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# The Effect of Transurethral Resection of the Prostate on Erectile and Ejaculatory Functions in Patients with Benign Prostatic Hyperplasia

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**Keywords**
Sexual function · Erectile function · Ejaculation function · Benign prostatic hyperplasia · Transurethral resection of prostate · Lower urinary tract symptoms

**Abstract**
***Introduction:*** The aim of this study was to investigate the effect of TURP on erectile function (EF) and ejaculatory function (EJF). ***Methods:*** A total of 91 patients who underwent TURP were retrospectively assessed. Patients were divided into two groups based on International Index of Erectile Function (IIEF-5): group A included 41 patients with normal EF, and group B included 50 patients with erectile dysfunction (ED). All patients were evaluated for EF and EJF at baseline, 1, 3, and 6 months after TURP by using IIEF-5, Ejaculatory Domain-Male Sexual-Health Inventory (Ej-MSHQ). ***Results:*** In group A, there were no significant statistical differences in mean IIEF-5 at baseline and after TURP 22.88 ± 0.81 versus 22.63 ± 2.63 ($p$ = 0.065). However, in group B, there was significant improvement in IIEF-5 after TURP all over the follow-up time points in comparison to the baseline ($p$ = <0.001). The loss of EJF was significant among patients in group A. There was significant improvement of IPSS and Qmax in group A after surgery compared to group B. ***Conclusion:*** The results confirmed that TURP has no significant negative influence on EF, and patients with preexisting ED were improved after TURP. On the contrary, the loss of EJF was significant.


## Introduction

Lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH) are very common clinical complaints among older men [1]. In fact, the prevalence of BPH is approximately 50% for men in their fifties and reaches up to 80% for men over 80 years of age, representing one of the most common diseases affecting males, with potentially significant impact on their quality of life [2]. Several studies have found that erectile func-

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tion (EF) and ejaculatory function (EJF) are frequently affected in patients with LUTS secondary to BPH in men over the age of 50 years [3].

Oral pharmacotherapy for LUTS secondary to BPH is effective, particularly with the widespread use of alpha-1 blockers alone or together with 5-alpha-reductase inhibitors. However, surgical therapies remain common for severe and refractory BPH-related LUTS or when patients have side effects or poor tolerance of medical therapy [4]. Despite many recent innovations in the surgical treatment of BPH, transurethral resection of the prostate (TURP) remains the gold standard surgical approach worldwide and one of the most frequently performed procedures in urology [5, 6]. As BPH in most cases is not a life-threatening condition, the main outcomes of its treatment are not only the improvement in LUTS and functional parameters but also quality of life after surgery. With significant sexual activity of aging males, the question of the effect of transurethral surgery on EF is of importance [7].

There are controversial results reported in the literature regarding the effect of TURP on sexual function. Some studies reported negative effects, whereas others showed an improvement in EF and EJF [7–11]. Li et al. [12] evaluated nine different approaches to the treatment of BPH in 18 RCTs with 2,433 participants. Overall, the authors found in this meta-analysis a small decrease in EF with short-term follow-up. However, at a longer follow-up of 12 months after TURP, the mean EF values returned to preoperative levels, especially in patients presenting with an initially high EF.

Ejaculatory failure is the most common sexual consequence following TURP and is often associated with significant bother. For decades, men have been counseled to expect dry orgasm after TURP because of the retrograde flow of semen as a result of bladder neck disruption [13]. Recently, together with a better understanding of the mechanisms of ejaculation, a greater importance has been given to the impact of dry ejaculation on patients' QoL [14]. A balance between symptomatic improvement in LUTS and preservation of sexual function needs to be addressed for men seeking surgical treatment [15].

Hence, the effect of TURP on EF and EJF is still controversial, with conflicting results based on generally low levels of evidence. The present retrospective study aims to assess EF and EJF after TURP for the treatment of LUTS secondary to BPH.

## Patients and Methods

*Study Design and Approval*

After obtaining an Institutional Review Board approval at Jordan University Hospital (10/2020/16049), we performed a retrospective analysis of 91 patients who underwent TURP for BPH between July 2016 and Jun 2020. All participants provided written informed consent prior to enrolment in the study.

Patients were divided into two groups based on EF before surgery, using International Index of Erectile Function-5 (IIEF-5): group A comprised patients in whom EF was normal before surgery (IIEF-5 score ≥22); group B comprised patients who had erectile dysfunction (ED) before surgery (IIEF-5 score <22).

*Inclusion and Exclusion Criteria*

Inclusion criteria were age over 45 years, TURP for LUTS secondary to BPH, sexually interested, with reported sexual activity over the last 3 months. Patients were excluded from analysis if they had prostate cancer, previous prostatic surgery, urethral stricture, bleeding diathesis, spinal cord injury, cerebrovascular accident, active urinary tract infection, bladder stones, neurogenic bladder disorders, and capsular or bladder perforation during surgery, severe hemorrhage during or immediately after surgery.

*Patient Assessment*

Medical, surgical, and sexual history using IIEF-5, Ejaculatory Domain of Male Sexual-Health Questionnaire (Ej-MSHQ), and the International Prostate Symptoms Score (IPSS) were performed. Physical examination including digital rectal examination, laboratory workup including urine analysis and culture, hemoglobin, creatinine, electrolytes, prostate-specific antigen (PSA), transabdominal ultrasound for prostate volume, prevoid, and postvoid residual (PVR) evaluation, and maximum flow rate measurement (Qmax) were evaluated.

*Intervention*

TURP was performed under general or spinal anesthesia. Intravenous antibiotics were given to all patients at the time of anesthesia induction and maintained throughout the hospital stay. Patients were then switched to oral antibiotics for another 3 days. Monopolar TURP was performed by the same urologist (S.A.). Prostate hyperplastic tissue was removed until the surgical capsule was reached. Continuous-flow 26 Fr resectoscopes (Karl-Storz, Germany) were used with the electrical current set for resection in glycine solution with cut/coagulation set at 130/70 W. At the end of the procedure, all resected prostatic tissues were evacuated and sent for histopathological examination. Diathermy of the bleeding areas was performed, and a three-way urethral catheter 20 Fr was inserted for irrigation with normal saline 0.9%. Operating times were calculated starting with the insertion of the resectoscope until the final removal of all resected prostatic tissues. All patients were discharged if they passed urine successfully after urethral catheter was removed.

*Outcome Measures and Assessment Tools*

The primary outcomes were to assess the changes in EF and EJF after TURP after 1 month, 3 months, and 6 months after TURP. EF was assessed using IIEF-5. The EF was classified as: no ED (22–25), mild ED (17–21), mild-to-moderate ED (12–16), moderate ED (8–11), and severe ED (1–7). Differences in the EF scores be-

**Table 1.** Baseline data and perioperative characteristics

| Variable | Group A ($N = 41$) | Group B ($N = 50$) | Statistical test |
|---|---|---|---|
| | mean (SD) | mean (SD) | $t$ test ($p$ value) |
| Age, years | 61.09 (4.95) | 71.78 (7.02) | 8.49 (<0.001) |
| BMI, kg/m$^2$ | 27.18 (3.39) | 27.11 (3.62) | 0.09 (0.93) |
| Prostate size, g | 61.59 (14.16) | 75.60 (15.86) | 4.40 (<0.001) |
| Resection weight, g | 22.51 (7.63) | 24.94 (7.40) | 1.54 (0.14) |
| IPSS at baseline | 24.83 (5.33) | 26.34 (4.17) | 1.52 (0.13) |
| Duration of surgery, min | 51.15 (13.91) | 68.34 (13.90) | 5.87 (<0.001) |
| | $N$ (%) | $N$ (%) | $\chi^2$ ($p$ value) |
| DM | | | |
| No | 32 (78.0) | 25 (50.0) | 7.57 (0.006) |
| Yes | 9 (22.0) | 25 (50.0) | |
| HTN | | | |
| No | 31 (75.6) | 25 (50.0) | 6.24 (0.012) |
| Yes | 10 (24.4) | 25 (50.0) | |
| IHD | | | |
| No | 37 (90.2) | 38 (76.0) | 3.15 (0.076) |
| Yes | 4 (9.8) | 12 (24.0) | |
| Medication | | | |
| Alpha blockers | 36 (87.8) | 29 (58.0) | 9.81 (0.002) |
| α-Blocker and 5α-reductase | 5 (12.2) | 21 (42.0) | |
| Anesthesia | | | |
| General | 26 (63.4) | 34 (68.0) | 0.09 (0.764) |
| Spinal | 14 (34.1) | 16 (32.0) | |

IPSS, International Prostate Symptom Score; SD, standard deviation; DM, diabetes mellitus; HTN, arterial hypertension; IHD, ischemic heart disease.

tween baseline and the last follow-up "EF evolution" were classified as "improved," "stable," or "deteriorated." Improvement was defined as a 5-point or greater improvement in the IIEF-5, deterioration was defined as a 5-point or greater decrease in the IIEF-5, and stable was defined as no such changes in the IIEF-5 score [16].

Ej-MSHQ was used for detailed assessment of the impact of TURP on EJF. This domain entails seven questions assessing ejaculatory frequency, latency, volume, force, pain, pleasure, and dry ejaculation. Each question has a score from 1 to 5 (best function), and the outcome of each question is considered significantly impaired once it equals 2 or less. A total Ej-MSHQ score of good EJF was considered for a range from 28 to 35, average from 22 to 27, and ejaculatory dysfunction for a score less than 22. Secondary outcome was to evaluate urinary function variables including LUTS using IPSS, Qmax test, and PVR urine at baseline, 2 weeks, 1 month, and 3 months after TURP.

*Statistical Analysis*

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0 (IBM, 2017). Descriptive statistics were used to summarize the data, including the means, standard deviations, and frequencies. Repeated measure analysis of variance (RMANOVA) was used to compare the changes in the clinical conditions over the four time points in the study. The level of significance was set at 0.05. Based on the level of measurement for the variables, $t$ test and $\chi^2$ test were used to compare the data between the two groups of the study and between baseline and at the 3 months follow-up after TURP. Analysis of covariance (ANCOVA) was used to examine the effect of potential covariates.

## Results

Table 1 shows baseline data and clinical perioperative characteristics in both groups. There were statistically significant differences between the two groups regarding age, prostate size, length of resection time, diabetes mellitus, arterial hypertension, and BPH medications.

Table 2 summarizes the mean IIEF-5 score in both groups at baseline and different time points of follow-up after TUPP. In group A, the mean IIEF-5 score remained stable after TURP with no significant statistical difference ($p = 0.065$). However, the mean IIEF-5 score in group B was significantly improved after TURP at all time points of follow-up and reached the maximum improvement at 6 months compared to baseline ($p = <0.001$; online suppl

**Table 2.** Mean of IIEF-5 score of both groups at baseline and follow-up time points after TURP

| Groups | Mean (SD)<br>Baseline (1) | Mean (SD)<br>One month (2) | Mean (SD)<br>Three months (3) | Mean (SD)<br>Six months (4) | *F* (*p* value) |
|---|---|---|---|---|---|
| Group A (*N* = 41) | 22.88 (0.81) | 22.15 (2.45) | 22.63 (2.09) | 22.63 (2.63) | 2.47 (0.065) |
| Group B (*N* = 50) | 11.34 (3.18) | 12.84 (4.25)<br>2 > 1 ($p < 0.001$) | 14.38 (4.88)<br>3 > 1 ($p < 0.001$)<br>3 > 2 ($p < 0.001$) | 15.46 (5.57)<br>4 > 1 ($p < 0.001$)<br>4 > 2 ($p < 0.001$)<br>4 > 3 ($p < 0.001$) | 37.03 (<0.001) |

SD, standard deviation.

**Table 3.** Mean of Ej-MSHQ score of both groups at baseline and follow-up time points after TURP

| Groups | M (SD)<br>Baseline | M (SD)<br>One month | M (SD)<br>Three months | M (SD)<br>Six months | *F* (*p* value) |
|---|---|---|---|---|---|
| Group A (*N* = 41) | 26.44 (3.43) | 19.88 (4.19) | 19.54 (4.32) | 19.12 (4.56) | 86.42 ($p < 0.001$) |
| Group B (*N* = 50) | 13.42 (4.09) | 13.08 (4.10) | 13.14 (4.61) | 13.30 (5.01) | 0.42 ($p = 0.74$) |

TURP, transurethral resection of prostate; SD, standard deviation.

**Table 4.** Comparison between the two groups of the study at baseline and at 3 months after TURP

| | Group A (*N* = 41) | | Group B (*N* = 50) | | *t* statistics | *p* value |
|---|---|---|---|---|---|---|
| | mean | SD | mean | SD | | |
| IPSS baseline | 24.83 | 5.33 | 26.34 | 4.17 | 1.52 | 0.13 |
| IPSS at 3 months | 4.95 | 3.09 | 8.52 | 4.64 | 4.21 | <0.001 |
| PVR baseline | 90.42 | 67.64 | 103.12 | 56.50 | 0.98 | 0.33 |
| PVR at 3 months | 27.12 | 18.71 | 31.60 | 25.27 | 0.94 | 0.35 |
| Qmax baseline | 9.16 | 3.21 | 8.25 | 4.05 | 1.17 | 0.24 |
| Qmax at 3 months | 29.46 | 10.18 | 23.62 | 9.14 | 2.88 | 0.005 |

IPSS, International Prostate Symptom Score; PVR, postvoid residual; Qmax, maximum flow; SD, standard deviation.

Fig. 1; see www.karger.com/doi/10.1159/000524957 for all online suppl. material).

The distribution of the EF evolution for patients in group A showed that most patients (90.2%) remained stable at 6 months after TURP. Also, there were 4 patients (9.8%) who developed de novo ED, 2 patients with mild ED, and another 2 patients who showed mild-to-moderate ED. In contrast, in group B 32% of patients remained stable regarding ED, 60% improved, and 8% had deteriorated at 6 months.

At 6 months post-TURP, patients in group A developed a significant decrease in the mean Ej-MSHQ score compared to baseline (26.44 ± 3.43 vs. 19.12 ± 4.56) ($p < 0.001$). On the other hand, patients in group B had a stable mean Ej-MSHQ score at 6 months of TURP compared to baseline (13.42 ± 4.09 vs. 13.30 ± 5.01) ($p = 0.74$). Table 3 (online suppl Fig. 2).

PVR and Qmax before TURP were not significantly different in both groups (Table 4). All patients in both groups had significant improvements in IPSS, PVR, and Qmax after TURP ($p$ = <0.001). However, after TURP, the mean IPSS was significantly better in group A compared to group B (4.95 vs. 8.52, $p < 0.0001$). Also, Qmax in group A was improved significantly more than in

**Table 5.** ANCOVA at 6 months after TURP on IIEF and Ej-MSHQ after control for potential covariates

| Covariates and groups | Mean square | *F*-statistics | *p* value |
|---|---|---|---|
| IIEF | | | |
| Age^ | 158.5 | 8.43 | 0.005 |
| Prostate size^ | 41.8 | 2.23 | 0.140 |
| DM^ | 0.52 | 0.03 | 0.870 |
| HTN^ | 2.94 | 0.16 | 0.690 |
| Medications^ | 33.49 | 1.78 | 0.190 |
| **Groups** | 218.1 | 11.60 | 0.001 |
| Ej-MSHQ | | | |
| Age^ | 170.11 | 8.01 | 0.006 |
| Prostate size^ | 80.94 | 3.80 | 0.054 |
| DM^ | 12.27 | 0.58 | 0.450 |
| HTN^ | 7.30 | 0.34 | 0.560 |
| Medications^ | 68.54 | 3.22 | 0.076 |
| **Groups** | 101.58 | 4.78 | 0.032 |

^Covariates.

group B (29.2 mL/s vs. 23.6 mL/s, $p = 0.005$). There was no significant difference between the groups regarding PVR after TURP (Table 4) (online suppl Fig. 3).

Table 5 presents the ANCOVA for the variables that showed significant differences at 6 months after TURP surgery between the two groups of the study. The only covariate that showed significant differences was the variable age for the EF and the ejaculation function. After controlling for the study covariates, there was a significant difference between the two groups on the EF ($F = 11.60$, $p = 0.001$) and on EJF ($F = 4.78$; $p = 0.032$).

## Discussion

The findings of this study show that TURP has no significant negative influence on EF, in contrast the EJF which was significantly deteriorated. The available data in the literature are conflicting. Our results agree with the studies, which reported that normal baseline EF might be protective against any post-TURP deterioration [17]. However, other reports showed that patients with normal baseline EF are more vulnerable to the negative effect of TURPs [18–20]. We reported that patients with normal EF before TURP (group A) had no significant changes in the mean IIEF-5 score after TURP, and 90.2% of patients remained stable at 6 months. However, the overall mean IIEF-5 score for patients with ED before TURP (group B) at different time points of follow-up was significantly better after TURP, with 60% of patients improved, 32% stable, and only 8% with deterioration. We presume that stability and improvement in the IIEF-5 are caused by a relief of LUTS.

Mishriki et al. [21] reported that a post-TURP improvement may also be related to axon regeneration and endothelial recovery. A neuropraxia-type axonal injury will heal in a few days to 3 months, while with an axonotmesis-type axonal injury recovery takes longer. In a condition where 20–30% of the axon is damaged, collateral branching is the primary mechanism of recovery. It begins at the first 4 days to 4 months following the injury.

Assessment of sexual function after TURP needs to address not only de novo ED but also any improvement in sexual function due to relief of LUTS, which possibly leads to an improvement in sexual function. However, most studies reported only the incidence of de novo ED after TURP and not the proportion of patients experiencing an improvement of sexual function after TURP [22]. As in the study conducted by Elshal et al. [23], we used the IIEF-5 and EF outcome was reported by EF evolution, which was defined as change of EF category, reporting outcome as improved, stable, or deteriorated. However, it would seem clinically meaningless to regard a change of EF score from 26 to 25 as significant as it results in a change in the EF category, while a change from 25 to 21 would be regarded as not significant since it does not lead to a change in the EF category.

Our data confirm the findings of several studies investigating the consequences of TURP on sexual function. Muenter et al. [13] reported that TURP did not lead to changes in EF in 52% of patients, and that EF improved, albeit insignificantly, in 29%. Moreover, in that study, EF decreased in 19% of patients. The authors believed that the reason for this deterioration of EF in some patients would be due to damage of the neurovascular bundles because the generated monopolar current passes in close proximity to the prostatic capsule. In contrast, Jaidane et al. [24] in a prospective study reported that there was a significant improvement of EF including a subgroup of patients with capsular perforation during TURP.

Capogrosso et al. [25] reported that patients with more severe baseline LUTS and the lowest baseline IIEF-EF scores have more significant increases in the IIEF-EF domain scores after HoLEP surgery. These authors suggested that the consequence of these results would be that patients with better baseline scores would likely benefit most from TURP in terms of both LUTS resolution and EF improvement. Our study showed no significant differ-

ences in IPSS, PVR, and Qmax between the two groups at baseline, but patients in group A developed better urinary outcomes such as IPSS and Qmax improvements after TURP than did patients in group B.

Any effect of TURP on EF may be brought about via several different mechanisms, including a psychogenic effect of an invasive procedure in the genital region, injury to the nerve tracts supplying the corpus cavernosum as a result of electrocoagulation, thrombosis of cavernosal arteries, venous leakage, and injury to the nerve tracts [12, 26]. Choi et al. [27] reported that the IIEF score was significantly decreased at 1 and 3 months after TURP; however, this was no longer seen after 6 months. The authors believed that patients who had better voiding symptoms after TURP had also an improved EF, which is also suggested by our results.

Ejaculatory failure is the most common sexual complication following TURP and is often associated with significant bother [13]. The well-known effect of TURP on ejaculation, that is, retrograde ejaculation or decreased ejaculate volume, was confirmed in our study. Our results showed that there was significant decrease in the mean of Ej-MSHQ score for patients in group A. In contrast, there were no significant changes on EJF for patients in group B. Mamoulakis et al. [17] reported a transient decline in orgasm after TURP that was ameliorated with time. They explained restoration of orgasmic function at 12 months to patients' adaptation to the new orgasm sensation in the presence of ejaculatory dysfunction. Giancarlo Marra et al. [28] reported in a systematic review that TURP and laser procedures including holmium, thulium, and GreenLight cause similar rates of ejaculatory dysfunction, which occur in almost three out of four to five men. Although providing less symptomatic benefit compared with transurethral resection of the prostate, transurethral incision of the prostate, transurethral needle ablation and transurethral microwave thermotherapy should be considered for men aiming to maintain normal ejaculation. UroLift is also a recent promising option for this category of patients.

The results of the present study regarding urinary function variables are in line with all previously published studies and are strikingly similar to the meta-analysis published by Ahyai et al. [29]. In this meta-analysis of 20 contemporary RCTs published between 2005 and 2009 and a maximum follow-up of 5 years, TURP resulted in an improvement of the mean Qmax, reduction of the mean IPSS, reduction of the mean QoL score and mean PVR.

Our study does have limitations. Small sample size, retrospective design, and short-term follow-up are the main limitations. A similar study with prospective design, larger sample size, and longer follow-up time would be needed to confirm our findings. Although there were differences between the two groups on age, prostate size, and some medical conditions at the baseline, it is important to recognize that there was no significant difference between the two groups on the IPSS at the baseline time. To control for the possible covariates effect, ANCOVA was used to compare between the 2 groups on the EF and EJF at 6 months after TURP, while controlling for age, prostate size, DM, HTN, and medication. The results supported the significant differences between the 2 groups at 6 months after TURP, while controlling for the potential confounding variables. As the above possible covariates showed significant differences at the baseline, we conducted the ANCOVA only at 6 months after the TURP, as this point of time in the study will give the best reflection for the participants' conditions on the study variables.

## Conclusion

EF and EJF are important outcomes to consider when discussing TURP for the treatment of BPH as they play a prominent role and influence the final treatment decision for many patients. It is important to assess the presence of ED in BPH patients before surgery to compare sexual function before and after treatment. We confirm that TURP as a gold standard treatment of LUTS caused by BPH has no significant negative influence on the quality of erection. In fact, we found that there was a significant improvement of EF in patients who previously had preexisting ED, and no negative effects occurred in patients who previously had normal EF. However, there was a significant negative impact on EJF following the procedure. We presume that the improvement observed in EF may be caused by relief of bothersome LUTS. Further prospective studies in larger population-based cohorts are certainly needed to better investigate this issue.

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## Statement of Ethics

The study protocol was reviewed and approved by the Institutional Review Board of Jordan University Hospital, Amman, Jordan (IRB reference no. 10/12020/16049), in accordance with the Helsinki Declaration. Informed written consent was obtained from all individual participants included in the study.

## Conflict of Interest Statement

The authors have no conflicts of interest to declare.


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## Author Contributions

Saddam H. Al Demour: manuscript writing/editing, data collection, conceived and designed the analysis, main conceptual idea, and design of the research.

Mohannad Abuhamad: data collection and management, and manuscript writing.

Abdallah Nader Santarisi: manuscript writing and design of the research.

Mohammad Al-Zubi: data collection and management, and manuscript writing.

Samer Fathi Al-Rawashdah: data collection and management, and manuscript writing.

Omar Halalsheh: data collection and management.

Antonio Carbone: design of the research and manuscript writing.

Antonio Luigi Pastore: design of the research and manuscript writing.

Muayyad M. Ahmad: analysis of the results and design of the research.

## Data Availability Statement

Due to the nature of this research and participant's information that could compromise their privacy, they did not agree for their data to be shared publicly. The data that support the findings of this study are available upon request from the corresponding author (Saddam H. Al Demour).

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