Original Article

Evaluation of the Efficacy and Safety of Bipolar and Monopolar Transurethral Prostate Resection in Geriatric Patients

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Abstract

Background: Benign prostatic hyperplasia unresponsive to medical treatment is an important problem for elderly patients. Although the gold standard surgical treatment is monopolar transurethral resection of the prostate (MTURP), postoperative complications are still a concern. **Aim:** The aim of this study was to determine which transurethral prostate resection (TURP) methods are more effective and safer in elderly patients. **Methods:** Patients who underwent TURP in our clinic between 2012 and 2021 were analyzed retrospectively and divided into three groups according to their ages. Patients were treated with MTURP (n = 169) and bipolar transurethral resection of the prostate (BTURP) (n = 1152). Pre- and post-operative data for age groups were compared according to TURP methods. **Results:** The resection speed in the BTURP method was statistically significantly faster in groups 2 and 3 ($P < 0.05$). Although not statistically significant ($P > 0.05$), there was a numerically smaller decrease in hemoglobin (Hb) value in group 2 and a numerically greater decrease in post-voiding residual (PVR) volume in groups 1 and 3 in the BTURP method. The increase in maximum urine flow (Qmax) was significantly higher only in group 2 ($P = 0.032$), but it was numerically higher in all groups in the BTURP method. **Conclusion:** The results of this study showed that BTURP was at least as effective and safe as MTURP in geriatric patients and also better in terms of Hb decrease, resection speed, Qmax increase, and PVR volume decrease.

Keywords: *Aging, benign prostatic hyperplasia, bipolar TURP, geriatrics, monopolar TURP, lower urinary tract symptoms, transurethral resection of the prostate*

Introduction

Lower urinary tract symptoms (LUTS) and difficulty in urination are frequently encountered conditions in aging males. Benign prostate hyperplasia (BPH) is the primary cause of LUTS and difficulty in urination, and although there are several factors affecting prostate growth, aging is the main reason. Prostate growth may not always cause LUTS and difficulty in urination and may have an asymptomatic course. When it is symptomatic, medical and surgical treatments can be applied. Surgical treatment is recommended for patients who do not respond to medical treatment or who develop complications related to BPH.[1]

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Transurethral resection of the prostate (TURP) is a procedure that has been well defined as the keystone of surgical treatment for many years as it provides successful results.[2] Considering the long-term results of randomized controlled studies, monopolar TURP (MTURP) has been accepted as the gold standard for the surgical treatment of BPH.[3] However, there are still concerns related to complications such

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as transurethral resection syndrome, bleeding, and urethral stricture.[4] A multicenter study showed that mortality was reduced (0.1%) in TURP treatment, but the morbidity rate remained high (11.1%) despite this decrease.[5] Therefore, in recent years, various technologies have been developed that have minimum risk and acceptable efficacy in the treatment of BPH. The primary of these technologies is bipolar TURP (BTURP). With the use of bipolar energy, fewer complications have been reported, and results are comparable to those of standard TURP.[6]

In MTURP, the passive electrode is placed on the body of the patient in the form of a cautery plate, and the active electrode is attached to the resectoscope. The stream flowing over the loop provides tissue for resection. Ten percent of the electric current that emerges from the device into the center of the urethra is acknowledged to be the primary source of urethral stricture that may develop as a result of the treatment.[7] Resection and coagulation cannot be achieved without fluid that transmits electrical current to the tissue. The fluids most frequently used in the procedure are hypotonic 1.5% glycine and sorbitol solutions. There is a risk (1–2%) of hypervolemic hyponatremia as a result of fluid retention in systemic circulation during the procedure.[8] Consequently, care must be taken to keep the operating time short. Otherwise, there may be unwanted conditions such as a reduction in the amount of targeted tissue resected, uncontrollable bleeding, and a prolonged length of stay in the hospital. The basis of bipolar energy consists of a new radiofrequency system. In BTURP, a special resection loop is used to join the entry and return sections over the same electrode for the completion of the electrical circuit. The electrical current does not need to pass through an earth plate on the patient, and the current is kept in the resection area. Resection occurs in an ionic fluid in this new technique. Isotonic saline is used as the solution.

The aim of this study was to determine which TURP method is safer and more effective in terms of age by comparing the decrease in hemoglobin (Hb) value, erythrocyte suspension (ES) replacement, increase in maximum urine flow (Qmax) rate, decrease in the amount of post-voiding residual (PVR) volume, operation time, resection speed (resected tissue/operation time), duration of hospitalization, and urethral catheter withdrawal.

Patients and Methods

Ethical approval declarations

Approval for the study was granted by the Medical and Health Sciences Research Ethics Committee of Başkent University (project no: KA22/95) and was supported by the Başkent University Research Fund.

Study design and sample

A retrospective examination was made of 1501 cases that underwent TURP in our clinic between April 2011 and April 2021. A total of 180 cases were excluded from the study due to the need for a second operation at the same time and prostate cancer was detected in the TURP specimen. The study included 1321 cases, comprising 1,152 BTURP and 169 MTURP. The information on all the cases was retrieved from the hospital records and patient files. All the cases included in the study were those with LUTS that did not respond to medical treatment with α-blockers and 5α-reductase inhibitors, which are recommended in the European Urology Association Guidelines.[9]

Data collection procedure

The cases were grouped as group 1 for those aged 64 years and under, group 2 for those aged between 65 and 75 years, and group 3 for those aged 76 years and above. The groups were compared in terms of decrease in Hb value, ES replacement, increase in Qmax, decrease in PVR volume, operation time, resection speed, hospitalization time, and urethral catheter withdrawal time according to MTURP and BTURP techniques.

All the surgical procedures were performed under spinal anesthesia in the lithotomy position. The operating time was calculated as the time from the first tissue resection to the placement of the urethral catheter. Postoperatively, a 24 French Foley 3-way irrigation catheter was used in all the patients.

A blood sample was taken preoperatively and within one hour postoperatively to evaluate perioperative blood loss. To evaluate the increase in Qmax and decrease in PVR volume, uroflowmetry and ultrasound were performed preoperatively and in the sixth postoperative week.

Statistical analysis

Data obtained in the study were analyzed statistically using Statistical Package for the Social Sciences (SPSS) for Windows version 25 software (IBM Corp. Released 2017, Armonk, NY, USA). Variables were stated as mean ± standard deviation values, numbers, and percentages. The conformity of the variables to a normal distribution was assessed with the Shapiro-Wilk test, and homogeneity of variances was assessed with the Levene test. In the comparisons of two groups of data with a normal distribution, the independent sample *t*-test was used, and for non-parametric data, the Mann-Whitney U-test was applied. Categorical data were analyzed with the Fisher's exact test and the Chi-square test. When the

expected frequencies were <20%, evaluation was made with the Monte Carlo simulation method. A value of $P < 0.05$ was accepted as statistically significant.

Results

A retrospective analysis was made of the data from 1,321 cases. The distribution of the age groups according to the operation methods is shown in Table 1. No statistically significant difference was determined between the groups ($P = 0.561$).

In all the groups, there was no significant difference in the American Society of Anesthesiologists (ASA) scores of the patients ($P > 0.05$). The preoperative findings of the patients are shown in Table 2. The prostate volume of the patients in group 1 and group 2 who underwent BTURP was statistically significantly larger than that of the MTURP patients ($P < 0.05$). No significant difference was determined in group 3 ($P = 0.732$).

The average duration of catheter withdrawal and hospitalization in all groups was two days, and there was no significant difference ($P > 0.05$). In group 1, the BTURP method had a statistically significant longer operation time and more resected tissue ($P < 0.05$), and no significant difference was observed in the other groups ($P > 0.05$). On the other hand, the resection speed in the BTURP method was statistically significantly faster in groups 2 and 3 ($P < 0.05$). The other perioperative and postoperative findings are shown in Table 3.

There was no statistically significant difference in the decrease in Hb value between the groups ($P > 0.05$), but there was a numerically lower decrease in the BTURP method in group 2 [Table 4]. Additionally, there was no statistically significant difference in terms of

Table 1: Distribution of the age groups according to the operation type

Age categories	Procedure		Test statistics	
	BTURP *n* (%)	MTURP *n* (%)	χ^2	*P*
Group 1	362 (85.8)	60 (14.2)	1.153	0.561
Group 2	528 (88.0)	72 (12.0)		
Group 3	262 (87.6)	37 (12.4)		

χ^2: Chi-square test

Table 2: Comparison of preoperative findings divided by groups according to the procedure

	Age groups	Procedure		Test statistics	
		BTURP	MTURP	Test value	*P*
ASA score, *n* (%)	Group 1 (1, 2, 3)	62 (84.9)	11 (15.1)	χ^2=0.863	0.557
1		285 (86.4)	45 (13.6)		
2		15 (78.9)	4 (21.1)		
3	Group 2 (1, 2, 3, 4)	56 (93.3)	4 (6.7)	χ^2=3.495	0.285
4		407 (88.1)	55 (11.9)		
		64 (83.1)	13 (16.9)		
		1 (100.0)	0 (0.0)		
	Group 3 (1, 2, 3, 4)	10 (76.9)	3 (23.1)	χ^2=6.309	0.085
		201 (90.1)	22 (9.9)		
		48 (80.0)	12 (20.0)		
		3 (100.0)	0 (0.0)		
Prostate size, mL	Group 1	61 (5–200)	48.5 (10–165)	*z*=2.656	0.008
M (min–max)	Group 2	70.0 (14.0–230.0)	54.5 (20.0–141.0)	*z*=3.286	0.001
	Group 3	65.0 (18.0–202.0)	63.0 (17.0–260.0)	*z*=0.343	0.732
Hb, mmol/l	Group 1	14.90 (9.05–18.20)	14.35 (7.90–17.80)	*z*=2.729	0.006
M (min–max)	Group 2	14.4 (8.2–20.0)	14.4 (9.52–17.7)	*z*=0.085	0.932
	Group 3	13.5 (9.2–17.5)	12.9 (7.89–16.3)	*z*=1.484	0.138
Creatinine, µmol/l	Group 1	0.90 (0.64–5.66)	0.90 (0.66–1.76)	*z*=0.743	0.458
M (min–max)	Group 2	0.96 (0.3–8.89)	0.89 (0.67–1.95)	*z*=2.577	0.010
	Group 3	1.06 (0.54–4.16)	1.0 (0.63–2.0)	*z*=1.391	0.164
Qmax, mL/s	Group 1	8.0 (1.0–26.0)	7.5 (1.0–22.0)	*z*=1.167	0.243
M (min–max)	Group 2	8.0 (1.0–29.0)	7.0 (1.0–16.0)	*z*=1.826	0.068
	Group 3	7.0 (1.0–22.0)	6.0 (1.0–13.0)	*z*=0.898	0.369
PVR, mL	Group 1	120.0 (0.0–660.0)	145.0 (25.0–800.0)	*z*=1.767	0.077
M (min–max)	Group 2	110.0 (1.0–1130.0)	122.5 (1.0–500.0)	*z*=0.889	0.374
	Group 3	130.0 (1.0–755.0)	145.0 (25.0–950.0)	*z*=0.339	0.734

%: column percentage, *M*: median, χ^2: Chi-square test statistic, *z*: Mann-Whitney *U*-test

Table 3: Comparisons of the findings of the groups during and after the operation according to the procedure

	Age groups	Procedure		Test statistics	
		BTURP	MTURP	Test value	*P*
Hb, mmol/l	Group 1	13.60 (8.20–16.80)	13.15 (9.90–16.20)	z=2.460	0.014
M (min–max)	Group 2	12.0 (8.3–16.4)	11.6 (8.53–14.6)	z=0.980	0.327
	Group 3	12.0 (8.3–16.4)	11.6 (8.53–14.6)	z=1.131	0.258
Creatinine, µmol/l	Group 1	0.84 (0.57–7.14)	0.81 (0.59–1.92)	z=1.064	0.287
M (min–max)	Group 2	0.86 (0.36–10.85)	0.79 (0.59–1.57)	z=3.062	0.002
	Group 3	0.92 (0.47–4.10)	0.85 (0.55–1.58)	z=1.488	0.137
Intraoperative ES replacement *n* (%)	Group 1	361 (86.0)	59 (14.0)	χ^2=2.110	0.229
		1 (50.0)	1 (50.0)		
No	Group 2	526 (88.0)	72 (12.0)	χ^2=0.274	>0.999
Yes		2 (100.0)	0 (0.0)		
	Group 3	257 (87.7)	36 (12.3)	χ^2=0.104	0.551
		5 (83.3)	37 (12.4)		
Postoperative ES replacement *n* (%)	Group 1	352 (85.9)	58 (14.1)	χ^2=0.061	0.683
		10 (83.3)	2 (16.7)		
No	Group 2	509 (88.0)	71 (12.2)	χ^2=0.960	0.494
Yes		19 (95.0)	1 (5.0)		
	Group 3	248 (88.3)	33 (11.7)	χ^2=1.713	0.256
		14 (77.8)	4 (22.2)		
Qmax, mL/sec	Group 1	18.0 (3.0–50.0)	18.0 (4.0–30.0)	Z=1.198	0.231
M (min–max)	Group 2	17.0 (1.0–50.0)	14.0 (1.0–40.0)	z=3.006	0.003
	Group 3	17.0 (1.0–53.0)	14.0 (2.0–39.0)	z=1.963	0.050
PVR, mL	Group 1	45.0 (10.0–380.0)	65.0 (5.0–320.0)	z=4.189	<0.001
M (min–max)	Group 2	45.0 (0.0–520.0)	45.0 (1.0–420.0)	z=1.489	0.134
	Group 3	45.0 (1.0–445.0)	75.0 (10.0–600.0)	z=2.841	0.005
Duration of urethral catheter, day M (min–max)	Group 1	2.0 (1.0–15.0)	2.0 (1.0–5.0)	z=1.371	0.170
	Group 2	2.0 (1.0–13.0)	2.0 (1.0–18.0)	z=0.908	0.364
	Group 3	2.0 (2.0–19.0)	2.0 (2.0–13.0)	z=0.443	0.658
Length of hospital stay, day	Group 1	2.0 (1.0–10.0)	2.0 (1.0–19.0)	z=0.871	0.384
M (min–max)	Group 2	2.0 (1.0–7.0)	2.0 (1.0–4.0)	z=0.003	0.998
	Group 3	2.0 (1.0–8.0)	2.0 (1.0–8.0)	z=1.491	0.136
Operating time, min	Group 1	60.0 (15.5–180.0)	45 (15.0–165.0)	z=4.401	<0.001
M (min–max)	Group 2	60.0 (15.0–190.0)	60.0 (25.0–155.0)	z=0.118	0.906
	Group 3	55.0 (20.0–150.0)	60.0 (20.0–235.0)	z=1.653	0.098
Resected tissue, mL	Group 1	19.65 (2.0–228.0)	14.0 (1.0–75.0)	z=2.568	0.010
M (min–max)	Group 2	22.0 (0.3–212.6)	18.0 (2.0–60.8)	z=1.643	0.100
	Group 3	21.3 (1.7–84.9)	18.0 (2.4–105.0)	z=0.177	0.860
Resection speed (resected tissue/operation time) *M (min–max)*	Group 1	0.31 (0.06–3.87)	0.32 (0.04–1.04)	z=0.097	0.923
	Group 2	0.37 (0.02–2.83)	0.3 (0.06–0.91)	z=3.084	0.002
	Group 3	0.39 (0.02–2.5)	0.37 (0.05–0.82)	z=2.285	0.022
Complications n (%)	Group 1	330 (85.1)	58 (14.9)	χ^2=2.107	0.201
None		32 (94.1)	2 (5.9)		
Urethral stricture	Group 2	466 (87.8)	65 (12.2)	χ^2=0.216	0.843
		61 (89.7)	7 (10.3)		
	Group 3	214 (88.4)	28 (11.6)	χ^2=0.757	0.376
		48 (84.2)	9 (15.8)		

%: column percentage, *M*: median, χ^2: Chi-square test statistic, z: Mann-Whitney *U*-test

perioperative and postoperative ES replacement in all groups ($P > 0.05$) [Table 3].

The increase in Qmax was significantly higher only in group 2 ($P = 0.032$), but it was numerically higher in all groups in the BTURP procedure [Table 4]. There was no significant difference in the decrease in the amount of PVR volume in all groups ($P > 0.05$), but it was numerically greater in the BTURP procedure in groups 1 and 3 [Table 4].

Table 4: Comparisons of the delta values of the groups according to the procedure

	Age categories	Procedure		Test statistics	
		BTURP *M (min–max)*	MTURP *M (min–max)*	*z*	*P*
Creatinine difference, µmol/l	Group 1	−0.07 (0.13)	−0.08 (0.14)	0.007	0.994
	Group 2	−0.1 (0.15)	−0.1 (0.16)	0.407	0.684
M (*IQR*)	Group 3	−0.13 (0.17)	−0.13 (0.15)	0.324	0.746
Hb difference, mmol/l	Group 1	−1.3 (1.1)	−1.3 (0.8)	0.293	0.770
M (*IQR*)	Group 2	−1.3 (1.1)	−1.5 (1.17)	1.534	0.125
	Group 3	−1.4 (1.2)	−1.2 (1.35)	0.897	0.369
Qmax difference, mL/s	Group 1	10.0 (9.0)	9.5 (10.75)	0.803	0.422
M (*IQR*)	Group 2	9.0 (11.0)	7.0 (9.75)	2.148	0.032
	Group 3	9.0 (9.0)	7.0 (8.5)	1.786	0.074
PVR difference, mL	Group 1	−75.0 (121.25)	−67.5 (112.5)	0.253	0.801
M (*IQR*)	Group 2	−65.0 (100.0)	−72.5 (92.5)	0.364	0.716
	Group 3	−80.0 (105.0)	−65.0 (145.0)	1.028	0.304

M: median; *z*: standardized Mann-Whitney *U*-test; IQR: interquartile range

Discussion

Approximately 70% of males aged >70 years are known to experience BPH symptoms of different degrees.[10] Surgical treatment is required for elderly patients who do not respond to medical treatment, as their quality of life will be more negatively affected. Although MTURP is accepted as the gold standard in surgical treatment,[3] there are concerns about complications.[4] Therefore, alternative minimally invasive treatments that can be comparable to MTURP have been investigated, and the main one of these is BTURP.

The most important of the reasons for the need for an alternative treatment is the fall in Hb seen in MTURP. Intra- and postoperative bleeding impairs visualization of the surgical area, reduces the amount of tissue removed, and increases the need for blood transfusion. It vaporizes the tissue and controls bleeding during tissue resection performed with the bipolar electrosurgery method. In addition, the greater depth of coagulation leads to better control of bleeding areas and good hemostasis during resection.[11] In some studies, it was reported that the Hb decrease was significantly less in patients who underwent BTURP.[12–15] In contrast to these, there are also studies showing that there is no statistically significant difference between the groups.[16–18] In the current study, there was no statistically significant difference in the decrease in Hb value ($P > 0.05$). However, although there was no statistically significant difference in group 2, there was a numerically greater decrease in the MTURP method. We think that this may have an impact on which technique to choose for geriatric patients who are planning to undergo surgical treatment for BPH.

The effect of MTURP and BTURP on the increase in Qmax and the decrease in PVR volume is indisputable. However, many studies have shown that there is no statistically significant difference between the two methods.[6,14,19] In this study, the increase in Qmax in the BTURP method was statistically significant in group 2 ($P = 0.032$). Moreover, although there was no significant difference, it was numerically higher in the other groups. Studies have shown that there is no statistically significant difference between the two methods in terms of reduction in PVR volume.[19,20] Although similar results were found in our study, the decrease in PVR volume was numerically higher in all groups except group 2, although it was not statistically significant in the BTURP method. These results suggest that BTURP is more effective in improving the quality of life of geriatric patients.

BTURP is thought to be more advantageous in terms of catheter withdrawal time and hospital stay due to its positive effect on hemostasis and bleeding. Starkman *et al*.[21] showed that the time to catheter removal and hospital stay were shorter in BTURP than in the MTURP method. There are other studies on this subject showing that it is statistically significantly shorter in the BTURP method.[14,20] In contrast to these, there are also studies showing that there is no difference in terms of duration.[16,17] In the current study, no statistically significant difference was determined in the duration of the catheter withdrawal and hospital stay ($P > 0.05$).

Urethral stricture is an important complication in terms of causing urination difficulties and requiring reoperation. In a study by Tefekli *et al*.,[22] urethral stricture was reported at a higher rate in the BTURP group. Several risk factors such as the high ablative energy used or the larger diameter of the resectoscope are thought to be responsible for this. Ho *et al*.[6] also showed a higher rate in the bipolar group. In the current study, no statistically significant difference was determined in all the groups ($P > 0.05$). The fact that it

is comparable to MTURP in terms of this complication that may require reoperation shows the suitability of BTURP for geriatric patients.

The fact that there is no TUR syndrome associated with the use of isotonic solution and thereby the operating time is not affected is an important advantage of bipolar electrosurgery. It can be applied to large-volume prostates, and greater tissue resection can be obtained due to the operating time not being affected. In a study by Poh *et al*.,[23] although not statistically significant, it was reported that more tissue was resected in the bipolar group. In another study, although there was no significant difference between prostate volumes, it was shown that in the BTURP method, the resected tissue was larger, the duration of the operation was shorter and the resection was faster.[15] In contrast to those studies, there are also reports in the literature of less resected tissue and a longer operating time in bipolar groups.[12,24] In this study, the prostate volumes of patients who underwent BTURP were larger in all age groups and statistically significant in groups 1 and 2. Resected tissue was numerically more significant in the bipolar method in all groups, although it was significant only in group 1 ($P = 0.01$). In the bipolar method, the operation time was statistically significantly longer in group 1 ($P < 0.001$), similar in group 2, and shorter in group 3. However, although prostate volumes were higher in groups 2 and 3 in the BTURP method, the resection rate was statistically significantly higher in these groups ($P < 0.05$). The shorter anesthesia and operation time provided by rapid tissue resection that will not cause complications is important for elderly patients, and therefore, we think that BTURP is more effective and safer in geriatric patients.

The main limitation of this study was that it was retrospective and serum sodium changes in patients were not analyzed. In the retrospective analysis of the patients' data, serum sodium change is not included in the evaluations because preoperative and postoperative serum sodium values are not available. A further limitation could be said to be the short follow-up period.

Conclusion

The results of this study demonstrated that BTURP is at least as effective and safe as MTURP for geriatric patients. BTURP seems to be a better technique in terms of Hb decrease, amount of resected tissue, resection rate, increase in Qmax, and decrease in PVR volume. Therefore, the BTURP method may be preferred for older patients in terms of efficacy and safety. In addition, it can be said that BTURP is safer for older patients because it is comparable in terms of the development of urethral stricture, which causes micturition disorders and causes the need for reoperation. Many studies are comparing BTURP and MTURP methods in the literature, but this study is important because there is no study comparing them in terms of efficacy and safety for geriatric patients. However, prospective randomized controlled studies comparing TURP methods according to age groups are needed, and we think that this study will lead the way.

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Conflicts of interest

There are no conflicts of interest.

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