Safety and Efficacy of Bipolar Versus Monopolar Transurethral Resection of the Prostate: A Comparative Study

Erkan Hirik,[1] Aliseydi Bozkurt,[1] Mehmet Karabakan,[1]* Huseyin Aydemir,[2] Binhan Kagan Aktas,[3] Baris Nuhoglu[1]

Purpose: Transurethral resection of the prostate (TURP) is considered gold standard for surgical treatment of benign prostatic hyperplasia (BPH). In this study, we aimed to compare post-operative clinical outcomes and adverse effects between monopolar and bipolar TURPs.

Materials and Methods: The study included 590 patients who underwent TURP by a single urologist (E.H.) between June 2006 and June 2014 with a diagnosis of BPH. Patients were divided into two groups as monopolar TURP (group 1, n = 300) and bipolar TURP (group 2, n = 290). Patients receiving oral anticoagulants or aspirin and those with prostate cancer diagnosis were not included in the study. Data regarding pre-operative age, International Prostate Symptom Score (IPSS), maximum urinary flow rate (Qmax), post voiding residual urine volume (PVR), serum prostate specific antigen (PSA) levels and prostate volume (Vp) of the patients were gathered from medical records. Groups were compared in terms of catheterization, operation time, hemoglobin (Hb) decrease, and IPSS, Qmax, and PVR values at post-operative 12th month follow-up visit.

Results: From pre-operative to post-operative period, IPSS, Qmax and PVR showed significant improvements within both groups ($P < .001$). When groups were compared with each other, bipolar TURP group had significantly lesser catheterization time and hemoglobin decrease than monopolar TURP group, while no significant differences were detected regarding all other variables.

Conclusion: Bipolar and monopolar TURPs are both effective and safe treatment modality for BPH. Bipolar TURP is superior to conventional monopolar TURP in terms of catheterization time and Hb decrease.

Keywords: prostatic hyperplasia; surgery; prospective studies; transurethral resection of prostate; methods; electrosurgery; adverse effects; hot temperature; electrocoagulation; instrumentation.

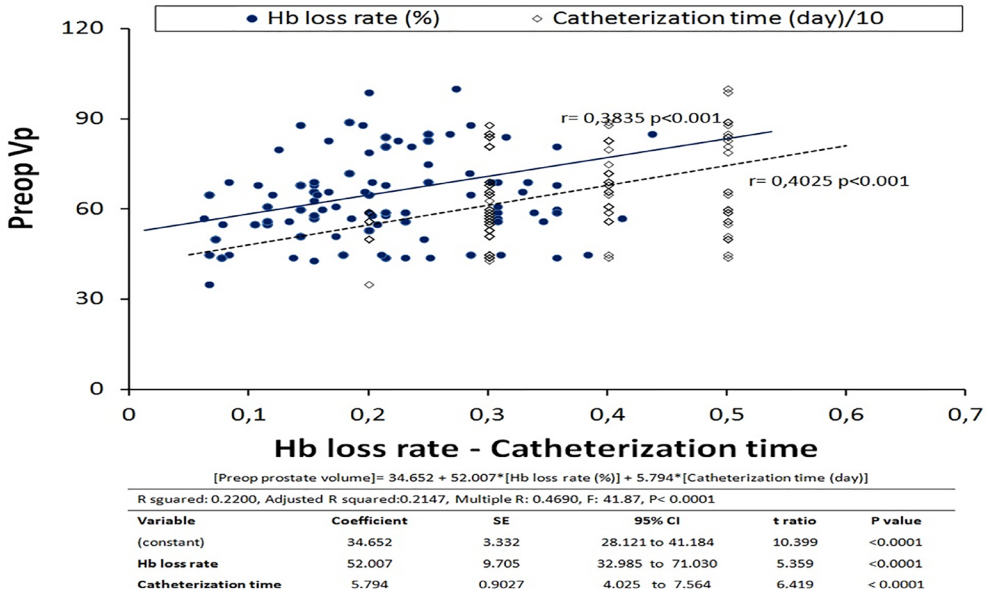
INTRODUCTION

Benign prostatic hyperplasia (BPH) is one of the most common urological diseases seen in aging men. The objectives of most of the methods used in the treatment of BPH are to eliminate lower urinary tract symptoms (LUTS), prevent disease progression, and reduce any complications that may emerge in the long-term.(1) Surgical treatment is recommended for patients unresponsive to medical therapy or those who have developed BPH-related complications.(2) Given the long-term results of randomized controlled trials (RCTs),-monopolar transurethral resection (M-TURP) has been considered the gold standard for surgical treatment of BPH.(3) This surgical technique involves endoscopic removal of inner prostate gland using a diathermy unit.

Although high success rates of M-TURP have been demonstrated with symptom score, urine flow rate, and other functional parameters, it is associated with significant morbidities, including perioperative and post-operative bleeding, TUR syndrome, extended hospitalization and even urinary incontinence, retrograde ejaculation and erectile dysfunction.(4) Therefore, several minimally invasive techniques using a variety of energy sources for resection, ablation or vaporization of the prostate have been developed in order to reduce the rates of TURP complications. These techniques are thought to be similar to M-TURP in terms of efficacy and safety but differ from it on some issues, such as the risk of developing TUR syndrome, requirement for blood transfusion, sexual function, and urinary incontinence rates.(5)

Unlike the conventional M-TURP system, in bipolar energy system, TUR is performed after generating a high-frequency current between two electrodes. These systems are referred to as plasmakinetic resection or bipolar TURP (B-TURP), and their most important dis-

[1] Department of Urology, Mengucek Gazi Training and Research Hospital, Erzincan University, Erzincan, Turkey.
[2] Department of Urology, Sakarya Education and Training Hospital, Sakarya, Turkey.
[3] Department of Urology, Ankara Numune Education and Training Hospital, Ankara, Turkey.
*Correspondence: Department of Urology, Mengucek Gazi Training and Research Hospital, Erzincan University, Basbaglar mah., Mengucek Gazi Hospital, no. 7, Erzincan, Turkey.
Tel: +90 446 212 2222. Fax: +90 446 212 2211. E-mail: mkarabakan@yandex.com.
Received April 2015 & Accepted September 2015



[Preop prostate volume]= 34.652 + 52.007*[Hb loss rate (%)] + 5.794*[Catheterization time (day)]

R sguared: 0.2200, Adjusted R squared:0.2147, Multiple R: 0.4690, F: 41.87, P< 0.0001

Variable	Coefficient	SE	95% CI	t ratio	P value
(constant)	34.652	3.332	28.121 to 41.184	10.399	<0.0001
Hb loss rate	52.007	9.705	32.985 to 71.030	5.359	<0.0001
Catheterization time	5.794	0.9027	4.025 to 7.564	6.419	< 0.0001

Figure 1. Multiple regression analysis of preoperative prostate volume and hemoglobin decrease and catheterization time in monopolar TURP method.

Abbreviations: Vp, prostate volume; Preop, preoperative, Hb, hemoglobin; SE, standard error; CI, confidence interval; r, correlation coefficient.

tinctive feature is elimination of TUR syndrome risk due to the use of isotonic fluid, instead of the irrigation fluid used in conventional TURP.[6] In this study, we aimed to compare post-operative clinical results and side effects of monopolar and bipolar TURPs.

MATERIALS AND METHODS

Study Population

Of 916 patients diagnosed with BPH who underwent TURP performed by a single urologist (E.H.) in 3 different hospitals located in the province of Erzincan from June 2006 to June 2014, 590 patients whose records were accessible were studied. Patients were divided into two groups as M-TURP (group 1, n = 300) and B-TURP (group 2, n = 290). Patients diagnosed with cancer based on pathological results, those with a history of previous prostate surgery, neurogenic lower urinary tract dysfunction and those receiving oral anticoagulants or aspirin were excluded from the study. Upper limit criterion for weight of prostate wasn't used. Required ethical permissions of the study have been obtained from Ethics Committee of Erzincan University, Mengucek Gazi Training, and Research Hospital.

Evaluations and Procedures

Data regarding pre-operative age, International Prostate Symptom Score (IPSS), maximum urinary flow rate (Qmax), post voiding residual urine volume (PVR), serum prostate specific antigen (PSA) levels, and prostate volumes (Vp) of the patients were obtained from medical records. All patients received spinal anesthesia. Storz resectoscope (Karl Storz GmbH, Tuttlingen, Germany) with 26 French (F) sheath was used for all patients who underwent M-TURP, while Gyrus plasmakinetic system resectoscope (Gyrus Medical Ltd., Bucks, UK) with 26 F sheath was used for B-TURP patients. Groups were compared in terms of urethral catheterization and operation time, decrease in hemoglobin (Hb), and IPSS, Qmax, and PVR values at post-operative 12th month follow-up visit.

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Science (SPSS Inc, Chicago, Illinois, USA) version 15.0 for Windows. Comparison was done using chi-square test for independent variables and the Mann-Whitney *U* test. A power analysis and multivariate regression analysis were also performed and added into the study.

RESULTS

There were no statistically significant differences between the two groups in terms of demographic characteristics. When intragroup pre-operative and post-operative data were compared, both groups were found to have significant improvements in IPSS, Qmax, and PVR ($P < .001$). When the groups were compared with each other, B-TURP group was found to have signifi-

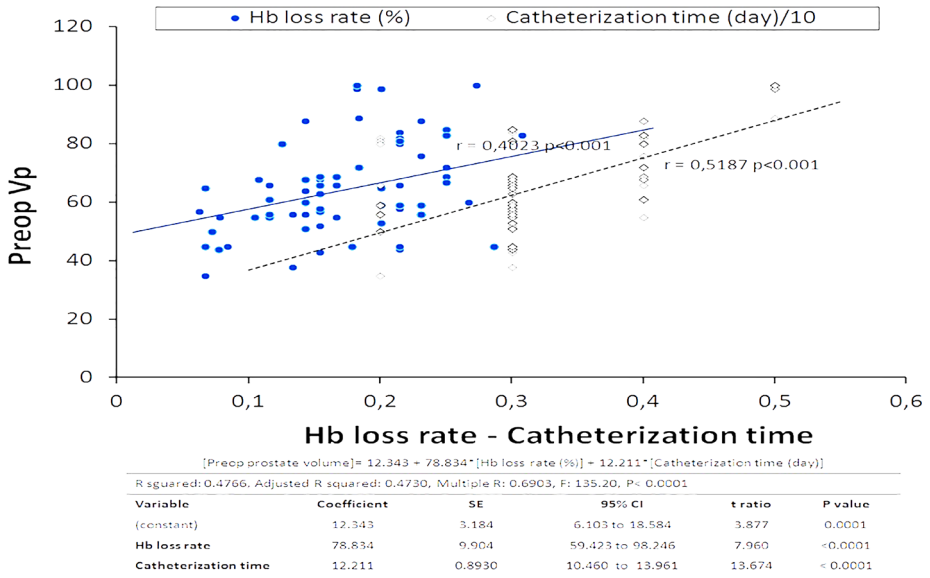


Figure 2. Multiple regression analysis of preoperative prostate volume and hemoglobin decrease and catheterization time in bipolar TURP method.
Abbreviations: Vp, prostate volume; Preop, preoperative, Hb, hemoglobin; SE, standard error; CI, confidence interval; r, correlation coefficient.

cantly shorter catheterization time (B-TURP 3.4 days, M-TURP 3.1 days, P = .001), and less hemoglobin decrease (B-TURP 16.9%, M-TURP 18.5%, P = .006) as compared to M-TURP group. Twelve patients (4%) from monopolar group and 3 (9%) patients from bipolar group required transfusion. No differences were detected in terms of all other variables (operation time, post-operative IPSS, post-operative PVR, and post-operative Qmax) (**Table**). TUR syndrome as dilutional hyponatremia was observed in 2 patients (0.6%) in monopolar group, where as none of the patients from bipolar group developed TUR syndrome.

Table. Comparison of data between the two study groups.

Variables	Monopolar TURP (n = 300)	Bipolar TURP (n = 290)	*P* Value
Age (years)	65.3 ± 9.3	66.4 ± 9.2	.154
Pre-operative IPSS (0-35)	23.7 ± 4.3	23.9 ± 4.5	.632
Pre-operative Qmax (mL/s)	5.8 ± 2.4	5.8 ± 2.4	.840
Pre-operative PVR (mL)	333.4 ± 212.3	309.1 ± 195.0	.149
Pre-operative Vp (mL)	63.7 ± 13.7	63.8 ± 14.1	.970
Pre-operative PSA (ng/mL)	3.2 ± 1.2	3.1 ± 1.3	.451
Post-operative IPSS (0-35)	6.1 ± 1.4	6.2 ± 1.3	.597
Post-operative Qmax (mL/s)	20.4 ± 2.4	20.1 ± 2.6	.254
Post-operative PVR (mL)	71.8 ± 42.5	68.9 ± 40.6	.390
Operation time (min)	60.6 ± 9.3	59.6 ± 9.4	.201
Catheterization time (days)	3.4 ± 0.8	3.1 ± 0.7	.001
Percentage change in post-operative IPSS	-73.6 ± 7.2	-73.4 ± 7.5	.760
Percentage change in post-operative Qmax	251.3 ± 118.2	234.6 ± 105.1	.085
Percentage change in post-operative PVR	-68.6 ± 33.1	-68.5 ± 31.6	.971
Percentage change in post-operative Hb	-17.9 ± 7.2	-16.9 ± 6.0	.006

Abbreviations: TURP, transurethral resection of the prostate; IPSS, International Prostate Symptom Score; Qmax, maximum urinary flow rate; PVR, post voiding residual urine volume; Vp, prostate volume; Hb, hemoglobin; PSA, prostate specific antigen.

The sample numbers that describe catheterization time and the level of the percentage change in Hb were selected by the order minimum 171 and 213 (n2/n1: 1, $\beta = 0.20$ vs $\alpha = 0.05$). Therefore, in accordance to the number of samples, the power indicator numbers were calculated by the order 0.961 and 0.915 in this study. Upon the analysis through multiple regression between prostate scales and the length of catheterization time and also the change of %Hb (independent parameter), it was obtained that 24% of the patients were under influence of such relevance ($P < .001$). Additionally, results of Spearman correlation analysis showed that there is a higher correlation between Vp and catheterization time as well as the change of %Hb in B-TURP method than monopolar method ($P < .001$) (**Figures 1 and 2**).

DISCUSSION

Surgical treatment is recommended for patients who do not benefit from medical treatment or those who have developed complications due to BPH (recurrent urinary retention, recurrent urinary tract infections, recurrent hematuria, renal failure, bladder stones, and etc.).[7] The goal of BPH treatment is to improve the quality of life, reduce symptoms and minimize adverse effects.[8]

TUR syndrome is the greatest cause of morbidity arising during operation. It may lead to clinical conditions, including headache, restlessness, confusion, cyanosis, dyspnea, arrhythmias, hypotension, convulsion, along with dilutional hyponatremia, and may even be fatal.[9] Particularly in conventional monopolar systems, glycine solution causing TUR syndrome is used as irrigating fluid, while isotonic saline solution is used for the same purpose in bipolar systems. The use of isotonic irrigation fluid theoretically may lead to decreased serum Na levels to a lesser extent and prevent the development of TUR syndrome. However, regardless of the type of irrigation fluid, it should be noted that fluid absorption to systemic circulation is not eliminated during the operation.[6] There is no report of TUR syndrome with B-TURP in the literature.[10,11] In our study, TUR syndrome as dilutional hyponatremia developed in 2 patients (0.6%) in the monopolar group, whereas TUR syndrome was not observed in any of the patients in bipolar group. If monopolar energy will be used, it is recommended to take precautions to prevent TUR syndrome such as avoiding extension of resection time (60 min), minimizing fluid pressure, and keeping the height of the fluid bag below 50 cm. A lot of work has reported that the bipolar system is reliable in terms of dilutional hyponatremia.[10-13]

Despite its reduction with the use of bipolar techniques, one of the TURP complications is bleeding, which is seen in 5% of cases.[6] In a meta-analysis by Mamualakis and colleagues[12] evaluating 12 studies, no significant difference was found between B-TURP and M-TURP in terms of the requirement for transfusion. Similarly, Ahya and colleagues[18] did not identify any significant difference in terms of the requirement for transfusion in their meta-analysis covering 10 studies; similar results were also reported in other studies.[12,14,15] There are also studies indicating that the requirement for transfusion is less in the case of B-TURP group.[16,17] In the meta-analysis of Mamualakis and colleagues,[12] in which they evaluated pre-operative and post-operative hemoglobin change, there was no difference between the two systems in nine studies. Other studies in the literature did not identify statistically significant differences between the groups in terms of hemoglobin change.[11,13] In our study, it was revealed that the bipolar group had less hemoglobin loss, as compared to the monopolar group and 12 patients (4%) from monopolar group and 3 (9%) patients from bipolar group required transfusion.

In randomized controlled trials performed in terms of catheterization time, B-TURP method appears to be advantageous. However, it is not easy to compare catheterization times reported in the literature. Some of the studies reported catheter removal at 24 hours after irrigation became clear, whereas some reported catheter removal in all patients immediately when irrigation became clear or on post-operative day 1, making it difficult to evaluate the results.[13,15,18] However, Ahya and colleagues[18] compared catheterization times in their meta-analysis and found that B-TURP has slightly shorter catheterization time. In our study, we identified that B-TURP group had significantly shorter catheterization times as compared to M-TURP group. In our study, mean operation times for M-TURP and B-TUR-P were 60.6 ± 9.3 min and 59.6 ± 9.4 min, respectively and there was no statistically significant difference between them. There was no statistical difference between the two groups, and yet a variety of findings on this issue were also reported in the literature. Erturhan and colleagues[16] found shorter operation times for bipolar group. Ho and colleagues[15] reported similar operation times for both groups. In a study by Michielsen and colleagues,[13] bipolar group had significantly longer operation times. The reported results vary depending on factors, including the experience of the surgeon, the loop size used, the amount of resected tissue, and etc. However, in our study, all patients underwent surgery by the same surgeon, making this study valuable and meaningful in this respect.

CONCLUSIONS

According to our results, B-TURP and M-TURP systems were found to have similar outcomes in the post-operative period. Both methods proved to be effective and safe in the treatment of BPH. We determined that B-TURP is superior to conventional M-TURP in terms of catheterization time and Hb decrease.

CONFLICT OF INTEREST

None declared.

REFERENCES

1. Wilt TJ, N'Dow J. Benign prostatic hyperplasia. Part 2-management. BMJ. 2008;336:206-10.
2. Kaplan SA. Update on the American Urological Association Guidelines for the treatment of benign prostatic hyperplasia. Rev Urol. 2006;8(Suppl4):S10-S7.
3. AUA Practice Guidelines Committee. AUA Guideline on management of benign prostatic hyperplasia (2003). Chapter 1: Diagnosis and treatment recommendations. J Urol. 2003;170:530-47.
4. Reich O, Gratzke C, Stief CG. Techniques andlong-term results of surgical procedures for BPH. Eur Urol. 2006;49:970-8.
5. Autorino R, Damiano R, Di Lorenzo G. Four-year outcome of a prospective randomised trial comparing bipolar plasmakinetic and monopolar transurethral resection of the prostate. Eur Urol. 2009;55:922-31.
6. Rassweiler J, Schulze M, Stock C, Teber D, De La Rosette J. Bipolar transurethral resection of the prostate-technical modifications and early clinical experience. Minim Invasive Ther Allied Technol. 2007;16:11-21.
7. Guidelines on benign prostatic hyperplasia; European Association of Urology Guidelines, 2014.
8. Lowe FC. Goals for benign prostatic hyperplasia therapy. Urology. 2002;59:1-2.
9. Mebust WK, Holtgrewe HL, Cockett AT, Peters PC. Transurethral prostatectomy: immediate and postoperative complications. A cooperative study of 13 participating institutions evaluating 3,885 patients. J Urol. 2002;167:999-1003.
10. Issa MM. Technological advances in transurethral resection of the prostate: bipolar versus monopolar TUR-P. J Endourol. 2008;22:1587-95.
11. Issa MM, Young MR, Bullock AR, Bouet R, Petros JA. Dilutional hyponatremia of TUR-P syndrome: a historical event in the 21st century. Urology. 2004;64:298-301.
12. 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.
13. Michielsen DP, Debacker T, De Boe V, et al. Bipolar transurethral resection in saline-an alternative surgical treatment for bladder outlet obstruction? J Urol. 2007;178:2035-9.
14. De Sio M, Autorino R, Quarto G, et al. Gyrus bipolar versus Standard monopolar transurethral resection of the prostate: a randomized prospective trial. Urology. 2006;67:69-72.
15. Ho HS, Yip SK, Lim KB, Fook S, Foo KT, Cheng CW. A prospective randomized study comparing monopolar and bipolar transurethral resection of prostate using transurethral resection in saline (TURIS) system. Eur Urol. 2007;52:517-24.
16. Erturhan S, Erbagci A, Seckiner I, Yagci F,Ustun A. Plasmakinetic resection of the prostate versus standard transurethral resection of the prostate: a prospective randomized trial with 1-year follow-up. Prostate Cancer Prostatic Dis. 2007;10:97-100.
17. Bhansali M, Patankar S, Dobhada S, Khaladkar S. Management of large (>60 g) prostate gland: Plasma Kinetic Superpulse (bipolar) versus conventional (monopolar) transurethral resection of the prostate. J Endourol. 2009;23:141-6.
18. Ahyai SA, Gilling P, Kaplan SA, et al. Meta analysis of Functional Outcomes and Complications Following Transurethral Procedures for Lower Urinary Tract Symptoms Resulting from Benign Prostatic Enlargement. Eur Urol. 2010;58:384-97.