Comparison of Transurethral Resection of the Prostate (TURP) with 0.5-cm Tissue Preservation Proximal to the Verumontanum and Standard TURP in terms of Postoperative Ejaculation Disorders

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Purpose: To compare postoperative ejaculation disorders (EjDs) between transurethral resection of the prostate (TURP) with 0.5-cm tissue preservation proximal to the verumontanum and the standard TURP procedure.

Materials and Methods: Between February 2016 and August 2020, 226 patients who underwent TURP for symptomatic benign prostatic hyperplasia were retrospectively screened. The patients were analyzed in two groups: In Group A (n = 106), TURP was performed by preserving 0.5-cm tissue proximal to the verumontanum, while in Group B (n = 120), standard TURP was performed. The postoperative voiding functions and EjD rates were compared.

Results: Similar findings were observed in the international prostate symptom score, health-related quality of life score, maximum urine flow rate, and post-void residual volume in both groups. In Group A, ejaculation was preserved in 55 (51.9%) patients, the ejaculation volume was decreased in 13 (12.3%), and EjD developed in 38 (35.8%). In Group B, ejaculation was preserved in 16 (13.8%) patients, the ejaculation volume decreased in 15 (12.5%), and EjD developed in 89 (74.2%).

Conclusion: The ejaculatory function of patients can be maintained in the TURP procedure through the preservation of 0.5-cm tissue from the proximal verumontanum. The modification of TURP can further reduce the risks and undesirable effects of the procedure. The implementation of novel surgical technique modifications and technological developments can potentially decrease complication rates. This approach will also eliminate the assumption that the development of EjD is inevitable after prostate surgery.

Keywords: benign prostate hyperplasia; ejaculation; postoperative ejaculation disorders; retrograde ejaculation; transurethral resection of the prostate.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a chronic and progressive condition that affects three-quarters of men later in life[1]. Clinically, BPH manifests itself through lower urinary tract symptoms (LUTS) that affect quality of life[2]. Another common disorder that ageing men suffer from is sexual dysfunction[3]. Sexual dysfunction includes not only erectile dysfunction but also ejaculation abnormalities, difficulty reaching orgasm, decreased libido, and overall dissatisfaction. Both BPH and sexual dysfunction have a significant impact on the quality of life of older men[4].

Although transurethral resection of the prostate (TURP) is currently the gold standard for surgical treatment of BPH, this procedure is not without complications. Ejaculation disorders (EjDs) refer to retrograde ejaculation (i.e., leakage of seminal fluid from the urethra into the meatus and bladder) or anejaculation. EjDs are considered an expense incurred in the process of recovering from LUTS after TURP. Patients are informed about this potential complication before surgery[5,6]. The choice of the deobstruction technique depends on many factors, such as prostate size, comorbidities, the surgeon's surgical preferences, and the patient's willingness to accept surgical sequelae related to surgery[7]. Many minimally invasive surgical techniques and approaches have been developed and continue to be developed to reduce the undesirable effects of TURP and increase its efficacy and safety[8].

Although the pathophysiology of EjD after BPH surgery is not fully understood, it appears that the preservation of the verumontanum borders, as well as the bladder neck, can reduce the risk of postoperative EjD[9,10]. Therefore, techniques that preserve ejaculation are gaining popularity among patients who wish to maintain normal ejaculation function. These techniques suggest preserving approximately 1 centimeter (cm) of paracollicular prostate tissue with or without the preservation of the bladder neck[10]. Existing studies show that ejaculation-preserving TURP can provide similar results in terms of improvement in LUTS compared to standard TURP[11]. Ongoing investigations are being conducted to determine the size, shape, and location of the preserved tissue related to the preservation of the bladder neck and verumontanum. In this study, we planned to compare EjD and functional results between TURP with 0.5-cm tissue preservation proximal to the verumontanum and standard TURP.

MATERIALS AND METHODS

Study population

Following the approval of the Clinical Research Eth-

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Table 1. Demographic information of the patients

Parameter	Group A Mean (SD) Median Min-Max	Group B Mean (SD) Median Min-Max	*p*-value
N	106	120	
Age (years)	69.45 (6.42) 68 55-78	70.06 (10.27) 69 57-79	.231
Prostate volume (cm^3)	53.9 (10.94) 52 41-65	54.9 (13.21) 51 43-69	.321
PSA (ng/dL)	2.56 (1.37) 2.37 0.5-4.1	2.67 (1.31) 2.41 0.4-4.2	.161
PVR (mL)	96 (22.58) 85 55-123	99.3 (33.3) 88 50-111	.785
IPSS	21.6 (4.66) 20 16-30	20.9 (2.6) 20 16-30	.307
Qmax (mL/sec)	4.30 (1.55) 5 1-8	4.96(1.66) 4 0-10	.215
HRQL score	4.31 (0.96) 4 0-5	4.91 (1.61) 4 0-5	.444

PSA: prostate-specific antigen, IPSS: international prostate symptom score, HRQL: health-related quality of life, Qmax: maximum urine flow rate, PVR: postvoid residual urine volume

ics Committee of Adıyaman University on January 18, 2022, 245 patients who underwent TURP for symptomatic BPH between February 2016 and August 2020 at the urology clinic of the Adıyaman University Faculty of Medicine were retrospectively reviewed. After applying the exclusion criteria, 226 patients were included in the sample. The patients were examined in two groups. In Group A (n = 106), TURP was performed with the preservation of 0.5-cm tissue from the verumontanum, while in Group B (n = 120), conventional TURP was performed. Written informed consent was obtained from all patients.

Study design and surgical technique

The surgical procedure used for the preservation of the verumontanum was a modification of the techniques described by Alloussi et al.[10]. The tissue to be preserved was determined by making a marking a 0.5-cm area proximal to the verumontanum. After the complete resection of the middle lobe to this point, paracollicular tissues were preserved, the resection of the side lobes was performed up to the verumontanum level, and a circular resection of the bladder neck was undertaken.

Inclusion and exclusion criteria

Patients who received medical treatment but had an international prostate symptom score (IPSS) of >14 and a maximum urine flow rate (Qmax) of ≤10 mL/sec, were sexually active, and did not have EjD were included in the study. The exclusion criteria were hypocontractility or hypoactivity of the detrusor in the urodynamic study, untreated acute urinary retention, incontinence, urethral stricture, EjD (confirmed by testing for the presence of sperm in urine after dry ejaculation), prostate cancer, previous prostate, bladder neck, or urethral surgery, metabolic disorders (including diabetes mellitus), and neurological disorders. Patients who developed postoperative urethral stricture and bladder neck contracture were also excluded from the study as these conditions may cause EjD.

Evaluations

In all cases, a general clinical assessment was per-

Table 2. Perioperative results of the patients

Parameter	Group A Mean (SD) Median Min-Max	Group B Mean (SD) Median Min-Max	*p*-value
Operation Time(min)	63.5 (13.5) 60 55-75	62.4 (12.19) 58 48-78	.454
Catheterization Time(h)	75.6 (20.6) 72 62-86	76.5 (21) 74 60-88	.170
Hemoglobin Decrease(g/dL)	1.3 (0.12) 1.1 0.9-2.5	1.1 (0.1) 1 0.4-2	.555
Hospital Stays(day)	3.5 (1.2) 2 1-5	3.2 (1.8) 2 1-5	.091

Table 3. Postoperative follow-up results

Parameter		Group A Mean (SD) Median Min-Max	Group B Mean (SD) Median Min-Max	*p*-value
PVR (mL)	Month 3	17.9 (5.69) 16.5 11-27	20.3 (5.87) 18.5 5-35	.069
	Month 6	18.7 (6.46) 17 5-30	17.3 (7.25) 12 0-40	.373
	Month 12	17.0 (7.53) 15 0-30	18.8 (6.51) 18 5-45	.237
IPSS	Month 3	10.70 (4.33) 8 5-16	10.1 (4.54) 6 6-18	.789
	Month 6	10.02 (4.11) 8 6-16	9.1 (3.96) 6 8-18	.489
	Month	9.0 (4.02) 8 6-16	9.2 (4.04) 8 8-16	.819
Qmax (mL/sec)	Month 3	17.26 (2.24) 15 11-25	19.8 (3.87) 16 10-35	.332
	Month 6	19.05 (2.25) 16 10-35	20.3 (3.84) 14 11-40	.451
	Month 12	20.25 (2.04) 16 10-40	21.0 (3.2) 15 10-35	.875
HRQL	Month 3	2.04 (1.37) 2 0-5	2.2 (1.22) 2 0-5	.754
	Month 6	2.1 (1.67) 2 0-5	2.5 (2.03) 2 0-5	.652
	Month 12	1.80 (1.34) 2 0-5	2.1 (.85) 2 0-5	.541

IPSS: International prostate symptom score, HRQL: health-related quality of life, Qmax: maximum urine flow rate, PVR: postvoid residual urine volume

formed, including a digital rectal examination (DRE), urine culture analysis, and measurements of prostate-specific antigen (PSA), post-void residual (PVR) urine volume, IPSS, Qmax, and health-related quality of life (HRQL) scores. Patients with a PSA value of >2.5 ng/mL or abnormal findings in DRE underwent an ultrasound-guided prostate biopsy before surgery. Spinal anesthesia was applied to all patients. All surgical procedures were performed using a bipolar 26-Fr continuous flow plasma kinetic system resectoscope. The Gyrus Pasmakinetic (Gyrus ACMI, USA) unit was used for cutting and coagulation (80 W and 120 W). During surgery, an isotonic sodium chloride irrigation solution was used for bladder irrigation (Koçak Farma, Turkey). At the end of the operation, a 22-Fr three-way Foley catheter (Coloplast, USA) was placed for continuous bladder irrigation with saline. On the postoperative third day, bladder irrigation was discontinued, and the catheter was removed according to department protocol, unless otherwise indicated.

Outcome assessment

The patients were usually discharged the day after the catheter was removed. They were evaluated at three-, six-, and 12-month intervals. During the follow-up examinations, PVR, IPSS, Qmax, HRQL, EjD (anejaculation/retrograde ejaculation and decreased volume of ejaculation), and ejaculation function (EjF) rates were evaluated and compared between the two groups.

The study was approved by the Clinical Research Ethics Committee of Adıyaman University on January 18, 2022, with decision number 2022-5/7. All human subjects provided written, informed consent with guarantees of confidentiality.

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics version 17.0 software (IBM Corporation, Armonk, NY, USA). For continuous variables with more than two groups, a one-way analysis of variance (ANOVA) analysis was conducted when the data met parametric assumptions. Otherwise, the Kruskal-Wallis H test was used. When the Kruskal-Wallis H test indicated a statistically significant difference (p-value < .05), the Mann-Whitney U test was performed for pairwise comparisons to identify specific group differences. Analyses based on patients' clinical characteristics were undertaken using ANOVA for multiple groups and the t-test for pairwise comparisons of continuous variables. For categorical variables analyzed in 2x2 contingency tables, the continuity-corrected chi-square test was used when expected cell frequencies ranged from 5 to 25, while Fisher's exact test was applied when any expected cell frequency was 5 or less. Throughout the analysis,

Table 4. Ejaculation results at the 12-month follow-up

		Group A n (%)	Group B n (%)	*p*-value
Ejaculatury dysfunction	Anejaculation/retrograde ejaculation	38 (35.8%)	89 (74.2%)	< .001
	Decreased volume of ejaculation	13 (12.3%)	15 (12.5%)	.373
	Preserved ejaculatury function	55 (51.9%)	16 (13.3%)	< .001

a p-value of less than .05 ($p < .05$) was considered statistically significant. The clinical significance of results was assessed based on appropriate measures of association, including mean/median differences and odds ratio estimates with 95% confidence intervals.

RESULTS

Groups A and B had similar preoperative characteristics in terms of age (69.45 ± 6.42 years versus 70.06 ± 10.27 years; 95% confidence interval [CI]: 60–73, odds ratio [OR] = 1.5, $P = .231$), prostate volume (53.9 ± 10.94 cm^3 versus 54.9 ± 13.21 cm^3; 95% CI: 46–62, OR = 1.3, P = .321), PSA (2.56 ± 1.37 ng/mL versus 2.67 ± 1.31 ng/mL; 95% CI: 1.2-3.8, OR = 1.2, $P = .161$), PVR (96 ± 22.58 mL versus 99.3 ± 33.3 mL; 95% CI: 61–106, OR = 1.1, $P = .785$), IPSS (21.6 ± 4.66 versus 20.9 ± 2.6 ; 95% CI: 16–30, OR = 0.9, $P = .307$), Qmax (4.30 ± 1.55 versus 4.96 ± 1.66; 95% CI: 2.5–11, OR = 0.6, P = .215), and HRQL (4.31 ± 0.96 versus 4.91 ± 1.61; 95% CI: 1–5 OR = 0.57, $P = .444$) (**Table 1**). There were no significant differences between the two groups in terms of the duration of surgery (63.5 ± 13.5 minutes versus 62.4 ± 12.19 minutes; 95% CI: 50–75, OR = 0.63, $P = .454$), the duration of catheterization (75.6 ± 20.6 hours versus 76.5 ± 21 hours; 95% CI: 64–84, OR = 0.6 , $P = .170$), the decrease in hemoglobin (1.3 ± 0.12 g/dL versus 11 ± 0.1 g/dL; 95% CI: 0.5–2 , OR = 1.2, $P = .555$), or the length of hospital stay (3.5 ± 1.2 days versus 3.2 ± 1.8 days; 95% CI: 1–5 , OR = 1.4, $P = .091$) among the perioperative results (**Table 2**). The results of LUTS at the third-, sixth-, and 12th-month follow-ups were similar between the groups (**Table 3**). However, the EjF rate was significantly higher in Group A (n = 55, 51.9%) versus n = 16, 13.3%, OR = 3.7, $P < .001$), and anejaculation/retrograde ejaculation was observed more frequently in Group B (n = 38, 35.8% versus n = 89, 74.2%, OR = 4.7, $P < .001$). The decrease in ejaculation volume was similar in both groups (n = 13, 12.3%) versus n = 15, 12.5%, OR = 1.1, $P < .001$) (**Table 4**).

DISCUSSION

The BPH Guidelines Panel reported the mean incidence of retrograde ejaculation, now referred to as EjD, to be 73% (15-99)[12]. Traditional TURP is performed by the careful removal of the apical tissue around the verumontanum[13]. We modified our operations accordingly by incorporating the Alloussi technique into our clinical practice. This technique emphasizes the importance of protecting ejaculation by sparing the paracollicular tissue and the tissue around the verumontanum for the preservation of antegrade ejaculation. Criticisms and observations related to this technique have led to confusion over the potential negative impact of leaving apical prostate tissues on the functional outcomes of voiding, which is the main goal of TURP, and the likelihood of requiring re-procedures. We concluded that leaving a smaller margin would be a more optimized approach to preserve ejaculation and alleviate LUTS. In our study, the results of LUTS were similar between the standard TURP and the modified TURP technique, which we performed by preserving 0.5-cm tissue proximal to the verumontanum. With the modified TURP, we determined the EjF rate to be 51.9%, and when we include those with reduced ejaculation, our EjF rate increased to 65%. In a recent study by Elshazly et al., a new technique was developed by combining two existing methods: preserving both the verumontanum and the bladder neck. Considering the excessive amount of tissue remaining in the verumontanum, the authors preserved only 0.5-cm tissue proximal to the verumontanum and reported an EjF rate of 80% with very encouraging results. However, given the limited number of patients and their lack of reported rates of reduction in ejaculatory volume, the argument that preservation of the bladder neck is unnecessary to preserve EjF is controversial[14]. We consider that even if bladder neck resection is performed, leaving enough paracollicular tissue 0.5 cm from the verumontanum is sufficient to preserve ejaculation.

The ejaculatory ducts traverse a straight path toward the seminal colliculus after drawing an anteromedial curve within the prostate, and their terminal portions diverge just before joining the prostatic urethra. Clear information about the morphology of the terminal part of the canals has not yet been obtained. The average length of the canals varies between 1.4 and 2.2 cm, and it has been shown that the lumen diameter is gradually getting smaller[15,16]. The ejaculation process is typically divided into two stages: emission and ejection[17]. The emission stage consists of contractions of the seminal vesicles and prostate, with the expulsion of sperm and seminal fluid into the posterior urethra, mediated by the sympathetic nerves (T10-L2)[18]. The ejection stage involves the pulsatile contractions of the bulbocavernosum and pelvic floor muscles with relaxation of the external urinary sphincter of somatic nerves (S2-S4). Ejection also includes a sympathetic spinal reflex with limited voluntary control. The neck of the bladder closes to prevent retrograde flow, the bulbocavernous, bulbospongiosus, and other pelvic floor muscles contract rhythmically, and the external urinary sphincter relaxes. The intermittent contraction of the urethral sphincter prevents retrograde flow into the proximal urethra[19]. Musculus ejaculatorius, located at the middle and proximal ends of the verumontanum, has been found to prevent this reversal by mechanically closing the paracollicular or supracollicular tissue, characterized as the head of ejaculation[20].

BPH is common in older men, and LUTS affects quality of life[21]. A large-scale study of 14,000 men reported that, although 90% of aging men had LUTS, and 83% continued to engage in sexual activity[22]. For years, men have been warned about the potential risk of developing EjD following TURP, as this complication is almost inevitable[23]. It has been accepted that in cases of bladder neck incision, despite the lower retrograde ejaculation rate, the incidence of EjD is much lower

compared to procedures that disrupt the integrity of the bladder neck[24,25]. Furthermore, studies indicate that there is evidence supporting the efficacy of EjD surgery[26]. It has been argued that there is a direct correlation between the preoperative incidence of EjD and the likelihood of a patient undergoing TURP. However, to date, these hypotheses have not been supported by solid clinical data. This can be partly attributed to the lack of standardized definitions for EjF and EjD[27].

The limitation of our study is that the study design was retrospective and based on clinical observation. In BPH, patient age is an important variable in guiding the selection of the most appropriate surgical option, taking into account comorbidities and, more specifically, the high correlation between age and EjD. However, due to the increase in life expectancy, there is also consideration for implementing ejaculation preservation strategies in older men[28]. Despite a growing understanding of anatomical and pathophysiological characteristics, as well as the importance of ejaculation for the HRQL of men of all ages, high-quality studies have only addressed LUTS and neglected sexual function as the primary outcome. Future studies should also consider EjD instead of solely defining LUTS. Clear hypotheses are also needed to formulate clear hypotheses to safely address the selection of the most appropriate surgical strategy, aiming to reduce ejaculation dysfunction and preserve ejaculation[28]. There is a scarcity of research that properly evaluates EjD, warranting high-quality studies investigating the incidence of EjD after BPH surgery. With the advancements in technology, improved techniques, such as UroLift and holmium laser enucleation of the prostate, have the potential to provide better outcomes and reduce complications in the treatment of EjD[29,30].

CONCLUSIONS

Due to the prolongation of life expectancy in aging men, the preservation of sexual functions is as important as improving the voiding function of patients in the treatment of LUTS. During the TURP procedure, the EjF of patients can be protected by preserving 0.5-cm tissue proximal to the verumontanum. The modification of TURP can further reduce the risks and undesirable effects of the procedure. The implementation of novel surgical technique modifications and technological developments can potentially decrease complication rates. This approach will also eliminate the assumption that the development of EjD is inevitable after prostate surgery.

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CONFLICT OF INTEREST

None of the contributing authors have any conflict of interest, including specific financial interests, relationships, or affiliations relevant to the subject matter or materials discussed in the manuscript.

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