Print ISSN 1110-208X.
Online ISSN 2357-0016

Original article

Monopolar Transurethral Resection of the Prostate versus Bipolar Resection for Mild to Moderate Benign Prostatic Enlargement: A Randomized Controlled Study

Hassan M. Youssef, Tarek M. El Karamany, Basheer N. El Mohammady, Amr M. El Dakhakhny, Ahmed A. Abd El Fatah

Urology Department, Faculty of Medicine Benha University, Egypt.

Corresponding to:
Dr. Hassan M. Youssef.
Urology Department, Faculty of Medicine Benha University, Egypt.
Email: hassantabl2020@gmail.com

Received:
Accepted:

Abstract:

Objective: To compare the safety and efficacy of monopolar transurethral resection of the prostate (M-TURP) versus bipolar transurethral resection of the prostate (B-TURP) in patients with benign prostatic hyperplasia (BPH) and prostate volumes between 30 and 80 ml scheduled for endoscopic resection. **Methods:** In this prospective, randomized, parallel-group study, 120 patients with prostate volumes >30 ml and ≤80 ml were enrolled. Participants were randomly assigned into two equal groups: Group A (control) underwent M-TURP, while Group B (study) received B-TURP. All patients underwent clinical evaluation, including preoperative transrectal ultrasound for prostate volume measurement, with intraoperative documentation of resection time, total operative duration, and weight of resected tissue. **Results:** Quality of life (QoL) scores at 1 and 6 months postoperatively were significantly improved in Group B compared with Group A (P = 0.006 and 0.003, respectively). Maximum urinary flow rate (Qmax) at 1 and 6 months was significantly higher in Group B (P = 0.002 and <0.001). International Prostate Symptom Score (IPSS) and post-void residual urine (PVRU) in 1 and 6 months were significantly lower in Group B (P < 0.05). Postoperative hemoglobin decline was also significantly less in Group B compared with Group A (P < 0.001). **Conclusions:** B-TURP provided superior safety and faster recovery compared with M-TURP for prostates 30–80 mL, while maintaining equivalent efficacy.

Keywords: Prostate Volume; Benign Prostatic Hyperplasia; TURP.

Introduction

Benign prostatic hyperplasia (BPH) is one of the most prevalent urological disorders affecting aging men, with incidence rising steadily with advancing age. BPH is characterized by benign prostatic enlargement (BPE), which may cause mechanical obstruction at the bladder neck, leading to bladder outlet obstruction (BOO) and lower urinary tract symptoms (LUTS) such as weak urinary stream, hesitancy, urgency, and incomplete bladder emptying [1-3]. The prevalence of LUTS and BOO increases linearly with age, often resulting in complications such as urinary tract infections, bladder calculi, hydronephrosis, and, in severe cases, renal impairment, all of which substantially impair quality of life (QoL) [4, 5].

Management strategies for BPH are guided by symptom severity and the presence of complications, and range from conservative approaches such as watchful waiting and pharmacotherapy to surgical interventions, including minimally invasive procedures, transurethral resection of the prostate (TURP), and open prostatectomy [6]. Conventional monopolar TURP (M-TURP) has long been considered the gold standard surgical option for symptomatic BPH. However, M-TURP carries risks such as intraoperative bleeding, transurethral resection syndrome (TURS), and postoperative complications, particularly in patients with large prostates, bleeding diatheses, or those receiving anticoagulant therapy [7, 8]. Although advances in surgical techniques have reduced mortality rates to 0.1%, morbidity remains notable, with reported complication rates of up to 11.1% [9].

The introduction of bipolar TURP (B-TURP) represents a significant technological advancement. Unlike M-TURP, bipolar systems confine the electrical current within the resectoscope, enabling the use of normal saline irrigation instead of hypotonic electrolyte-free solutions, thereby eliminating the risk of hyponatremia and TURS [10, 11]. Furthermore, B-TURP provides superior hemostasis, permits longer resection times, and has demonstrated comparable efficacy with potentially fewer perioperative complications compared to M-TURP [12].

This study aims to compare the safety and efficacy of M-TURP and B-TURP in patients with BPH and prostate volumes of 30–80 ml, and to determine whether B-TURP offers superior outcomes that justify its adoption as a potential new gold standard for surgical management.

Subjects and Methods

This prospective, randomized, parallel-group trial was conducted at the Urology Department, Benha University Hospitals, between 2021 and 2023, and enrolled 120 patients with prostate volumes >30 ml and ≤80 ml. Ethical approval was obtained (MS 25-7-2021), and informed written consent was secured from all participants.

Inclusion criteria: Male patients aged 50–80 years with prostate volume 30–80 ml presenting with one or more of the following: refractory urinary retention, hematuria, bladder stone, elevated serum creatinine, or vesicoureteral reflux.

Exclusion criteria: Patients with elevated PSA until prostatic malignancy was excluded by TRUS-guided biopsy; bladder or prostatic tumors; prior prostatic or urethral surgery; neurological disorders; urethral stricture; bleeding tendency; or contraindications to anesthesia.

Randomization and grouping

Cases were randomly allocated into two equal groups through sealed opaque envelopes and computer-generated randomization. Group A (M-TURP) comprised sixty cases who underwent M-TURP, and Group B (B-TURP) comprised sixty cases who underwent B-TURP.

Outcomes

Primary endpoint: Improvement in functional outcomes measured by International Prostate Symptom Score (IPSS), maximum urinary flow rate (Qmax), and post-void residual urine

(PVRU) at 6 months postoperatively. **Secondary endpoints:** Operative parameters (resection time, total operative duration, resected tissue weight), perioperative safety outcomes (hemoglobin drop, transfusion rate, TUR syndrome, complications), and postoperative recovery measures (catheterization time, hospital stay, and QoL score).

Sample size calculation:

Sample size was calculated using OpenEpi v3, based on IPSS means reported by Elsakka et al. [13], who demonstrated that the mean International Prostate Symptom Score (IPSS) at 3 months was 16.6 ± 2.2 in the B-TUVP group and 18.8 ± 2.0 in the M-TURP group. Using these data, with a confidence level of 95%, a margin of error of 5%, study power of 90%, and a 1:1 allocation ratio, the minimum required sample size was forty patients (20 in each group). To improve statistical reliability and compensate for potential dropouts, the sample size was expanded to 120 patients.

Clinical evaluation and preoperative assessment

All cases underwent complete history taking (age, sex, BMI) and a physical examination, including a focused neurological evaluation. Data collected included co-morbidities, preoperative PV measured by transrectal ultrasound (mL), resection time (minutes), total operation time, weight of resected tissue (g), volume of irrigation fluids used during the procedure, and the number of cases requiring vasopressor support [14].

The following assessments were conducted: urinalysis; ultrasound of the kidneys, ureters, and bladder including PV measurement; serum PSA (considering levels <4 ng/ml as normal) [15], international prostate system score (IPSS) evaluation (0–7= mild, 8–19 = moderate, 20–35 = severe) [16], post-void residual urine volume (PVRU); digital rectal examination; TRUS; uroflowmetry (Q-max test); abdominal and pelvic ultrasound with post-void residual measurement. TRUS-guided biopsy was performed if PSA exceeded 4 ng/dl. The QOL score (scale 0–6) was also documented.

Routine laboratory investigations included complete blood count (Hb, WBCs, platelets), coagulation profile (PT and INR), fasting and postprandial blood sugar, kidney and liver function tests, and electrolytes (serum sodium and potassium).

Operative technique:

All surgeries were conducted under spinal anesthesia. Glycine 5% or distilled water was utilized as the irrigant during M-TURP, while saline was used during B-TURP. Postoperatively, all cases received continuous bladder irrigation until the urine cleared, and hemoglobin and hematocrit levels were assessed immediately after surgery. Catheters were removed once urine was completely clear, and PVRU was measured to confirm adequate bladder emptying before discharge. Intraoperative adverse events, including bleeding, TURS, and clot retention, were documented.

M-TURP were carried out using a 26Fr Karl Storz continuous flow resectoscope with an 8 mm standard loop electrode (Valleylab Force EZ unit, Boulder, CO, USA) set to 140 W for cutting and 40 W for coagulation.

B-TURP was done via a 26Fr Karl Storz continuous flow resectoscope with a Storz bipolar electrode (EMED ES-Vision device, EMED, NY, USA) set at 350 W for cutting and 120 W for coagulation.

Technique of TRUP:

The case was positioned in lithotomy, and a diagnostic urethrocystoscopy was first performed. Prophylactic coagulation was applied at the key prostatic artery points — 5, 7, 2, and 10 o’clock — followed by a meticulous mental mapping of vital anatomical landmarks. These included the ureteral orifices, the prostate's dimensions, the verumontanum, and the external urethral sphincter, all of which guided the subsequent resection. The bladder neck was carefully resected, followed by the removal of the adenoma in quadrants. Once excised, hemostasis was confirmed, and the case was placed under continuous irrigation post-surgery [17].

Intraoperative observations included tracking adverse events like clot retention, bleeding-related blood transfusions, and fluctuations in Hb levels. Estimated blood loss and the need for transfusions were monitored, particularly when Hb fell below 9 g/dL or if hemodynamic stability was threatened, as assessed by the anesthetist. Capsular perforation and the volume of irrigant used were also noted. The occurrence of TURS was carefully documented, defined as a significant drop in serum sodium (below 125 mmol/L) alongside at least two associated symptoms such as nausea, vomiting, bradycardia, hypotension, angina, anxiety, or confusion [18]. The time spent with the catheter in place and total hospitalization days were documenetd. Late-stage postoperative adverse events, including bladder neck stenosis, UTIs, secondary hemorrhage, and strictures, were monitored closely. Follow-up evaluations were scheduled at 1, 3, and 6 m after surgery, during which the IPSS, QOL, Qmax, PVRU, and any adverse events were assessed.

Statistical analysis:

Data analysis was carried out using SPSS v28 (IBM Inc., Armonk, NY, USA). Quantitative data were exhibited as mean ± standard deviation (SD) and compared between groups using the unpaired Student's T-test. Categorical variables were expressed as frequencies and percentages and analyzed using the Chi-square test or Fisher's exact test as appropriate. Paired sample t-tests were applied for comparisons of correlated samples. Statistical significance was set at a two-tailed P< 0.05.

Results

Out of 157 cases initially assessed for eligibility, 23 were excluded due to non-compliance with the established criteria, and 14 declined participations. The remaining ones were allocated into two groups, each consisting of 60 participants. No patients were lost to follow-up or dropped out during the study period; therefore, all 120 randomized participants completed the trial and were included finally. **Figure 1**

The demographic characteristics, such as age, weight, and associated comorbidities, were similar between the groups. **Table 1**

In terms of perioperative data, group B had significantly decreased catheter time, volume of continuous irrigation, and hospital stay as opposed to group A (P<0.001). However, PV, resection time, operation time, and resected prostate weight were comparable between the two groups. **Table 2**

Postoperative sodium levels were significantly decreased in group A as opposed to group B (P<0.001), although preoperative sodium levels were comparable between the groups. In group A, the postoperative sodium level was significantly reduced as opposed to preoperative levels (P<0.001), while group B exhibited no significant difference in sodium levels. Both groups had comparable preoperative and postoperative serum creatinine levels. Regarding Hb levels, group A had significantly decreased postoperative Hb as opposed to group B (P<0.001), with comparable levels preoperatively. In group A, postoperative Hb was significantly decreased than preoperative levels (P<0.001), while in group B, there was no significant difference. Furthermore, the decline in Hb was significantly decreased in group B (P<0.001). Postoperative hematocrit (HCT) levels were significantly decreased in group A as opposed to group B (P<0.001), while preoperative HCT levels were comparable between the groups. Both groups exhibited significant declines in postoperative HCT as opposed to preoperative values (P<0.001), and the decrease in HCT was significantly smaller in group B (P<0.001). **Table 3**

Preoperative values for QOL, PSA, IPSS, Qmax, and PVRU were comparable between the two groups. **Table 4**

Throughout the follow-up period, QOL scores were markedly lower in Group B compared to Group A at both 1 and 6 m (P = 0.006 and 0.003, respectively), though no statistical difference emerged at the 3-month evaluation. Similarly, Qmax values were significantly higher in Group B at 1 and 6 m (P = 0.002 and <0.001, respectively), yet remained comparable between groups at 3 m. In addition, IPSS and PVRU measurements consistently showed greater reductions in Group B across all time points (P < 0.05). Notably, both cohorts experienced significant enhancements in Qmax and substantial declines in QOL, IPSS, and PVRU when contrasted with their respective preoperative baselines (P < 0.001) at 1, 3, and 6 m. **Table 5**

With respect to adverse events, intraoperative bleeding was observed in 11 cases (18.3%) in Group A and 3 cases (5%) in Group B. Secondary hemorrhage was noted in 2 cases (3.3%) in Group A and 1 patient (1.7%) in Group B. Blood transfusions were required in 4 cases (6.7%) in Group A compared to 1 case (1.7%) in Group B. Clot retention developed in 5 individuals (8.3%) in Group A but was not encountered in Group B. Bladder neck stenosis occurred in 1 case (1.7%) within Group A, with no instances reported in Group B.

Regarding infections, UTIs were diagnosed in 4 cases (6.7%) in Group A and 2 (3.3%) in Group B. TURS manifested in 5 cases (8.3%) in Group A versus 1 case (1.7%) in Group B. Bladder perforations were documented in 4 individuals (6.7%) in Group A and 3 (5%) in Group B.

Notably, the rate of intraoperative bleeding was significantly lower in Group B compared to Group A (18.3% vs. 5%, P = 0.043). The frequencies of other complications showed no statistically significant differences between the two groups. **Table 6**

Table 1: Demographics of the enrolled cases

		Group A (n=60)	Group B (n=60)	P
Age (years)		62.67 ± 4.74	60.02 ± 4.43	**0.002***
Weight (Kg)		68.02±6.39	67.8±6.66	0.856
Comorbidities	**Yes**	22 (36.7%)	18 (30%)	0.561
	No	38 (63.3%)	42 (70%)	

Data presented as mean ± SD, or frequency (%), *: statistically significant as P <0.05

Table 2: Perioperative data of the enrolled cases

	Group A (n=60)	Group B (n=60)	P
Prostate volume (ml)	58.17 ± 10.33	55.0 ± 12.84	0.139
Resection time (min)	56.4 ± 8.13	53.78 ± 8.85	0.094
Operation time (min)	92.6 ± 11.85	91.47 ± 13.24	0.622
Catheter time (days)	3.08 ± 0.87	1.98 ± 0.87	**<0.001***
Resected prostate	30.82±4.3	31.6±4.08	0.308
Volume of continuous irrigation (mL)	5183.17±1094.18	3973.8±617.15	**<0.001***
Hospital stays (days)	6.07±1.52	2.98±0.81	**<0.001***

Data presented as mean ± SD, *: statistically significant as P <0.05.

Table 3: Sodium, creatinine, haemoglobin, and haematocrit levels of the enrolled cases

		Group A (n=60)	Group B (n=60)	P
Sodium (mEq/L)	**Preoperative**	140.95 ± 3.76	140.42 ± 3.38	0.415
	Postoperative	134.13 ± 4.28	139.37 ± 3.47	**<0.001***
	P	**<0.001***	0.096	
Serum creatinine (mg/dL)	**Preoperative**	1.0 ± 0.15	1.03 ± 0.13	0.209
	Postoperative	0.99 ± 0.16	1.02 ± 0.14	0.239
	P	0.686	0.564	
Hemoglobin (g/dL)	**Preoperative**	12.25±0.8	12.26±0.7	0.895
	Postoperative	9.13±1.21	11.89±1.33	**<0.001***
	P	**<0.001***	0.053	
Fall in Hb		3.12±0.83	0.55±0.94	**<0.001***
Hematocrit (%)	**Preoperative**	38.53±1.08	38.48±1.13	0.805
	Postoperative	34.95±1.44	36.98±1.1	**<0.001***
	P	**<0.001***	**<0.001***	
Fall in HCT		3.58±1.11	1.28±0.67	**<0.001***

Data presented as mean ± SD, Hb: hemoglobin, HCT: hematocrit *: statistically significant as P <0.05.

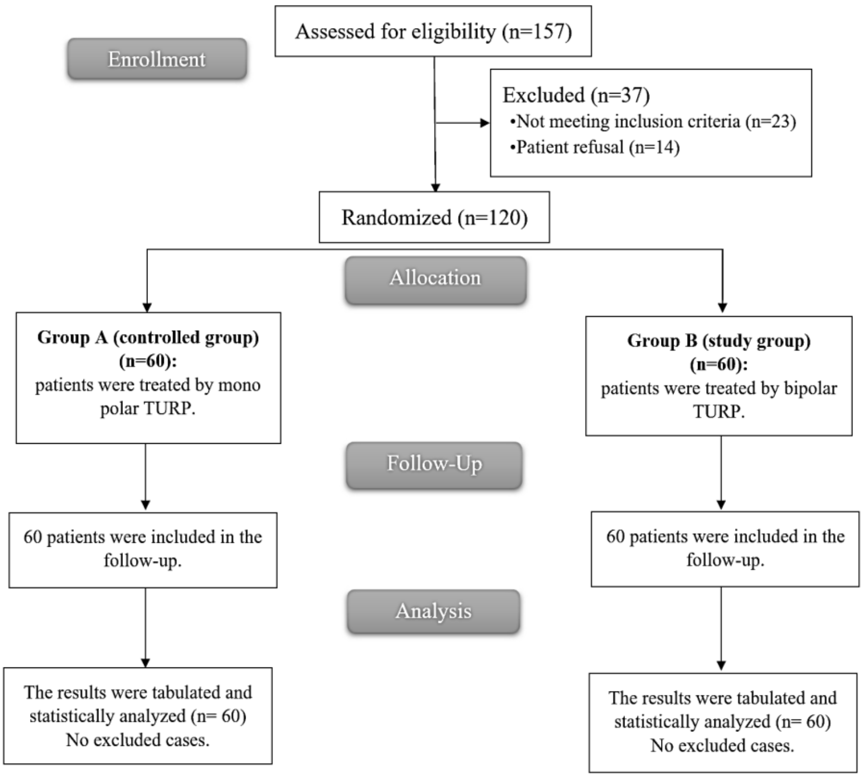

Figure 1: CONSORT flowchart of the enrolled cases

Table 4: Preoperative QOL, PSA, IPSS, Q. max and PVRU of the enrolled cases

	Group A (n=60)	**Group B (n=60)**	**P**
QOL	5.0 ± 0.8	5.03 ± 0.86	0.827
PSA	5.1 ± 0.84	5.03 ± 0.76	0.649
IPSS	27.82 ± 2.9	27.92 ± 2.44	0.838
Q. max	7.6 ± 1.17	7.42 ± 1.25	0.409
PVRU	194.07 ± 19.69	188.63 ± 17.84	0.116

Data presented as mean ± SD, QOL: quality of life, PSA: prostate-specific antigen, IPSS: international prostate system score, **PVRU: post-void residual *: statistically significant as P <0.05.**

Table 5: Follow up according to QOL, IPSS, Q. max and PVRU of the enrolled cases.

		Preoperative	**After 1 m**	**After 3 m**	**After 6 m**	**P**
QOL	**Group A (n=60)**	5.0 ± 0.8	4.05 ± 1.06	3.38 ± 1.43	3.1 ± 1.34	**P1<0.001*** **P2<0.001*** **P3<0.001***
	Group B (n=60)	5.03 ± 0.86	3.52 ± 1.02	3.13 ± 1.23	2.48 ± 0.87	**P1<0.001*** **P2<0.001*** **P3<0.001***
	P#	0.827	**0.006***	0.306	**0.003***	
IPSS	**Group A (n=60)**	27.82 ± 2.9	22.33 ± 3.9	11.57± 5.47	11.3 ± 5.33	**P1<0.001*** **P2<0.001*** **P3<0.001***
	Group B (n=60)	27.92 ± 2.44	15.15± 3.25	9.85 ± 2.61	6.62 ± 1.73	**P1<0.001*** **P2<0.001*** **P3<0.001***
	P#	0.838	**<0.001***	**0.030***	**<0.001***	
Q. max	**Group A (n=60)**	7.6 ± 1.17	10.58± 1.53	12.38± 1.76	15.93± 2.25	**P1<0.001*** **P2<0.001*** **P3<0.001***
	Group B (n=60)	7.42 ± 1.25	11.57 ± 1.8	12.97 ± 2.4	18.68± 3.98	**P1<0.001*** **P2<0.001*** **P3<0.001***
	P#	0.409	**0.002***	0.131	**<0.001***	
PVRU	**Group A (n=60)**	194.1±19.69	43.72±18.31	38.35±15.68	26.25± 5.78	**P1<0.001*** **P2<0.001*** **P3<0.001***
	Group B (n=60)	188.6± 17.84	28.77±13.71	29.65 ± 8.98	23.03±10.29	**P1<0.001*** **P2<0.001*** **P3<0.001***
	P#	0.116	**<0.001***	**<0.001***	**0.037***	

Data presented as mean ± SD, QOL: quality of life, IPSS: international prostate system score, PVRU: post-void residual *: statistically significant as P <0.05. P: P between group A and group B, P1: P between preoperative and after 1 month, P2: P between preoperative and after 3 m, P3: P between preoperative and after 6 m

Table 6: Incidence of adverse events of the enrolled cases

	Group A (n=60)	Group B (n=60)	P
Intra-operative bleeding	11 (18.3%)	3 (5%)	**0.043***
2ry Hemorrhage	2 (3.3%)	1 (1.7%)	1.00
Blood transfusion	4 (6.7%)	1 (1.7%)	0.364
Clot retention	5 (8.3%)	0 (0%)	0.057
Bladder neck stenosis	1 (1.7%)	0 (0%)	1.00
UTI	4 (6.7%)	2 (3.3%)	0.679
TUR	5 (8.3%)	1 (1.7%)	0.207
Perforation	4 (6.7%)	3 (5%)	1.00

Data presented as frequency (%), UTI: urinary tract infection, TUR: transurethral resection, *: statistically significant as P <0.05

Discussion

BPH is a leading cause of LUTS in aging men, and TURP remains a benchmark for durable relief. B-TURP was introduced to preserve efficacy while reducing dilutional hyponatremia, bleeding, and catheter-related morbidity versus M-TURP. Comparing our results with contemporary evidence clarifies where bipolar energy confers measurable advantages and where outcomes remain equivalent, thereby informing procedural choice, perioperative counselling, and service planning [19].

In our study, intraoperative bleeding and transfusion requirements were more frequent with M-TURP, whereas B-TURP showed better hemostasis. Postoperative sodium decline was evident after M-TURP but not after B-TURP. Catheterization time, irrigation needs, and hospital stay were all shorter with B-TURP. During follow-up, patients undergoing B-TURP achieved greater improvements in quality of life, urinary flow, and symptom scores, while both groups experienced significant overall gains compared to baseline.

Regarding bleeding and transfusion, external data generally support reduced blood loss with B-TURP. Fagerström et al. reported mean blood loss 472 mL with B-TURP vs 855 mL with M-TURP, and a meta-estimate by Alexander et al. [19] showed a transfusion risk ratio of 0.42 (95% CI 0.30–0.59) favoring bipolar. Several series also observed greater hematocrit declines after monopolar resection [20-22].

Regarding clot retention, findings are mixed but tilt toward fewer events with bipolar. Mamoulakis et al. [23] found clot retention significantly less frequent with B-TURP (p=0.03), translating to a number needed to harm of 20 for monopolar. Tang et al. [24] similarly noted higher clot retention with M-TURP. Other single-center trials showed overlapping ranges (e.g., 1–5 cases with bipolar vs 2–12 with monopolar; [25]; [26]).

Regarding TUR syndrome and serum sodium, evidence consistently favours bipolar. Singh et al. documented a minimal sodium change with B-TURP (~1.2 mEq/L) versus a 4.6 mEq/L decline after M-TURP (P=0.001), with some monopolar cases reaching 125 mEq/L. Meta-analyses [24, 27] reported TUR syndrome in monopolar cohorts (e.g., 13–24 cases) and none with bipolar in pooled data, while several trials demonstrated significantly smaller postoperative sodium drops at 2 h with B-TURP [28, 29], despite comparable baselines.

Regarding catheter time and hospital stay, multiple studies align with shorter catheterization and LOS after bipolar resection. Stucki et al. [30] found earlier catheter removal (2.52 vs 3.4 days) and shorter LOS (3.02 vs 3.88 days) with B-TURP. Komura et al. [25] reported shorter catheter duration (20.6 h vs 35.8 h; P=0.042) and LOS (2.4 vs 3.4 days;

P=0.045). Day-case discharge was more frequent with bipolar in Méndez-Probst et al. (7 vs 3 patients). Some datasets highlight system factors: when insurance covered longer stays, indwelling catheters correlated with extended LOS [(31)]. Compared with open surgery, bipolar consistently reduced LOS and catheter time [(32, 33)].

Regarding functional outcomes (IPSS, Qmax, PVRU, and QoL), early advantages for bipolar are reported in several studies, but medium- to long-term outcomes often converge. Fagerström et al. [(22)] observed faster recovery at 3–6 weeks favouring bipolar, yet no difference by 18 months. Stucki found similar IPSS improvements by 3 and 12 months. Autorino's 48-month follow-up likewise showed comparable symptom relief. Across procedures, large series document substantial improvements from baseline in Qmax and PVRU (e.g., Simforoosh et al. [(34)] reported mean PVRU reductions of ~86–88 mL by 3–6 months), and studies including very large prostates demonstrated parallel gains after bipolar and open/simple prostatectomy (Al-Refaey 2020; Reda 2014; Srivastava 2016).

Regarding urethral stricture and bladder neck stenosis, signals are inconsistent. Tefekli et al. [(35)] raised concern for higher stricture rates with bipolar, but subsequent analyses did not corroborate this [(36, 37)]. Among nine studies evaluating strictures/neck stenosis, only Stucki et al. [(30)] detected a higher urethral stricture rate with B-TURP (P=0.002), while pooled assessments generally showed no systematic difference.

Regarding re-intervention, meta-analytic data suggest comparable retreatment rates. Mamoulakis et al. [(23)] reported re-intervention in 9.9% after monopolar vs 14.8% after bipolar (P=0.32), indicating no statistically meaningful divergence in durability between energy modalities.

Regarding overall efficacy and safety profile, systematic reviews consistently find similar efficacy between B- and M-TURP for symptom and flow outcomes, with bipolar conferring lower risks of acute dilutional hyponatremia/TUR syndrome and signals toward less bleeding-related morbidity [(38, 39)]. Some reviews caution that evidence for reduced transfusions or clot retention, while suggestive, is not uniformly definitive [(24, 40)].

Taken together, the literature portrays B-TURP as achieving symptom and flow improvements comparable to M-TURP while reducing physiological perturbations (notably sodium shifts) and often shortening catheterization and LOS. Variability in bleeding and stricture outcomes across studies underscores the influence of technique, instrumentation, and case mix. Our findings align with this consensus and reinforce bipolar energy as a safe, efficient default for contemporary TURP practice, including in larger prostates, without compromising functional efficacy.

This study was limited by its single-center design and relatively short follow-up of 6 months, which may not capture long-term durability or late complications. The inclusion of only mild to moderate prostate volumes (30–80 mL) restricts applicability to larger glands, and blinding was not feasible, introducing potential bias. Additionally, cost-effectiveness and broader patient-reported outcomes were not assessed.

Conclusions

B-TURP demonstrated significant efficacy for cases with BPH, along with shorter catheterization times, reduced LOS, and less adverse events. B-TURP serves as a dependable alternative to open surgery, significantly diminishing associated morbidity while preserving comparable efficacy, even for large PVs.

References

1. Zubair A, Davis S, Balogun DI, Nwokeocha E, Chiedozie CA, Jesuyajolu D. A scoping review of the management of benign prostate hyperplasia in Africa. Cureus. 2022;14:311-5.

2. Vredeveld T, van Benten E, Beekmans R, Koops MP, Ket JCF, Mollema J, et al. Reliability and validity of assessment methods available in primary care for bladder outlet obstruction and benign prostatic obstruction in men with lower urinary tract symptoms: a systematic review. BMJ Open. 2022;12:562-9.
3. Lee HY, Wang CS, Juan YS. Detrusor underactivity in men with bladder outlet obstruction. Biomedicines. 2022;10:78-87.
4. Chen JL, Jiang YH, Lee CL, Kuo HC. Precision medicine in the diagnosis and treatment of male lower urinary tract symptoms suggestive of benign prostatic hyperplasia. Ci Ji Yi Xue Za Zhi. 2020;32:5-13.
5. Chughtai B, Forde JC, Thomas DD, Laor L, Hossack T, Woo HH, et al. Benign prostatic hyperplasia. Nat Rev Dis Primers. 2016;2:160-9.
6. Miernik A, Gratzke C. Current treatment for benign prostatic hyperplasia. Dtsch Arztebl Int. 2020;117:843-54.
7. Zhang J, Wang Y, Li S, Jin S, Zhang S, Zhao C, et al. Efficacy and safety evaluation of transurethral resection of the prostate versus plasmakinetic enucleation of the prostate in the treatment of massive benign prostatic hyperplasia. Urol Int. 2021;105:735-42.
8. Franco JVA, Tesolin P, Jung JH. Update on the management of benign prostatic hyperplasia and the role of minimally invasive procedures. Prostate Int. 2023;11:1-7.
9. Reich O, Gratzke C, Bachmann A, Seitz M, Schlenker B, Hermanek P, et al. Morbidity, mortality and early outcome of transurethral resection of the prostate: a prospective multicenter evaluation of 10,654 patients. J Urol. 2008;180:246-9.
10. Alexander CE, Scullion MM, Omar MI, Yuan Y, Mamoulakis C, N'Dow JM, et al. Bipolar versus monopolar transurethral resection of the prostate for lower urinary tract symptoms secondary to benign prostatic obstruction. Cochrane Database Syst Rev. 2019;12:96-9.
11. Pirola GM, Maggi M, Castellani D, Sciarra A, Rubilotta E, Gubbiotti M. A cost-benefit analysis of bipolar TURP for the treatment of bladder outflow obstruction. Res Rep Urol. 2021;13:487-94.
12. Abdulwahab Al-Radhi M, Lun LK, Safi M, Al-Danakh A, K MA-K, Al-Najar A, et al. Can bipolar transurethral enucleation of the prostate be a better alternative to the bipolar transurethral resection of the prostate?: A prospective comparative study. Medicine (Baltimore). 2021;100:25-45.
13. Elsakka AM, Eltatawy HH, Almekaty KH, Ramadan AR, Gameel TA, Farahat Y. A prospective randomised controlled study comparing bipolar plasma vaporisation of the prostate to monopolar transurethral resection of the prostate. Arab J Urol. 2016;14:280-6.
14. Karadeniz MS, Bayazit E, Aksoy O, Salviz EA, Tefik T, Sanli O, et al. Bipolar versus monopolar resection of benign prostate hyperplasia: a comparison of plasma electrolytes, hemoglobin and TUR syndrome. Springerplus. 2016;5:17-9.
15. Huang Y, Li ZZ, Huang YL, Song HJ, Wang YJ. Value of free/total prostate-specific antigen (f/t PSA) ratios for prostate cancer detection in patients with total serum prostate-specific antigen between 4 and 10 ng/mL: A meta-analysis. Medicine (Baltimore). 2018;97:249-54.
16. Lammers HA, Teunissen TAM, Bor H, Smid IS, Lagro-Janssen ALM. No relationship between the international prostate symptom score and post-void residual volume in primary care. Res Rep Urol. 2020;12:167-74.
17. El-Deen AAG, Abd-Elbaky TM, Sultan MF, Younes SF, Salama MHAE-R. Hemostatic effect of monopolar and bipolar resection of the prostate. Menoufia Med J. 2018;31:14-22.
18. Ibrahimi A, Ziani I, El Boukili El Makhoukhi Z, El Sayegh H, Benslimane L, Nouini Y. Transurethral resection syndrome: A rare complication of intraperitoneal bladder perforation during transurethral resection of bladder tumor. Urol Case Rep. 2021;34:101-5.
19. Alexander CE, Scullion MM, Omar MI, Yuan Y, Mamoulakis C, N'Dow JM, et al. Bipolar versus monopolar transurethral resection of the prostate for lower urinary tract symptoms secondary to benign prostatic obstruction. Cochrane Database Syst Rev. 2021;12:Cd009629.
20. Kong CH, Ibrahim MF, Zainuddin ZM. A prospective, randomized clinical trial comparing bipolar plasma kinetic resection of the prostate versus conventional monopolar transurethral resection of the prostate in the treatment of benign prostatic hyperplasia. Ann Saudi Med. 2009;29:429-32.
21. Chen Q, Zhang L, Fan QL, Zhou J, Peng YB, Wang Z. Bipolar transurethral resection in saline vs traditional monopolar resection of the prostate: results of a randomized trial with a 2-year follow-up. BJU Int. 2010;106:1339-43.
22. Fagerström T, Nyman CR, Hahn RG. Complications and clinical outcome 18 months after bipolar and monopolar transurethral resection of the prostate. J Endourol. 2011;25:1043-9.
23. Mamoulakis C, Schulze M, Skolarikos A, Alivizatos G, Scarpa RM, Rassweiler JJ, et al. Midterm results from an international multicentre randomised controlled trial comparing bipolar with monopolar transurethral resection of the prostate. Eur Urol. 2013;63:667-76.
24. Tang Y, Li J, Pu C, Bai Y, Yuan H, Wei Q, et al. Bipolar transurethral resection versus monopolar transurethral resection for benign prostatic hypertrophy: a systematic review and meta-analysis. J Endourol. 2014;28:1107-14.

25. Komura K, Inamoto T, Takai T, Uchimoto T, Saito K, Tanda N, et al. Could transurethral resection of the prostate using the TURis system take over conventional monopolar transurethral resection of the prostate? A randomized controlled trial and midterm results. Urology. 2014;84:405-11.
26. Demirdag C, Citgez S, Tunc B, Simsekoglu F, Can G, Onal B. The clinical effect of bipolar and monopolar transurethral resection of the prostate more than 60 milliliters. Urology. 2016;98:132-7.
27. Mamoulakis C, Ubbink DT, de la Rosette JJ. Bipolar versus monopolar transurethral resection of the prostate: a systematic review and meta-analysis of randomized controlled trials. Eur Urol. 2009;56:798-809.
28. Seif NE, Shehab HA, Elbadawy AM. Prophylaxis versus treatment against transurethral resection of prostate syndrome: The role of hypertonic saline. Anesth Essays Res. 2020;14:104-11.
29. Okuma N, Hino H, Kuroki M, Matsuura T, Mori T. Symptomatic absorption of normal saline during transurethral resection of the prostate: a case report. JA Clin Rep. 2022;8:43-9.
30. Stucki P, Marini L, Mattei A, Xafis K, Boldini M, Danuser H. Bipolar versus monopolar transurethral resection of the prostate: a prospective randomized trial focusing on bleeding complications. J Urol. 2015;193:1371-5.
31. Sugihara T, Yasunaga H, Horiguchi H, Nakamura M, Nishimatsu H, Kume H, et al. In-hospital outcomes and cost assessment between bipolar versus monopolar transurethral resection of the prostate. J Endourol. 2012;26:1053-8.
32. Kwon JS, Lee JW, Lee SW, Choi HY, Moon HS. Comparison of effectiveness of monopolar and bipolar transurethral resection of the prostate and open prostatectomy in large benign prostatic hyperplasia. Korean J Urol. 2011;52:269-73.
33. Srivastava A, Dhayal IR, Rai P. Management of large prostate gland in men with impaired renal function: Comparison of safety, efficacy and outcomes of monopolar, bipolar transurethral resection and open prostatectomy. Urol Int. 2016;96:413-20.
34. Simforoosh N, Abdi H, Kashi AH, Zare S, Tabibi A, Danesh A, et al. Open prostatectomy versus transurethral resection of the prostate, where are we standing in the new era? A randomized controlled trial. Urol J. 2010;7:262-9.
35. Tefekli A, Muslumanoglu AY, Baykal M, Binbay M, Tas A, Altunrende F. A hybrid technique using bipolar energy in transurethral prostate surgery: a prospective, randomized comparison. J Urol. 2005;174:1339-43.
36. Hueber PA, Al-Asker A, Zorn KC. Monopolar vs. bipolar TURP: assessing their clinical advantages. Can Urol Assoc J. 2011;5:390-1.
37. Sinha MM, Pietropaolo A, Hameed BMZ, Gauhar V, Somani BK. Outcomes of bipolar TURP compared to monopolar TURP: A comprehensive literature review. Turk J Urol. 2022;48:1-10.
38. Cornu JN, Ahyai S, Bachmann A, de la Rosette J, Gilling P, Gratzke C, et al. A systematic review and meta-analysis of functional outcomes and complications following transurethral procedures for lower urinary tract symptoms resulting from benign prostatic obstruction: An update. Eur Urol. 2015;67:1066-96.
39. Gomes CM, Moromizato JKM, Brandão TBV. Bipolar and monopolar transurethral resection of the prostate are equally effective and safe in this high quality randomized controled trial. Int Braz J Urol. 2021;47:145-8.
40. Foster HE, Barry MJ, Dahm P, Gandhi MC, Kaplan SA, Kohler TS, et al. Surgical management of lower urinary tract symptoms attributed to benign prostatic hyperplasia: AUA guideline. J Urol. 2018;200:612-9.

To cite this article: Hassan M. Youssef, Tarek M. El Karamany, Basheer N. El Mohammady, Amr M. El Dakhakhny, Ahmed A. Abd El Fatah. Monopolar Transurethral Resection of the Prostate versus Bipolar Resection for Mild to Moderate Benign Prostatic Enlargement: A Randomized Controlled Study. BMFJ XXX, DOI: 10.21608/bmfj.2025.387996.2432.