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COMPARISON OF BIPOLAR AND MONOPOLAR TRANSURETHRAL RESECTION OF BLADDER TUMOR: EVALUATING OBTURATOR NERVE REFLEX, BLADDER PERFORATION, AND LENGTH OF HOSPITAL STAY

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Abstract

OBJECTIVE: To compare bipolar and monopolar transurethral resection of bladder tumor in terms of *obturator nerve reflex, bladder perforation, and length of hospital stay.*

METHODOLOGY: *This prospective comparative study was conducted from 2 July 2025 to 2 October 2025 at the Department of Urology, Institute of Kidney Diseases, Peshawar, and involved 182 patients aged 40 to 70 years presenting with diagnosed bladder tumor, enrolled via non-probability consecutive sampling. Patients were equally divided into two groups. Patients with a history of prostatic surgery, compromised cardiac, renal, or pulmonary function, and recurrent tumors were excluded. Patients in Group A underwent bipolar resection, while patients in Group B underwent monopolar resection. The primary endpoints were obturator nerve reflex, bladder perforation, and hospital stay. Data were analyzed with SPSS 27. The Mann-Whitney U test and Chi-square/Fisher exact test were used for comparison. We considered $p \leq 0.05$ significant.*

RESULTS: *The median age was 61 years in the bipolar group and 62 years in the monopolar group. Obturator nerve reflex occurred in 7 (7.7%) patients in the bipolar group and 18 (19.8%) in the monopolar group ($p = 0.018$). Bladder perforation was observed in 1 (1.1%) patient in the bipolar group and 3 (3.3%) patients in the monopolar group ($p = 0.621$). The median hospital stay was 2 days (IQR: 1 to 3) in the bipolar group and 3 days (IQR: 2 to 4) in the monopolar group ($p < 0.001$).*

CONCLUSION: *Bipolar transurethral resection of bladder tumor significantly reduced obturator nerve reflex; it was associated with a shorter hospital stay than monopolar transurethral resection. Bipolar TURBT offers a safer alternative for patients with bladder tumor.*

INTRODUCTION

Bladder tumor is a common condition that affects the urinary tract and leads to significant healthcare burden worldwide. Most newly diagnosed bladder tumors are classified as non-muscle invasive bladder cancer, commonly managed via TURBT.

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It plays an essential role not only in establishing the histopathological diagnosis but also in tumor staging. Complete tumor resection is vital, as insufficient excision may contribute to residual disease, tumor progression, and the need for recurrent surgical procedures. Refinement of the TURBT approach has become a vital area of interest within contemporary urological practice.1-3Monopolar transurethral resection is considered a conventional technique for the resection of bladder tumor. Though the monopolar resection has established satisfactory oncological outcomes, concerns remain about complications such as obturator nerve injury, excessive bleeding, and transurethral resection syndrome. Such complications may extend the hospital stay, increase the postoperative morbidity, and compromise the patient's recovery.[4-6]

Advances in endourological technology have led to the introduction of bipolar electrosurgical systems. In bipolar resection, active and return electrodes are positioned within the resectoscope, allowing the electrical current to circulate locally without traversing the patient's body and enabling isotonic saline irrigation, thereby reducing the risk of electrolyte disturbances and TUR syndrome. Bipolar energy is believed to offer enhanced hemostasis and surgical precision. These advantages have generated growing interest among urologists seeking effective techniques to manage bladder tumors.[7-9] Studies have compared the bipolar and monopolar TURBT and revealed that bipolar TURBT may decrease the duration of hospitalisation. Controversy persists regarding obturator reflex incidence, bladder perforation rates, and recurrence-free survival.[10-12] The growing emphasis on patient safety and improved outcomes has intensified the need to recognize the most suitable electrosurgical modality for TURBT. Although bipolar technology appears promising, limited availability in resource-constrained settings may limit its adoption. Comparative assessment of bipolar and monopolar TURBT is consequently significant for determining whether clinical benefits validate broader implementation. Consequently, evaluating these techniques within local institutions is vital to determine their feasibility and applicability in routine clinical practice. Local evidence may also help formulate guidelines suited to regional healthcare systems. To compare bipolar and monopolar transurethral resection of bladder tumor in terms of obturator nerve reflex, bladder perforation, and length of hospital stay.

Material and Methods

This prospective comparative study was conducted in the Department of Urology, Institute of Kidney Diseases, Peshawar from 2 July-2025 to 2 October 2025. We obtained ethical approval from the institute before commencing the study. We calculated the sample size using OpenEpi, assuming a bladder perforation rate of 0% and 8% for bipolar and monopolar transurethral resection of bladder tumor. With a power of 80% and a Confidence level of 95%, the sample size was 182 patients. This study selected patients aged 40 to 70 years of both genders with bladder tumor using non-probability consecutive sampling. Bladder tumor was defined as patients presenting with hematuria, dysuria, and urinary urgency. Diagnosis was confirmed by histological examination showing mitosis, necrosis, lymphovascular invasion, and perineural invasion. Patients with a history of prostatic surgery, compromised cardiac, renal, or pulmonary function, allergy to anesthetic agents, and recurrent tumors were excluded. All patients provided written informed consent. Using the alternate allocation procedure, patients diagnosed with bladder tumors were divided equally into two groups, A and B. With the aid of a 24 Charriere resectoscope and a UES 40 generator set at 260/100W, patients in Group A had bipolar resection under spinal anesthesia using an Olympus TURis system; 0.9% normal saline was used as the irrigant. Using a Storz and an ERBE, patients in Group B underwent monopolar TURBT under spinal anesthesia. We used 1.5% glycine as the irrigant. The primary endpoints of the study were obturator nerve reflex (defined as positive during the procedure by observing the presence of muscle spasms or involuntary contractions of the adductor muscles of the thigh during surgical manipulation near the obturator nerve), bladder perforation (defined as positive

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during the procedure by observing the perivesical fatty tissue indicating subserosal injury), and hospital stay post-procedure. Data were analyzed using IBM SPSS ver 27. Numerical variables such as age, operative time, and hospital stay were assessed for normality using the Shapiro-Wilk test and were presented using the median IQR. Frequencies and percentages were used for categorical variables such as obturator nerve reflex, bladder perforation, tumor size (< 3 cm/ ≥ 3 cm), tumor grade (low/high), tumor multiplicity (solitary/multiple), smoking, and gender. We used the chi-square test and Fisher's exact test to compare categorical primary endpoints, and the Mann-Whitney test to compare the numerical endpoint, hospital stay, between the two groups. For all tests, we considered $p \leq 0.05$ significant.

RESULTS

This study included 182 patients, with 92 patients allocated to each treatment arm. The median age in the bipolar arm was 61 years (IQR 53 to 66), and in the monopolar arm it was 62 years (IQR 53 to 68). In the bipolar group, 68 (74.7%) of the patients were male, while in the monopolar arm, 70 (76.9%) patients were male. Smoking was reported in 41 (45.1%) patients in the bipolar group and 44 (48.4%) in the monopolar group. Table I presents tumor characteristics for both groups. Table II presents the median operative time in both groups; it was significantly lower in the bipolar arm than in the monopolar arm ($p < 0.001$). Table III compares the obturator nerve reflex, bladder perforation, and median hospital stay in both groups. The obturator nerve reflex was observed in 7 (7.7%) cases in the bipolar resection group and in 18 (19.8%) cases in the monopolar resection group; the difference was statistically significant ($p = 0.018$). Bladder perforation occurred in 1 (1.1%) case in the bipolar arm and in 3 (3.3%) cases in the monopolar arm; the difference was not statistically significant ($p = 0.621$). The median hospital stay was 2 days (IQR 1 to 3) in the bipolar resection group and 3 days (IQR 2 to 4) in the monopolar resection group; this difference was also statistically significant ($p < 0.001$).

Table I Tumor characteristics in both groups

		Groups			
		Group A (Bipolar)		Group B (Monopolar)	
		Frequency	Percentage	Frequency	Percentage
Tumour Size	< 3 cm	60	65.9%	56	61.5%
	> = 3 cm	31	34.1%	35	38.5%
Tumour grade	Low grade	47	51.6%	44	48.4%
	High grade	44	48.4%	47	51.6%
Tumour multiplicity	Solitary	56	61.5%	53	58.2%
	Multiple	35	38.5%	38	41.8%

Table II Comparison of Operative time in both groups

Operative time (Mins)	Median	IQR	p value
Group A (Bipolar)	48	35-55	< 0.001
Group B (Monopolar)	53	45-58	
			Mann-Whitney test used

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Table III Comparison of obturator nerve reflex, bladder perforation and median hospital stay in both groups

		Groups				p value
		Group A (Bipolar)		Group B (Monopolar)		
		Frequency	Percentage	Frequency	Percentage	
Obturator nerve reflex	Yes	7	7.7%	18	19.8%	0.018[a]
	No	84	92.3%	73	80.2%	
Bladder perforation	Yes	1	1.1%	3	3.3%	0.621[b]
	No	90	98.9%	88	96.7%	
Hospital stay (Days)		Median	IQR	Median	IQR	< 0.001[c]
		2	1-3	3	2-4	

[a]Chi square test used; [b]Fisher exact test [c]Mann-Whitney test used

DISCUSSION

This study compared bipolar and monopolar transurethral resection of bladder tumors, assessing obturator nerve reflex, bladder perforation, and length of hospital stay. The study found that most patients in both groups were male. This disparity can be attributed to the fact that males have a greater exposure to chemicals and toxins in the form of tobacco use. Apart from tobacco use, the incidence of bladder tumor also depends on the genetic and hormonal differences between men and women. Women are mostly diagnosed with bladder tumors in their later stages of life, especially postmenopause and early menopause.[14] Regarding the main findings of the present study, bipolar TURBT significantly reduced the incidence of obturator nerve reflex compared to monopolar TURBT (p = 0.018). The present study did not use an obturator nerve block, allowing direct measurement of true reflex rates without pharmacological suppression. The study found no significant difference in bladder perforation between the bipolar and monopolar arms (p = 0.621). The hospital stay was significantly shorter in the bipolar arm (p < 0.001) as well. These findings from the present study suggest that bipolar TURBT offers greater safety advantages over the conventional monopolar technique. Tzelves et al., in their systematic review comparing both techniques, reported that bipolar resection was associated with a lower incidence of obturator nerve jerks.[2] Elmekawy et al. documented obturator jerk in 7.4% of monopolar cases and 3.1% of bipolar cases, and zero cases in holmium laser technique.[15] Haque et al. reported no obturator reflex incidence in either group and attributed this to routine use of nerve block.[16] Cetin et al. did not find a significant difference in obturator reflex between the two techniques in their repeat TURBT cohort.[17] This discrepancy may be explained by differences in surgical technique, patient selection, and the fact that their study involved only patients undergoing second resection. The mechanism behind the difference observed in obturator nerve reflex in both groups in this study is well understood. Monopolar current passes through the patient's body and can stimulate the obturator nerve directly. Bipolar current remains restricted between the active and return electrodes on the resectoscope tip. This design lowers stray current and reduces nerve stimulation.[18] The study found no difference between the groups with respect to bladder perforation, as only 1 incidence of bladder perforation was encountered in the bipolar group and 3 incidences in the monopolar arm (p = 0.621). Elmekawy et al. reported no significant

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difference in the incidence of bladder perforation across all three groups studied.[15] Wong et al., in their study comparing bipolar and monopolar TURBT, reported no incidence of bladder perforation.[19] The present study found that the hospital stay was significantly shorter for the bipolar arm than the monopolar arm ($p < 0.001$). This finding has practical significance for resource-limited settings where hospital beds are often insufficient, and patient turnover is high. Hussain et al., in their comparison of monopolar and bipolar transurethral resection of the prostate, similarly reported significantly shorter hospital stays with bipolar diathermy. However, their study focused on prostate resection rather than bladder tumors. [20]Clinical and public health implications of the findings of this study are meaningful. In resource-limited settings, reducing complications is directly linked with cost savings. Bipolar TURBT significantly reduced the incidence of obturator nerve reflex, which is a known risk factor for bladder injury. The bipolar technique also eliminates the need for glycine irrigation, which in turn removes the risk of TUR syndrome. Imran et al. in their study reported TUR syndrome in 4.0% of monopolar patients and none in the bipolar group. Although their study was on prostate surgery, the same principle applies to bladder tumor resection as well, as both procedures use identical irrigation fluids and energy sources.[21]The present study has several limitations. This single-center study limits generalisability to other populations and settings. The lack of long-term follow-up means we could not record and compare recurrence and progression rates between the two procedures. Another limitation is operator experience. The study also did not standardize intraoperative interventions such as obturator nerve block, which may have reduced reflex events in both groups. Future studies should include multicentre trials with long-term follow-up. Such studies should assess recurrence-free and progression-free survival as primary outcomes.

CONCLUSION

bipolar transurethral resection of bladder tumor significantly reduced obturator nerve reflex, and it was associated with shorter hospital stay as compared to monopolar transurethral resection. However, no significant difference was observed in bladder perforation, as both groups had lower incidences. In the present study, bipolar TURBT was a safe and efficient option for patients.

Ethical Approval Statement: The College of Physicians and Surgeons Pakistan (CPSP), Research Evaluation Unit, approved this study under reference number **CPSP/REU/URO-2024-021-10033, dated July 2, 2025.**

Conflict of interest: None

Funding received for the study: None

Consent from patients taken: Yes

Authors' Contributions (ICMJE Guidelines)

Musaddif Riaz contributed to the study's conception and design, data acquisition, data analysis and interpretation, and manuscript drafting. **Muhammad Asaad Shamsher** contributed to study supervision, critical revision of the manuscript for important intellectual content, and final approval. **Hassamullah Khan, Sajjad Muhammad Khan Shinwari, Uzair Rahim, and Faiz ur Rahman** contributed to data acquisition, literature review, and critical revision of the manuscript. All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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