

A clinical study comparing BIVAP saline vaporization of the prostate with bipolar TURP in patients with prostate volume 30 to 80 mL: Early complications, physiological changes and postoperative follow-up outcomes

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Abstract

Introduction: We compare BIVAP saline vaporization of the prostate with bipolar transurethral resection of the prostate (TURP) in the treatment of benign prostatic hyperplasia.

Methods: In total, we included 86 patients treated with BIVAP ($n = 44$) and bipolar TURP ($n = 42$). The inclusion criteria were maximum urinary flow rate (Q_{max}) ≤ 10 mL/s, International Prostate Symptom Score (IPSS) ≥ 16 , and prostate volume measured with transrectal ultrasound scan between 30 and 80 mL. Serum electrolyte, hemoglobin, and hematocrit levels were determined preoperatively and postoperatively. All patients were evaluated at the postoperative first and third months and the IPSS score, post-void residual urinary volume (PVR), Q_{max} , and average urinary flow rate (Q_{ave}) were compared. Statistical analyses were performed using SPSS 16.0 program and statistical significance was set at $p < 0.05$.

Results: Preoperative demographic characteristics were similar in the 2 groups. The mean operation time was significantly higher ($p = 0.02$) and hospitalization time was significantly lower ($p = 0.04$) in the BIVAP group when compared to the bipolar TURP group. There was no significant difference between 2 groups in terms of preoperative and postoperative serum electrolyte, hemoglobin and hematocrit levels. Postoperative complication rates were similar in the 2 groups. The only exception was the rate of severe dysuria, which was significantly higher in the BIVAP group. No statistical difference was noted between the groups in terms of postoperative follow-up results.

Conclusion: Bipolar TURP is a safe and highly effective technique which can be used in the surgical treatment of benign prostatic obstruction with minimal side effects. BIVAP saline vaporization of the prostate seems to be a potential alternative to bipolar TURP with shorter hospitalization time.

Introduction

Benign prostatic hyperplasia (BPH) is increasing in frequency and is a significant problem for aging men.^{1,2} Conventional transurethral resection of the prostate (TURP) still remains the gold standard for the surgical management of bladder outlet obstruction (BOO) caused by BPH, particularly in the patients with a prostate volume of < 100 mL.^{3,4} Nevertheless, significant complications remain associated with TURP and the general morbidity rate of TURP is 18% and the overall mortality rate ranges between 0.17% and 0.77%.^{3,5-10}

Due to significant complication rates observed following TURP, several studies have evaluated the safety and efficacy of new surgical techniques to potentially minimize the risks of TURP to treat lower urinary tract symptoms (LUTS) resulting from BPH.¹⁻⁴ Recent trials investigating for the optimal surgical treatment for BPH compare different modalities in terms of minimal invasiveness, postoperative complications, physiological changes and outcomes.¹⁻⁴ Bipolar TURP and BIVAP saline vaporization of the prostate are common minimally invasive surgical methods to treat BPH. Bipolar TURP can permit a longer resection time and provide improved hemostasis, thus enabling the clinician to operate larger prostates effectively without compromising safety.¹ There is limited data comparing the efficacy and safety of BIVAP saline vaporization of the prostate with alternative minimally invasive techniques.

In this study, we determine the efficacy, safety and postoperative short-term outcomes of the recently developing endoscopic technique of BIVAP saline vaporization of the prostate, in a retrospective comparison with bipolar TURP. The study presented here is, to the best of our knowledge, the first trial comparing BIVAP saline vaporization of the prostate with bipolar TURP.

Methods

The study included 86 patients who underwent surgical therapy for LUTS due to BPH at our institution between May 2012 and January 2013. Data were evaluated retrospectively. There were 42 patients in Group 1 who were operated with bipolar TURP and 44 patients in Group 2 who underwent BIVAP saline vaporization of the prostate.

Approved written informed consent properly explaining the surgical methods, benefits and possible risks of both surgical procedures were read and filled in preoperatively by all study patients. Preoperative demographic data of the patients were noted. The following standard preoperative investigation protocol were administered to all study patients: prostate-specific antigen (PSA), International Prostate Symptom Score (IPSS), quality of life (QoL) score, uroflowmetry measuring the maximum urinary flow rate (Qmax) and average urinary flow rate (Qave), and transrectal and suprapubic ultrasound scan measuring prostate volume and post-void residual urinary volume (PVR).

The inclusion criteria were of Qmax ≤ 10 mL/s, IPSS ≥ 16 , and prostate volume measured with transrectal ultrasound scan between 30 and 80 mL. We excluded patients with severe comorbidities, previous prostate and/or urethral surgery, bladder cancer, confirmed or suspected prostate cancer, increased PSA, coagulopathy, and suspected neurogenic bladder dysfunction. We found 8 patients in the bipolar group and 9 patients in BIVAP group with preoperative urinary retention. Moreover, 12 patients in the bipolar group and 11 patients in the BIVAP group had a median lobe preoperatively. Serum sodium, potassium, chloride, hemoglobin, and hematocrit levels were determined preoperatively and on postoperative day 1. Operation and hospitalization time were noted. All patients were evaluated at the first and third postoperative months and the IPSS score, QoL score, PVR, Qmax, and Qave were compared between the 2 groups.

Each procedure was performed at the Izmir University Department of Urology by 1 of the 3 experienced surgeons (OA, AK, YZA) who are skilled in both BIVAP saline vaporization of the prostate and bipolar TURP. All patients underwent Otis urethrotomy previous to the prostate resection. Otis urethrotomy was performed in all of the study patients to decrease the rate of possible postoperative urethral stricture. All patients received continuous bladder irrigation postoperatively. Postoperative complications, including transient hematuria (<2 weeks), urethral stricture requiring incision, urinary incontinence, urinary tract infection, severe dysuria (<3 weeks) and fever greater than 38°C , were also noted.

Statistical analyses were performed with SPSS 16.0 program. All data were presented as median and standard deviation. Demographic characteristics were summarized as percentages. The Chi-square test was applied to deter-

mine the statistical significance of the differences between the preoperative and postoperative follow-up parameters. Statistical significance was set at $p < 0.05$.

Results

No statistical difference was noted between 2 groups in terms of preoperative demographic characteristics (Table 1). The groups were similar with respect to preoperative PSA, prostate volume, IPSS score, QoL score, Qmax, Qave, and PVR values (Table 1). Both procedures were successfully performed in all cases. The mean operation time was significantly higher ($p = 0.02$) and the hospitalization time was significantly lower ($p = 0.04$) in Group 2 compared to Group 1 (Table 1). All patients were discharged after the urethral catheter was removed, after which patients were able to urinate spontaneously. None of the patients required re-catheterization due to urinary retention or re-hospitalization. The pathological finding was BPH in all BIVAP and bipolar TURP cases.

There was no significant difference between the 2 groups in terms of preoperative and postoperative serum electrolyte, hemoglobin and hematocrit levels (Table 2). Changes in

Table 1. Preoperative demographic characteristics of the patients

	Bipolar (n=42)	BIVAP (n=44)	p value
Age (years)	65.6 \pm 6.2 (57-75)	65.8 \pm 6.9 (55-74)	0.71
Height (cm)	165.2 \pm 5.3 (162-179)	168.5 \pm 5.8 (161-182)	0.91
Weight (kg)	73.7 \pm 7.2 (65-89)	71.4 \pm 6.5 (64-91)	0.93
Operation time (min)	36.3 \pm 9.8 (25-44)	56.8 \pm 11.6 (33-71)	0.02
PSA (ng/dL)	2.1 \pm 1.1 (0.7-2.5)	1.9 \pm 0.9 (0.9-2.3)	0.08
Prostate volume (mL)	55.7 \pm 16.4 (43-67)	53.6 \pm 15.2 (45-71)	0.85
IPSS score	19.3 \pm 2.8 (17-25)	18.7 \pm 2.3 (16-26)	0.42
Qmax (mL/s)	6.8 \pm 3.2 (5-9)	7.6 \pm 3.7 (6-11)	0.53
Qave (mL/s)	4.1 \pm 0.7 (3-5)	4.2 \pm 0.6 (3-6)	0.51
QoL score	3.8 \pm 0.6 (3-5)	4.2 \pm 0.5 (4-7)	0.67
PVR (mL)	123.7 \pm 66.8 (55-130)	119.6 \pm 63.1 (53-125)	0.48
Hospitalization time (day)	2.3 \pm 1.1 (1-3)	1.2 \pm 0.5 (1-2)	0.04
Patients presented with urinary retention (n)	8	9	>0.05
Patients with median lobe	12	11	>0.05

PSA: prostate-specific antigen; IPSS: International Prostate Symptom Score; Qmax: maximum flow rate; Qave: average flow rate; QoL: quality of life; PVR: post-void residual.

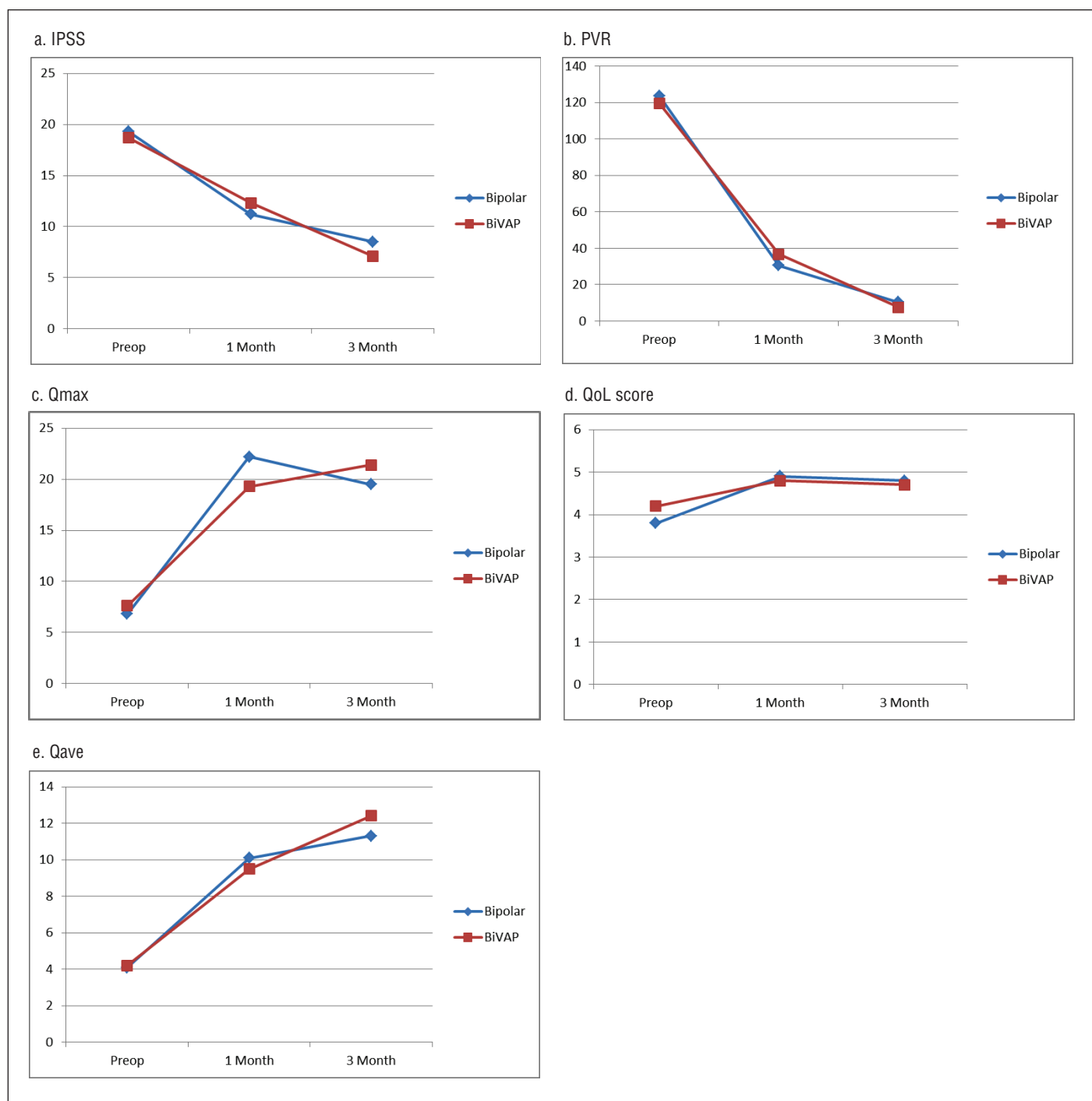


Fig. 1. International Prostate Symptom Score (IPSS), post-void residual (PVR), maximum blood flow (Qmax), quality of life (QoL) score, and average blood flow (Qave) evaluations performed preoperatively and on the postoperative first and third months in both groups.

serum electrolyte, hemoglobin, and hematocrit levels were similar. Table 3 summarizes the postoperative complication rates in both groups (p values could not be measured since the numbers were unsuitable for statistical comparison). None of the patients experienced hematuria requiring blood transfusion. The rates of transient hematuria, urethral

stricture requiring incision, high fever, urinary tract infection, and urinary incontinence were similar in both groups. However, the rate of severe dysuria was significantly higher in the BiVAP group. Figure 1 illustrates the preoperative data, as well as the 1- and 3-month postoperative data for IPSS, QoL score, PVR, Qmax, and Qave. Significant improve-

Table 2. Serum electrolyte, hemoglobin and hematocrit values of the patients measured preoperatively and on the postoperative day 1

	Bipolar (n=42)	BIVAP (n=44)	p value
Na (mEq/L)			
Preoperative	140.7 ± 2.2	140.4 ± 2.5	>0.05
Postoperative	139.3 ± 3.4	139.7 ± 3.2	>0.05
Mean change	-1.4	-0.7	
Cl (mEq/L)			
Preoperative	103.4 ± 3.6	104.1 ± 3.8	>0.05
Postoperative	103.1 ± 3.9	103.9 ± 3.7	>0.05
Mean change	-0.3	-0.2	
K (mEq/L)			
Preoperative	4.3 ± 0.5	4.4 ± 0.4	>0.05
Postoperative	4.2 ± 0.6	4.1 ± 0.5	>0.05
Mean change	-0.1	-0.3	
Hemoglobin (g/dL)			
Preoperative	14.5 ± 1.5	14.2 ± 1.3	>0.05
Postoperative	13.2 ± 1.7	13.6 ± 1.5	>0.05
Mean change	-1.3	-0.6	
Hematocrit (%)			
Preoperative	42.8 ± 2.6	43.5 ± 3.1	>0.05
Postoperative	39.2 ± 3.7	40.3 ± 2.8	>0.05
Mean change	-6.6	-3.2	

ment was noted in all of these findings at the postoperative period in both groups when compared to preoperative values. However no statistical difference was noted between the 2 groups. Severe dysuria (less than 3 weeks) and QoL were subjectively evaluated based on patient complaints and follow-up IPSS and QoL scores were objectively evaluated. None of the patients had severe dysuria at the postoperative month 3.

Discussion

Due to the associated morbidity and mortality rates, the gold standard status of monopolar TURP is controversial. Several new therapeutic modalities have been reported as an alternative to monopolar TURP.^{1-4,11-15} In a previous trial, the authors performed a meta-analysis of 20 randomized, controlled studies comparing transurethral electrovaporization and TURP for symptomatic prostate obstruction.⁹ The authors concluded that electrovaporization techniques were as effective as monopolar TURP with decreased complication rates. The authors also mentioned that electrovaporization techniques were associated with shorter catheterization and hospitalization time. Bipolar TURP offered functional outcomes comparable with monopolar TURP, as well as the benefits of decreased overall complication rates and improved hemostasis.^{1,16} Bipolar TURP and electrovaporization techniques may provide significant improvement in intraoperative visibility secondary to reduced bleeding and

Table 3. Postoperative complications

	Bipolar, n (%)	BIVAP, n (%)
Transient hematuria (<2 weeks)	2 (4.7)	1 (2.2)
Urethral stricture requiring incision	1 (2.3)	3 (6.8)
Unexplained fever >39°C	1 (2.3)	1 (2.2)
Urinary incontinence	3 (7.1)	1 (2.2)
Urinary tract infection	5 (11.9)	3 (6.8)
Severe dysuria	2 (4.7)	5 (11.3)

a more detailed visual differentiation of the adenomatous tissue and prostatic capsule.^{1,16}

Bipolar TURP and BIVAP saline vaporization of the prostate are frequently performed at our clinic for the surgical treatment of BPH and we rarely use monopolar TURP. In our experience, both techniques provide a satisfactory prostatic fossa and a particularly smooth surface without any irregularities at the end of the procedure. We noted reduced capsular perforation and intraoperative bleeding rates with both bipolar TURP and BIVAP compared to monopolar TURP. The potential advantages of BIVAP include the ability to remove prostatic tissue during both active and passive movements of the resectoscope and the absence of resected specimens' evacuation. In the present study, all patients were discharged after the urethral catheter was removed and the same care pathway was applied in all patients without any effort to remove the urethral catheter early. Hospitalization time was significantly lower in the BIVAP group when compared to bipolar TURP group ($p = 0.04$). This finding is similar to previous studies which reported a significantly shorter catheterization period postoperatively and a shorter hospital stay in patients who underwent electrovaporization techniques.^{1,3,9} The mean operation time was significantly higher in the BIVAP group compared to the bipolar TURP group ($p = 0.02$). This was probably because of more time was required to remove the same amount of prostate tissue with BIVAP compared to bipolar TURP.

The optic, scope, sheath size, energy used, endpoint of surgical capsular fibres or open channel were the same in both procedures, except the loop used during the operation. In all patients, the procedure was carried out in a systematic way circumferentially. All patients were examined for possible malignancy with PSA and digital rectal examination prior to the operation. Patients who had a suspicious prostate cancer were excluded from the study. We routinely resected prostatic tissue for pathological examination during the bipolar TURP. Since we did not take a pathological specimen during the BIVAP, we do not have data regarding the mean weight of the resected tissue for each group. There were no crossover techniques where one modality was switched to the other.

Our study findings presented no significant difference between the 2 groups in terms of preoperative and postop-

erative serum electrolyte, hemoglobin and hematocrit levels, changes in serum electrolyte, hemoglobin, and hematocrit levels. The incidence of postoperative complications, including transient hematuria, urethral stricture requiring incision, high fever, urinary incontinence and urinary tract infection were similar in both groups. The only exception was severe dysuria. The irritative symptoms, including severe dysuria secondary to electrovaporization techniques, are debatable.^{1,17-19} In our study, concurrent with previous studies, severe dysuria was significantly higher in the BIVAP group compared to bipolar TURP group ($p = 0.042$). There is a wide variation in the recatheterization rates after electrovaporization techniques and bipolar TURP in the literature.^{1,18,20} None of the patients required recatheterization or rehospitalization in the present study. In terms of follow-up parameters, the published data found similar improvements in both groups for IPSS score, PVR, Qmax, Qave and QoL score at the first and third postoperative months.

Our findings demonstrated that both BIVAP saline vaporization of the prostate and bipolar TURP can be effectively and safely done in the surgical treatment of BPH-related LUTS, with similar postoperative improvement and minimal adverse effects. Although our study represents, to the best of our knowledge, the first study comparing BIVAP saline vaporization of the prostate with bipolar TURP, it has some limitations. The main limitations of our study include its non-randomized retrospective nature and the relatively short postoperative follow-up period. We could not report on the sixth and twelfth postoperative month follow-up outcomes since we did not have the relevant data. Therefore, it is difficult to conclude that BIVAP is totally safe for long-term outcomes from this study design. In addition, the outcomes presented here represent a single-centre experience. Multicentre, randomized, larger studies with longer follow-up are needed to confirm our findings.

Conclusion

BIVAP saline vaporization of the prostate and bipolar TURP are safe and highly effective minimally invasive techniques to surgically treat BPH. Although the longer operation time and higher rate of postoperative irritative symptoms are unfavourable features of the BIVAP procedure, a shorter hospitalization period seems to be a significant advantage compared to bipolar TURP. Randomized, larger studies with longer follow-up are needed to conclude that BIVAP is safe for long-term outcomes.

Competing interests: Dr. Aydogdu, Dr. Karakose and Dr. Atesci all declare no competing financial or personal interests.

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