Davide Arcaniolo *et al*. [12] concluded that there was no difference in terms of operative time between the two types of the operations with p=0.75.

In our trial, the mean intraoperative volume of irrigation fluid in B-TURP group was 20.6 liters while in B-TUEP group it was 33 liters with high statically significant difference (p<0.001). This finding was also detected by Ibrahim, M. E. S. M. *et al*. [16] as they reported that The average amount of intraoperative irrigation fluid was substantially greater in the plasmakinetic enucleation of the prostate (PKEP) group, with a mean of 35.1 liters, compared to the plasmakinetic resection of the prostate (PKRP) group, which had a mean of 33.1 liters (P=0.004).

Regarding the intra-operative complications, we reported one case of capsular perforation and another case of significant intra-operative bleeding in B-TURP group while B-TUEP group exhibited capsular perforation in two cases and superficial mucosal bladder injury in one case with no significant difference between the two groups (P=0.33). Ibrahim, M. E. S. M. *et al*. [16] also reported the occurance of capsular perforation in 2 (6.9%) cases in the enucleation group and in one (3.4%) case in the resection group with no significant difference (P=0.64) which is concomitant with our results. In contrast, Yang, Chong-Yi, *et al*.(13) reported capsular perforation in 6 (1.88%) cases versus 2 (0.75%) cases in TURP and TUEP groups respectively (P= 0.028). The explanation of the lower incidence of perforation in B-TURP in The reason for our findings may be because TURP is often not prolonged to the fibers of the capsule owing to concerns about capsular rupture and extensive venous hemorrhage.

During assessment of the postoperative haemoglobin drop, we found that the patients underwent resection had a statistically significant drop in their post-operative Hb concentration compared to the patients in group (B) (p<0.001). Similarly, Yucong Zhang *et al*. [14] concluded that the enucleation group exhibited lower hemoglobin loss than was observed in the resection group. This can be explained by the combination of blunt dissection with plasma electrode coagulation in B-TUEP, which was convenient for the cessation of subcapsular haemorrhage.

In the present study, postoperative blood transfusion was needed in two cases (10%) in the resection group while no one in the enucleation group had blood tranfusion. In a randomized controlled study conducted by Zhu, Lingfeng, *et al*. [17], it was shown that just one patient (2.5%) in the B-TURP group needed a blood transfusion owing to substantial bleeding, but no such cases were recorded in the PKEP group. The disparity in the need for blood transfusion might perhaps be attributed to the limited sample size of our research.

When looking to the duration of hospital stay in our trial, it was shorter in B-TUEP (2.05 days) group than B-TURP (3.2

days) group with high statistically significant difference (p<0.001). Similar to our results, both Zhu, Lingfeng, *et al.* [17] and Jiang Y, *et al.* [18] confirmed that postoperative hospital stay was also shorter in the PKEP group.

Additionally, among our patients, the duration of catheterization in patients underwent B-TUEP was shorter than that of the B-TURP patients (3.15 days vs. 4.85 days) (p<0.001). This finding was concomitant with the results of a prospective comparative study by Al-Radhi, M. Abdulwahab, *et al.* [19] as they reported that the B-TUEP group had shorter catheterization time than B-TURP group (4.3 days vs. 5.6 days) where P=.032 and this can be explained by less intraoperative bleeding in B-TUEP patients that leads to less bladder irrigation time and consequently shorter catheterization time.

Our research found that there was a statistically significant improvement in both groups when comparing the preoperative and 1, 3, and 6 months postoperative IPSS and QoL scores evaluations. However, there were no significant statistical differences seen between the two groups in terms of the average change value at each subsequent time point of evaluation.

This improvement in IPSS and QOL in the present study were in agreement with the results of the systematic review and meta-analysis by Wroclawski, Marcelo Langer, *et al.* [20].

When looking to the Qmax after 3 months, there were statistically significant differences between the two groups as the enucleation group had higher values (23.4 mL/s) than the resection group (19 mL/s) where P=0.033. A study by Palaniappan, Sundaram, *et al.* [21] showed that the improvement in Qmax was significantly better for the enucleation group (21.1 mL/s vs. 17.1 mL/s, p< 0.01) which is in agreement with our trial.

During assessment of the post-operative complications in our trial, B-TURP group showed complications in 4 cases including hematuria with clot retention in one case, transient urinary incontinence with recovery within 3 months in two cases and Epididymo-orchitis with UTI in one case only while in B-TUEP patients the complications were recorded in 6 cases as hematuria with clot retention in one case and transient urinary incontinence with recovery within 3 months in 5 cases and there was no statistically significant difference between the two groups (P=0.375). In contrast, some authors [21] reported that A notably greater proportion of individuals had urine incontinence after undergoing bipolar enucleation. This may be attributed to the need of doing a more thorough dissection in the area around the external sphincter when identifying the cleavage plane in the enucleation process.

Finally, the bipolar enucleation procedure is a challenging technique with a relatively longer learning curve and it has some advantages over the bipolar resection technique. However, our study has limitations in the form of the small number of the patients and the short follow up term. Therefore, multi-center RCTs with larger sample size and longer follow-ups are still needed.

Conclusions

B-TUEP is an effective procedure with significant improvement in postoperative Qmax and a safe theraputic option of prostatic enlargement between 60 to 100 gm as it was associated with shorter catheterization time and hospital stay with less hemoglobin drop postoperatively. Both B-TURP and B-TUEP had statically significant improvement in IPSS and QoL scores in patients with prostatic enlargement between 60 to 100 gm.

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Conflict of Interest: Nil.

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