Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Urology

Assessing the Safety and Effectiveness of Bipolar Technology in Transurethral Prostate Resection: A study in a Tertiary Care Private Hospital

Dr. Mohammad Hasibul Islam[1*], Dr. N I Bhuiyan[2], Dr. Tasnim Alam Manzer[3], Dr. Md. Abdullah Al Mamun[4], Dr. Ranen Biswas[5], Dr. Md. Sayeef Ullah Sujan[6]

[1]Assistant Professor, Department of Urology, North East Medical College Hospital, Sylhet
[2]Associate Professor, Department of Urology, Bangladesh Medical College Hospital, Dhaka
[3]Assistant Professor, Department of Urology, East West Medical College Hospital, Dhaka
[4]Assistant Professor, Department of Urology, Jahurul Islam Medical College & Hospital, Bajitpur, Kishoregonj
[5]Consultant, Department of Urology, Sheikh Fazilatunnessa Mujib Memorial KPJ Specialized Hospital, Gazipur
[6]Assistant Professor, Department of Urology, Shaheed Monsur Ali Medical College Hospital, Dhaka

DOI: 10.36347/sjams.2024.v12i01.015 | **Received:** 05.12.2023 | **Accepted:** 12.01.2024 | **Published:** 21.01.2024

***Corresponding author:** Dr. Mohammad Hasibul Islam
Assistant Professor, Department of Urology, North East Medical College Hospital, Sylhet

Abstract **Original Research Article**

Background: Benign enlargement of prostate (BEP) is a common affliction among aging males, predominantly emanating from the transition zone of the prostate, resulting in lower urinary tract symptoms. Despite the availability of diverse treatment modalities, transurethral resection of prostate (TURP) has conventionally served as a benchmark intervention. Recently, there has been a growing interest in bipolar energy techniques, spurred by their potential advantages in mitigating complications such as TUR syndrome and surgical bleeding. ***Objectives:*** The main aim of the study to evaluate the safety profile (including serum sodium and hemoglobin reductions, clot retention, TUR syndrome, catheterization duration, and hospital stay) and efficacy (resection rate, maximum flow rate increase, and International Prostate Symptom Score reduction) within the bipolar technique for the TURP. ***Methods & Materials:*** A prospective observational study was conducted at the Department of Urology, Square Hospitals Ltd, Dhaka, Bangladesh, spanning December 2020 to November 2021. The study employed comprehensive preoperative assessments, including bipolar transurethral resection of the prostate (B-TURP) using Olympus ESG-400 energy platform. Surgical parameters, postoperative monitoring, and statistical analysis were meticulously executed to evaluate outcomes and complications for symptomatic benign enlargement of prostate. ***Results:*** In a sample of 50 individuals undergoing bipolar transurethral resection of the prostate (B-TURP), the distribution of ages revealed 66.97±7.95 years as the bipolar system's average age, ranging from 53-82 years. The majority resided in urban areas (62%), with family income predominantly in the 25000-50000 bracket (42%). Preoperative baseline variables, including IPSS, Qmax, serum hemoglobin, and sodium levels, exhibited similar values between groups. Intraoperatively, the mean resection rate was 0.56±0.16 gm/min. Postoperatively, B-TURP resulted in a slight mean decrease in serum hemoglobin of 0.81±0.35 g/dL and a negligible decrease in serum sodium of 0.36±0.27 mmol/L. Only 1 patient postoperatively had an incidence of clot retention, whereas no incidence of TUR syndrome. Catheter was removed after 2.28±0.53 days, then discharged from hospital at 2.51±.061 days. At 6 weeks, B-TURP demonstrated a noticeable improvement in mean IPSS decrease of 21.34±3.62 and an increased Qmax by 16.96±4.54 mL/sec on uroflowmetry. ***Conclusion:*** This study substantiates the effectiveness of bipolar transurethral resection of the prostate (B-TURP) in alleviating complications linked to benign enlargement of prostate (BEP) surgery. The results underscore B-TURP as a secure and proficient strategy for addressing symptomatic BEP, challenging previously expressed apprehensions in the existing literature.

Keywords: Benign Enlargement of Prostate (BEP), Prostatic epithelium, Intravesical pressure, Hyponatremia, Ultrasonography.

INTRODUCTION

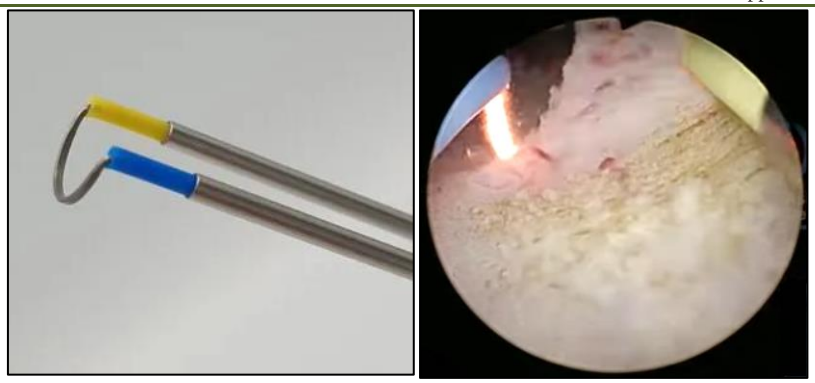
Benign enlargement of prostate (BEP) stands out as a prevalent ailment among aging males, manifesting as a hyperplastic process involving the prostatic epithelium and stroma, either individually or in combination. BEP consistently originates in the transition zone of the prostate, with its etiology being multifactorial and under endocrine control [1]. Lower Urinary Tract Symptoms (LUTS) resulting from BEP-related obstruction (BPO) pose a significant challenge in the medical care of elderly males. The incidence of LUTS and BPO rises linearly with age, reaching 50% by

age 60 and 90% by age 85 [2,3]. Various therapeutic approaches, based on the symptoms and complications of LUTS and BPO, include watchful waiting, pharmacological therapy, transurethral resection of the prostate (TURP), or open prostatectomy. Monopolar TURP is widely used for TURP as "gold standard", whereas a hypotonic non-physiological glycine is used as irrigation fluid, which may lead to dilutional hyponatremia with or without transurethral resection (TUR) syndrome, inducing high morbidity [1]. To mitigate fluid absorption during TURP, strategies such as maintaining low intravesical pressure through low inflow pressure, continuous flow resectoscopy, and limiting the resection time have been recommended [4]. Despite these measures, the incidence of TUR syndrome persists at 2% [5]. Recently, bipolar energy has been employed for Transurethral Resection of the Prostate (TURP) [6]. In the mid-1990s, a "pseudo-bipolar" transurethral resection in saline system by Olympus and later the first true bipolar Plasma Kinetic (PK) system by Gyrus-ACMI was invented, adopted by others [7], also known as Transurethral Resection in Saline (TURIS) or Bipolar TURP (B-TURP). The bipolar electrical current flows from one arm and returns directly to the other arm of the loop or loop to sheath, creating controlled plasma pockets around the loop, facilitating tissue cutting and vessel sealing [8]. This system's ability to use physiologic isotonic normal saline for irrigation reduces fluid absorption-related morbidities. The sodium drop in Bipolar TURP was significantly less at 10.7, with a significantly lower incidence of TUR syndrome [9]. Moreover, there was a 34% reduction in surgical bleeding due to the 'cut-and-seal' effect of plasma [10]. However, some studies reported no significant difference in the drop in hemoglobin and serum sodium change. Instead, some observed a slower resection rate in Bipolar TURP at 0.45 versus 0.56 gm/min [11]. Thus, a certain degree of uncertainty persists in the existing body of evidence.

METHODOLOGY & MATERIALS

A prospective observational study was conducted at the Department of Urology, Square Hospitals Ltd, Dhaka, Bangladesh. The study spanned one year, commencing in December 2020 and concluding in November 2021. During this time frame, a total 50 patients diagnosed with BEP included in the study, who underwent bipolar TURP. The procedure for this study involved a comprehensive approach, starting with detailed history-taking and clinical examinations to assess preoperative International Prostate Symptom Score (IPSS). Preoperative evaluations included ultrasonography of KUB, prostate with MCC and PVR, urinalysis, urine culture and sensitivity, uroflowmetry, serum PSA, serum hemoglobin and sodium levels, blood coagulation profile, HbA1C, and blood grouping with Rh typing. Operations were conducted by a single experienced urologist using bipolar transurethral resection of the prostate (TURP) with Olympus ESG-400 energy platform with standard power settings of 200 W for cutting and 120 W for coagulation (Figure 1). The procedure included standardized resection steps using 0.9% normal saline as irrigant fluid with 26F continuous flow resectoscope, and key parameters such as resection time, resection rate, and weight of resected prostatic chips were recorded. Postoperatively, complications, serum electrolyte, and hemoglobin levels, incidence of TUR syndrome & clot retention, catheterization duration, and hospital stay were monitored. Follow-up at 6 weeks included reassessment of IPSS and maximum flow rate (Qmax). The study's procedural steps were meticulously carried out, ensuring a detailed evaluation of outcomes and complications in the context of bipolar TURP for symptomatic benign enlargement of prostate. After compilation, the data was presented in the form of text, tables, and figures, as necessary. Statistical analysis of the results was done by using computer-based statistical software, Excel free software.

Inclusion and Exclusion criteria: The study included individuals aged 50 years or older with symptomatic benign enlargement of prostate (BEP) warranting surgical intervention. Inclusion criteria comprised those with indications for surgery such as refractory urinary retention, renal insufficiency due to BEP, complications like recurrent urinary infections, hematuria, upper urinary tract changes, stone formation, significant post-void residual volume (>100 mL), and a maximum flow rate (Qmax) less than 10 mL/sec despite failed pharmacological management. Participants were also required to have a prostate size ≥ 40 gm and an International Prostate Symptom Score (IPSS) exceeding 19. Exclusion criteria encompassed inability to provide informed consent, contraindications to surgical intervention, severe comorbidities limiting life expectancy or surgical candidacy, documented or suspected prostate cancer, neurogenic bladder, active urinary infection, past prostate operation, bladder outflow obstruction due to other causes, chronic retention of urine or PVR >250 mL, long-standing uncontrolled Diabetes Mellitus (HbA1C > 8%), coagulopathy, unfit for anesthesia, participation in concurrent BEP-related clinical trials, and conditions or medications potentially impacting study outcomes or participant safety.



A B

Figure 1: (A) Bipolar cutting loop (B) TURP with bipolar cutting loop

RESULT

Table 1 illustrates the distribution of ages in a sample of 50 individuals. The data is categorized into three age ranges: 53-62, 63-72, and 73-82. The corresponding frequencies indicate the number of individuals falling within each age range. The percentages column provides the relative distribution of each age range, showcasing that 26% of the sample belongs to the 53-62 age group, 44% to the 63-72 age group, and 34% to the 73-82 age group and bipolar system was 66.97±7.95 years with a range of 53-82 years. Among the participants, 38% resided in rural areas, while 62% were from urban settings. Regarding family income, the majority fell within the 25000-50000 bracket, constituting 42% of the sample, followed by 24% in the 50001-100000 range, 22% in the 100001-200000 range and 10% in > 200000. Table 2 displays the baseline variables for the Bipolar TURP, presenting key outcome measures and associated statistical values. Preoperatively the mean IPSS in bipolar system was 25.82±2.91, Qmax was 6.90±4.17 mL/sec. Preoperative hemoglobin level was 12.85±1.20 gm/dL. Before B-TURP, serum sodium level was 138.61±2.43 mmol/L, showing within normal range. Table 3 shows resected volume of prostate, resection time & resection rate in bipolar TURPs. In bipolar system, 32.05±10.76 gm. prostate chips were resected within 48.18±19.03 minutes. From this, calculated mean resection rate was 0.59±0.16 gm/min. Table 4 shows postoperative decrease in hemoglobin level in bipolar system. Postoperatively, the mean serum hemoglobin decrease was 0.81±0.35 gm/dL and the mean postoperative serum sodium decrease was 0.36±0.27 mmol/L. Postoperatively, only 1 among 50 patients developed 2 episodes of clot retention, none developed any feature of TUR syndrome. Table 5 shows mean catheterization time and mean hospital stay time after B-TURP, which was 2.28±0.53 days and 2.51±0.61 days, respectively. 36 patients (72%) after bipolar TURP required catheterization for 2 days. In the rest of the patients, catheter was removed after 3 days in 12 patients (24%) and 4 days in only 2 patient (4%). While 35 patients (70%) of bipolar system stayed in hospital for 2 days. Rest of the patients of bipolar system were discharged after 3 days in 11 patients (22%), 4 days in only 3 patients (6%) and only 1 patient was discharged after 5 days (2%). Table 6 shows, on follow up at 6 weeks, mean IPSS decrease was 21.34±3.62 after B-TURP. Table 7 shows, improvement of Maximum flow rate (Qmax) on uroflowmetry by 16.96±4.54 mL/sec at 6 week follow up.

Table 1: Distribution of ages in bipolar system. (n=50)

Age (years)	**Frequency**	**Percentages**
53-62	13	26%
63-72	20	44%
73-82	17	34%
Mean ± SD	66.97±7.95	
Area		
Rural	19	38%
Urban	31	62%
Monthly Family Income (Taka)		
25000-50000	21	42%
50001-100000	12	24%
100001-200000	11	22%
> 200000	5	10%

Table 2: Baseline variables of Bipolar system. (n=50)

Outcome	Value
Preoperative IPSS (Range)	25.82±2.91 (19 – 34)
Preoperative Qmax (mL/sec) (Range)	6.90±4.17 (0 – 15.7)
Preoperative prostate size (gram) (Range)	59.6±10.02 (40 – 135)
Preoperative hemoglobin level (gm/dL) (Range)	12.85±1.20 (10.4 – 14.8)
Preoperative sodium level (gm/dL) (Range)	138.61±2.43 (135.3 – 143.6)

Table 3: Resected volume of prostate, resection time & resection rate. (n=50)

Outcome	Value
Resected volume (gram) (Range)	32.05±10.76 (15 – 92)
Resection time (minute) (Range)	48.18±19.03 (23 – 115)
Resection rate (gm/min) (Range)	0.59±0.16 (0.28 – 0.89)

Table 4: Serum hemoglobin & sodium decrease. (n=50)

	Value
Serum hemoglobin decrease (gm/dL) (Range)	0.81±0.35 (0.2 – 1.7)
Serum sodium decrease (mmol/L) (Range)	0.36±0.27 (0.1 – 2.8)

Table 5: Catheterization time & Duration of hospital stays (n=50)

	Value
Catheterization time (day) Range	2.28±0.53 (2-4)
Hospital stay (day) Range	2.35±0.61 (2-5)

Table 6: International prostate symptom score (IPSS) decrease (n=50)

	Value
IPSS decrease on follow up (Range)	21.34±3.62 (15 – 28)

Table 7: Maximum flow rate (Q max) increase (n=50)

	Value
Qmax increase on follow up (mL/sec) (Range)	16.96±4.54 (7.3 – 27.2)

DISCUSSION

This prospective study had been designed to observe the complications to the safety & efficacy of TURP with bipolar technique. Male patients of age 50 years or more with symptomatic benign enlargement of prostate requiring surgery with prostate size ≥ 40 grams were used in the study. After fulfilling selection criteria, patient under the system were managed by bipolar TURP. Total 50 patients with prostate size between 40-135 grams underwent TURP in the department of urology, Square Hospital were included in the study. Age and other preoperative baseline variables, hemoglobin level, serum sodium level, prostate size, IPSS & Qmax were assessed. Preoperative hemoglobin & sodium levels were either normal or corrected and confirmed before operation. Prostate size was assessed by abdominal ultrasonography and Qmax by uroflowmetry.

Perioperative outcome variable, resection rate was calculated by dividing resected volume by resection time. Postoperative change of serum hemoglobin & sodium level, incidence of clot retention & TUR syndrome, duration of catheterization & hospital stays and at 6 weeks, IPSS decrease & Qmax increase were assessed as outcome variables. In our study, displays the baseline variables for the Bipolar system, presenting key outcome measures and associated statistical values. Mean age was 66.97±7.95 years with a range of 53-82 years. The mean age of this study was comparable that compared the safety and the efficacy of plasmakinetic bipolar [13,14]. Similar studies done by some authors where the mean age was almost similar to the present study [15-18]. Mean resection time of 48.18±19.03 minutes in this study took to resect mean volume of 32.05±10.76 grams using regular bipolar TURP loop. Then resection rate was calculated to 0.59±0.16 gm/min. We found a smooth uninterrupted pattern of resection by the bipolar system, along with a less frequent need for separate coagulation of bleeding vessels in between cutting due to the "cut and seal" effect of the bipolar system. Resected tissues less likely to be adherent with the cutting loop facilitated a quick bipolar resection. The mean resection time was 33 minutes in bipolar TURP [16]. The operative time was 62 minutes in bipolar TURP in another study [19]. But another study compared bipolar TURIS with monopolar TURP found that the mean resection time was significantly higher in bipolar system, 68.6 minutes, because of using a smaller bipolar cutting loop [20]. There was also a visually negligible charring effect on tissue during cutting and coagulation using bipolar technique, but we didn't analyze the degree of tissue charring by histological examination in the current study. Among these 50 participants, 2 patients were with cardiac pacemakers. None of them showed any arrhythmia or pacemaker dysfunction during bipolar prostate resection and coagulation, though as per instruction pacemaker settings were temporarily readjusted accordingly by specialized technician during TURP. The amount of hemoglobin decrease was assessed, which was calculated by subtracting postoperative hemoglobin level, measured at 06 hours after completion of operation in bipolar system, from preoperative hemoglobin level, measured in the morning of operation day. In this present study, decrease of hemoglobin was 0.81±0.35 gm/dL. Postoperative changes in hemoglobin levels were minimal and none of the patients required blood transfusion. This assessment supports "cut and seal" effects of bipolar system. In a study showed 1.22±0.54 gm/dL hemoglobin decrease in bipolar TURP [17]. In this study, the mean postoperative serum sodium decrease in bipolar system was also negligible (0.36±0.27 mmol/L), because of use of normal saline as an irrigant, which was also measured and calculated similarly as hemoglobin decrease. In a study, mean decrease in serum sodium level was 1.2 mEq/L in bipolar system which had significant difference [15]. Another study also found the postoperative serum sodium level was lower in bipolar system, 10.7±1.8 mmol/L [9]. In our study, a single patient developed 2 episodes of clot retention in 1st postoperative day, which was managed by active bladder wash with followed by increased irrigation. No patients after B-TURP developed TUR syndrome, though resection time was nearly 2 hours in some patients. Different studies support zero incidence of TUR syndrome after bipolar resection [7,9,15,16]. Patient became catheter-free within 2-4 days of bipolar resection, as urine became visibly clear 1 day before catheter removal, followed by discharge from hospital after establishing satisfactory voiding, which was mostly on the same day of catheter removal, except in 4 patients, who voided at evening, therefore discharged on next morning. IPSS was sufficiently reduced and Qmax was satisfactorily improved in the bipolar system of the current study at 6 weeks' follow-up. IPSS decrease and Qmax improvement were also measured by calculating differences between preoperative and 6-week postoperative values. IPSS was reduced to value of 2-9 at follow-up from a preoperative value of 19-34 and Qmax improved from 0-15.7 mL/sec to 17.2-36.5 mL/sec. After B-TURP, mean differences were 21.34±3.62 and 16.96±4.54 mL/sec, respectively. These results are also supported by different studies where patients' symptoms and flow were improved similarly [15-17]. In another study also found significant but equal improvement in IPSS [18,20]. In the current study, no stricture urethra was observed within a very short postoperative follow-up of only 6 weeks. Long-term study would be helpful to identify any stricture.

Limitations of the study: Limitations of the study include its single-center nature, small sample size, absence of transrectal ultrasound for measuring prostate size, a short follow-up period, no comparison with monopolar TURP or other forms of surgical options, and the omission of pathological samples for thermal artifacts.

CONCLUSION

In conclusion, this study addressed the challenges of benign enlargement of prostate (BEP) surgery with a focus on bipolar transurethral resection of the prostate (B-TURP). Despite concerns in previous literature, our findings demonstrated the effectiveness of B-TURP in reducing chance of complications, including low sodium drop and surgical bleeding supporting this rapidly growing technology as a viable alternative for TURP. The study provides valuable insights into the potential advantages of B-TURP as a safe and efficient approach for managing symptomatic BEP. However, a long term, multi-centered, comparative study would be helpful to further comment on conclusion.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethical Committee.

REFERENCE

1. Smith, D. R. (2013). *Smith and Tanagho's general urology*. McGraw Hill Professional.
2. Verhamme, K. M. C., Dieleman, J. P., Bleumink, G. S., Van der Lei, J., Sturkenboom, M. C. J. M., & Panel, T. P. E. E. (2002). Incidence and prevalence of lower urinary tract symptoms suggestive of benign prostatic hyperplasia in primary care—the Triumph project. *European urology*, *42*(4), 323-328.
3. Bhansali, M., Patankar, S., Dobhada, S., & Khaladkar, S. (2009). Management of large (> 60 g) prostate gland: PlasmaKinetic Superpulse (bipolar) versus conventional (monopolar) transurethral resection of the prostate. *Journal of endourology*, *23*(1), 141-146.
4. Michielsen, D. P., Coomans, D., Braeckman, J. G., & Umbrain, V. (2010). Bipolar transurethral resection in saline: the solution to avoid hyponatraemia and transurethral resection syndrome. *Scandinavian journal of urology and nephrology*, *44*(4), 228-235.
5. Mebust, W. K., Holtgrewe, H. L., Cockett, A. T. K., Peters, P. C., Bueschen, A. J., Carlton Jr, C. E., ... & Witherington, R. (1989). Transurethral prostatectomy: immediate and postoperative complications. A cooperative study of 13 participating institutions evaluating 3,885 patients. *The Journal of urology*, *141*(2), 243-247.
6. Eaton, A. C., & Francis, R. N. (2002). The provision of transurethral prostatectomy on a day-case basis using bipolar plasma kinetic technology. *BJU international*, *89*(6), 534-537.
7. Issa, M. M. (2008). Technological advances in transurethral resection of the prostate: bipolar versus monopolar TURP. *Journal of endourology*, *22*(8), 1587-1596.
8. Mashni, J., Godoy, G., Haarer, C., Dalbagni, G., Reuter, V. E., Ahmadie, H. A., & Bochner, B. H. (2014). Prospective evaluation of plasma kinetic bipolar resection of bladder cancer: comparison to monopolar resection and pathologic findings. *International urology and nephrology*, *46*, 1699-1705.
9. Ho, H. S., Yip, S. K., Lim, K. B., Fook, S., Foo, K. T., & Cheng, C. W. (2007). A prospective randomized study comparing monopolar and bipolar transurethral resection of prostate using transurethral resection in saline (TURIS) system. *European urology*, *52*(2), 517-524.
10. Fagerström, T., Nyman, C. R., & Hahn, R. G. (2010). Bipolar transurethral resection of the prostate causes less bleeding than the monopolar technique: a single-centre randomized trial of 202 patients. *BJU international*, *105*(11), 1560-1564.
11. Poh, B. K., Mancer, K., Goh, D., Lim, T., Ng, V., Ng, K. K., & Ng, F. C. (2011). PlasmaKineticTM (bipolar) transurethral resection of prostate: a prospective trial to study pathological artefacts, surgical parameters and clinical outcomes. *Singapore Med J*, *52*(5), 336-339.
12. Kirkwood, B. R. & Sterne, J. A. C. (2003). Essentials of medical statistics, 2nd Ed. Massachusetts: Blackwell Science.
13. Huang, X., Wang, L., Wang, X. H., Shi, H. B., Zhang, X. J., & Yu, Z. Y. (2012). Bipolar transurethral resection of the prostate causes deeper coagulation depth and less bleeding than monopolar transurethral prostatectomy. *Urology*, *80*(5), 1116-1120.
14. Erturhan, S., Bayrak, Ö., Seçkiner, İ., Demirbağ, A., Erbağcı, A., & Yağcı, F. (2013). Comparative outcomes of plasmakinetic versus monopolar transurethral resection of benign prostatic hyperplasia: 7 years' results. *Turkish journal of urology*, *39*(4), 220.
15. Singh, H., Desai, M. R., Shrivastav, P., & Vani, K. (2005). Bipolar versus monopolar transurethral resection of prostate: randomized controlled study. *Journal of endourology*, *19*(3), 333-338.
16. Autorino, R., Damiano, R., Di Lorenzo, G., Quarto, G., Perdonà, S., D'Armiento, M., & De Sio, M. (2009). Four-year outcome of a prospective randomised trial comparing bipolar plasmakinetic and monopolar transurethral resection of the prostate. *European urology*, *55*(4), 922-931.
17. Xie, C. Y., Zhu, G. B., Wang, X. H., & Liu, X. B. (2012). Five-year follow-up results of a randomized controlled trial comparing bipolar plasmakinetic and monopolar transurethral resection of the prostate. *Yonsei medical journal*, *53*(4), 734-741.
18. Stucki, P., Marini, L., Mattei, A., Xafis, K., Boldini, M., & Danuser, H. (2015). Bipolar versus monopolar transurethral resection of the prostate: a prospective randomized trial focusing on bleeding complications. *The Journal of urology*, *193*(4), 1371-1376.
19. Fagerström, T., Nyman, C. R., & Hahn, R. G. (2011). Complications and clinical outcome 18 months after bipolar and monopolar transurethral resection of the prostate. *Journal of endourology*, *25*(6), 1043-1049.
20. Komura, K., Inamoto, T., Takai, T., Uchimoto, T., Saito, K., Tanda, N., ... & Azuma, H. (2015). Incidence of urethral stricture after bipolar transurethral resection of the prostate using TUR is: Results from a randomised trial. *BJU international*, *115*(4), 644-652.