

Evaluation of Sexual Function Following Bipolar Vaporization vs. Monopolar Transurethral Resection of the Prostate

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Abstract

Background: Little light has been shed on the erectile functions following bipolar vaporization of the prostate.

Methods: A prospective study included 100 cases with a history of endoscopic prostatic surgery. Cases were allocated to two groups; group I of fifty cases were subjected to the conventional monopolar TURP and Group II were subjected to bipolar vaporization of the prostate. All patient were assessed 3- and 6-months after the operation, severity of benign prostatic hypertrophy symptoms and erectile function were re-assessed using IPSS and IIEF-5, respectively.

Results: Although all patients in both groups demonstrated significantly lower IIEF-5 scores 3-months postoperative ($p < 0.0001$), the percentage of IIEF-5 scores reduction was insignificantly different between both groups. No significant differences were found at the 6-months follow up. The EF in group II (bipolar vaporization group) was slightly better, yet insignificantly different than group I. The incidence of complications (TURP syndrome, bladder perforation, intraoperative bleeding, postoperative bleeding and postoperative UTI) in group I (monopolar TURP) was significantly higher than the incidence in group II (bipolar vaporization) Among the study variables, it seems that DM and HTN and development of post-operative complications (especially intraoperative bleeding, capsular perforation and UTI) were significantly associated with development of post-operative ED

Conclusion: No significant difference was found regarding sexual function following monopolar TURP and the bipolar vaporization of the prostate. However, the bipolar TURP is safer with less complication

Keywords: Bipolar vaporization; TURP; Prostate; Erection; LUTS.

LIST OF ABBREVIATIONS

Benign prostatic hyperplasia (BPH)

Transurethral resection of the prostate (TURP)

Lower urinary tract symptoms (LUTS)

Bladder outlet obstruction (BOO)

International prostate symptom score (IPSS)

Peak urinary flow rate (Q_{max})

Peak systolic velocity (PSV)

Plasma kinetic vaporization of the prostate (PKVR)

International index of erectile function -5 (IIEF-5)

RhoA-Rho-kinase (ROCK)

Introduction

Benign prostatic hyperplasia (BPH) is a frequently reported problem among the elderly. Despite being benign, it badly affects the patient's quality of life with the frequently encountered symptoms of the lower urinary tract and the hindered sexual functions mainly erection and ejaculation^[1,2].

Although, transurethral resection of the prostate (TURP) remained the main therapeutic option for lower urinary tract symptoms (LUTS) which results from bladder outlet obstruction (BOO) for long time, its high morbidity rated encouraged the search for safer and less invasive therapeutic options such as laser-based techniques [3,4].

The development of bipolar vaporization and resection systems is a great achievement in this field and is considered to be much safer than the older maneuver; monopolar TURP^[5]. It is based on the well-known electrical principles of the transurethral high-frequency surgery^[6].

There is controversy about the exact impact of different TURP techniques on the patient's sexual function. TURP usually improves the LUTS, however, there is scarcity in literature regarding the ability of TURP to improve the impaired sexual function and to the best of our knowledge, factors predicting the improvement of sexual function following TURP are not clear. Moreover, the studies comparing the patient's erectile functions following the bipolar TURP and the monopolar TURP are scares. Thats why, the current study investigated the effect of monopolar TURP and

bipolar vaporization on the patient's sexual functions. It also evaluated the possible prognostic factors, good and poor, for the sexual function following TURP.

Patients and Methods

Study design

A prospective study performed in the Urology Department, Benha University Hospital and Alagouza Hospital on 100 BPH patients who signed an informed written consent, elaborating the aim, methods, anticipated benefits and potential hazards, before joining the study which had secured the approval of the scientific research ethics committee of Benha Faculty of Medicine.

Inclusion criteria were; BPH resistant to medications (excluding those on 5-alpha reductase inhibitors and/or phosphodiesterase inhibitor type 5), scoring more than 9 on the international prostate symptom score (IPSS), peak urinary flow rate (Q_{max}) less than 10 ml/sec, BPH-induced urine retention, the total prostate size is 30-60gm on ultrasound (abdominal unless TRUS is indicated) and being sexually active for at least six months before surgery.

Exclusion criteria were; Poorly controlled diabetes, history of cerebrovascular stroke, Parkinson disease, bladder cancer in the last two years, other causes of LUTS as cystitis, urethral stricture, cancer prostate, abnormal penile duplex (Peak systolic velocity (PSV) less than 15 cm/s which indicates severe arterial disease and persistent EDV greater than 5 cm/s which suggests venous leak.

Baseline pre-operative evaluation

In the baseline pre-operative visit, each patient was subjected to a thorough history taking and was assigned a score demonstrating the severity of the BPH according to the International Prostate Symptom Score (IPSS) ^[7,8]. Erectile functions were evaluated using a self-administrated questionnaire as well as the international index of erectile function -5 (IIEF-5) which includes five categories of severe (5-7), moderate (8-11), mild to moderate (12-16), mild (17-21), and no ED (22-25) ^[9,10]. Patients also were subjected to clinical genital examination including digital rectal examination, pelvi-abdominal U/S with calculation of post-voiding residual and penile duplex.

Pre-operative laboratory tests included liver and kidney function tests, complete blood picture, bleeding profile, Hb A1c, hormonal profile (testosterone, prolactin) and prostatic specific antigen (PSA).

Surgical procedures

Cases were allocated to two groups; group I of fifty cases were subjected to the conventional monopolar TURP (Nesbit technique) and Group II were subjected to plasma kinetic vaporization of the prostate "PKVR" using a Storz or Olympus Fr26 continuous flow resectoscope with plasmakinetic electrode using the bipolar current.

Postoperative evaluation and Follow up

3- and 6-months after the operation, severity of benign prostatic hypertrophy symptoms and erectile function were re-assessed using IPSS and IIEF-5, respectively.

Statistical Methods

IBM© SPSS© Statistics version 23 (IBM© Corp., Armonk, NY) was used for data analysis. The unpaired t-test was used to compare the intergroup differences of continuous numerical variables presented as mean \pm SD. The Pearson chi-squared test

or Fisher's exact test were used appropriately to compare categorical variables presented as number and percentage. The chi-squared test was used for ordinal data and trend identification. The linear mixed model detected the changes in IIEF. Significance level was set at P-values <0.05.

Results

According to OpenEpi, sample size was set at 100 patients (50/group) with confidence level 95 % and the power of the test 80%.

A simple randomization method (shuffled cards) was concealed and applied by independent registered nurses and the outcome assessor was not aware by the type of operation performed on each patient.

The 100 patients were examined for suitability to join this study. Based upon the exclusion criteria, 16 patients were excluded. Moreover, 9 patients didn't complete the follow up visits which were determined in the study protocol. At the end, 75 patients only completed the study. Figure (1)

I. Baseline preoperative evaluation

Patients' mean age was 65.2 ± 5 years with no insignificant difference between both study groups regarding age, prostate size and IPSS. The IIEF scores in group I were 22.21 ± 0.4 and in group II 22.46 ± 0.6 , without significant difference ($p=0.4$) (**Table 1**).

II. Postoperative Outcome

Urinary Symptoms

Urinary symptoms were significantly improved in both treatment groups following the intervention ($p < 0.0001$), however, the percentage of clinical improvement was insignificantly different between both groups (**Table 2**).

Erectile Function

Patients in both groups reported significant reduction in IIEF-5 scores 3 months postoperative ($p < 0.0001$), however, the percentage of IIEF-5 scores reduction was insignificantly different between both groups. At the 6-months follow up visit, IIEF-5 scores didn't show any significant difference from the scores reported at 3 months visit following the intervention (**Table 3**).

Sixteen patients (50%) out of the 32 patients who undergone monopolar TURP didn't develop ED following surgery (IIEF-5 scores= 22-25), while 11 patients of them (34.37%) developed mild ED (IIEF scores=17-21) and 5 only (16.62) developed mild to moderate ED (IIEF scores=12-16).

Of the 43 patients who underwent bipolar vaporization, sexual function was preserved in 27 patients (62.7%), however, 14 patients (32.5%) developed mild ED and 2 patients only (4.6%) developed mild to moderate ED. The EF in group II (bipolar vaporization group) was slightly better, but the difference between the 2 groups was insignificant.

Receiver-operating characteristic (ROC) curve was applied to predict the improved sexual function using preoperative IIEF score. Preoperative IIEF score has fair-to-good predictive value. Area under ROC curve (AUC) = 0.771, SE = 0.041, 95% CI = 0.660 to 0.860, P-value < 0.0001 . Best cut-off criterion is IIEF score > 22 : Sensitivity = 57.1% (95% CI = 41.0% - 72.3%), specificity = 97% (95% CI = 84.2% - 99.9%), positive predictive value = 96% (95% CI = 77.4% - 99.4%), negative predictive value = 64% (95% CI = 55.5% - 71.7%). Figure 2

Safety of the procedures

Regarding the operation safety, the incidence of complications (TURP syndrome, bladder perforation, intraoperative bleeding, postoperative bleeding and postoperative UTI) in group I (monopolar TURP) was significantly higher than the incidence in group II (bipolar vaporization) (**Table 4**).

Among the study variables, it seems that DM and HTN and development of post-operative complications (especially intraoperative bleeding, capsular perforation and UTI) were significantly associated with development of post-operative ED (**Table 5**).

Discussion

Erection and/or ejaculation disorders have been strongly associated with BPH and suggested to be a result of a disrupted nitric oxide -cyclic guanosine monophosphate pathway, an enhanced RhoA-Rho-kinase (ROCK) contractile signaling, a hyperactivity of the autonomic adrenergic signaling or an atherosclerosis of the pelvic blood vessels ^[11, 12].

Management of BPH guidelines includes general instructions, medical treatment and surgical TURP. Monopolar TURP was considered as the standard treatment especially for those who didn't respond well to medical treatment and those who ask for active treatment. Bipolar TURP is an equivalent effective alternative, yet safer with inter- and post- operative hazards ^[13].

The current results showed that the bipolar vaporization is significantly safer with better outcomes than the monopolar TURP which caused significantly more side

effects in group I. In agreement with **Geavlete et al.** ^[14], 1.8% of their patients in the TURP group have experienced TURP syndrome while none of the TURis patients group have that serious syndrome. However, **Otaola-Arca et al.**, ^[15] couldn't detect any significant difference in their prospective randomized study regarding the efficacy nor the safety of the monopolar transurethral resection of the prostate and the bipolar plasmakinetic transurethral resection of the prostate as a therapeutic intervention of BPH.

The effect of TURP on erectile function is an area of debate. There is some lack of knowledge of the exact mechanisms of sexual affection following treating LUTS due to BPH surgically. Many studies discussing this point are available in literature in which TURP may improve, deteriorate or not affecting sexual function ^[16].

The study in hands demonstrated a significantly low overall IIEF scores of the whole sample denoting a significantly deteriorated postoperative sexual functions. Although TURP is generally considered a safe procedure, an incidence of post TURP erectile dysfunction ranging between 4- 40% has been reported in most of the published literature and the varying rates has been owed to the different methods of assessment of EF and the different length of follow up periods^[17]. **Tscholl et al.** ^[18] reported the development of temporary erectile dysfunction is a significant proportion of their patients for 2-3 month following TURP. This could be expected due to the post-operative pain and stress. Moreover, **Liu et al.** ^[19] reported a slight deterioration in sexual function (mild decline in postoperative IIEF-5 scores), however, there study sample were already suffering from ED before the surgery. The mechanism by which TURP may induce ED is not clear yet. The possible explanations include direct thermal/chemical erectile nerve injury, psychological impact of the intervention ^[20],

injury of the cavernous nerve, cavernous arteries fibrosis or thrombosis, corpora cavernosa fibrosis, and venous leakage ^[17].

On the other hand, **Li et al.** ^[21] reported that BPH patients with normal baseline erectile function, TURP may improve the IIEF-5 scores in over one year of follow-up. This improvement was associated with the significant improvement in urinary symptoms. **Pavone et al.** ^[22] reported also postoperative improvement of EF in 16.2% of their sample following TURP. This improvement in the erectile function following TURP might be related to the relief of the obstructive urinary symptoms caused by BPH. Relief of LUTS is strong correlated with the improvement in erectile function, either this relief is produced by surgical intervention or medical treatment e.g. alpha-blocker treatment ^[23].

The relatively alternative procedure to regular M.TURP; the bipolar TURP (B.TURP), was introduced as a safer operation, however; cutting the tissue using the bipolar systems needs a very high electrical power to generate plasma, leading to massive heat production with the possible subsequent thermal tissue injury ^[24].

In the current work, there was insignificant difference between both groups regarding the changes in IIEF-5 scores and the distribution of ED following the maneuver. Few prospective studies reported insignificantly different outcomes regarding sexual function following B.TURP and M.TURP ^[20;25-27]. Most of the available RCT-based meta-analyses regarding this issue either didn't mention bipolar vaporization or touched it roughly. This might be because of the relatively more recent evidence of the better safety profile of bipolar vaporization and its possible impact on sexual function ^[5].

In the present work, there was insignificant difference in the clinical findings between the patients who developed post-operative ED and those in whom erectile function was preserved. However, the presence of associated comorbidities (DM and hypertension) as well as the development of complications (especially intraoperative bleeding, capsular perforation and UTI) were significantly more common in the group of post-operative ED. This comes in agreement with **El Shorbagy et al.** ^[28] study.

Mamoulakis et al. ^[20] stated that patients with higher pre-operative IIEF/EF scores had a lower probability of deterioration of erectile function, and those with severe ED at baseline visit had a higher chance of improvement following the operation. In addition, it was suggested that patients with more severe preoperative urinary symptoms may have a higher chance to develop EF improvement after the operation due to the amelioration of LUTS ^[29].

Improving urinary symptoms associated with BPH is a priority for most of the patients, however, the impact of the used therapeutic option on the erectile function of the patient is one of his main concerns. Despite the great importance of this issue, there are no well-established data about the exact impact of different BPH therapeutic options on the erectile function of the patient, and the factors suggesting improvement or deterioration of sexual function following the operation. Considering the conflicting variable findings in literature, and our limited number of cases with large number of patients who escaped follow up, more prospective comparative studies with a large sample size and long-term follow-up should be needed to elucidate this mystery.

Conclusion

Bipolar vaporization of the prostate has many advantages over monopolar TURP regarding safety and incidence of complications however, no significant difference were found regarding sexual function between both techniques.

Conflict of interest:

The authors have no competing interests to declare that are relevant to the content of this article.

Funding:

No funding, grants, or other support was received

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Table 1. The baseline preoperative clinical findings in the two treatment groups

| Variable | Group I | Group II | P-value |
|---------------------------|----------------------------------|----------------------------------------|----------------|
| | Monopolar TURP (n=32) | Bipolar Vaporization (n=43) | |
| Age (years) | 65.12±4.9 | 65.1±5.1 | 0.9 |
| Prostate size (ml) | 55.56±4.8 | 53.7±6.4 | 0.17 |
| Preoperative IPSS | 27.15±4.6 | 26.8±4.8 | 0.75 |
| Preoperative IIEF | 22.21±0.4 | 22.46±0.6 | 0.4 |

Data are mean ± SD or number (%), IPSS: *International Prostate Symptom Score*.

Table 2. Change in urinary symptoms in both study groups

| Treatment Groups | IPSS scores | | | |
|----------------------------------------------|--------------|----------------|------------------|--------------------|
| | Preoperative | After 3 months | <i>P1</i> -value | %of IPSS reduction |
| All patients (n=75) | 26.9±4.7 | 6.8±3.4 | < 0.0001 | 74.70±12.12 |
| Group I: Monopolar TURP (n=32) | 27.15±4.6 | 6.4±3.6 | < 0.0001 | 77.4±10.8 |
| Group II: Bipolar Vaporization (n=43) | 26.8±4.8 | 7.1±3.2 | < 0.0001 | 72.7±12.7 |
| <i>P3</i>-value | 0.8 | 0.37 | - | 0.09 |

P1: Difference between pre-operative and 3 months post-operative IPSS scores. *P2*:

Difference between both groups.

Table 3. Pre- and post-operative Erectile function in both study groups

| Treatment Groups | <i>IIEF</i> scores | | | | | |
|----------------------------------------------|--------------------|----------------|----------|--------------------------|----------------|----------|
| | Pre-operative | After 3 months | P1-value | % of IIEF after 3 months | After 6 months | P2-value |
| All patients (n=75) | 22.36±0.5 | 20.7±2.4 | < 0.0001 | 6.9±11.15 | 21.12±2.6 | 0.3 |
| Group I: Monopolar TURP (n=32) | 22.21±0.4 | 20.43±2.9 | 0.001 | 7.8±13.14 | 20.8±3.2 | 0.51 |
| Group II: Bipolar Vaporization (n=43) | 22.46±0.6 | 21.02±2.01 | < 0.0001 | 6.3±9.5 | 21.3±2.3 | 0.31 |
| P3- value | 0.4 | 0.3 | - | 0.57 | 0.62 | - |

Data are mean ± SD, *Unpaired t-test. *IIEF*: *International Index of Erectile Function*. P1: Difference between pre-operative and 3 months post-operative *IIEF* scores. P2: Difference 3- and 6- months post-operative *IIEF* scores. P3: Difference between both groups.

Table 4. Incidence of adverse outcomes in both study groups

| Adverse outcome | Group I Monopolar TURP (n=32) | Group II Bipolar Vaporization (n=43) | P-value |
|--------------------------------|----------------------------------------------|-----------------------------------------------------|----------------|
| TURP syndrome | 1 (3.125 %) | 0 (0.0%) | <0.0001 |
| Bladder perforation | 2 (6.25 %) | 2 (4.65%) | <0.0001 |
| Intraoperative bleeding | 3 (9.375%) | 3 (6.97%) | <0.0001 |
| Postoperative bleeding | 4 (12.5%) | 3 (6.97%) | <0.0001 |
| Postoperative UTI | 8 (25%) | 6 (13.95%) | <0.0001 |

Data are number (%),TURP: Syndrome Transurethral Resection of the Prostate, UTI:

Urinary tract infection.

Table 5. Factors affecting the changes in sexual function following the operation

| The study variables | Patients who developed ED (n=32) | Patients who didn't develop ED (n=43) | p |
|-------------------------------------------|-----------------------------------------|----------------------------------------------|----------|
| Age | 66.03±4.7 | 64.5±5.1 | 0.21 |
| Baseline prostate size | 53.7±6.4 | 55.1±5.4 | 0.3 |
| Baseline IPSS | 27.6±4.3 | 26.4±4.9 | 0.27 |
| Baseline IIFE | 22.4±0.5 | 22.3±0.5 | 0.39 |
| % of IPSS reduction | 75.47±13.04 | 74.1±11.5 | 0.36 |
| Associated comorbidities (DM, HTN) | 16 (50%) | 19 (44.18%) | <0.0001 |
| Intraoperative bleeding | 4 (12.5%) | 2 (4.6%) | <0.0001 |
| Capsular perforation | 2 (6.25%) | 2 (4.6%) | <0.0001 |
| Post-operative UTI | 10 (31.25%) | 4 (9.3%) | <0.0001 |

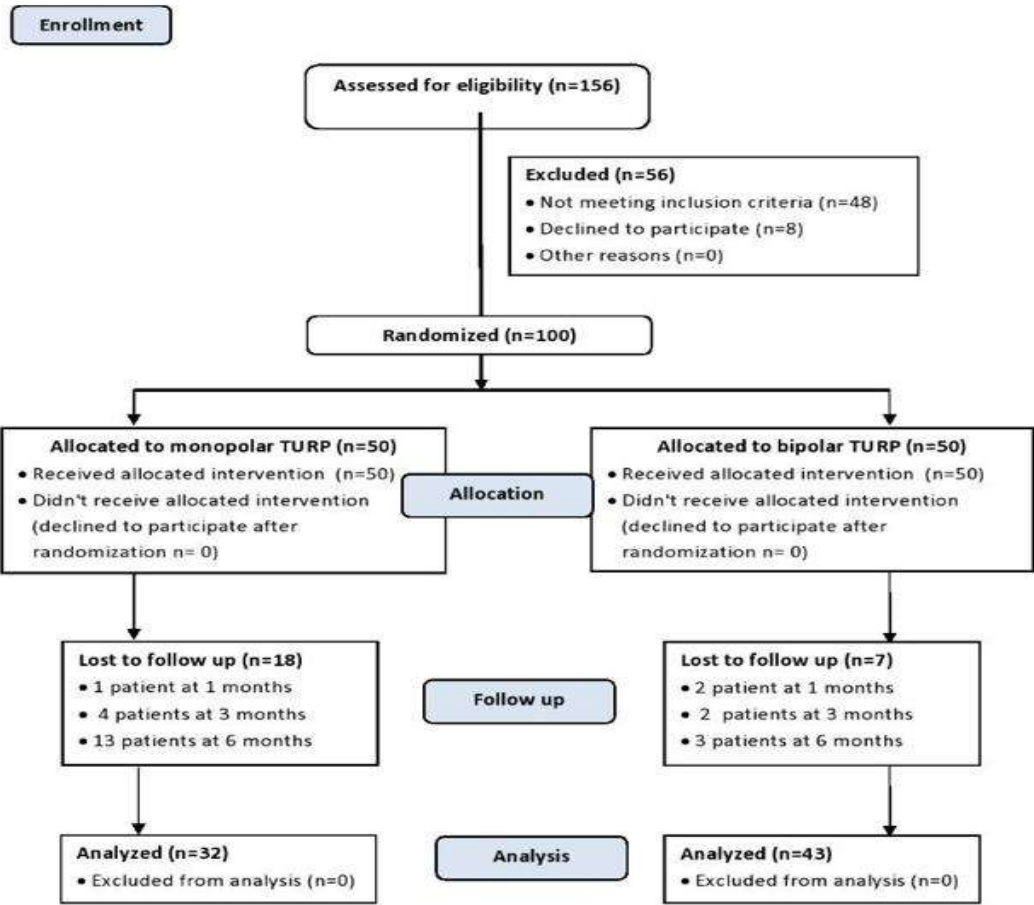


Figure 1. flow chart

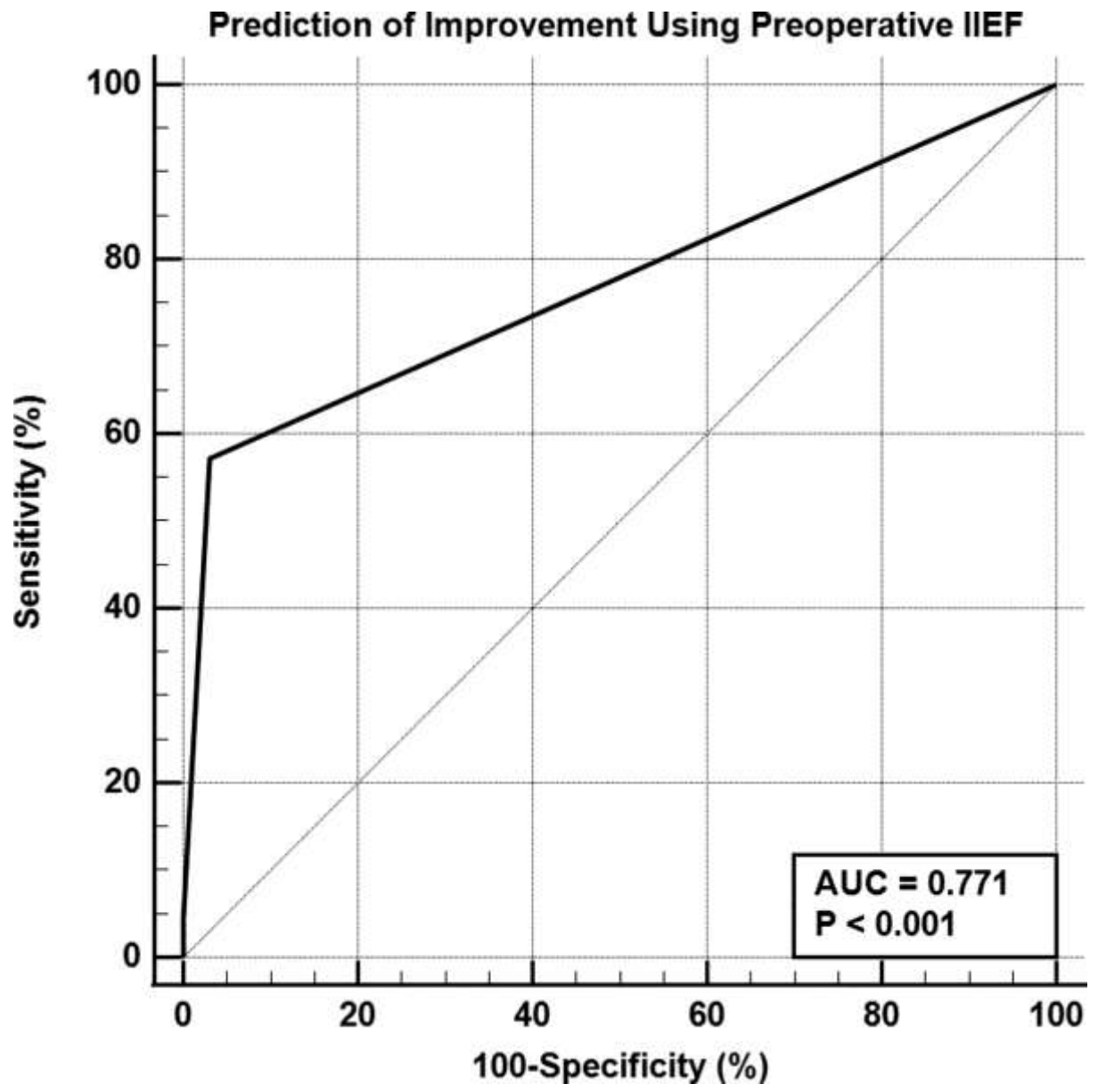


Figure 2. Receiver-operating characteristic (ROC) curve for prediction of improved sexual function using preoperative IIEF score.