Effects of bipolar and monopolar transurethral resection of the prostate on urinary and erectile function: a prospective randomized comparative study

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What's known on the subject? and What does the study add?

- Standard monopolar transurethral resection of prostate (TURP) remains the gold standard surgical treatment of benign prostatic hyperplasia-related lower urinary tract symptoms. Bipolar salin TURP offers rapid tissue removal and haemostasis during resection with better vision under saline irrigation while eliminating risk of TUR syndrome.
- Few prospective randomized studies have investigated the effect of bipolar and monopolar TURP on erectile function. The study found that bipolar saline TURP is a safe and effective procedure that is associated with a significantly shorter operating time, a smaller reduction in serum sodium levels and similar efficacy compared with conventional monopolar TURP.

Objective

- To evaluate the outcomes of bipolar vs conventional monopolar transurethral resection of the prostate (TURP) on urinary and erectile function.

Material and Methods

- A total of 286 patients with benign prostatic hyperplasia (BPH) were randomized to bipolar or monopolar conventional TURP treatment groups.
- Operative and early postoperative variables and complications were recorded and all patients were re-evaluated at 1, 3, 6 and 12 months after surgery using the International Prostate Symptom Score (IPSS), uroflowmetry, post-void residual urine volume (PVR) and the erectile function domain of the International Index of Erectile Function (IIEF-ED).
- A comparative evaluation of erectile function was performed on 188 preoperatively non-catheterized patients with regular sexual partners.

Results

- The operating time was shorter in the bipolar TURP group. Postoperative bleeding and blood transfusion requirements did not significantly differ between the two groups. Sodium levels were significantly lower in the monopolar group than in the bipolar group.
- Transuretheral resection syndrome developed in two (1.4%) patients in the monopolar group. Both groups had similar and significantly improved IPSS values, maximum urinary flow rate values and PVR measurement.
- ED worsened in 32 (17.0%) patients, improved in 53 (28.2%) patients, and was unchanged in 103 (54.8%) patients. Changes in the IIEF scores during the follow-up period were similar between the bipolar and monopolar groups.

Conclusion

- Bipolar TURP is a safe and effective procedure that is associated with a significantly shorter operating time, a smaller reduction in serum sodium levels and a similar efficacy compared with conventional monopolar TURP.

Keywords

transurethral resection of prostate, TURP, erectile dysfunction, monopolar, bipolar

Introduction

The 'gold standard' surgical treatment of clinically obstructive BPH is TURP, but life-threatening complications such as transurethral resection (TUR) syndrome are occasionally observed [1]. The most important aetiological factor for TUR syndrome is the intraoperative use of hypotonic irrigation solutions such as glycine. In recent years, bipolar electrosurgical technologies with isotonic saline irrigation solutions have been implemented in an attempt to minimize BPH-related complications [1–3]. When compared with conventional monopolar TURP, the impact of bipolar TURP on preoperative bleeding, early postoperative outcomes (e.g. blood transfusion requirements), and long-term outcomes (e.g. urethral stricture) are still debated. In additional, the effects of TURP, particularly monopolar TURP, on erectile function remain highly controversial. Few prospective randomized studies have investigated the effect of bipolar and monopolar TURP on erectile function [4].

We compared the preoperative, early postoperative, and long-term urinary and erectile functions of bipolar vs. conventional monopolar TURP in a prospective, randomized trial in patients with BOO attributable to BPH.

Material and Methods

Between February 2009 and January 2011, 286 men with BPH-related LUTS were enrolled in the study and prospectively randomized into a monopolar TURP and a bipolar TURP group. Informed consent was obtained from all patients, and the study was approved by the institutional ethics committee. A full medical history was obtained from all patients, and the patients were evaluated preoperatively using physical examination and DRE, urine analysis, urine culture, serum electrolytes, kidney function, complete blood count, PSA, the IPSS, inclusive of the question on quality of life, and a quality-of-life (QoL) score, and uroflowmetry. In addition, prostate volumes and post-void residual urine volumes (PVRs) were measured using TRUS and abdominal ultrasonography, respectively. Patients preoperative sexual function was assessed using a score derived from the erectile function domain of the International Index of Erectile Function (IIEF-ED). The sum of scores relating to the questions 1 to 5 and 15 of the IIEF-ED was calculated based on a maximum score of 30. To be included in the study, patients were required to have symptomatic BPH that required surgery owing to urinary retention or failed medical therapy. Patients with neurogenic bladder dysfunction, previous prostatic or urethral surgery, prostate cancer, bladder calculus and coagulopathy were excluded.

After routine cysto-urethroscopy, monopolar TURP (using a Martine ME 411 electrosurgical generator [Gebruder Martin, Tuttlingen, Germany] with power settings of 80 to 100 W and 50 to 70 W for cutting and coagulating currents, respectively) or bipolar TURP (using an Olympus UES 40 [SurgMasterSystem, Tokyo, Japan] generator with power setting of 200 W for cutting and 100 W for coagulation) was performed with a 26-F continuous flow resectoscope using mannitol or saline irrigation under general or spinal anaesthesia. At the end of each procedure, a 22-F three-way Foley catheter was inserted, and continuous irrigation saline was maintained until bleeding stopped. A complete blood count and a serum electrolyte panel were evaluated in each patient during the early postoperative period. Operating time, length of hospitalization, perioperative complications, early postoperative complications, catheterization time, changes in haemoglobin levels and changes in serum electrolytes, including sodium, chloride and potassium, were recorded.

All patients were re-evaluated at 1, 3, 6 and 12 months after surgery by IPSS, QoL score, uroflowmetry, PVR and IIEF-ED. A comparative evaluation of erectile function was performed on 188 preoperatively non-catheterized patients with regular sexual partners.

Statistical Analysis

Data were analysed using SPSS 16.0 for Windows (SPSS, USA). Normality tests (Kolmogorov–Smirnov test, $P > 0.05$) were performed to evaluate the distributions of numeric variables. If the distribution of numeric variables were normal, statistical analysis was performed using parametric Student's *t*-tests. Mann–Whitney *U*-tests were used to evaluate numerical variables with a skewed distribution. Categorical variables were analysed using chi-squared or Fisher's exact tests. General linear models were used to compare preoperative and postoperative IIEF-ED scores at 1, 3, 6 and 12 months.

Results

In the monopolar TURP group, 130 of 143 (90.1%) patients were followed for at least 1 year, and in the bipolar TURP group, 127 of 143 (88.8%) patients were followed for the same time period. The number of patients who dropped out of the study was similar in both groups. Of the 29 patients who dropped out, four died from a myocardial infarction, one from respiratory insufficiency and one from a cerebrovascular accident, and the other 23 patients were lost to follow-up. The long-term outcomes of the study and their comparisons with preoperative variables were based on data from 257 patients.

Preoperative variables including mean age, IPSS, QoL, prostate volume and haemoglobin level were similar in the monopolar and bipolar groups (Table 1). In the bipolar and

Table 1 Preoperative demographic characteristics.

Preoperative variables*	Monopolar group	Bipolar group	*P*
Age, years	67.7 (7.7)	67.4 (9.3)	0.76
IPSS score	18.5 (2.7)	18.8 (2.4)	0.32
QoL score	4.0 (0.8)	4.1 (0.6)	0.24
Q_{max}, mL/s	8.0 (3.6)	7.2 (2.9)	0.40
PVR, mL	106.9 (62.7)	118.9 (76.7)	0.33
Prostate volume, mL	55.9 (23.9)	59.7 (24.9)	0.76

**Values are reported as mean (SD).*

Table 2 Comparative evaluation of the changes in electrolyte and haemoglobin values.

Variable	Monopolar group	Bipolar group	*P*
Na, mEq/L			
Preoperative	140.3 (2.7)	140.5 (2.6)	0.70
Postoperative	137.6 (5.6)	139.1 (3.3)	0.004
Mean change	−2.82 (5.8)	−1.30 (3.8)	0.03
K, mEq/L			
Preoperative	4.3 (0.4)	3.8 (0.5)	0.65
Postoperative	4.1 (0.4)	4.1 (0.2)	0.91
Mean change	−0.18 (0.4)	0.03 (0.5)	0.06
Cl, mEq/L			
Preoperative	103.5 (4.0	104.2 (3.6)	0.08
Postoperative	102.2 (5.5	104.4 (6.1)	0.01
Mean change	−1.27 (6.0	0.16 (5.9)	0.16
Haemoglobin, g/dL			
Preoperative	13.2 (1.6)	13.1 (1.3)	0.62
Postoperative	11.8 (1.4)	11.9 (1.4)	0.72
Mean change	1.41 (1.23)	1.2 (0.9)	0.09

Values are reported as mean (SD). SD, standard deviation.

monopolar groups, the mean (SD) operating times were 54.0 (21.0) and 58.7 (16.8) min, respectively ($P = 0.03$). The mean (SD) drop in postoperative haemoglobin levels after 24 h of follow-up was 1.2 (0.9) g/dL in the bipolar group and 1.41 (1.23) g/dL in the monopolar group ($P = 0.1$). Blood transfusions were required in three (2.1%) patients in the bipolar group and in eight (5.6%) patients in the monopolar group ($P = 0.2$).

The changes in the electrolyte concentrations were similar in both groups, with the exception of sodium (Table 2). The mean postoperative sodium level was significantly lower in the monopolar group than in the bipolar group. TUR syndrome developed in two (1.4%) patients who underwent monopolar TURP, but no patients in the bipolar group developed this syndrome. Patients in the bipolar group were catheterized for a mean (SD; range) of 2.4 (1.0; 1–5) days, and the mean (SD; range) catheterization time in the TURP group was 2.6 (1.2; 1–7) days. There was no significant difference in the length of hospital stays between the two groups. Monopolar TURP patients were discharged home at a mean (SD; range) 2.7 (1.4; 1–16) days, and bipolar TURP patients were discharged at a mean (SD; range) of 2.5 (1.3; 1–13) days. Five patients in the bipolar and six patients in the monopolar group complained of some degree of incontinence, and all of these patients spontaneously recovered within 6 months. Re-catheterization because of clot retention was needed in two patients in the monopolar group and one patient in the bipolar group.

The mean (SD) preoperative IPSS score decreased to 10.3 (3.0) and 10.8 (2.9) in the bipolar and monopolar groups, respectively (Fig. 1). The mean (SD) maximum urinary flow rate (Q_{max}) values increased over the 12-month period from 7.2 (3.1) to 17.1 (3.1) in the bipolar group and from 8.0 (3.6) to 16.3 (4.7) in the monopolar group ($P < 0.001$ for both groups; Fig. 2). The improvements in Q_{max} and IPSS were similar in the two groups (Figs 1,2). In preoperatively catheterized patients, the mean (SD) Q_{max} values and IPSS scores over the 12-month follow-up from 14.5 (3.8) to 9.5 (2.5) in the monopolar group; 16.4 (4.8) and 8.6 (1.9) in the bipolar group, respectively. PVRs decreased significantly in regularly followed patients (Fig. 3). Maximum improvements in the Q_{max} values and IPSS scores were achieved at 3 and 6 months, respectively, but decreases in PVR persisted throughout the 12-month follow-up periods. After 1 year of follow-up, re-operations or dilatations

Fig. 1 Comparative evaluation of the effects of both monopolar and bipolar TURP on IPSS.

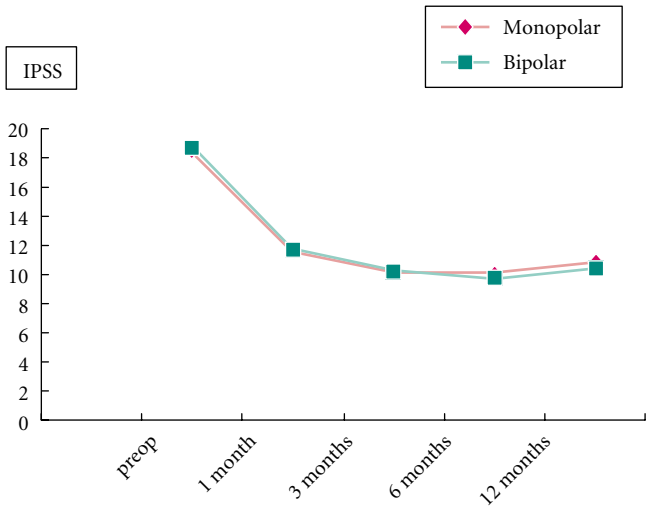


Fig. 2 Comparative evaluation of the effects of both monopolar and bipolar TURP on Q_{max}.

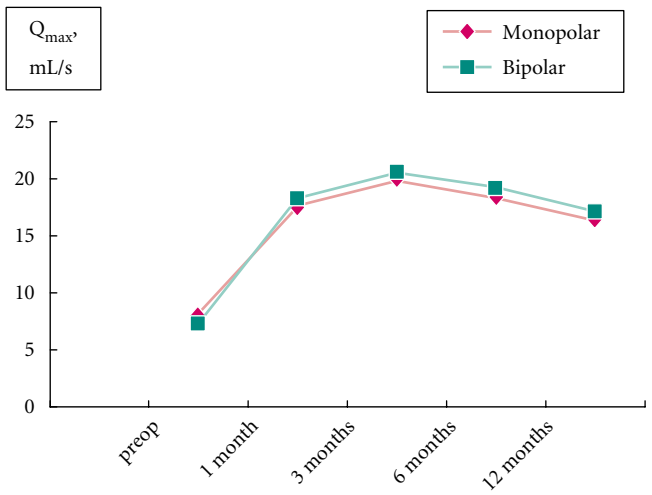


Fig. 3 Comparison of time-related changes in PVR in both monopolar and bipolar TURP groups.

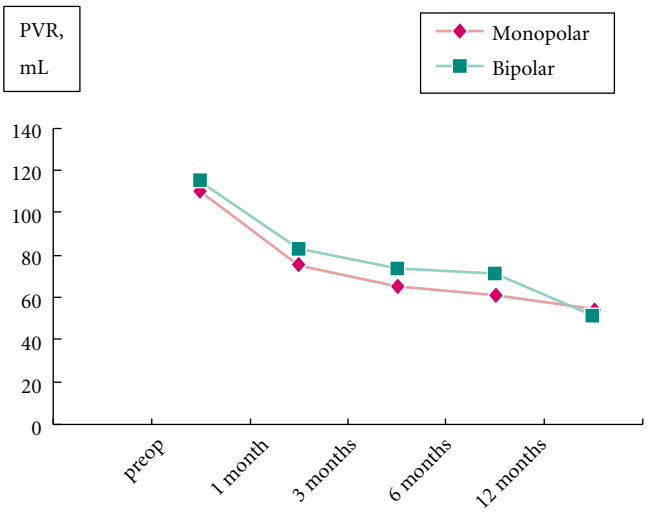
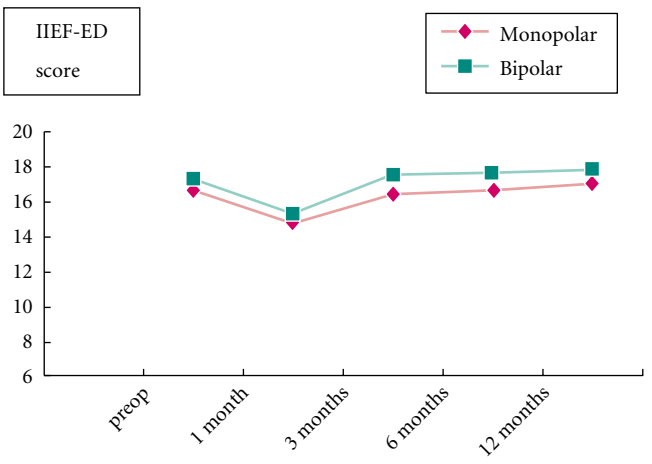


Fig. 4 Comparative evaluation of IIEF-ED scores of both monopolar and bipolar TURP groups (the evaluation was performed on non-catheterized patients with regular sexual partners).



owing to urethral stricture or bladder-neck contracture were required in eight patients (6.3%) patients in the bipolar group and in six patients (4.6%) in the monopolar group ($P = 0.7$).

Erectile function was measured preoperatively in a total of 188 non-catheterized patients with regular sexual partners. The mean (SD) preoperative IIEF-ED scores for the mono- and bipolar groups were 16.8 (5.6) and 16.9 (5.7), respectively ($P = 0.9$). In both groups, a significantly decrease was observed in IIEF-ED scores at the first postoperative month compared with the preoperative scores. In addition, a significant improvement in mean IIEF-ED scores was detected at 3 months postoperatively when compared with 1-month IIEF-ED scores. This improvement in IIEF-ED scores was maintained at 6 and 12 months postoperatively (Fig. 4). Although 12-month mean IIEF-ED scores in both the mono- and bipolar groups improved slightly, relative to the preoperative IIEF-ED, these changes were not significant. When IIEF-ED scores of all 188 patients were compared, ED worsened in 32 (17.0%), improved in 53 (28.2%) and was unchanged in 103 (54.8%) patients (Fig. 5). In 10 (18.2) of the 55 patients with preoperatively normal erectile function, ED developed during the 1-year follow-up; however, in 19 (14.3 %) of the 133 patients with preoperative ED, IIEF-ED scores increased more than 26 points with subsequent improvements in erectile function. No correlation was found between worsening of IIEF-ED scores, mean patient

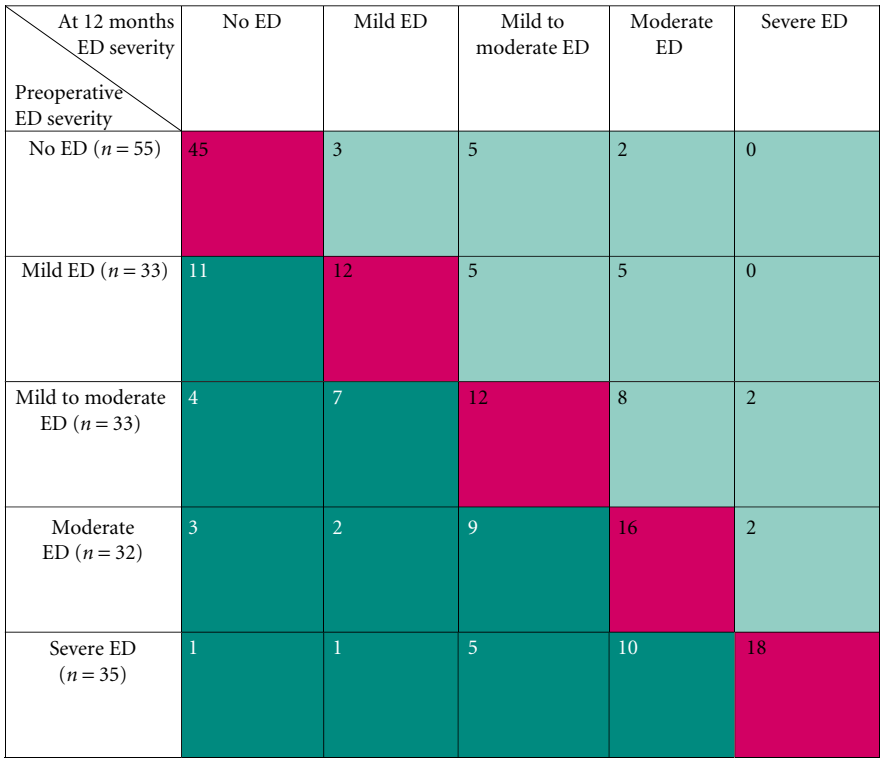


Fig. 5 Pre- and postoperative prevalence and severity of ED in the monopolar and bipolar TURP groups.

Table 3 Factors affecting IIEF-EF domain scores after TURP.

Variable	Group 1: improved or unchanged	Group 2: worsened	*P*
Mean (SD) age, years	65.9 (8.5)	65.3 (6.9)	0.60
Mean (SD) age of partner, years	60.1 (8.9)	58.7 (6.6)	0.23
Mean (SD) prostate volume, mL	57.6 (24.9)	49.9 (24.2)	0.10
Mean (SD) total testosterone, ng/dL	439.5 (183.8)	374.1 (121.9)	0.14
Mean (SD) operating time, min	54.9 (20.2	56.2 (14.9)	0.55
Diabetes mellitus, % (*n*)			
No	87.8 (137)	81.2 (26)	
Yes	12.2 (19)	18.8 (6)	
Hypertension % (*n*)			
No	59.6 (93)	53.1 (17)	
Yes	40.4 (63)	46.9 (15)	
Monopolar TURP % (*n*)	48.7 (76)	59.4 (19)	0.33
Bipolar TURP % (*n*)	51.3 (80)	40.6 (13)	
Capsule perforation % (*n*)			
No	78.2 (122)	68.7 (22)	
Yes	21.8 (34)	31.3 (10)	

age, mean partner age, duration of operation, prostate volume, serum testosterone level, presence of capsule perforation, diabetes mellitus, hypertension and energy type used during the prostate resection (Table 3).

Discussion

Bipolar TURP is performed with a saline irrigating fluid instead of glycine. Using saline during the resection protects against TUR syndrome, which is one of the important potential complications of TURP. In addition, bipolar TURP promotes better haemostasis and decreases overall complications when compared with standard monopolar TURP [5]. Furthermore, the bipolar approach allows the coagulation of the small venous bleedings that can impair endoscopic visualization during the resection; therefore, a clearer view can be obtained with the bipolar approach than with the monopolar approach, potentially enabling earlier completion of the resection and shorter operating times. In the present study, operating times were

shorter in the bipolar TURP group than in the monopolar group. Some studies have reported longer operating times for bipolar TURPs, whereas others have reported that operating times are similar between the two groups [2,5,6].

Various studies have reported that the amount of perioperative bleeding is greater in the monopolar groups than in the bipolar groups [5]. Fagerström et al. [5] reported that the mean blood loss in the bipolar group was 235 mL compared with 350 mL in the monopolar group ($P = 0.001$). In their study, blood transfusions were needed in 4% of the patients in the bipolar group and 11% of patients in the monopolar group ($P < 0.01$). In the present study, the decrease in the mean concentration of haemoglobin in the monopolar group was greater than that of the bipolar group, but the difference was not significant. During the early postoperative period, blood transfusions were required in three (2.1%) and eight (5.6%) patients in the bipolar and monopolar groups, respectively. Similarly, Ho et al. [1] observed larger decreases in the haemoglobin concentrations in their monopolar group with no significant difference (1.2 mg/dL in the bipolar group and 1.8 mg/dL in the monopolar group). This small difference between the haemoglobin values could be attributable to two factors. First, during bipolar TURP, small venous bleedings that minimally affect the haemoglobin levels are cauterized. Second, during monopolar resection, experienced surgeons do not pay attention to small venous bleedings and thus do not cauterize them.

One of the most potentially serious complications of TURP is TUR syndrome. The development of TUR syndrome is closely related to capsule perforation and increased fluid absorption during prolonged operations. Chen et al. [4] carried out a randomized clinical study, with 2-year follow-up, comparing bipolar with monopolar TURPs. They reported decreases in mean postoperative serum sodium levels for the bipolar and monopolar TURP groups of 3.2 and 10.7 mmol/L, respectively ($P < 0.01$) [4]. In the monopolar arm of the randomized study by Ho et al. [1], symptomatic TUR syndrome was detected. The operating times for their two patients were >70 min. In the present study, a significant decrease was detected in the mean sodium concentration of the monopolar group when compared to that of the bipolar group. TUR syndrome developed in two patients in the monopolar group, and these patients were followed up in the intensive care unit. By contrast, none of the patients in the bipolar TURP group developed TUR syndrome.

In the present study, the hospital stays and catheterization times were similar in the bipolar and monopolar groups. Seckiner et al. [7] prospectively compared bipolar and monopolar TURPs in a 1:1 randomization study and reported similar hospital stays and catheterization times. Indeed, hospital stay can occasionally be shorter in the bipolar group owing to a decreased requirement for post-TURP irrigation. In our clinical practice, however, the patient is discharged from hospital if he has not developed fever or significant haematuria after the removal of the urinary catheter and if he is able to urinate spontaneously. Nevertheless, similar studies have reported that a significant decrease in catheterization and length of hospital stay could be achieved using bipolar energy sources. In one of these studies, Iori et al. [8] randomized 120 patients with LUTS into a Gyrus PlasmaKinetic™ system or standard TURP and found significantly shorter catheterization times in the plasmakinetic group.

The present results confirm that both the bipolar and monopolar techniques of performing TURP reduce IPSS scores and PVR and improve urinary flow. The most important reason for this improvement is the complete removal of the obstructive prostatic tissue. According to the present results, maximum improvements are observed at 3 postoperative months for Q_{max} values and at 6 months for IPSS scores; however, PVR consistently decreases over 12 months.

Debates are ongoing concerning the impact of bipolar and monopolar techniques on the formation of urethral strictures. Some authors have reported higher rates of urethral strictures related to bipolar TURPs [9], whereas others have reported similar rates between the two techniques [2,4,10]. In the present study, the number of urethral strictures requiring surgery or dilatation was not significantly different between the groups. This result was similar to the results of the multicentre study by Mamoulakis et al. [10], who observed the development of urethral strictures in 1.4% of patients treated with bipolar TURP and in 3.6% patients treated with monopolar TURP. Urge incontinence was observed in 4.6% and 3.9% of the patients in the monopolar and bipolar groups, respectively. The symptoms of all patients with urge incontinence were improved within the first 6 months, which may be related to application of higher energy on the prostate capsule.

Several recent studies have found a strong association between LUTS and ED [11,12]. LUTS have been identified as an independent risk factor for ED. In many studies, improvements in erectile function were obtained in patients with ED who received medical therapy for BPH [13,14]. Similarly, phosphodiesterase-5 inhibitors used for ED have been reported to improve BPH symptoms [15,16]. Nonetheless, the impact of TURP on erectile function is still debated within the literature. In the present study, IIEF-ED scores at 1 month after surgery were significantly lower than those detected during the preoperative period; however, scores improved to their preoperative levels by the third postoperative month. Furthermore, this

improvement in IIEF-ED scores was maintained at 12 months and was nonsignificant when compared with the preoperative IIEF scores. Worsening IIEF-ED scores during the early postoperative period can be explained by a few mechanisms. One of these mechanisms is the risk of creating direct thermal damage to cavernosal nerves during TURP because the cavernous nerves to the apex and base of the prostate approach until 1.5 and 3 mms, respectively [17]. The second potential factor is the impact of surgical stress during the early postoperative period. The incidence of newly diagnosed postoperative ED in patients treated with TURP has been reported to be between 0 and 32.5% [18–20]. Comorbidities such as diabetes mellitus and capsular perforation were reported as aetiological factors for newly developed ED during the postoperative period [21]; however, in the present study, 17.0% of the patients experienced a deterioration in erectile function during the 12 months of follow-up. During follow-up, ED developed in 18.2% of patients with normal erectile function, but no association between erectile function, age, diabetes mellitus, and capsular perforation was found.

In conclusion, bipolar TURP is a safe and effective procedure that is associated with significantly shorter operating times, lower reductions in serum sodium levels and similar improvements in urinary symptoms during 12 months of follow-up when compared with conventional monopolar TURP. The degree of ED worsened in 17.0% of the total cohort, whereas it was improved or unchanged in 83.0% of all the patients. In nearly 18% of the patients with normal preoperative erectile functions, ED developed. Erectile function returned to normal in 14% of the patients with preoperative ED.

Conflict of Interest

None declared.

References

1 **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: 517–22

2 **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

3 **Starkman JS, Santucci RA.** Comparison of bipolar transurethral resection of the prostate with standard transurethral prostatectomy: shorter stay, earlier catheter removal and fewer complications. *BJU Int* 2005; 95: 69–71

4 **Chen Q, Zhang L, Fan QL, Zhou J, Peng YB, Wang Z.** Bipolar transurethral resection in saline vs traditional monopolar resection of the prostate: results of a randomized trial with a 2-year follow-up. *BJU Int* 2010; 106: 1339–43

5 **Fagerström T, Nyman CR, Hahn RG.** Bipolar transurethral resection of the prostate causes less bleeding than the monopolar technique: a single-centre randomized trial of 202 patients. *BJU Int* 2010; 105: 1560–4

6 **Fagerström T, Nyman CR, Hahn RG.** Complications and clinical outcome 18 months after bipolar and monopolar transurethral resection of the prostate. *J Endourol* 2011; 25: 1043–9

7 **Seckiner I, Yesilli C, Akduman B et al.** A prospective randomized study for comparing bipolar plasmakinetic resection of the prostate with standard TURP. *Urol Int* 2006; 76: 139–43

8 **Iori F, Franco G, Leonardo C et al.** Bipolar transurethral resection of prostate: clinical and urodynamic evaluation. *Urology* 2008; 71: 252–5

9 **Tefekli A, Muslumanoglu AY, Baykal M, Binbay M, Tas A, Altunrende F.** A hybrid technique using bipolar energy in transurethral prostate surgery: a prospective, randomized comparison. *J Urol* 2005; 174: 1339–43

10 **Mamoulakis C, Skolarikos A, Schulze M et al.** Results from an international multicentre double-blind randomized controlled trial on the perioperative efficacy and safety of bipolar vs monopolar transurethral resection of the prostate. *BJU Int* 2012; 109: 240–8

11 **Rosen R, Altwein J, Boyle P et al.** Lower urinary tract symptoms and male sexual dysfunction: the multinational survey of the aging male (MSAM-7). *Eur Urol* 2003; 44: 637–49

12 **Boyle P, Robertson C, Mazzetta C et al.** The association between lower urinary tract symptoms and erectile dysfunction in four centres: the UrEpik study. *BJU Int* 2003; 92: 719–25

13 **Kaplan SA, Gonzalez RR, Te AE.** Combination of alfuzosin and sildenafil is superior to monotherapy in treating lower urinary tract symptoms and erectile dysfunction. *Eur Urol* 2007; 51: 1717–23

14 **Faydaci G, Kuyumcuoglu U, Eryildirim B, Aktas A, Tarhan F, Tuncer M.** Effectiveness of doxazosin on erectile dysfunction in patients with lower urinary tract symptoms. *Int Urol Nephrol* 2011; 43: 619–24

15 **Egerdie RB, Auerbach S, Roehrborn CG et al.** Tadalafil 2.5 or 5 mg administered once daily for 12 weeks in men with both erectile dysfunction and signs and symptoms of benign prostatic hyperplasia: results of a randomized, placebo-controlled, double-blind study. *J Sex Med* 2012; 9: 271–81

16 **Roehrborn CG, Kaminetsky JC, Auerbach SM,**

Montelongo RM, Elion-Mboussa A, Viktrup L. Changes in peak urinary flow and voiding efficiency in men with signs and symptoms of benign prostatic hyperplasia during once daily tadalafil treatment. *BJU Int* 2010; 105: 502–7

17 **Walsh PC, Lepor H, Eggleston JC et al.** Radical pros-tatectomy with preservation of sexual function: anatomi-cal and pathological considerations. *Prostate* 1983; 4: 473–85

18 **Mishriki SF, Grimsley SJ, Lam T, Nabi G, Cohen NP.** TURP and sex: patient and partner prospective 12 years follow-up study. *BJU Int* 2011; 109: 745–50

19 **Deliveliotis C, Liakouras C, Delis A, Skolarikos A, Varkarakis J, Protogerou V.** Prostate operations: long-term effects on sexual and urinary function and quality of life. Comparison with an age-matched control population. *Urol Res* 2004; 32: 283–9

20 **Bieri S, Iselin CE, Rohner S.** Capsular perforation localization and adenoma size as prognostic indicators of erectile dysfunctional after transurethral prostatectomy. *Scand J Urol Nephrol* 1997; 31: 545–8

21 **Poulakis V, Ferakis N, Witzsch U, de Vries R, Becht E.** Erectile dysfunction after transurethral prostatectomy for lower urinary tract symptoms: results from a center with over 500 patients. *Asian J Androl* 2006; 8: 69–74

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Abbreviations: TUR, transurethral resection; QoL, quality of life; PVR, post-void residual urine volume; IIEF-ED, erectile dysfunction domain of the International Index of Erectile Function; Q_{max}, maximum urinary flow rate; ED, erectile dysfunction.

