

Original Article

A Comparison of the Effects of Bipolar Plasma Kinetic and Monopolar Transurethral Resection on the Incidence of Transurethral Resection Syndrome

Dilsen Ornek¹, Cihan Doger³, Kadriye Kahveci², Kemal Oskay⁴, İsmail Aytaç¹, Aysun Postacı¹, Semih Başkan¹, Kaan Aktaş⁵, Serkan Gökkaya⁵

¹Ankara Numune Training and Research Hospital, Department of Anesthesiology and Reanimation, Ankara, Turkey.

²Ulus State Hospital, Department of Anesthesiology and Reanimation, Ankara, Turkey.

³Ankara Atatürk Training and Research Hospital, Department of Anesthesiology and Reanimation, Ankara, Turkey.

⁴Gazi Mustafa Kemal State Hospital, Department of Urology, Ankara, Turkey.

⁵Ankara Numune Training and Research Hospital, Department of Urology, Ankara, Turkey.

Abstract

Background: The study aims to compare bipolar PlasmaKinetic with monopolar transurethral resection of prostate (TURP) in terms of TUR syndrome and the amount of blood loss. **Methods:** We retrospectively investigated the medical records of fifty-five patients who underwent monopolar TURP (Group M, n=30) or bipolar PlasmaKinetic TURP (Group PK, n=25). Symptoms or signs of TUR syndrome, changes in hemoglobin, hematocrit, platelet, serum sodium, serum potassium and fasting blood glucose were compared between both groups. **Results:** Patient's characteristics, the amount of irrigation fluid and operation time were comparable between the two groups. After the operation, hemoglobin values in group PK were higher than in group M (13.59±1.55 gr/dL vs. 12.25±1.6 gr/dL; $P<0.05$). Serum sodium in Group M decreased significantly after the operation (baseline 138.1±5.54 mEq/L vs. postoperative 133.87±8.26 mEq/L; $P<0.05$). TUR syndrome was diagnosed in 3 patients in Group M whereas it was not observed any of the patients in Group PK. Length of hospital stay were found significantly higher in Group M than in the group PK. **Conclusion:** Bipolar plasmaKinetic TURP is a safe method that provides less risk of TUR syndrome, shorter hospital stay, and less bleeding.

Key words: Cautery, Prostate, Transurethral resection of prostate.

Introduction

Central nervous system changes, circulatory and electrolyte imbalances are the main complications of TURP which is known as TUR syndrome, which occurs as result of excessive absorption of irrigating fluid. This syndrome may potentially cause neurologic disorder, pulmonary edema, cardiovascular compromise, and death.^[1,2] In patients undergoing monopolar TURP, the incidence of TUR syndrome was 0.7-1.4%.^[3] Various irrigating

Address for correspondence:

Dr. Dilsen Ornek
Ankara Numune Training and Research Hospital,
Department of Anesthesiology and Reanimation,
Ankara, Turkey.
Email Id: dilsenpinar@yahoo.com

solutions have been used for transurethral resection of prostate, normal saline being the most physiological. The recent availability of bipolar cautery has permitted the use of normal saline irrigation. Furthermore, with the use of saline 0.9% instead of glycine the dreaded TUR syndrome can be avoided.^[3,4] Conventional monopolar TURP still remains as a "gold standard" treatment for BPH despite both open surgery and bipolar TURP are newly developed ablation techniques such as laser, microwave heating, ultrasonic heating, etc.^[5,6] However, the fact that bleeding occurs more due to the uses of monopolar devices and nonelectrolyte irrigation fluids in monopolar TURP. It may also cause such complications as decreased visibility and prolonged surgery time.^[7,8] As a result of such studies, bipolar energy technology being used in open surgery started to be applied in transurethral resection. Bipolar TURP is technically a modified version of monopolar TURP. Bipolar TURP causes less thermal damage and fewer complications by use of isotonic saline in irrigation fluid.^[7,9] The reduction of bleeding by use of isotonic saline in irrigation fluid and increasing visibility facilitate the control of resection depth.^[10,11] Studies have shown that the rate of TUR syndrome related to bipolar TURP was quite low.^[11-13]

In this study, we aimed to compare monopolar TURP (M-TURP) with bipolar plasma kinetic TURP (PK-TURP) in terms of complications such as transurethral resection syndrome and the amount of blood loss.

Materials and Methods

We retrospectively investigated the medical records of 55 adult patients with American Society of

Anesthesiologists (ASA) physical status I or III, aged 45-86 years, who had weight of prostate ranged from 20 to 60 g, with maximum urinary flow rate (Qmax)<15mL/s and International Prostate Symptom Score (IPSS)>16. Patients with a high serum PSA level or known prostate cancer, neurogenic bladder, urethral stricture, bladder stone or tumor, and previous history of prostate surgery, diabetes, chronic renal failure, and congestive heart failure were excluded from the study.

Patients who underwent monopolar transurethral resection of prostate (TURP) (Group M, n=30) or bipolar PlasmaKinetic transurethral resection of prostate (TURP) (Group PK, n=25) were compared. Whereas glycine 1.5% solution was used, as an irrigating fluid in Group M, normal saline 0.9% solution was used in Group PK. All cases were premedicated with intravenous midazolam 0.07mg/kg 30 minutes prior to the operation. Heart rate (HR), mean arterial pressure (MAP), and peripheral O₂ saturation (SpO₂) were monitored in all cases. Spinal anesthesia was performed in the sitting position by administering 15 mg 0.5% bupivacaine with a 26 gauge needle at L4-5 interspace. Perioperative maintenance fluid was estimated as 3 mL/kg/h. Preoperative fluid need and perioperative maintenance fluid was carried out with 0.9% NaCl infusion. Irrigation fluids used during TURP were given by continuous free-flow method. All patients were catheterized with 22 Fr 3-way Foley catheters. At the end of the operation, intravenous 20 mg furosemide was administered for diuresis. Throughout the postoperative 24 hours, irrigation was administered to the patients with 0.9% NaCl through Foley catheter till urine gets a clear color. Catheters were removed in 2-4 days.

A single experienced urologist carried out all surgical procedures. In the Group M, operation was performed using a 26 Fr continuous flow resectoscope, standard loop electrode, and Martin electrosurgical generator (Karl Storz Endoskope, Tuttlingen, Germany). Glycine 1.5% solution was used as an irrigating fluid in Group M. In the Group PK, operation was performed using a 27 Fr continuous flow resectoscope (Gyrus Medical Ltd., Cardiff, UK). Normal 0.9% saline solution was used in Group PK.

Patients' demographics, operation time, weight of resected prostatic tissue and the amount of irrigation fluid used were measured. TUR syndrome and length of hospital stay were recorded. Hemoglobin, hematocrit, platelet, serum sodium, serum potassium and fasting blood glucose were also recorded before and after the operation within 1st hour. TUR syndrome was defined as sodium of 125 mmol/L or less after TURP with 2 or more symptoms or signs of TUR syndrome such as bradycardia, hypotension, chest pain, nausea, vomiting, mental confusion, anxiety, paresthesia and visual disturbance.^[14]

Data were evaluated with SPSS 15.0 software pack (SPSS Inc., Chicago, IL, USA). All data are presented as mean \pm SD or median (min- max). Kolmogorov

Smirnov test was used to identify the distribution of variables. After testing for normal distribution, data were compared using the independent samples *t* test and the Chi-square test. Nonparametric statistical methods were used for the heterogeneous variables. The Mann-Whitney U test was used for nonparametric variables. P values lower than 0.05 were considered as significant. An a priori power analysis based on previously published data,^[15] suggested that a minimum of 20 patients in each group would be required to detect a 20% of the difference in serum sodium level between Group M and Group PK with a power of 0.8 and α = of 0.05.

Results

Table 1 shows the characteristics of the patients. Baseline parameters were similar in both groups. Operation time (59.33 \pm 28.91 vs 60.8 \pm 32.36; *P*=0.86) and the amount of irrigation fluid (14900 \pm 1360.78 vs 14920 \pm 1579.03; *P*=0.993) was comparable between the two groups but the amount of resected tissue in Group PK was higher than in Group M (34.2 \pm 8.98 gr and 28.83 \pm 8.17 gr, *P*=0.026) [Table 2]. After the operation, hemoglobin values in Group PK were higher than in Group M (13.59 \pm 1.55 gr/dL vs. 12.25 \pm 1.6 gr/dL; *P*=0.004). In Group M, serum sodium concentrations decreased significantly after the operation than baseline (mean baseline sodium 138.1 \pm 5.54 mEq/L vs. mean postoperative sodium 133.87 \pm 8.26 mEq/L; *P*<0.05). However, serum sodium in Group PK did not change after the operation (Before the operation serum sodium 138.04 \pm 2.57 mmol/L vs. after 138.08 \pm 2.31 mmol/L; *P*=0.679). Insignificant reductions in serum potassium levels in both Group M and group PK (*P*=0.713) was recorded. Transurethral resection syndrome was diagnosed in 3 patients in Group M, whereas it was not determined in Group PK. Postoperative fasting blood glucose values in Group M were insignificantly higher compared with in the Group PK (115.10 \pm 19.92 mg/dL and 104.20 \pm 25.63 mg/dL ; *P* = 0.082) Length of hospital stay (4.7 \pm 1.44 days, and 2.68 \pm 1.7 days; *P* < 0.05) were found significantly higher in Group M than in the group PK [Table 3].

Discussion

We showed that serum sodium decreased postoperatively in patients who underwent monopolar TURP, whereas serum sodium unchanged in patients who underwent bipolar PlasmaKinetic TURP. TUR syndrome was not observed postoperatively in any of the patients in the Group PK. Decline in the hemoglobin values in Group PK was lower compared with Group M. TUR syndrome is observed due to hypotonic fluids flowing through intravascular region and defined as fluid loading, dilutional hyponatremia and electrolyte imbalance. The clinical spectrum ranges from asymptomatic hyponatremia to electrocardiographic

changes, nausea, vomiting, convulsions, coma, alterations of vision, pulmonary edema, cardiovascular compromise. A clinical manifestation of TUR syndrome that itself with restlessness, headache, confusion, convulsion, delirium, dyspnea, cyanosis, and even coma along with such clinical symptoms as hypotension, hypertension, bradycardia, cerebral edema and death.^[2,7,8] Monopolar TURP is used for the surgical treatment of BPH conventionally. Today, the most frequently used irrigation solutions are 1.5% glycine and sorbitol solutions, and these solutions can cause the risk of significant extravasation and development of TUR syndrome (1-2%).^[9,10] There are studies suggesting that the possibility of hyponatremia and TUR syndrome may be eliminated by employing isotonic saline solution as irrigation fluid along with bipolar energy.^[7,10] In our study, TUR syndrome was diagnosed in 3 patients who underwent monopolar TURP. Several studies reported a significantly lower NaCl rates after monopolar TURP compared with bipolar TURP.^[11-16] In contrast to report Autorino et al did not find significant differences postoperative hemoglobin, and sodium levels between the two procedures.^[17]

Table 1: Patient characteristics and preoperative data.

Variables	Group M (n=30)	Group PK (n=25)	P value
Age (Year)	65.50 (54-86)	66.00 (45-82)	0.347
Weight (kg)	75.50 (55-100)	76 (55-100)	0.892
IPSS	22.7 (16-35)	22.6 (16-35)	0.959
Qmax (ml/sn)	8.1 (4-14)	8.12 (4-13)	0.865
Weight of prostate (g)	45 (25-60)	40 (25-60)	0.945
Hb (g/dL)	14.60(10.20-16.40)	14.70 (11.70-17.80)	0.748
Hct (%)	42.60 (31.80-48.00)	43.48±4.58	0.862
Platelet (mm ³)	252.50 (138.00-516.00)	275.00 (163.00-421.00)	0.554
Na (mmol/l)	138.1±5.54	138.04±2.57	0.956
K (mmol/l)	4.31±0.35	4.35±0.45	0.910
FBG (mg/dL)	103.6±13.06	103.96±19.59	0.571

Data are presented as mean ± SD and median (min-max). IPSS International Prostate Symptom Score, Qmax Maximum Urinary Flow Rate, Hb Hemoglobin, Hct hematocrit, Na Serum Sodium, K Serum Potassium, FBG Fasting Blood Glucose.

Table 2: Perioperative data.

Variables	Group M (n=30)	Group PK (n=25)	P value
Resected tissue amount (gr)	28.83± 8.17	34.2± 8.98	0.026*
Irrigation fluid amount (mL)	14900± 1360.78	14920± 1579.03	0.993
TUR time (dk)	59.33± 28.91	60.8± 32.36	0.86

Values are expressed as mean ± SD.

*P<0.05

TUR: Trans Urethral Resection

We found that serum sodium levels unchanged postoperatively in the Group PK. Similarly, Starkman et al.^[9] reported that the sodium levels were similar before and after the operation in bipolar TURP cases (139 mEq/L and 140 mEq/L respectively). We believe that the use of normal saline as irrigation fluid in Group PK caused less reduction in Hb levels as it led to better visibility and less bleeding. Patankar et al.^[18] found less bleeding in bipolar group compared with monopolar TURP. Dirk et al.^[19] showed that bipolar TURP provided better hemostasis and less blood loss in patients who had anticoagulant therapy. Similarly, the present study revealed that hemoglobin levels in Group PK were significantly higher than those in Group M postoperatively. Yousef et al.^[20] observed insignificant decrease in the postoperative serum sodium in glycine and glucose groups, while insignificant increase observed in saline group (142.6± 12.6 mmol/l). In their study, there was a significant elevation in the postoperative mean value of blood sugar level in the glucose group (170.2 ± 35.9 mg/dl), whereas insignificant increase was observed in saline and glycine groups. In the present study, it was observed that postoperative fasting blood glucose values in Group M were significantly higher compared with preoperative levels, but no difference was found between the groups in the immediate postoperative levels of fasting blood glucose. In diabetic patients, further studies need on the subject whether bipolar TURP method is safer than conventional TURP.

Table 3: Postoperative data.

Variables	Group M (n=30)	Group PK (n=25)	P value
Hb (g/dL)	12.10 (9.10-15.40)	13.80 (10.10-16.70)	0.004*
Hct (%)	36.65 (27.20-46.30)	40.60 (31.30-49.30)	0.027*
Plt (mm ³)	217.50 (123.00-405.00)	234.00 (155.00-358.00)	0.254
Na (mmol/L)	133.87± 8.26	138.08± 2.31	0.011 [#]
K (mmol/L)	4.23± 0.38	4.19± 0.39	0.713
FBG (mg/dL)	115.10± 19.92	104.20± 25.63	0.082
Hospital stay (day)	4.7± 1.44	2.68± 1.7	0.000*

Data are presented as median (min-max) or mean ± SD.

IPSS International Prostate Symptom Score, Qmax Maximum Urinary Flow Rate, Hb Hemoglobin, Hct hematocrit, Plt Platelet, Na Serum Sodium, K Potassium Chlorine, FBG Fasting Blood Glucose

* Mann-Whitney U test,

[#] Unpaired t test P<0.05

Xie CY et al.^[21] suggested that the resection times be shorter and the amount of resected tissue be higher

in bipolar TURP. In our study, there was no statistical difference in terms of TUR times between the groups but the amount of resected tissue was higher in PK-TURP group. Yoon et al reported the duration of catheterisation (2.28 vs 3.12 d) and the hospital stay (3.52 vs 4.27 d) were shorter in the bipolar group.^[22] Similarly, in our study, both catheterization time and hospital stay in group PK were statistically significantly shorter than in group M. Conversely, Seckiner et al. found that operative duration, amount of resected tissue and duration of catheterisation were not different statistically between the patients underwent bipolar plasmakinetic resection of the prostate and the patients underwent standard TURP.^[23] The cause of the different results might be due to skill of the surgeon performing surgical procedures.

Conclusion

Bipolar PK-TURP has caused shorter hospital stay, less bleeding and reduced risk of TUR syndrome. As a result, bipolar PK-TURP appears to be a good alternative to monopolar TURP.

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