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Study on the Efficacy and Safety Profile of Bipolar and Monopolar TURP

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ABSTRACT
Benign prostatic hyperplasia (BPH) significantly impacts older men's quality of life by causing lower urinary tract symptoms (LUTS). Transurethral resection of the prostate (TURP) remains the preferred surgical treatment. Monopolar TURP (M-TURP) has long-term efficacy but risks complications, while bipolar TURP (B-TURP) offers enhanced safety, reducing hyponatremia and bleeding through saline-based irrigation. To analyze the efficacy and safety of bipolar and monopolar TURP. This prospective study (Nov 2022-May 2024) compared outcomes and complications of bipolar and monopolar TURP in 50 benign prostatic hyperplasia (BPH) patients at PMCH. Using stratified sampling, 25 patients received each procedure. Inclusion focused on patients with urinary retention, ineffective treatments, or hematuria. Data collection adhered to ethical standards, analysed via SPSS 27 and Excel, with ANOVA assessing significance (P<.05). In this study, bipolar and monopolar TURP showed similar outcomes for most clinical parameters, with no significant differences in age (p=0.291), postvoid residual urine (p=0.820), prostate volume (p=0.578), or urine flow rate (p=0.731). However, hospital stay duration (p=0.000) and serum sodium levels (p=0.034) were significantly higher in one group, indicating some variances in postoperative recovery. The study has concluded that both bipolar and monopolar TURP are effective in managing benign prostatic hyperplasia (BPH) by reducing urinary symptoms and enhancing quality of life.

INTRODUCTION

The majority of older men globally, benign prostatic hyperplasia (BPH) is a widespread disorder that can have a substantial effect on their quality of life by causing a variety of lower urinary tract symptoms (LUTS). In accordance to the American Urological Association, the prostatic transition zone, which comprises 5% of the prostate and grows continuously throughout life, is the site of the histologic diagnosis known as benign prostatic hyperplasia (BPH)[1]. These symptoms, which fall into the obstructive and irritative categories, include straining, nocturia, frequency, dysuria, hesitation, thin stream, intermittence, post-void dribbling and reduced urine force. For LUTS and BPO, there are several treatment options, including as open prostatectomy, minimally invasive therapy, medication therapy, watchful waiting and transurethral resection of the prostate (TURP)[2]. Transurethral resection of the prostate (TURP) is the most frequent surgical surgery for BPH and is regarded as the "gold standard" therapy for dilated benign prostates [3]. TURP is an endoscopic technique that relieves blockage of the urethra by removing prostatic tissue that is impinging on it using a resectoscope equipped with a wire-loop electrode. Common complaints in BPO include ejaculatory dysfunction (EjD), which manifests as retrograde ejaculation and erectile dysfunction (ED). Transurethral surgical options are becoming more and more popular as many men who want surgery BPO alleviation are concerned about maintaining their sexual function[4]. In 1926, Maximilian Stern introduced the first resectoscope and transurethral resection of the prostate (TURP)[5]. The surgical "preeminent benchmark" for BPO is monopolar TURP (M-TURP) because of its long-term effectiveness. Complications include TUR syndrome, hemorrhage, erectile dysfunction and urethral strictures, however, continue to raise challenges [6]. MTURP involves placing a passive electrode on the patient's body, while an active electrode is attached to the resectoscope. The resection process involves tissue resection, with 10% of the electric current emerging from the device being the primary source of urethral stricture. Resection and coagulation require fluid that transmits electrical current to the tissue [7]. By addressing a key problem in M-TURP, bipolar technology (B-TURP) enables it to be conducted in normal saline, with encouraging results[8,9]. By employing high frequency radiation to produce a plasma layer containing energy-charged particles, bipolar transurethral resection of the prostate, which was first performed 15 years ago, causes tissue disintegration by molecular dissociation. In the mid-1990s, Olympus invented a "pseudo-bipolar" transurethral resection in saline system, later adopted by Gyrus-ACMI as the first true bipolar Plasma Kinetic (PK) system. This system uses bipolar electrical current to create controlled plasma pockets around the loop, facilitating tissue cutting and vessel sealing. It also reduces fluid absorption-related morbidities by using physiological isotonic normal saline for irrigation[10,11]. Compared to traditional monopolar systems, this technique minimizes side effects and decreases the resection temperature, which may lessen thermal harm to nearby tissue[12]. The utilization of an irrigating fluid is frequently necessary for endoscopic surgical procedures and its effects might vary according on the rate, volume and type of absorption. Studies have demonstrated advantages such as reduced bleeding and hyponatremia and normal saline is a more physiological solution with less adverse effects[13,14]. Despite advancements in surgical methods, lubricants and equipment, urethral stricture remains one of the primary late complications of TURP. When compared to traditional TURP, bipolar TURP significantly lowers the IPSS score, improves Qmax after surgery and has better postoperative bladder outcomes[15,16].

Aims and Objectives: This prospective study aimed to compare outcomes and complications between bipolar and monopolar transurethral resection of the prostate (TURP) procedures in patients with symptomatic benign prostatic hyperplasia (BPH).

MATERIALS AND METHODS

Research Design: This prospective comparative study was conducted from November 2022 to May 2024. Stratified random sampling selected 50 BPH patients from the inpatient department of Pacific Medical College Hospital (PMCH), with 25 patients undergoing bipolar TURP and 25 undergoing monopolar TURP. Informed consent was obtained from all participants, and demographic data, clinical history, physical examination findings and baseline investigations were systematically collected. The list of eligible patients was updated daily from both inpatient and outpatient departments, ensuring a robust selection process. The study design maintained rigorous ethical standards, ensuring participants' consent and adherence to inclusion criteria. Data from the procedures, outcomes and complications were consolidated in a master Excel chart for structured analysis. This study's objective was to provide a comparative evaluation of bipolar versus monopolar TURP in managing BPH, examining differences in patient outcomes and surgical risks. The methodology demonstrated a systematic approach to patient selection, data collection and analysis, aiming for an equitable comparison between the two surgical methods.

Inclusion Criteria:

- Patients diagnosed with Benign Prostatic Hyperplasia in IPD of PMCH.

- Patients had symptomatic BPH, those who required surgery owing to urinary retention or failed medical therapy and gross hematuria of prostatic involvement.
- Patients are ready to give consent for the study and surgical procedure.

Exclusion Criteria:

- Patients with neurogenic bladder dysfunction.
- Previous prostatic or urethral surgery.
- Patients with prostate cancer, Bladder calculus.
- Patients were not willing to give consent.

Statistical Analysis: The study used SPSS 27 for effective analysis. MS Excel was used for creating graphs and other calculations. The continuous data were expressed as mean±standard deviation while the discrete data were expressed as frequency and its respective percentage. The study used ANOVA as the statistical tool for comparing the variables.* The level of significance was considered to be P<.05.

RESULTS AND DISCUSSIONS

(Fig. 1) shows the outcomes of bipolar and monopolar TURP patients in this study. For bipolar TURP, the first column lists patient ages from 53-72. Each patient's procedure results are in the second column. For monopolar TURP, the third column shows patient ages from 53-72, while the fourth column shows procedure results. Data analysis shows that the two methods yield different results. Bipolar TURP results for 53-year-olds varied from 72-51, while monopolar TURP outcomes ranged from 72-59. This pattern repeats across age groups, with different operation outcomes. Data analysis may indicate trends like average outcomes, success rates, or age-outcome correlations for each procedure.

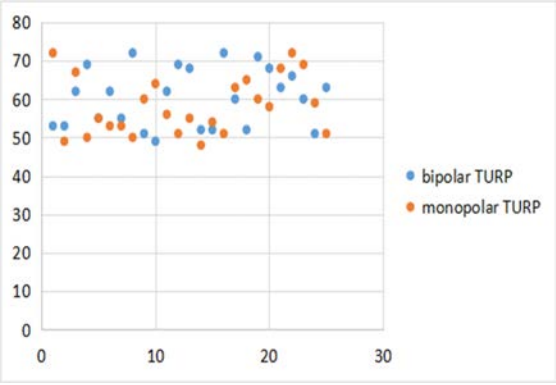

Fig. 1: Age Distribution in Each Group

The mean age of patients undergoing bipolar and monopolar transurethral resection of the prostate (TURP) procedures was slightly different between the two groups. Patients in the bipolar TURP group had a mean age of 60.4 years with a standard deviation of 7.59 years, indicating some age variation within this group. Conversely, the monopolar TURP group had a marginally younger mean age of 58.12 years, with a similar standard deviation of 7.52 years.

Table 1: Mean Age of Patients in Bipolar and Monopolar TURP Group

Age of patients	Bipolar TURP	Monopolar TURP
Mean	60.4	58.12
SD	7.59	7.52

According to ultrasonography findings, bipolar TURP patients have an average kidney size of 15 centimeters with a standard deviation of 1.65, while monopolar patients have 14.36 centimeters with 1.95. An average bladder size of 365.88 milliliters with a standard deviation of 18.58 for bipolar TURP patients and 357.48 with a standard deviation of 3.86 for monopolar patients. Bipolar TURP patients had an average prostate volume of 35.68 cubic centimeters (±4.21), whereas monopolar TURP patients have an average of 36.32 cubic centimeters (±3.86), indicating modest differences in the two groups. During bipolar TURP, postvoid residual urine averages 53.12 milliliters (±4.94), while monopolar TURP patients average 52.8 milliliters (±4.95), demonstrating equivalent post-procedure urinary drainage efficacy. Uroflowmetry data show similar urine flow rates during voiding for bipolar and monopolar TURP patients, with an average of 13.2 ml/s (±4.94) and 13.2 ml/s (±2.16), respectively. Bipolar TURP patients have similar serum PSA levels to monopolar TURP patients, averaging 6.76±1.61ng/ml and 6.64 ±1.8ng/mL (Table 2).

Table 2: Ultrasound Features of Kidney, Ureter and Bladder with Prostate Volume and Postvoid Residual Urine Measurements and Uroflowmetry

Ultrasound Feature	Bipolar TURP	Monopolar TURP
Kidney Size	15±1.65	14.36±1.95
Bladder Size	365.88±18.58	357.48±3.86
Prostate Volume	35.68±4.21	36.32±3.86
Postvoid residual urine	53.12±4.94	52.8±4.95
Uroflowmetry (Urine Flow rate)	13.2±4.94	13±2.16
Serum prostate-specific antigen (PSA)	6.76±1.61	6.64±1.8
Uroflowmetry (Urine Flow rate)	13.2±4.94	13±2.16

(Fig. 2) shows the mean serum PSA values for bipolar and monopolar TURP groups. Bipolar TURP patients have a mean serum PSA of 6.76, while monopolar individuals have 6.64. These findings reveal a slight variation in mean serum PSA levels between bipolar and monopolar TURP patients. The change is minimal and may not affect clinical practice. In addition to blood PSA values, patient demographics, medical history and prostate disease characteristics must be examined to make clinical recommendations.

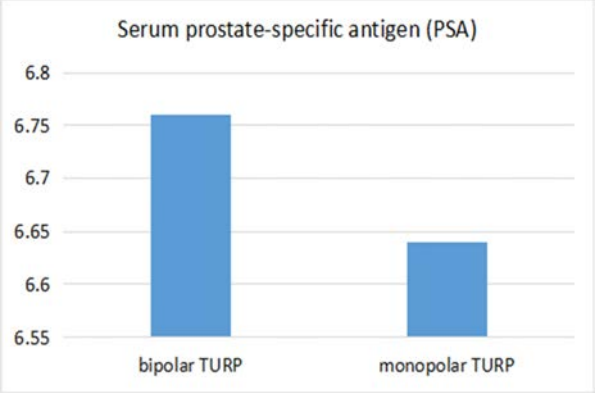

Fig. 2: Findings of Mean Serum Prostate-Specific Antigen (PSA) in Each Group

Patients undergoing bipolar TURP had an average hemoglobin level of 13.172 g/dL (±0.67), while those undergoing monopolar TURP had an average of 13.112 g/dL (±0.92). TLC values for bipolar TURP and monopolar TURP patients are similar, with averages of 11115.68 cells per cubic millimeter (±904.54) and 11038.84 cells per cubic millimeter (±866.73), respectively. Neutrophil levels in bipolar TURP patients average 7.996 thousand cells per cubic millimeter (±0.38), while monopolar TURP patients average 8.052 thousand cells per cubic millimeter (±0.322). Patients with bipolar TURP had similar lymphocyte counts, averaging 4.728 thousand cells per cubic millimeter (±0.14) whereas monopolar TURP patients have 4.744 thousand cells per cubic millimeter (±0.12). Other white blood cell subtypes such monocytes, eosinophils, and basophils have similar averages between the two surgical groups, indicating similar post-procedure hematological responses (Table 3).

Table 3: Findings of the Parameters of Blood Test in Each Group

Blood test parameter	Bipolar TURP	Monopolar TURP
Hemoglobin Level	13.172±0.67	13.112±0.92
TLC	11115.68±904.54	11038.84±866.73
Neutrophils	7.996±0.38	8.052±0.322
Lymphocytes	4.728±0.14	4.744±0.12
Monocytes	0.22±0.07	0.2±0.07
Eosinophils	0.66±0.02	0.62±0.02
Basophils	0.0416±0.02	0.0408±0.01

Among the demographic factors, age showed no significant difference between the groups (F=1.138, p=0.291). In urine routine analysis, while blood in urine was not significantly different (F=0.310, p=0.580), the presence of bacteria was significantly higher in one group compared to the other (F=0.000, p=1.000). Measurements of kidney size (F=1.558, p=0.218) and bladder size (F=2.496, p=0.121) did not show significant differences, nor did prostate volume (F=0.313, p=0.578) or postvoid residual urine (F=0.052, p=0.820). Uroflowmetry results for urine flow rate also demonstrated no significant difference (F=0.120, p=0.731). Similarly, levels of serum prostate-specific antigen (PSA) (F=0.062, p=0.805), hemoglobin (F=0.068, p=0.795), TLC (F=0.094, p=0.760), BUN (F=1.410, p=0.241), serum creatinine (F=1.079, p=0.304) and differential counts of neutrophils, lymphocytes, monocytes, eosinophil and basophil did not yield significant differences between the groups. However, there were notable differences in serum sodium (F=4.766, p=0.034) and serum potassium (F=3.274, p=0.077) levels, which were higher in one group compared to the other. In the postoperative and follow-up phase, while prostate volume (F=1.714, p=0.197) and recurrence rates (F=0.214, p=0.646) did not significantly differ, postoperative bleeding (F=3.273, p=0.077) and hospital stay duration (F=49.899, p=0.000) were significantly higher in one group. However, urinary incontinence rates showed no significant difference (F=2.000, p=0.164) between the groups (table 4).

Table 4: Significance Findings of the Patients Between Two Groups

Parameters		F	P-value
	Age	1.138	0.291
Urine Routine	Blood	0.310	0.580
	Protein	0.077	0.782
	Bacteria	0.000	1.000
USG of kidney, ureter	Kidney Size	1.558	0.218
and bladder with	Bladder Size	2.496	0.121
prostate	Prostate Volume	0.313	0.578
volume and postvoid	Postvoid residual urine	0.052	0.820
residual urine	Uroflowmetry (Urine Flow rate)	0.120	0.731
measurement	Serum prostate-specific antigen (PSA)	0.062	0.805
	Hemoglobin Level	0.068	0.795
	TLC	0.094	0.760
	Neutrophils	0.307	0.582
Differential Counts	Lymphocytes	0.168	0.683
(n × x 10^3/µL)	Monocytes	0.923	0.341
	Eosinophil	0.283	0.597
	Basophil	0.018	0.894
	BUN	1.410	0.241
	Serum Creatinine	1.079	0.304
	Serum Sodium	4.766	0.034
	Serum Potassium	3.274	0.077
	Prostate Volume	1.714	0.197
	Recurrence	0.214	0.646
Postoperative and	Postoperative Bleeding	3.273	0.077
Follow-up	Hospital Stay	49.899	0.000
	Urinary Incontinence	2.000	0.164

The most common surgical procedure with the longest follow-up duration for individuals with intermediate prostate volume is monopolar TURP. According to evaluations, it can lower LUTS intensity by 71% on average, resulting in an average drop of 12 points in IPSS score. The maximal urinary flow rate (Qmax) increased by an average of 120%, which is likewise a considerable rise. On average, the residue after micturition drops by 60%. The effectiveness and consistency of these findings support monopolar

TURP's superior role in treating benign prostatic hyperplasia. As with any medical intervention, it is essential to evaluate the risks and benefits for each patient individually[17,18]. There is no noticeable distinction in the urodynamic results or symptoms at 3 and 12 months between bipolar TURP and standard TURP, according to a number of randomized investigations. The risk of retrograde ejaculation is thought to be comparable for both methods. Although the use of saline in Bipolar TURP eliminates the danger of irrigation fluid resorption syndrome, it is unclear if bleeding risk is decreased[17,19]. Although BTURP is linked to a lower risk of hyponatremia, TUR syndrome, and bleeding than MTURP, both procedures alleviate urinary symptoms. The time frame of the operation, urethral strictures, quality of life, shorter catheterisation, International Prostate Symptom Score (IPSS) and period of hospitalization do not appear to differ much between these two surgeries[20]. Numerous studies demonstrate that, in comparison to M-TURP, bipolar TURP permits a longer operating period while maintaining more significant glands and improving homeostasis because of its cut and seal execution. Reduced collateral and penetrative tissue injury, less tissue charring, improved surgical capsule identification and less granulation tissue development are some of the additional benefits of the bipolar method[21-23]. The bipolar approach involves less training, improves patient satisfaction and is safer for individuals with diabetes and cardiac pacemakers. Because of similar complication rates, it is also a less intrusive and less expensive surgical approach for managing BPH[24]. In a study performed by Hueber and his team concluded that, >80 years, a major surgical treatment for benign prostatic obstruction (BPO) has been transurethral resection of the prostate (TURP). But because of its morbidity, which includes urethral stricture, hemorrhage and TURP syndrome, it is still important. Bipolar TURP, or B-TURP, has recently put traditional M-TURP to the test by providing additional time for resection and hemostatic management without sacrificing safety. Randomized studies comparing B-TURP and M-TURP have been conducted., however the majority has not shown superior results. The mean resection time and operational time did not differ significantly between B-TURP and M-TURP, according to a Canadian single-blind randomized controlled experiment. The benefits of B-TURP must be assessed by a well planned, multicenter RCT that includes cost analysis and long-term follow-up[25]. Another research examined the outcomes of addressing elderly adults with benign prostatic hyperplasia (BPH) who also had internal comorbidities using bipolar and monopolar transurethral resection of the prostate (B-TURP, M-TURP). A comparison was made between eligible individuals who were 75 years of age or older and had at least one internal comorbidity. In comparison to the M-TURP group, the B-TURP group saw fewer mortality, less intraoperative bleeding, shorter hospital stays, irrigation times and indwelling catheter times. There were no discernible changes in urine or problems after a year. Because B-TURP has less side effects, it seemed a more logical choice[26]. In this study, 94 individuals with lower urinary tract symptoms associated with benign prostatic hyperplasia had their bipolar and monopolar TURPs evaluated. There were two groups of patients: B and M. The findings revealed no discernible difference in the two groups' need for blood transfusions. But the monopolar group had no transurethral resection syndrome, a shorter hospital stay and catheterisation duration and lower blood salt levels after surgery. With a shorter catheterisation duration, a shorter hospital stay and less sodium decrement, the study found that bipolar TURP is a safe and effective method[27]. Finally, by stabilizing comorbidities, properly executing the procedure and closely monitoring the patient's state, either B-TURP or M-TURP can be utilized to treat elderly patients with BPH who have a high surgical risk. Additionally, because of its decreased incidence of side effects, B-TURP is a more rational option for patients with severe comorbidities or weak general health.

CONCLUSION

The study has concluded that both bipolar and monopolar TURP are effective in managing benign prostatic hyperplasia (BPH) by reducing urinary symptoms and enhancing quality of life. However, bipolar TURP offers advantages over monopolar TURP, particularly in terms of safety, as it reduces the risk of complications such as hyponatremia, TUR syndrome, and postoperative bleeding. This makes bipolar TURP a preferable option for patients with higher surgical risks or comorbidities. This study provides valuable insights into the comparative efficacy and safety profiles of bipolar and monopolar TURP in treating benign prostatic hyperplasia (BPH). Both techniques effectively reduce urinary symptoms and improve patients' quality of life. However, bipolar TURP shows several distinct advantages, including a reduced risk of hyponatremia, TUR syndrome and postoperative bleeding, likely due to its use of saline as an irrigating solution and enhanced hemostatic capabilities. The findings indicate no significant differences in operative time, hospitalization duration, or catheterisation duration between the two groups, underscoring the comparable effectiveness of both approaches in managing BPH.

REFERENCES

1. Lokeshwar, S.D. et al., 2019, Epidemiology and treatment modalities for the management of benign prostatic hyperplasia', Transl. Androl. Urol., 8: 529-539.

2. Verhamme, K.M.C., J.P. Dieleman, G.S. Bleumink, J.V. Lei and M.C.J.M. Sturkenboom, 2002. Incidence and Prevalence of Lower Urinary Tract Symptoms Suggestive of Benign Prostatic HyperplAsia in Primary Care-The Triumph Project. Eur. Urol., 42:323-328.
3. Panigrahi, S., A.S. Pattajoshi, S.K. Mahapatra, R.K.S. P and B. Sahu, 2021. Monopolar vs. Bipolar Trans Urethral Resection of Prostrate (TURP) - A Comparative Outcome Analysis in Benign Prostatic HyperplAsia-A Single Centre Experience in Western Odisha. J. Evidence Based Med. Healthcare, 8: 2875-2879.
4. Rieken, M., T. Antunes-Lopes, B. Geavlete and T. Marcelissen, 2018. What Is New with Sexual Side Effects After Transurethral Male Lower Urinary Tract Symptom Surgery? Eur. Urol. Focus, 4: 43-45.
5. Casanueva, E. and F.E. Viteri, 2003. Iron and oxidative stress in pregnancy. J. Nutr., 133: 1700-1708.
6. Rassweiler, J., D. Teber, R. Kuntz and R. Hofmann, 2006. Complications of Transurethral Resection of the Prostate (TURP)-Incidence, Management and Prevention. Eur. Urol., 50: 969-980.
7. Kervancioglu, E., E. Hasirci, F. Salgur, Z. Cicek and H. Doruk, 2024. Evaluation of the Efficacy and Safety of Bipolar and Monopolar Transurethral Prostate Resection in Geriatric Patients. Niger. J. Clin. Pract., 27: 1020-1026.
8. Mamoulakis, C., D.T. Ubbink and J.J.M.C.H.D. Rosette, 2009. Bipolar versus Monopolar Transurethral Resection of the Prostate: A Systematic Review and Meta-analysis of Randomized Controlled Trials. Eur. Urol., 56: 798-809.
9. Tang, Y., J. Li, C. Pu, Y. Bai, H. Yuan, Q. Wei and P. Han, 2014. Bipolar Transurethral Resection Versus Monopolar Transurethral Resection for Benign Prostatic Hypertrophy: A Systematic Review and Meta-Analysis. J. Endourology, 28: 1107-1114.
10. Islam, M.H., N.I. Bhuiyan, T.A. Manzer, M.A.A. Mamun, R. Biswas and S.U. Sujan, 2024. Assessing the Safety and Effectiveness of Bipolar Technology in Transurethral Prostate Resection: A study in a Tertiary Care Private Hospital. Scholars J. Applied Med. Sci., 12: 85-90.
11. Mashni, J., G. Godoy, C. Haarer, G. Dalbagni, V.E. Reuter, H.A. Ahmadie and B.H. Bochner, 2014. Prospective evaluation of plasma kinetic bipolar resection of bladder cancer: Comparison to monopolar resection and pathologic findings. Int. Urol. Nephrology, 46: 1699-1705.
12. Wendt-Nordahl, G., A. Häcker, O. Reich, B. Djavan, P. Alken and M.S. Michel, 2004. The Vista System: A New Bipolar Resection Device for Endourological Procedures: Comparison with Conventional Resectoscope. Eur. Urol., 46: 586-590.
13. Hafez, M.H.E.S., M.H.E.D.A.E. Hamid, S.A.E. Raouf, S.M. Soaida and M.M. Marie, 2014. Bipolar versus monopolar transurethral prostate resection: Comparison of hemodynamic and biochemical changes. Egypt. J. Anaesth., 30: 47-52.
14. Hahn, R.G., 2006. Fluid absorption in endoscopic surgery. Br. J. Anaesth., 96: 8-20.
15. Ahyai, S.A., P. Gilling, S.A. Kaplan, R.M. Kuntz and S. Madersbacher et al., 2010. Meta-analysis of Functional Outcomes and Complications Following Transurethral Procedures for Lower Urinary Tract Symptoms Resulting from Benign Prostatic Enlargement. Eur. Urol., 58: 384-397.
16. Boukhlifi, Y., M. Tetou, L. Hamedoun, K. Blelhaj and M. Mrabti et al., 2024. Comparison of Bipolar and Monopolar Transurethral Resection of the Prostate, Functional Outcomes and Analysis of Factors Predictive of Complications: A Prospective Study. Scholars J. Applied Med. Sci., 12: 102-106.
17. Madersbacher, S., J. Lackner, C. Brössner, M. Röhlich, I. Stancik, M. Willinger and G. Schatzl, 2005. Reoperation, Myocardial Infarction and Mortality after Transurethral and Open Prostatectomy: A Nation-Wide, Long-Term Analysis of 23, 123 Cases. Eur. Urol., 47: 499-504.
18. de Sio, M., R. Autorino, G. Quarto, R. Damiano and S. Perdonà et al., 2006. Gyrus bipolar versus standard monopolar transurethral resection of the prostate: A randomized prospective trial. Urology, 67: 69-72.
19. Sinha, M.M., et al., 2022. 'Outcomes of bipolar TURP compared to monopolar TURP: A comprehensive literature review., Türk Ürol. DergisiTurkish J. Urol., 48: 1-10.
20. Ali, F.M. and A.A. Obaid, 2022. Comparative Study of Monopolar and Bipolar Transurethral Resection in Patients with Benign Prostatic Adenoma. International journal of drug delivery technology, 12: 863-869.
21. Pal, D., V.S. Madduri and M. Bera, 2016. Monopolar versus bipolar transurethral resection of prostate for benign prostatic hyperplAsia: Operative outcomes and surgeon preferences, a real-world scenario. Urol. Ann., Vol. 8 .10.4103/0974-7796.184900.
22. Raghuvanshi, K., A. Raval, D.K. Jain, K.P. Vartak and S. Patil et al., 2019. Comparative Assessment of Monopolar Versus Bipolar Transurethral Resection of Prostate for the Management of Benign Prostatic Enlargement. Urological Sci., 30: 262-265
23. Kim, J.Y., K.H. Moon, C.J. Yoon and T.C. Park, 2006. Bipolar Transurethral Resection of the Prostate: A Comparative Study with Monopolar Transurethral Resection. Korean J. Urol., Vol. 47 .10.4111/kju .2006.47.5.493.

24. Singhania, P., D. Nandini, F. Sarita, P. Hemant and I. Hemalata, 2010. Transurethral resection of prostate: A comparison of standard monopolar versus bipolar saline resection. Int. braz j urol, 36: 183-189.
25. Hueber, P.A., A. Al-Asker and K.C. Zorn, 2011. Monopolar vs. bipolar TURP: Assessing their clinical advantages. Can. Urological Assoc. J., 5: 390-391.
26. Yang, E.J., H. Li, X.B. Sun, L. Huang, L. Wang, X.X. Gong and Y. Yang, 2016. Bipolar versus monopolar transurethral resection of the prostate for benign prostatic hyperplAsia: Safe in patients with high surgical risk. Sci. Rep., Vol. 6 .10.1038/srep21494.
27. Musapur, E., M. Sarkarian, P. Mousapour and J. Rahimizadeh, 2018. Bipolar versus Monopolar Transurethral Resection of Prostate (TURP), Advantages and Disadvantages in 6-Month Follow-Up. Brieflands, Jentashapir J. Health Res., Vol. 0 .10.5812/jjhr.60396.