

Benign Prostatic Hyperplasia; Holmium Laser Enucleation versus Bipolar Transurethral Enucleation in treatment of patients with symptomatic BPH

Amr M. Lotfy, Akrm A Elmarakbi, Ahmed Mahmoud Abdelbary, Amr Medhat Massoud, Osama M. Elsyed, Maged Moustafa Fouda and Ossama Mahmoud Mohamad

Department of Urology, Faculty of Medicine, Bani-Suef University, Bani-Suef, Egypt.

***Corresponding Author: Amr M. Lotfy**

ABSTRACT

Objective: to compare the safety and effectiveness of Holmium Laser Enucleation of Prostate (HoLEP) and Bipolar Transurethral Enucleation of Prostate (B-TUEP) for management of symptomatic > 80 gm prostate over a 6-months follow-up period.

Methods: Through a randomized controlled study 80 patients were divided into two equal groups representing HoLEP and B-TUEP. Operative parameters and perioperative complications were recorded. Six months post-intervention, Patients were assessed by international prostate symptom score (IPSS) and peak urine flow rate (Qmax) with measurement of the post-voiding residual urine (PVR) and compared with the preoperative parameters.

Results: There was no significant difference between both groups in age, prostate size, PSA, Qmax, IPSS and PVR pre-intervention. Operative time and irrigation fluid volume were significantly longer in B-TUEP as well as catheterization duration and hospital stay. While resected tissue weight and complications were not significantly different between both groups. There was significant postoperative improvement in 6 months in IPSS, PVR and Qmax in both groups as compared to preoperative parameters.

Conclusions: Both B-TUEP and HoLEP effectively treat BPH, with HoLEP requiring less hospitalization, catheter indwelling and operative time.

KEYWORDS: Surgical Management, Valvular Infective Endocarditis, Mortality.

How to Cite: Amr M. Lotfy, Akrm A Elmarakbi, Ahmed Mahmoud Abdelbary, Amr Medhat Massoud, Osama M. Elsyed, Maged Moustafa Fouda and Ossama Mahmoud Mohamad, (2025) Benign Prostatic Hyperplasia; Holmium Laser Enucleation versus Bipolar Transurethral Enucleation in treatment of patients with symptomatic BPH, Vascular and Endovascular Review, Vol.8, No.6s, 145-150.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a common cause of bladder outlet obstruction (BOO) in males with lower urinary tract symptoms (LUTS). Between 50 and 75 percent of men over 50 and 80 percent of men over 70 have BPH (1). Surgery is required for patients with refractory urine retention, bladder stones, bladder diverticulum, treatment-resistant macroscopic hematuria, or upper urinary tract dilatation caused by BPH (2). The conventional transurethral resection of the prostate (TURP) is considered the "gold standard" for treating BPH (3, 4). Although technological developments have made TURP performed by experienced surgeons quite safe, considerable blood loss and transurethral resection syndrome are nevertheless commonly reported side effects (5).

The surgical management of BPH has undergone an ongoing advancement in the past few years. Achieving standard resection results with high safety is the aim of the recently developed minimally invasive resection techniques. Novel techniques for enucleating the prostate, such as the recently developed holmium laser enucleation of the prostate (HoLEP), which is regarded as one of the laser-based operations that improve hemostasis and the functional outcome for patients after surgery (6,7). Regardless of prostate size, several studies have found that HoLEP may be safer and more effective than TURP. (8–10). However, this procedure's high learning curve poses the biggest obstacle to its wider application (11). One way to combine extremely effective TURP with a successful laser enucleation outcome is to use bipolar transurethral enucleation of the prostate (B-TUEP) (12). B-TUEP has been used as a long-term, safe, and effective treatment for BPH at a number of health care facilities. It provides better results at both short- and long-term follow-up when compared to TURP (13). Although numerous studies have compared HoLEP with B-TUEP, there is ongoing discussion over the benefits and drawbacks of each method. HoLEP is as effective as B-TUEP, according to Neill et al. (14) with the benefit of requiring less postoperative irrigation and having a shorter operating time. Another study by Magistro et al. (15) revealed no statistically significant difference between the two procedures' perioperative parameters, surgical outcomes and safety profile. In this study, we aimed to compare the safety and effectiveness of B-TUEP and HoLEP in males with BPH over a 6-month follow-up.

STUDY DESIGN:

This was a randomized controlled study that was conducted from January 2022 to February 2023 with 80 BPH-diagnosed patients from the urology department's outpatient clinic at Beni-Suef University Hospital. Six months were devoted to the research. Patients were included if they had a prostate volume >80 cc and satisfied the criteria for surgical intervention like those who don't respond to medical treatment, those with refractory retention or repeated attacks of hematuria due to BPH. Conversely, those having urinary bladder stones; previous urethral or prostate surgery; History of neurogenic bladder; Prostate cancer was excluded and eliminated from the study. The sample size was determined using the Ostend, Belgium-based MedCalc® version 12.3.0.0 software. It was determined that a sample size of 76 instances would be enough to detect a statistically significant difference between the groups. The number of people in the sample was set at 80 after calculating a dropout rate of 5%. Eighty patients participated, split evenly between two groups. Forty patients in the first group underwent HoLEP, and forty patients in the second group underwent B-TUEP.

PREOPERATIVE EVALUATION:

Prior to surgery, patients underwent a history evaluation that included an IPSS assessment, examination, Qmax measurement (for those without urinary retention) and assessment of post-void residual urine (PVR) using ultrasound (US). Prostate volume was measured using Trans rectal ultrasound (TRUS). Urine analysis, urine culture, serum creatinine and coagulation profile were all done as laboratory studies. Also, PSA was done for all patients, and prostate biopsy was performed whenever indicated. Endoscopic therapy of the prostate was delayed in biopsied individuals for four weeks after TRUS biopsy. Postoperative complications were classified using the Clavien-Dindo classification system. Written informed consent was obtained from all patients, and the Review Board approved the study (approval number: FMBSUREC/01122019/Fouda). Patients were divided into groups A (HoLEP) and B (B-TUEP) at random using block randomization and the closed envelope method. The sealed envelopes were opaque.

TECHNIQUE:

Each procedure was carried out by an expert surgeon who performed more than 50 cases of enucleation with each energy source. All procedures were done under spinal anesthesia with a single dose of intravenous prophylactic antibiotic (third generation cephalosporin) administered thirty minutes before surgery. In HoLEP technique lumenis brand high-power holmium lasers producing 80-120 watts of output were used in the operation. The laser's parameters were changed such that it would emit energy at a rate of 20-25 hertz and a level of 2-2.5 joules. The A550 um laser fiber is being considered. A 26-French-centimeter diameter characterizes the lk laser resectoscope. The inner sheath of the under consideration continuous flow instrument is constructed to accommodate a stabilizing guide, or storz. In this work, an A30 telescope was used in conjunction with a bridge and an endoscopic camera. The existence of a sizable median lobe determined whether the two- or three-lobe approach would be used. People who had a sizable median lobe were treated using the three-lobe technique. The bladder neck and verumontanum were cut open by an incision made at 5 and 7 o'clock. During the enucleation of the median lobe, the resectoscope was used to raise the lobe and provide counter traction. The lobe was removed surgically from the bladder at the neck and reattached within the bladder for morcellation. In patients without a median lobe, doctors made a single incision at the 6 o'clock position. Then, the lateral lobes were enucleated at a transverse angle to the verumontanum. The lobe was then separated from the capsule using a lateral motion of the laser fiber and an upward elevation of the lobe using the resectoscope's back. At 12 o'clock, an incision was made to remove the lobe, which was then transferred to the bladder for morcellation.

Olympus UES 40 surgmaster and the B-TUEP loop were used to execute B-TUEP technique. The spatula shape gives this tungsten wire loop its distinctive appearance. Starting at the 12 o'clock position, the surgeon then moved laterally to the 5 and 7 o'clock locations to enucleate the prostate's lateral lobes that sit next to the verumontanum. A circular incision was made in the mucosa around the apical adenoma. The middle lobe and both lateral lobes were dissected retrogradely, beginning at the apex and working their way down to the bladder, during the operation. For this analysis, we used a B-TUEP loop dissection. After the bladder tissue lobes were dissected free, morcellation was performed. To avoid bladder damage during morcellation, a single or double inflow may be used to keep the bladder distended.

Following surgery in both procedures, a 22Fr 3-way irrigating urethral catheter was inserted and irrigation continued until hematuria stopped. The amount of resected tissues, the volume of irrigating fluid, and the operational time—which was estimated from the start of the endoscopic process till catheter insertion—were all recorded. Prior to discharge, the catheterization duration and hospital stay had been recorded along with the PVR urine assessment. Patients were followed up at 6 months by IPSS, Qmax, and PVR urine measurement. Evaluation during follow-up was blinded to both groups. Both groups were evaluated also for possible complications.

STATISTICAL METHODS:

The statistical analysis was performed using MedCalc version 20 (MedCalc, Ostend, Belgium) for data input, processing, and statistical analysis. Comparisons between quantitative variables were done using Mann-Whitney test. Wilcoxon signed rank test was used for comparison of non-normally distributed data. For comparing categorical data, Chi-square (χ^2) test was performed. A P-value <0.05 was considered statistically significant, and <0.01 was considered highly significant.

RESULTS:

All basic clinical and laboratory data were recorded in table (1) namely age, IPSS, Qmax, PVR, prostate volume, PSA and INR and revealed insignificant differences between both groups. Table (2) lists the operative and postoperative parameters measured for both groups. The average weight of tissue removed by the holmium and plasmakinetic energy sources did not differ significantly (p =0.193), but there were significant differences favoring HoLEP in the operative time (p =0.014), amount of irrigation fluid needed for complete adenoma enucleation (p =0.048), time needed for catheter removal (p <0.001), length of hospital stay (p <0.001), and measured Qmax (p <0.001). The postoperative efficacy parameters, including IPSS, Qmax and PVR were evaluated in both groups at 6 months postoperative, as shown in table (3) with a highly statistically significant difference (p <0.001) was documented in both groups in comparison with their preoperative parameters. Regarding postoperative complications and according to Clavien–Dindo classification, there was no statistically significant difference between both groups as shown in table (4). There was no need for blood transfusion in all patients. Irritative urinary symptoms were the most commonly observed complication after both procedures and were cured using anticholinergics and disappeared within one month. Within three months of surgery, all documented cases of postoperative stress urinary incontinence (SUI) get improved. Four months after surgery, one case (2.5%) in B-TUEP developed bladder neck contracture, which was treated with bladder neck resection. One patient (2.5%) in the HoLEP group had urethral stricture, which was treated with visual internal urethrotomy (VIU).

TABLES:

Table (1): Preoperative baseline data

Variable	HoLEP (40)	B-TUEB (40)	P-value
Age (years)	70 (68 – 75)	70 (68 – 72)	0.515 (NS)
IPSS	26 (21.5 – 30)	25 (22 – 28.5)	0.725 (NS)
Prostate volume (n)	96 (90 – 160)	96.5 (90 – 105)	0.693 (NS)
Qmax (ml/s)	9 (9 – 11)	10 (9 – 11)	0.113 (NS)
PVR (ml)	210 (180 – 250)	215 (200 – 226)	0.595 (NS)
PSA (ng/ml)	7 (5 – 8)	6.5 (5 – 8.5)	0.749 (NS)
INR	1 (1 – 1)	1 (1 – 1)	1.00 (NS)

NS=non-significant difference, IPSS= International prostate symptom score, Qmax = Peak flow rate, PVR = Post-void residual urine, PSA: prostate specific antigen.

Data presented as median with minimum and maximum values.

P values determined by Mann- Whitney's U test (non-parametric data).

Table (2): Operative & postoperative surgical outcomes

variable	HoLEP (40)	B-TUEB (40)	P-value
IPSS	8 (7-10)	12 (10-15)	< 0.001**
Qmax (ml/s)	21 (19 – 23)	16.5 (15 – 18)	< 0.001**
PVR (ml)	18 (15 – 23.5)	20 (15 – 28)	0.336 (NS)
Operative time (min.)	89 (70 – 99.5)	95 (85 – 100)	0.041 (S)
Catheterization time (h.)	24 (24 – 24)	36 (36 – 36)	< 0.001**
Hospital stay (days)	1.3 (1-2)	2.1 (1-5)	< 0.001**
Irrigation fluid Volume (liters)	66 (58.5-74.5)	74 (57.5-88.5)	= 0.048 (S)
Resected gland wt. (gm)	22 (21-23)	23 (21-24)	0.193 (NS)

S= significant, NS=non-significant difference, **= highly significant, IPSS= International prostate symptom score, Qmax = Peak flow rate, PVR = Post-void residual.

Data presented as median with minimum and maximum values.

P values determined by Mann- Whitney's U test.

Table (3): Treatment efficacy

Variable	Preoperative	At 6 months	P-value
IPSS			
HoLEP	26 (21.5 – 30)	8 (7-10)	< 0.0001**
B-TUEP	25 (22 – 28.5)	12 (10-15)	< 0.0001**
Qmax			
HoLEP	10 (9 – 11)	21 (19 – 23)	< 0.0001**
B-TUEP	10 (9 – 11)	16.5 (15 – 18)	< 0.0001**
PVR			
HoLEP	210 (180 – 250)	18 (15 – 23.5)	< 0.0001**
B-TUEP	215 (200 – 226.5)	20 (15 – 28)	< 0.0001**

Data presented as median with minimum and maximum values.

P values determined by Wilcoxon's test used.

Table (4): Postoperative complications

variable	HoLEP (40)	B-TUEB (40)	P-value
Grade 1			
Mild to moderate dysuria	2 (0.8%)	3 (1.2%)	= 0.666 (NS)
Urine retention	0 (0%)	0 (0%)	1.00 (NS)
Grade 2			
Transient SUI	3 (1.2%)	4 (1.6%)	= 0.718 (NS)
Blood transfusion	0	0	1.00 (NS)
Grade 3			
BN contracture	0 (0%)	1 (2.5%)	0.317 (NS)
Urethral stricture	1 (2.5%)	0 (0%)	0.317 (NS)
Overall complications 'rate			
	6 (2.4%)	8 (3.2%)	= 0.623 (NS)

SUI: stress urinary incontinence, BN: bladder neck.

Data presented as numbers with percentages.

P values determined by the Chisquare test.

DISCUSSION:

According to European Association of Urology (EAU) guidelines HoLEP and open prostatectomy represent the gold standard surgical management of prostatic adenomas more than 80 mL (16). The holmium laser has been shown to be safe and effective, and it is versatile enough to be used in treating urolithiasis, stricture and prostatic diseases (17, 18). Similar in safety and efficacy to holmium lasers, bipolar energy was first proposed by Neill et al. as a substitute energy source for prostate enucleation. But there were a higher chance of bleeding and a longer operative and catheter time (14). We carried out the present study to evaluate both techniques in terms of safety and efficacy.

According to the current study, the HoLEP group had a median operating time of 89 minutes as opposed to 95 minutes for the B-TUEP group, a significant difference is observed ($p=0.014$). This is due to better control of bleeding and more obvious vision during enucleation. Previous studies by Habib et al. and Neill et al. reported a shorter operative time with the HoLEP group compared with the B-TUEP group. Similar to the current study, the Habib et al. study focused on the enucleation of big prostate adenomas and found that the B-TUEP group's mean operating time was 93.5 minutes, whereas the HoLEP groups was 71.5 minutes. Neill et al. found that the HoLEP operation had a mean operative time of 43.6 ± 5.3 min, while B-TUEP procedures had a mean operative time of 60.5 ± 6.1 min. However, their study was conducted on an average prostate volume of 55 ml (14, 21). According to the current study, the HoLEP group's median catheterization time was 24 hours, while the B-TUEP groups were 36 hours. In the same way, the HoLEP group's median hospital stay was 1.3 days, while the B-TUEP groups were 2.1 days. Both findings were statistically significant. When compared to the B-TUEP technique, the HoLEP procedure has a shorter catheter duration, which may be explained by improved hemostasis, less postoperative irrigation required, and a quicker recovery. A study by Habib et al. 2019 found that the duration of catheter removal for B-TUEP was 26.8 ± 20.9 hours, while the duration for HoLEP was 17.3 ± 4 hours. Being evaluated in hours rather than days is most likely the cause of this slight difference. Furthermore, a study by Neill et al. 2006 found no differences in the time it took to remove the catheter. Both Habib et al. and Neill et al. found no statistically significant difference in hospital stays between the two groups (14, 21).

Patients in the HoLEP group had a statistically significant improvement in IPSS and Qmax ($p<0.001$) in comparison to those in the B-TUEP group, with respect to postoperative efficacy parameters. Also, the amount of residual urine after voiding was less in HoLEP group but with no statistically significant difference ($p=0.336$). These findings were inconsistent with preceding studies conducted by Neill et al., Shoma et al., and Habib et al. (14, 19, and 21), which reported similar outcomes for the same parameters between both groups. According to Yamamichi et al., (20) one of the primary prognostic indicators of improvement for voiding symptoms is the volume of the resected tissues. The weight of the resected tissues in the two groups was almost identical in the current study, with the resected glands 22 gm and 23 gm in the HoLEP group and B-TUEP group respectively. There was no statistically significant difference ($p=0.193$) between the two groups, and these findings were similar to the research done by Habib et al (21).

Regarding postoperative complications in the present study, there was no statistically significant difference between both groups. During the early postoperative period, SUI was observed in 3 (1.2%) patients in the HoLEP group and 4 (1.6%) patients in the B-TUEP group. These findings were in line with prior studies conducted by Neill et al. and Habib et al (14, 21). Neither procedure was discontinued nor changed to an alternate type of surgery; both demonstrated sufficient hemostasis without the need for blood transfusion. There was only one reported case of urethral stricture in the HoLEP group that required endoscopic dilatation, and one case of bladder neck contracture in the B-TUEP group that required an endoscopic resection. These findings are comparable with Habib et al. and Neill et al., who both reported nearly similar results (14, 21). The main drawbacks of the current study were that it failed to address the cost analysis and learning curve of each technique, particularly in a developing country. Furthermore, our study was unable to conduct a pressure flow study to evaluate the voiding dysfunction.

CONCLUSIONS:

In brief, both HoLEP and B-TUEP were considered to be safe and effective in the surgical management of large prostatic adenomas (>80 cc). In terms of Qmax, IPSS, PVR urine improvement, operative time, catheterization time and hospital stay,

HoLEP technique outperformed B-TUEP technique. However, both techniques' safety profiles and rates of complications were nearly similar, so this research may recommend HoLEP technique as a preferable choice in clinical practice.

ABBREVIATIONS:

HoLEP: Holmium laser enucleation of prostate

B-TUEP: Bipolar transurethral enucleation of prostate

BOO: Bladder outlet obstruction

BPH: Benign prostatic hyperplasia

LUTS: Lower urinary tract symptoms

TURP: Transurethral resection of prostate

US: Ultrasound

TRUS: Trans-rectal ultrasound

SUI: Stress urinary incontinence

IPSS: International prostate symptom score

Qmax: Maximum flow rate

PVR: Post-void residual urine volume

VIU: Visual internal urethrotomy

CONFLICT OF INTEREST

There are no conflicts of interest related to this article, as the authors have made clear.

FUNDING

There was no funding provided to the authors for this study.

ACKNOWLEDGEMENTS

The authors express their gratitude to each and every one of the study participants.

REFERENCES

1. Egan, K. B. (2016). The Epidemiology of benign prostatic hyperplasia is associated with lower urinary tract symptoms: Prevalence and incident rates. *Urologic Clinics of North America*, 43(3), 289–297. <https://doi.org/10.1016/j.ucl.2016.04.001>
2. Gravas, S., Cornu, J. N., Gacci, M., Gratzke, C., Herrmann, T. R. W., Mamoulakis, C., Rieken, M., Speakman, M. J., & Tikkinen, K. A. O. (2021). EAU guidelines on management of non-neurogenic male lower urinary tract symptoms (LUTS), incl. Benign prostatic obstruction (BPO). Available at: <https://uroweb.org/guideline/treatment-of-non-neurogenic-male-luts>.
3. Gratzke C, Bachmann A, Descazeaud A, et al. (2015): EAU guidelines on the assessment of non-neurogenic male lower urinary tract symptoms including benign prostatic obstruction. *Eur Urol*. 67(6):1099–1109. Crossref. PubMed. ISI.
4. Parsons JK, Dahm P, Köhler TS, et al. (2020): Surgical management of lower urinary tract symptoms attributed to benign prostatic hyperplasia: AUA guideline amendment 2020. *J Urol*. 204(4):799–804. Crossref. PubMed. ISI.
5. Omar MI, Lam TB, Alexander CE, et al. (2014): Systematic review and Meta-analysis of the clinical effectiveness of bipolar compared with monopolar transurethral resection of the prostate (TURP). *BJU Int*. 113(1):24–35. Crossref. PubMed. ISI.
6. Boeri L, Capogrosso P, Ventimiglia E, et al. (2020): Clinical comparison of holmium laser enucleation of the prostate and bipolar transurethral enucleation of the prostate in patients under either anticoagulation or antiplatelet therapy. *Eur Urol Focus*. 6(4):720–728. Crossref. PubMed.
7. Enikeev D, Taratkin M, Morozov A, et al. (2020): Long-Term outcomes of holmium laser enucleation of the prostate: a 5-Year Single-Center experience. *J Endourol*. 34(10):1055–1063. Crossref. PubMed. ISI.
8. Park S, Kwon T, Park S, et al. (2017): Efficacy of holmium laser enucleation of the prostate in patients with a small prostate (≤ 30 mL). *World J Mens Health*. 35(3):163–169. Crossref. PubMed.
9. Gazel E, Kaya E, Yalcin S, et al. (2019): Comparison of the efficacy of holmium laser enucleation of the prostate in treating prostate volumes of ≤ 80 and > 80 mL. *Urol Int*. 102(3):306–310. Crossref. PubMed. ISI.
10. Yılmaz S, Yalçın S, Yılmaz M, et al. (2021): Comparison of outcomes of holmium enucleation of the prostate for small- and moderate-sized prostates. *Andrologia*. 53(3): e13970. Crossref. PubMed. ISI.
11. Robert G, Cornu JN, Fourmarier M, et al. (2016): Multicentre prospective evaluation of the learning curve of holmium laser enucleation of the prostate (HoLEP). *BJU Int*. 117(3):495–499. Crossref. PubMed. ISI.
12. Ryang SH, Ly TH, Tran AV, et al. (2020): Bipolar enucleation of the prostate-step by step. *Andrologia*. 52(8): e13631. Crossref. PubMed. ISI.

13. Arcaniolo D, Manfredi C, Veccia A, et al. (2020): Bipolar endoscopic enucleation versus bipolar transurethral resection of the prostate: an ESUT systematic review and cumulative analysis. *World J Urol.* 38(5):1177–1186. Crossref. PubMed. ISI.
14. Neill MG, Gilling PJ, Kennett KM, et al. (2006): Randomized trial comparing holmium laser enucleation of prostate with plasmakinetic enucleation of prostate for treatment of benign prostatic hyperplasia. *Urology.* 68(5):1020–1024. Crossref. PubMed. ISI.
15. Magistro G, Schott M, Keller P, et al. (2021): Enucleation vs. Resection: a matched-pair analysis of TURP, HoLEP and bipolar TUEP in medium-sized prostates. *Urology.* 154:221–226. Crossref. PubMed. ISI.
16. Oelke M, Kirschner-Hermanns R, Thiruchelvam N, Heesakkers J. (2012): Can we identify men who will have complications from benign prostatic obstruction (BPO)? ICI-RS 2011. *Neurourol. Urodyn.* 31: 322–6.
17. Teichmann JMH, Rao RD, Rogenes VJ, et al: (1997): Ureteroscopic management of ureteral calculi: electrohydraulic versus holmium:YAG lithotripsy. *J Urol* 158: 1357–1361.
18. Biyani CS, Cornford PA, and Powell CS (1997): Use of the holmium:YAG laser for urethral stricture under topical anaesthesia. *Int Urol Nephrol* 29: 331–332.
19. Shoma A, Nageib M, Nabeeh A. (2016): Pd24-05 holmium laser (Holep) versus bipolar enucleation (Tueb) of the prostate. An objective evaluation through a prospective randomized study (Prt). *J. Urol.* 195(4S): e512–e513.
20. Yamamichi F, Shigemura K, Kitagawa K, Fujisawa M. (2019): Predictive factors of improvement for voiding symptoms after holmium laser enucleation of the prostate. *Int. J. Urol.* 26: 136–7.
21. Habib E, Ayman LM, ElSheemy MS et al. (2020): Holmium laser enucleation vs bipolar plasmakinetic enucleation of a large volume benign prostatic hyperplasia: a randomized controlled trial. *J. Endourol.* 34: 330–8.