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Bipolar versus Monopolar Transurethral Resection of Bladder Tumors among Patients with Localized Primary Bladder Tumor

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ABSTRACT

Background: The surgical treatment of bladder tumors is now safer thanks to recent developments in transurethral instrumentation for the treatment of bladder tumors. Specifically, the use of bipolar energy has improved the incidence of both short-term and long-term bleeding and produced long-lasting therapy benefits.

Objective: To compare bipolar versus monopolar transurethral resection of bladder tumors (B-TURBT vs M-TURBT) in terms of its clinical and pathological outcome.

Methods: A cross-sectional retrospective study was conducted on 200 patients that fit the inclusion criteria who were enrolled in the study and randomized for bipolar TURBT (B-TURBT) and (M-TURBT) during the period from May 2022 to January 2024 at Damanhur National Medical Institute. A thorough history and clinical examination and laboratory investigations were recorded preoperatively, intraoperatively, and postoperatively as well as the pathological analysis.

Results: There was a significant difference among the studied group regarding resection time, hemoglobin drop, hospital stay, catheter time ($p<0.05$). There wasn't significant difference among the studied group regarding serum (S.) Na drop ($p>0.05$). There wasn't significant difference among the studied group regarding number of lesions, second look TURBT ($p>0.05$). There was a significant difference among the studied group regarding tissue artifact ($p<0.05$). Most (51%) of the Bipolar group was at Ta stage and 46% of Monopolar group was at Ta stage, (62%) most of the Bipolar group was low grade and 57% of Monopolar group was low grade, and there wasn't significant difference among the studied group regarding stage and grade ($p>0.05$).

Conclusion: Bipolar TURBT is safe and effective in treating bladder tumors. It is advantageous in decreased resection time, hemoglobin drop, catheterization time, hospital stay and tissue artifact.

Keywords: Bipolar transurethral resection, Bladder tumors, Pathological investigation, Postoperative complications, resection time.

INTRODUCTION

The disease entity known as bladder cancer (BC) is quite diverse. Urothelial carcinoma is identified in over 90% of patients with this condition; the other individuals are diagnosed with neuroendocrine tumors, squamous cell carcinoma, or adenocarcinoma [1, 2].

It is anticipated that the incidence of BC will continue to rise globally, which will directly impact the demand for primary treatment and diagnostic techniques. The prevalence of the condition will rise in tandem with its incidence, which has significant implications for clinical follow-up [3]. Appropriate and ideal patient care depends on accurate tumor staging and histologic grading. TURBT is the mainstay of BC diagnosis, therapy, and staging [4].

TURBT is often carried out using monopolar electrocautery, which necessitates that the current go through the patient's body from the resection electrode to the electrode on the skin as the current travels through the irrigation. The active and return electrodes of the bipolar system are close to one another and are separated by an insulator [5]. Bipolar resection is potentially safer than monopolar circuits because the bipolar resectoscope procedure keeps patients out of the circuit by using physiologic conductive saline as an irrigation solution [6].

Bladder wall perforation, intra- and postoperative bleeding (which may require blood transfusions or reintervention), blood clot-induced urine retention, obturator nerve stimulation, and tumor spillage are among the possible complications of conventional resection [7]. Certain characteristics of bladder tumors, such as their placement in hard-to-reach areas (bladder dome, anterior bladder wall) or lateral bladder walls that make them more vulnerable to obturator nerve stimulation, and their larger size (≥3 cm), necessitated the search for an improved endoscopic surgical technique [7].

Bladder damage and other postoperative problems are less common in patients with bipolar TURBT. The results demonstrate that B-TURBT is superior than monopolar resection [8]. Improvements in every stage of the staging process are required to increase accuracy and provide better treatment for BC patients, as incorrect clinical staging, and particularly under-staging, is a major issue in BC [9]. For TURBT, bipolar electrocautery is a good fit. The urologist may make a thorough and accurate diagnosis with bladder tissue from bipolar TURBT, which has the same histologic quality as that from regular monopolar TURBT [10].

So, this study aimed to compare bipolar versus monopolar transurethral resection of bladder tumors (B-TURBT vs M-TURBT) in terms of its clinical and pathological outcome.

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PATIENTS AND METHODS

A cross-sectional retrospective study was carried out on 200 patients that fit the inclusion criteria who were enrolled in the study and randomized for bipolar TURBT (B-TURBT) and (M-TURBT) during the period from May 2022 to January 2024 at Damanhur National Medical Institute.

The inclusion and exclusion criteria:

Any patient with localized primary bladder tumor ≥2 cm. We excluded active urinary tract infections, unfitness for spinal anesthesia, recurrent bladder tumors, tumors in bladder diverticulum, tumors with metastases by CTU, and patients with uncontrolled bleeding diathesis.

Preoperative Evaluation:

A detailed history and clinical examination were part of the clinical evaluation. Personal history (name, age, sex, employment, place of residence, marital status, and any unusual behaviors, such as smoking). Complaint: hematuria, with lower urinary tract symptoms (LUTS), accidentally discovered. History (previous abdominal operation, medical problems, urologic surgeries, other surgeries). Vital signs (pulse, blood pressure, temperature). Local examination was a complete abdominal examination including genitourinary, digital rectal (DRE), and bimanual examinations. Urine analysis, CBC, RBS, kidney function tests (blood urea and s. creatinine), liver function (liver enzymes and bleeding profile).

Ultrasonography of the abdomen and pelvis (U/S), contrast-enhanced abdomen and pelvis, computerized tomography (CECT), and chest CT when metastasis was suspected. Prior to the surgery, anticoagulants and antiplatelet medications were ceased where necessary, usually, five to seven days before the day of the procedure, and it was replaced by enoxaparin before the procedure. Before the surgery began, the INR of patients taking warfarin was assessed. On the morning of the operation, the patient was told to take all his or her other prescribed drugs as prescribed. An hour before instrumentation, intravenous antibiotics were administered. The operating surgeon had the final decision which antibiotic to employ; however, we favored using a broad-spectrum cephalosporin.

Intraoperative evaluation:

Spinal was done in all cases with lithotomy position. Urethro-cystoscopy evaluated the whole urethra, evaluated the prostate, evaluated the bladder for pathology, mass site, size, number, and shape, and evaluated for stones, diverticula, and site of ureteric orifices. Bipolar TURBT was performed using a bipolar electrosurgical unit.

We used the 26 F resectoscope (Karl Storz®, Tuttlingen, Germany) with saline irrigation in bipolar resection evaluation following surgery intravesical chemotherapy administered immediately after surgery (Mitomycin C) was given to all cases apparently of low risk on stratification table within the first 6 hours according to the EAU Guidelines unless bladder perforation is suspected after the TURBT or if significant hematuria is present **[11].** Before discharge the following data are recorded catheterization time, Postoperative hospital stay time, any postoperative complications. Serum hemoglobin and sodium levels were measured on day 1.

Postoperatively:

The patient was released with oral antibiotics (quinolones) and analgesics. The patient was instructed to avoid vigorous activity and to return in two weeks to await histology findings.

Pathological analysis: All resected specimens were preserved in formalin before being sent to our institute's Pathology Department, where they were sectioned and stained with hematoxylin and eosin. The thorough histological evaluation comprised WHO grade, lamina propria invasion, deep muscle invasion, CIS, and LVI **[12]**. Thermal damage was evaluated and categorized according to the number of tissue artifacts into 3 grades: Grade 1: with tissue, artifacts comprising less than one-third of the whole specimen. Grade 2: Artifacts making up less than one-third of the total specimen. Grade 3: more than two-thirds of the specimen is affected by the tissue artifacts **[13].** Postoperative complications were categorized using the modified Clavien-Dindo classification **[14] (Figure 1).**

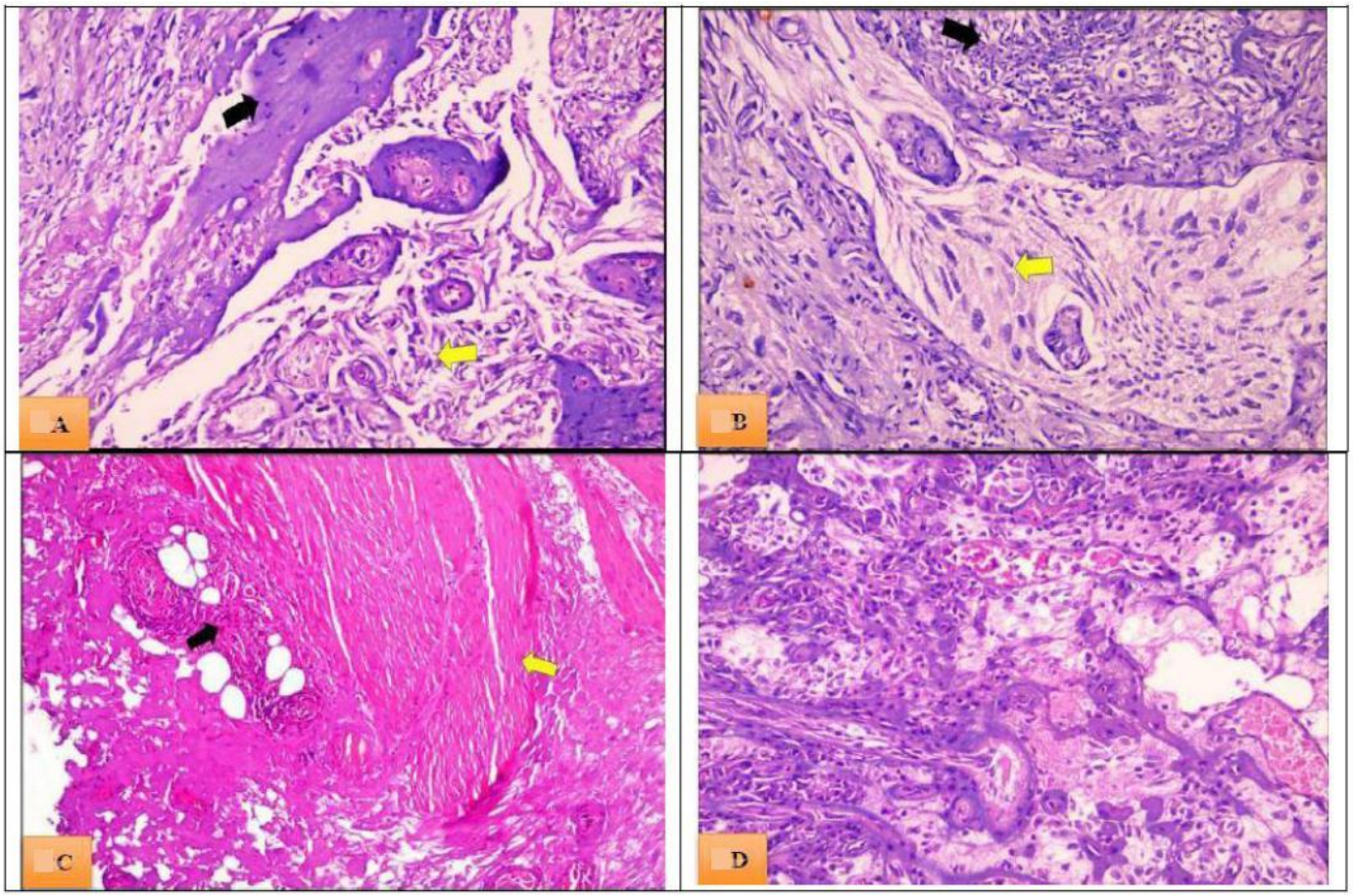

Figure (1): (A) A case of bladder carcinoma treated by M-TURBT technique (yellow arrow) (H&E X200). **(B)** A case of bladder carcinoma treated by B-TURBT technique showed severe degree of tissue artifact (H&E X400). **(C).** A case of bladder carcinoma; the tumor (black arrow) infiltrating detrusor muscle (yellow arrow) treated by B-TURBT technique showed severe degree of tissue artifact (H&E X400). **(D)** A case of bladder carcinoma treated by M-TURBT technique showed severe tissue artifact (H&E X400).

Outcome of the study:

Postoperative complications, operation duration, and hospital stay were among the current study's outcomes.

Sample size estimation:

The study included 200 patients who were hospitalized between May 2022 and January 2024 and who underwent B-TURBT and M-TURBT and met the inclusion criteria.

Ethical approval:

The Damanhur National Medical Institute Ethics Committee authorized this investigation. Individuals were given a detailed explanation of the study's aims before signing an informed consent form. The permission form was created using the rules set by the Egyptian Ministry of Health's Quality and Improvement System and the Helsinki Declaration.

Statistical analysis:

SPSS version 25.0 on a PC was used to tabulate and statistically assess the results. Quantitative data were presented as mean± SD. The Kolmogorov-Smirnov test demonstrated that the variables' distribution was normal. Qualitative data were presented as frequency and percentage. The X^2-test, independent t-test (t), and Mann-Whitney U test (U) were among the analytical statistics. Any P-value below 0.05 was regarded as statistically significant.

RESULTS

In our study, figure 2 displays a flowchart for the study population. Starting in May 2022 and continuing through January 2024, 200 patients randomized for TURBT who were admitted to Damanhur Medical National Institute. 200 patients were divided into two groups, group A (patient with bipolar TURBT) (n=100), group B (monopolar TURBT) (n=100) **(Figure 2).**

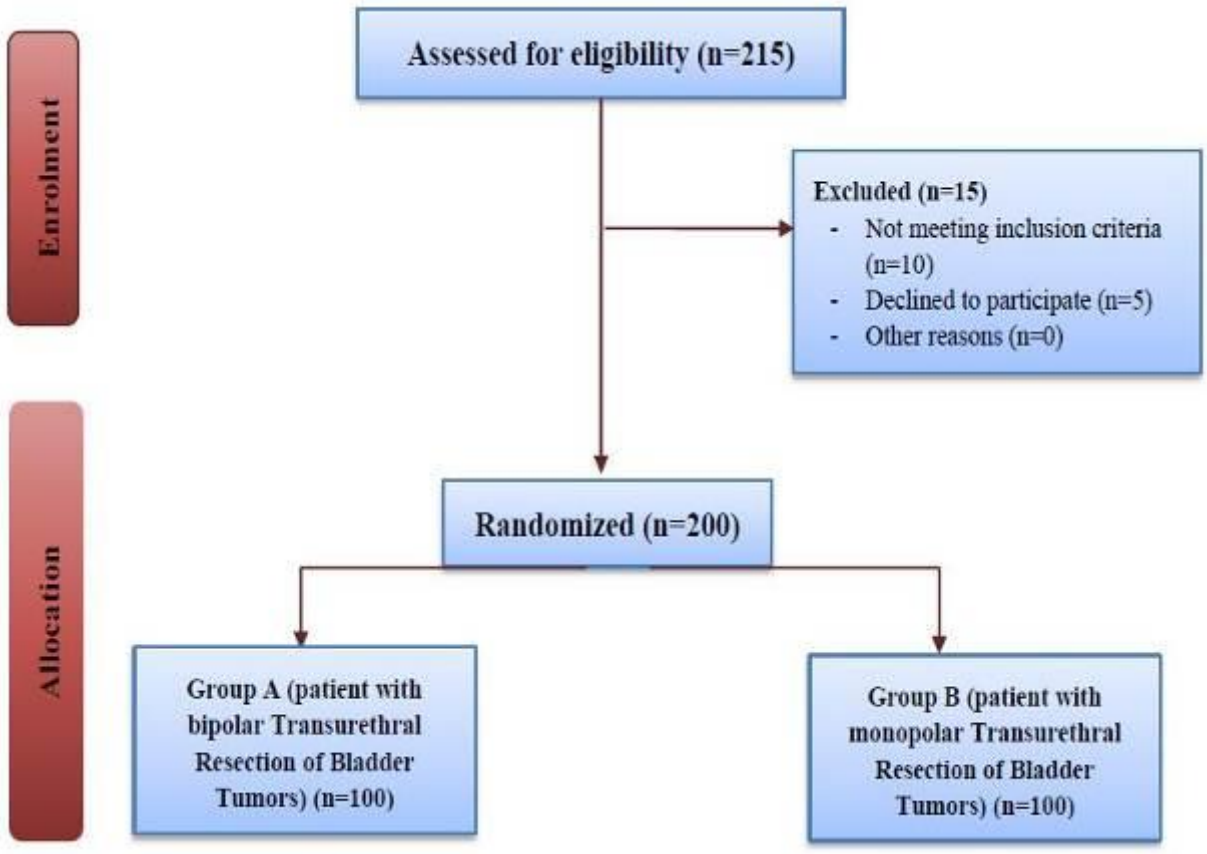

Figure (2): Flowchart of the studied groups.

There was significant variation in BMI across the study groups. There wasn't significant difference among the study group for age, gender, and tumor location **(Table 1)**.

Table (1): Demographic data among the studied groups.

Variables	Bipolar group (n=100)		Monopolar group (n=100)		t	*P value*
Age (years) Mean ± SD.	63.65±8.99		63.80±9.89		0.112	0.911
Sex	**N**	**%**	**N**	**%**	**X^2=** 1.963	0.057
Male	24	24.0	83	83.0		
Female	76	76.0	17	17.0		
BMI (kg/m^2) Mean ± SD.	25.73±5.13		28.89±8.56		3.166	**0.002***
Tumor location					**X^2=** 6.002	0.540
Trigone	15	15.0	11	11.0		
Dome	9	9.0	3	3.0		
Multifocal	15	15.0	16	16.0		
Posterior wall	6	6.0	6	6.0		
Anterior wall	12	12.0	16	16.0		
Left lateral wall	22	22.0	27	27.0		
Right lateral wall	15	15.0	18	18.0		
Bladder neck	6	6.0	3	3.0		

*Significant.

There was a significant difference among the studied group regarding Tumor size, HB drop, Hospital stay, and catheter time. There wasn't significant difference among the studied group regarding resection time and S. Na drop **(Table 2)**.

Table (2): Pathological and clinical data among the studied groups.

Variables	Bipolar group (n=100)	Monopolar group (n=100)	t	*P value*
	Mean ± SD.	Mean ± SD.		
Tumor size (cm)	4.62±1.15	3.50±1.21	6.701	**<0.001***
Resection time (min)	23.22±6.60	23.22±6.60	0.000	1.000
Hemoglobin drop	0.42±0.15	0.59±0.20	6.852	**<0.001***
S. Na drop	2.04±0.84	2.04±0.84	0.000	1.000
Hospital stays (days)	2.04±0.84	3.44±1.75	7.218	**<0.001***
Catheter time (days)	3.48±1.82	6.79±3.79	7.878	**<0.001***

*significant

In our study, Regarding the number of lesions and second look TURBT, there was no discernible difference between the groups under study, (85%) most of Bipolar group had single number of lesions and 83% of Monopolar group had multiple number of lesions **(Table 3)**.

Table (3): Tumor characteristics at second TURBT.

Variables	Bipolar group (n=100)		Monopolar group (n=100)		X^2	*P value*
Number of lesions	**N**	**%**	**N**	**%**		
Single	85	85.0	83	83.0	0.149	0.700
Multiple	15	15.0	17	17.0		
Second look TURBT	21	21.0	24	24.0	0.258	0.611

There was a substantial difference among the tested groups regarding tissue artifact. Most of the Bipolar group was at the Ta stage, and 46% of the Monopolar group was at the Ta stage. Most of the Bipolar group and monopolar groups had low grade. There wasn't significant difference among the studied group regarding stage and grade **(Table 4)**.

Table (4): Pathological features of tumors among the studied groups.

Variables	Bipolar group (n=100)		Monopolar group (n=100)		X^2	*P value*
Stage	**N**	**%**	**N**	**%**		
T1	25	25.0	30	30.0	0.712	0.700
T2	24	24.0	24	24.0		
Ta	51	51.0	46	46.0		
Grade						
Low	62	62.0	57	57.0	0.519	0.471
High	38	38.0	43	43.0		
Tissue artifact						
Grade 1	33	33.0	17	17.0		
Grade 2	49	49.0	55	55.0	7.640	**0.022***
Grade 3	18	18.0	28	28.0		

*significant.

There was a significant difference among the studied group regarding stromal coagulation, atypical morphologic changes, abnormal cell orientation. Most of the Bipolar group and the Monopolar group were moderate stromal coagulation. (44%) of the Bipolar group and 66% of Monopolar group had moderate atypical morphologic changes. There wasn't significant difference among the studied group regarding crushing **(Table 5)**.

Table (5): Morphological Changes among the studied groups.

Variables	Bipolar group (n=100)		Monopolar group (n=100)		X^2	*P value*
Stromal coagulation	**N**	**%**	**N**	**%**		
Absent	4	4.0	0	0.0		
Mild	35	35.0	14	14.0	20.900	**<0.001***
Moderate	57	57.0	71	71.0		
Severe	4	4.0	15	15.0		
Crushing						
Absent	0	0.0	4	4.0		
Mild	37	37.0	29	29.0	5.101	0.165
Moderate	59	59.0	63	63.0		
Severe	4	4.0	4	4.0		
Atypical morphologic changes						
Absent	18	18.0	12	12.0	9.933	**0.019***
Mild	30	30.0	18	18.0		
Moderate	44	44.0	66	66.0		
Severe	8	8.0	4	4.0		
Abnormal cell orientation						
Absent	16	16.0	14	14.0		
Mild	34	34.0	13	13.0	17.417	**<0.001***
Moderate	42	42.0	69	69.0		
Severe	8	8.0	4	4.0		

*significant

DISCUSSION

The surgical treatment of prostatic enlargement is now safer thanks to recent developments in transurethral instrumentation for the treatment of benign prostatic hyperplasia. In particular, the use of bipolar energy has improved the incidence of both short-term and long-term bleeding and produced long-lasting therapy outcomes [15]. It makes logical sense to use bipolar energy to the resection or vaporization of bladder tumors after its successful use in treating patients with blockage of the bladder outlet. Although the technology is still in its infancy, one small research has demonstrated better safety outcomes [7].

Bipolar energy was used to perform TURBT, particularly in patients with larger tumors, bleeding disorders, or those who are taking anticoagulation therapy [16]. When compared to MTUR BT, the B-TURBT appears to have a precise cutting ability and dependable hemostatic property, with a safe and correct incision of the bladder layer that reduces the danger of bleeding with little changes in the hemoglobin level, which was based on the prostatic experience of **Mamoulakis *et al.*** [17].

In this study, there was significant variation in BMI across the study groups. There wasn't significant difference among the study group for age, gender, and tumor location. In the same line, 121 patients who had TURBT with plasma kinetic energy had an average follow-up of 4.1 years (range 3–5.5 years), according to a study by **Pu *et al.*** [18]. The patients' ages ranged from 36 to 87 years old, with a median age of 61. Additionally, **Haque *et al.*** [19] investigated the research that comprised 50 UBC patients getting TURBT in total. 60.9 was the average age. The male-to-female ratio was 9:1, and 45 (90.0%) of the patients were male. According to them, males seem to experience sex differences in BC at a greater rate than women.

Additionally, **Bolat *et al.*** [20] also examined 140 patients in total, 70 of whom were randomly assigned to the M-TURBT and 70 of whom were assigned to the B-TURBT groups. There weren't statistically significant variations between the two groups' baseline characteristics. Age, sex, BMI, and smoking status did not significantly differ between the two groups. However, preoperative hemoglobin and creatinine levels were similar for both groups. Bleeding was the most focused complication during TURBT. Male patients were more common than female patients in their study. While, **Wong *et al.*** [21] discovered that the tumor and patient features were comparable between the groups. Males made up 78.4% of the bipolar group's cases and 71.7% of the monopolar groups. 54.3% of the monopolar group and 56.9% of the bipolar group had a single tumor.

Our analysis revealed that while there wasn't significant difference in the examined group's resection time or S. Na decrease, there was a significant difference in the researched group's tumor size, hemoglobin drop, hospital stay, and catheter time. Additionally, the mean tumor size was 1.9 cm in diameter, according to **Pu *et al.*** [18]. Papillary morphology was seen in every tumor. According to their findings, the average length of stay in the hospital

after surgery was three days, and the average duration of the operation was twenty-five and sixteen minutes.

Other research by **Bolat *et al.*'s** [20] discovered that the M-TURBT group's mean tumor size was 3.0 ± 2.8 cm, while the B-TURBT groups was 3.4 ± 3.0 cm (p=0.429). Although the M-TURBT group's operation duration was greater than the B-TURBT group's (36.5 ± 23.3 min vs. 34.1 ± 16.2 min respectively), they reported that the difference wasn't statistically significant (p=0.491). Complete tumor resection rate was greater in B-TURBT than M-TURBT (89.2% vs. 78.5%, respectively), although the difference wasn't statistically significant (p=0.152).

According to **Bolat *et al.*** [20]**,** hemoglobin level declines were similar in each group. In contrast to monopolar TURPT, bipolar TURPT was linked to notable positive results, according to **Cui *et al.*'s** [22] regarding pooled analysis for resection time, catheterization time, and hemoglobin drop. Additionally, in their study comparing B-TURBT and M-TURBT procedures, **Elmahdy *et al.*** [23] found that the bipolar group's resection time was considerably lower (22.67 ± 6.18 min) than the monopolar group's (27.47 ± 7.27 min) (P = 0.009). They discovered that the bipolar group had a considerably smaller hemoglobin decline (preoperative to postoperative) than the monopolar group, with 0.41 ± 0.14 versus 0.64 ± 0.18 g/dl (P = 0.001).

Elmahdy *et al.* [23] discovered a significant difference (P = 0.044) between the bipolar and monopolar groups' mean catheterization times, which were 2.93 ± 1.28 and 3.87 ± 2.45 days, respectively. Bipolar groups had a shorter mean hospital stay than monopolar groups (1.67 ± 0.71 vs. 2.37 ± 1.30 days, respectively, P = 0.012). None of the patients experienced perioperative complications such TUR syndrome or significant hematuria with or without clots. B-TURB was linked to a noticeably shorter resection time than the monopolar group, according to their findings.

According to **Elmahdy *et al.*** [23], the hemoglobin decline was lower in the bipolar group. However, no patient needed a blood transfusion, and there were no reports of chronic intraoperative bleeding or postoperative clot urinary retention. Additionally, compared to the monopolar operation, the bipolar resection was more effective in cutting and concurrently controlling bleeding, which is why **Mahmoud *et al.*** [24] observed a considerably quicker resection time in the B-TURBT group. Furthermore, the bipolar group's postoperative hemoglobin level variations were considerably lower in the **Yang *et al.*** [25] investigation, but the alterations were slight and none of the patients needed transfusions.

Furthermore, compared to M-TURBT, B-TURBT was linked to a noticeably shorter hospital stay and catheterization duration, according to **Zhao *et al.*** [26]. When comparing B-TURBT to M-TURBT, another research by **Del Rosso *et al.*** [27] revealed a substantial decrease in the mean hospital stay and catheterization time.

Our investigation revealed that there was a substantial difference among the tested groups regarding tissue artifact, (51%) most of the Bipolar group was at Ta stage and 46% of Monopolar group was at Ta stage, (62%) most of the Bipolar group was low grade and 57% of Monopolar group was low grade, there wasn't significant difference among the studied group regarding stage and grade. Also, **Elmahdy *et al.*** [23] reveled that there weren't significant differences in thermal damage occurred to the specimens including tissue artifact in the two studied groups. The tissue artifacts did not interfere with the pathological diagnosis.

Additionally, **Haque *et al.*** [19] found that there were 22 (44.0%) patients with high grade transitional cell carcinoma and 27 (54.0%) individuals with low grade. 22 (44.0%) pTa low grade, 18 (36.7%) pT1 high grade, 8 (16.3%), and 2 (4.1%) pT2 high grade urothelial carcinomas were found in the pathological findings. Furthermore, **Bolat *et al.*** [20] discovered no statistically significant variations between the groups in terms of tumor grades (p=0.094) or tumor stages (p=0.291). According to **Wong *et al.*** [21]**,** 74.5% of the patients in the bipolar group were Ta stage, whereas 58.7% of the cases in the monopolar group were (p = 0.1). They found that 89.1% of the cases in the monopolar group and 78.4% of the cases in the bipolar group were grade 2 or above, indicating that tumor grade was likewise comparable. Intravesical Bacillus Calmette-Guerin treatment was administered to three patients in the bipolar arm and one patient in the monopolar arm during follow-up. Also, **Elmahdy *et al.*** [23] found no statistical differences in tumor grade, invasion of lamina propria and muscularis layers, presence of carcinoma in situ, and lymph vascular invasion between bipolar and monopolar groups.

Our investigation revealed that there was a substantial variation among the tested group regarding stromal coagulation, atypical morphologic changes, abnormal cell orientation, (57%) most of the Bipolar group was moderate stromal coagulation and 71% of Monopolar group was moderate stromal coagulation, (44%) most of the Bipolar group was Moderate Stromal coagulation and 66% of Monopolar group was Moderate Stromal coagulation, there wasn't significant difference among the studied group regarding Crushing.

According to **Pu *et al.*** [18], there were 16 (13.2%) sequelae, including 3 (2.5%) cases of hematuria requiring blood transfusion and 2 (1.7%) cases of bladder perforations. Both holes were modest extraperitoneal perforations that required merely extended catheter draining. Six patients (4.9%) had adductor contractions, whereas five patients (4.1%) had urethral strictures. There wasn't transurethral resection (TUR) syndrome detected following the procedure. Furthermore, **Haque *et al.*** [19] discovered

that the most prevalent morphologies were papillary tumor (28%), wide solid mass (22%), and papillary solitary (22%). Other uncommon morphologies documented were papillary broad-base tumor, solid, solitary broad-base solid, isolated solid, papillary solid, and solitary broad-base papillary.

Additionally, **Cui *et al.*** [22] found that rates of bladder perforation and obturator nerve reflex did not differ statistically significantly between bipolar TURPT and monopolar TURPT. Although **Bolat *et al.*** [20] did not find any significant differences in the number of patients with thermal tissue damage (7 patients vs. 3 patients, p=0.194) or muscle tissue sampling rates (64.6% vs. 72.3%, p=0.345), they did find that the group's mean catheterization and hospitalization times were similar. The M-TURBT group experienced a considerably greater rate of bladder perforation than the B-TURBT group (21.5 % vs. 6.1%, respectively, p=0.039). **Bolat *et al.*** [20] found that subserosal damage was noted in the M-TURBT group at 16.9% and in the B-TURBT group at 4.6%. Three patients in the M-TURBT group and one patient in the B-TURBT group experienced complete bladder perforation. All these perforations were extra peritoneally, and patients were managed conservatively with the long duration time of the urethral caterer. According to their findings there were no appreciable variations between the groups in terms of recoagulation, clot retention, blood transfusion needs, or febrile urinary tract infections. TUR syndrome was not seen in the B-TURBT or M-TURBT groups.

Our findings are in line with those of the 1978 population-based case-control research known as the National BC research [28]. Male never smokers continued to have a greater risk of BC than female never smokers, as was the case in our study. However, in many regions of the world where cigarette smoking is significantly more widespread among men than women, disparities in smoking prevalence are probably a significant factor in explaining the male excess of BC [29,30]. Our findings as well as the National BC Study's**.** According to **Jemal *et al.*** [31]**,** greater incidence rates of BC in US men are not entirely explained by variations in smoking habits. Because men are more likely than women to work in certain occupations that have historically been linked to BC risk, such as those involving the manufacturing of aromatic amines, leather, paint, truck driving, machining, and aluminum, higher incidence rates in men may also be a result of occupational exposures[32].

CONCLUSION

Bipolar TURBT outperforms monopolar TURBT in terms of obturator jerk and bladder perforation. The histopathological evaluation of the specimens reveals similar pathological changes and the same histologic quality in profound tissue examples in both M-TURBT and B-TURBT. Bipolar TURBT is an appropriate therapy method for NMIBC patients. Bipolar TURBT is safe and effective in treating bladder tumors. It is advantageous in decreasing resection time, hemoglobin drop, catheterization time, and hospital stay.

Conflict of interest: None.
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REFERENCES

1. **Alanee S, Alvarado-Cabrero I, Murugan P *et al.* (2019):** Update of the International Consultation on Urological Diseases on bladder cancer 2018: non-urothelial cancers of the urinary bladder. World Journal of Urology, 37:107-14.
2. **Ferlay J, Colombet M, Soerjomataram I *et al.* (2019):** Estimating the global cancer incidence and mortality in 2018: GLOBOCAN sources and methods. International Journal of Cancer, 144(8):1941-53.
3. **van Hoogstraten L, Vrieling A, van der Heijden A *et al.* (2023):** Global trends in the epidemiology of bladder cancer: challenges for public health and clinical practice. Nat Rev Clin Oncol., 20: 287–304.
4. **Van Rhijn B, Burger M, Lotan Y *et al.* (2009):** Recurrence and progression of disease in non-muscle-invasive bladder cancer: from epidemiology to treatment strategy. Eur Urol., 56(3):430-42.
5. **Xie K, Cao D, Wei Q *et al.* (2021):** Bipolar versus monopolar transurethral resection of non-muscle-invasive bladder cancer: a systematic review and meta-analysis of randomized controlled trials. World Journal of Urology, 39(4):1177-86.
6. **Puppo P, Bertolotto F, Introini C *et al.* (2009):** Bipolar transurethral resection in saline (TURis®): outcome and complication rates after the first 1000 cases. Journal of Endourology, 23(7): 1145-9.
7. **Geavlete B, Multescu R, Georgescu D *et al.* (2011):** Innovative technique in nonmuscle invasive bladder cancer-bipolar plasma vaporization. Urology, 77(4):849-54.
8. **Sugihara T, Kattan M, Nishimatsu H *et al.* (2014):** Comparison of perioperative outcomes including severe bladder injury between monopolar and bipolar transurethral resection of bladder tumors: A population-based comparison. J Urol., 192(5):1355-9.
9. **Bostrom P, van Rhijn B, Fleshner N *et al.* (2010):** Staging and staging errors in bladder cancer. European Urology, 9(1): 2-9.
10. **Wang D, Bird V, Leonard V *et al.* (2004):** Use of bipolar energy for transurethral resection of bladder tumors: Pathologic considerations. Journal of Endourology, 18(6):578-82.
11. **Babjuk M, Burger M, Compérat E *et al.* (2019):** European Association of Urology Guidelines on Non-muscle-invasive Bladder Cancer (TaT1 and Carcinoma in Situ) - 2019 Update. Eur Urol., 76(5):639-57.
12. **Fischer A, Jacobson K, Rose J *et al.* (2008):** Hematoxylin and eosin staining of tissue and cell sections. Cold Spring Harb Protoc., 8: 4986. doi: 10.1101/pdb.prot4986.
13. **Saini A, Ahuja A, Seth A *et al.* (2015):** Histomorphological features of resected bladder

tumors: Do energy source makes any difference. Urology Annals, 7(4):466-69.

14. **Dindo D, Demartines N, Clavien P (2004):** Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg., 240(2): 205-13.
15. **Smith D, Khoubehi B, Patel A (2005):** Bipolar electrosurgery for benign prostatic hyperplasia: transurethral electrovaporization and resection of the prostate. Current Opinion in Urology, 15(2):95-100.
16. **Gupta N, Saini A, Dogra P *et al.* (2011):** Bipolar energy for transurethral resection of bladder tumours at low-power settings: initial experience bipolar TURBT. BJU International, 108(4): 553-56.
17. **Mamoulakis C, Skolarikos A, Schulze M *et al.* (2012):** Results from an international multicentre double-blind randomized controlled trial on the perioperative efficacy and safety of bipolar vs monopolar transurethral resection of the prostate. BJU Int., 109(2):240-48.
18. **Pu X, Wang H, Wu Y *et al.* (2008):** Use of bipolar energy for transurethral resection of superficial bladder tumors: long-term results. Journal of Endourology, 22(3):545-50.
19. **Haque M, Samir Swain S, Mishra A *et al.* (2023):** Comparison of bipolar and monopolar transurethral resection of bladder tumours: A randomised clinical study. Journal of Clinical and Diagnostic Research, 17(6): 1-5.
20. **Bolat D, Gunlusoy B, Degirmenci T *et al.* (2016):** Comparing the short-term outcomes and complications of monopolar and bipolar transurethral resection of non-muscle invasive bladder cancers: a prospective, randomized, controlled study. Arch Esp Urol., 69(5): 225-33.
21. **Wong C, Lim J, Ko I *et al.* (2024):** Monopolar versus bipolar transurethral resection of bladder tumour: post-hoc analysis of a prospective trial. World Journal of Urology, 42(1): 1-6.
22. **Cui Y, Chen H, Liu L *et al.* (2016):** Comparing the efficiency and safety of bipolar and monopolar transurethral resection for non-muscle invasive bladder tumors: A systematic review and meta-analysis. Journal of Laparoendoscopic & Advanced Surgical Techniques, 26(3):196-202.
23. **Elmahdy A, Elaskary F, Elgharbawy M *et al.* (2022):** Is bipolar superior to monopolar energy for transurethral resection of bladder tumors? Menoufia Medical Journal, 35(2): 938-44.
24. **Mahmoud M, Tawfick A, Mostafa D *et al.* (2019):** Can bipolar energy serve as an alternative to monopolar energy in the management of large bladder tumours >3 cm? A prospective randomised study. Arab J Urol., 17(2):125-31.
25. **Yang S, Song P, Kim H (2011):** Comparison of deep biopsy tissue damage from transurethral resection of bladder tumors between bipolar and monopolar devices. Korean J Urol., 52(6): 379-83.
26. **Zhao C, Tang K, Yang H *et al.* (2016):** Bipolar versus monopolar transurethral resection of nonmuscle-invasive bladder cancer: A meta-analysis. J Endourol., 30(1): 5-12.
27. **Del Rosso A, Pace G, Masciovecchio S *et al.* (2013):** Plasmakinetic bipolar versus monopolar transurethral resection of non-muscle invasive bladder cancer: a single center randomized controlled trial. Int J Urol., 20(4): 399-403.
28. **Hartge P, Harvey E, Linehan W *et al.* (1990):** Unexplained excess risk of bladder cancer in men. J Natl Cancer Inst., 82(20): 1636–1640.
29. **Warner K (2005):** The role of research in international tobacco control. Am J Public Health, 95(6): 976–984.
30. **Samanic C, Kogevinas M, Dosemeci M *et al.* (2006):** Smoking and bladder cancer in Spain: effects of tobacco type, timing, environmental tobacco smoke, and gender. Cancer Epidemiol Biomarkers Prev., 15(7): 1348–1354.
31. **Jemal A, Siegel R, Xu J *et al.* (2010):** Cancer statistics, 2010. CA Cancer J Clin., 60(5): 277–300.
32. **Dryson E, 't Mannetje A, Walls C *et al.* (2008):** Case-control study of high-risk occupations for bladder cancer in New Zealand. Int J Cancer, 122(6): 1340–1346.