Comparison of Monopolar *Versus* Bipolar Repeat Transurethral Resection of Bladder Tumours

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ABSTRACT

Objective: To compare the effects of monopolar and bipolar energy sources on efficacy of both techniques and possible complications in bladder cancer patients undergoing repeat Transurethral resection of bladder tumour (re-TURBT).

Study Design: Descriptive study.

Place and Duration of the Study: University of Health Science, Izmir Bozyaka Research and Training Hospital, Turkiye, from 2019 to 2021.

Methodology: Patients undergoing re-TURBT were inducted. Patients with residual tumour at initial TURBT, recurrent bladder cancer and patients with a non-urothelial pathology report in initial TURBT were excluded. The primary outcome was the complication ratio of the TURBT which were obturator reflex, bladder wall perforation, coagulum retention, fever, and TUR syndrome. The secondary outcome was the efficacy of the TURBT procedure, such as complete tumour resection, adequate sampling of deep muscle tissue, and sampling of qualified tissues without any thermal damage.

Results: One hundred and twenty-three patients were enrolled; 75 patients in re-M-TURBT group and 48 patients in re-B-TURBT group were analysed. Demographic and tumour characteristics, and complication rates according to the Clavien classification, were similar between the two groups (p = 0.302). The catheterisation time was shorter significantly in the bipolar re-TURBT group (median 4 *vs.* 3 days, respectively, p = 0.025).

Conclusion: Monopolar and Bipolar energy sources are techniques that can be used safely in re-TURBT in terms of both appropriate pathology sampling (adequate muscle tissue sampling, cautery artifact) and complication (obturator reflex, hyponatraemia, haemoglobin decrease, bleeding) rates.

Key Words: *Bladder Cancer, Monopolar, Bipolar, TURBT, Obtrator reflex, Complications.*

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INTRODUCTION

Bladder cancer is the most common malignancy of the urinary tract and 75% of them are non-muscle invasive. While transurethral resection of bladder tumour (TURBT) is the first option for diagnosis, it can be also therapeutic for non-muscle invasive bladder cancer (NMIBC). Current guidelines strongly recommend re-TURBT for accurate staging, especially for stage T1 bladder cancer, those with residual tumours, and those with high risk for recurrence and accurate staging.[1,2] Moreover, the EAU guidelines also showed that second resection improved the recurrence-free survival (RFS) and progression-free survival (PFS) in patients without muscle tissue in the specimen of the initial resection.[2]

Monopolar technology was first produced in 1910 and became the corner stone for TURBT over time.[3]

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The potential hazard of this modality is TUR syndrome that includes hypotonic fluid absorption causing electrolyte imbalance.[4] Also, during monopolar resection, active current stimulates the obturator nerve and activates the adductor muscles, which causes bladder wall perforation. Thus, bipolar resectoscope has been used for the treatment of non-muscle-invasive bladder cancer such as prostate resection (TURP).[5] In bipolar technique, the current completes the circuit on itself without passing through the patient.[6] The use of nonconducting irrigation fluid is not necessary and normal saline is used during bipolar TUR, which reduces the risk of TUR syndrome.[7] In addition to these, data were shared that it causes less thermal damage and the specimen quality is better.[8,9]

Although monopolar and bipolar TURBT procedures had been previously evaluated in terms of quality of pathological specimens and various complications in the initial TURBT, this comparison has not been performed in re-TURBT so far.[9-12] In this study, the aim was to compare the perioperative outcomes and complications of monopolar and bipolar TUR in patients who underwent re-TURBT.

METHODOLOGY

The Institutional Review Board (IRB no: 031504) approved this single-centre, retrospective study. The written informed consent form was obtained from all patients prior to the study.

A total of 123 patients who underwent TURBT due to bladder cancer between the years of 2019 and 2021 and required re-TURBT according to EAU criteria were included in the study. Data of the patients who underwent re-TURBT at the Department of Urology, University of Health Science, Izmir Bozyaka Research and Training Hospital were collected retrospectively from the hospital records. In view of these recommendations, a second TURBT was performed in defined cases: after incomplete initial TURB, or in case of doubt about completeness of a TURB; if there was no detrusor muscle in the specimen after the initial resection, with the exception of Ta LG/G1 tumours and primary CIS; in T1 tumours. But, according to this study design, the patients with residual tumour at initial TURBT, recurrent bladder cancer and primer non-urothelial cancer on pathology report in initial TURBT were excluded.

Both surgical techniques were performed in the lithotomy position. Spinal anaesthesia was applied to all patients, after the surgical site cleaning, routine cystourethroscopy was performed with a 26Fr resectoscope and a 30-degree forward-oblique telescope before Re-M-TURMT. Power settings (Karl Storz Endoscope, Tuttlingen, Germany) were set to 120w and 80w for cutting and coagulation, respectively. In patients who underwent Re-B-TURBT, bipolar generator adjustment (Olym-pus, Hamburg, Germany) was used at 200w for cutting and 120w for coagulation.

Resections were performed from the previous resected areas and, if present, from the new lesions A 22F three-way Foley catheter was placed in all patients. Continuous irrigation was performed in case of haematuria. In the postoperative period, the patients without complications were discharged on the first day by removing the catheter.

Primary outcomes were the complications of the TURBT in the way of obturator reflex, bladder wall perforation, coagulum retention, fever and TUR syndrome. Intensity of obturator reflex was mentioned in the previous study.[12] TUR syndrome was defined as evidence of a central nervous system disturbance such as nausea, vomiting, restlessness, confusion, or even coma with a circulatory abnormality both intra- and postoperatively with low sodium level.

The secondary outcomes were the efficacy of both TURBT procedures, such as adequate tissue sampling, as low thermal damage as possible, and no residual tumour.

The statistical analyses were performed by using the Statistical Package for the Social Sciences (SPSS) version 22.0. Chi-square and Student t-tests were used to compare the categorical and continuous data, respectively. Shapiro–Wilk test was used for the detection of normal distribution of the data, and it was determined that it did not comply with the normal distribution. The independent two group comparisons were evaluated using the Mann–Whitney U test, and the categorical data were evaluated using the Chi-square test. A p-value <0.05 was considered statistically significant. The categorical variables were analysed using Chi-square or Fisher's exact test.

RESULTS

A total of 123 patients were enrolled, and 75 patients in re-M--TURBT group and 48 patients in re-B-TURBT group were analysed. Demographic and tumour characteristics were statistically similar between both groups. These features are demonstrated in Table I.

Table I: Demographic datas.

	re- M-TURBT (n:75)	re- B-TURBT (n:48)	p-value
Gender (n,%)			0.510¶
Male	70 (93.3)	43 (89.6)	
Female	5 (6.67)	5 (10.4)	
Age (years) (mean±SD)	65.75 ± 8.24	66.90 ± 9.18	0.472*
BMI (kg/m^2) Median (IQR)	27.6 (23.5-29.4)	27.4 (24.0- 29.3)	0.832¥
ASA score (n,%)			0.215¶
1	1 (1.3)	2 (4.2)	
2	60 (80)	32 (66.7)	
3	14 (18.7)	14 (29.1)	
Comorbidity (n,%)	51	29	0.757¶
Diabetes mellitus	5 (9.8)	2 (6.9)	
Hypertension	12 (23.5)	4 (13.8)	
Coronary artery disease	9 (17.6)	4 (13.8)	
Copd	4 (7.8)	3 (10.3)	
≥2	21 (41.1)	16 (55.2)	
Smoking (n,%)	75	48	0.208¶
Absent	25 (33.3)	22 (45.8)	
Passive	45 (60)	21 (43.7)	
Active	5 (6.7)	5 (10.5)	
Tumour localisation (n,%)			
Lateral wall	54 (72)	34 (70.8)	
Others	21 (28)	14 (29.2)	
Tumour size (cm) Median (IQR)	1 (1-2)	1.5 (1-2)	0.162¥
Focality (n,%)			0.737¶
Unifocal	30 (40)	22 (45.8)	
Multifocal	45 (60)	26 (54.2)	
Stage (n,%)			0.352¶
Ta	8 (10.7)	2 (4.2)	
T1	64 (85.3)	45 (93.8)	
T1 + CIS	3 (4)	1 (2)	
Grade (n,%)			0.055¶
PUNLP	1 (1.4)	0 (0)	
Low	38 (52.8)	15 (31.3)	
High	33 (45.8)	32 (66.7)	

**Student t-test; ¶Chi-square, ¥Mann-Whitney U test. BMI: Body mass index; min:Minutes; Copd:* Chronic obstructive pulmonary disease*; SD = Standard deviation;* ASA: *American Society of Anaesthesiologists.*

Table II: Perioperative and postoperative outcomes at re-TURBT.

	Re-M-TURBT (n:75)	re-B-TURBT (N:48)	p-value
Stage (n,%)			0.367¶
T0	52 (69.3)	37 (77.1)	
Ta	11 (14.7)	4 (8.3)	
T1	3 (4)	4 (8.3)	
T2	9 (12)	3 (6.2)	
Grade (n,%)			0.091¶
0	49 (65.3)	34 (70.8)	
PUNLP	4 (5.3)	4 (8.3)	
Low	12 (16)	1 (2.1)	
High	10 (13.3)	9 (18.8)	
CIS			0.145¶
No	72 (96)	43 (89.6)	
Yes	3 (4)	5 (10.4)	
Time interval between primary TUR and re-TUR	43.1 (42.5-43.5)	42.8 (42.5-43.3)	0.680¥
Obturator reflex (n, %)	6 (8)	2 (4.2)	0.480¶
Muscle tissue sampling (n, %)	43 (57.3)	35 (72.9)	0.088¶
Cautery artifact (n, %)	3 (4)	4 (8.3)	0.430¶
Hb decrease (g/dL) Median (IQR)	0.4 (0- 1.1)	0.45 (0-1.1)	0.908¥
Transfusion rates, n (%)	1 (1.3)	1 (2.2)	1¶
Na decrease (mmol/L) Median (IQR)	0 (0-1)	0 (-2- 2)	0.353¥
Operation time (min) Median (IQR)	20 (15-30)	20 (15-25)	0.915¥
Catheterisation time (day) Median (IQR)	4 (2-5)	3 (1-4)	0.025¥
Length of Stay (day) Median (IQR)	2 (1-3)	1 (1-2)	0.280¥
Clavien-Dindo classification			
No complication	66 (88)	39 (81.2)	0.302¶
Clavien I-II (minor)	7 (9.3)	8 (16.7)	0.225¶
Clavien III-V (major)	2 (2.7)	1 (2.1)	1¶

¶ Chi-square, ¥Mann-Whitney U test. SD = Standard deviation; PUNLP: Papillary urothelial neoplasm of low malignant potential; TUR = Transurethral resection; Hb = Haemoglobin; Na = Sodium; min: Minute.

Time interval between initial TUR and re-TUR was similar between the groups (p = 0.680). Re-TUR specimens were similar in terms of tumour stage, tumour grade, and presence of CIS.

There was also a similarity between the groups in terms of obturator reflex, muscle tissue sampling, cautery artifact, haemoglobin decrease, transfusion rate, sodium decrease, and complication rates according to the Clavien-Dindo classification system. Only catheterisation time was statistically shorter in the re-B-TURBT group than re-M-TURBT group (Median 3 *vs.* 4 days respectively, p = 0.025) (Table II).

When the patients were evaluated according to the Clavien scoring system, 9 complications were observed in each group. As Grade 1 complications, fever was observed in 5 patients in the re-M-TURBT group, while fever in 5 patients and haematuria not requiring blood transfusion in 1 patient were observed in re-B-TURBT group (p = 0.336). While acute urinary retention was observed in one patient in each group as Clavien Dindo Grade 3a complication, active haematuria requiring endoscopic intervention was observed in one patient in the re-M-TURBT group (p = 1). No Grade 4 and 5 complications were observed in either group.

DISCUSSION

The main benefits of bipolar electrocautery are clean-cuts, less tissue damage, and clear vision compared to the monopolar systems. It was found that muscle tissue sampling, cautery artifact rates which demonstrate the specimen quality did not differ significantly between monopolar and bipolar systems. Moreover, transfusion rates, operation time, and length of stay were comparable between the groups. Only the catheterisation time was shorter in the B-TURBT group.

Transurethral resection is the first and most important step for diagnosis and treatment of bladder cancer. It is also essential to perform re-TURBT for patients with T1 stage, Ta high grade and without muscle tissue in the initial TURBT specimen[1] because residual tumour can be encountered in 33-55% of patients with T1 tumours and 41.4% of patients with TaHG tumours. A recent systematic review and meta-analysis considered that overall detrusor sampled rate was 66%. In other words, adequate muscle tissue sampling cannot be performed in one-third of the patients.[13] Even with adequate muscle tissue sampling, residual and upstaging T1 bladder cancer risk in re-TURBT had been reported to be approximately 50% and 10%, respectively.[13] Re-TURBT not only has re-staging advantage, it also improves the survival of the patients. Many studies demonstrated that both recurrence-free and progression-free survival rates were better in patients who had undergone re-TURBT in comparison with only TURBT.[14-16] Because of the re-staging and survival advantages of re-TURBT, improving the quality of this procedure is very crucial. With this aim, many studies were performed, assessing the fluorescence or narrow-band imaging cystoscopes during the resection or en-block resection techniques.[17-19]

In order to improve the quality of re-TURBT, this study evaluated the different energy sources. To the best of authors' knowledge, this is the first study comparing perioperative outcomes and short-term complications of monopolar and bipolar resectoscopes during the re-TURBT procedure.

Some studies had emphasised that almost no TUR syndrome was seen in B-TURBT.[5,20] TUR syndrome was not observed in any patient in this study. This result may be related to the short operation times.

Another advantage of the bipolar system is better coagulation and less blood loss.[21,22] In several previous studies,[9,12,21] no patients received blood transfusion in either group. However, in this study, one patient who underwent B-TURBT required blood transfusion, while patients in the M-TURBT group did not need any transfusion.

Venkatramani *et al*. reported that no difference was found between the monopolar and bipolar TUR techniques in terms of obturator reflex (49.2% *vs.* 60%, p = 0.27, respectively).[9] In the same study, bladder perforation rate, change in haematocrit level, blood transfusion rate, coagulum retention or need for re-intervention, reduction in serum sodium level, and operation time were not different in both groups. Further, vigorous cautery artifact was higher in the monopolar arm (46.7% *vs.* 25%, p = 0.0096). On the other hand, Bolat *et al*. found that monopolar technique had significantly higher obturator reflex and bladder perforation than bipolar.[23] It should be emphasised that the above-mentioned comparisons were performed during the initial TUR procedure.

Mashni *et al*. evaluated cautery artifact in patients undergoing M-TURBT and B-TURBT, and as a result, the authors remarked that bipolar kit causes less tissue disruption and allows easier assessment of staging and grading of bladder tumours.[24] However, there was no difference in the clinical outcomes between resection methods. In a prospective randomised study, Bolat *et al*. concluded no statistically significant difference in the degrees of thermal damage on deep muscle biopsy when monopolar and bipolar energy sources were compared during the resection of bladder tumours that located lateral wall.[25] In this study, the authors performed obturator nerve block in each group of patients in order to prevent obturator reflex-related tissue damage. Another thing that should be noted is that there was no qualitative system in the literature to determine the degree of thermal damage, so this system was needed in order to make more objective evaluations.

The main limitations of this study included its retrospective nature, operations performed by different surgeons, and the pathology specimens evaluated by different pathologists. Another limitation was the relatively small sample size. Therefore, these results should be confirmed with large volume of patient, randomised prospective studies. Further, because the primary and secondary end-points of the study were not oncologic outcomes, recurrence-free and progression-free survivals were not evaluated. However, the fact that the study was designed and well-standardised, since a uniform anaesthesia method was used, and it was the first study conducted on patients who underwent re-TUR can be considered as its strength.

CONCLUSION

Improving the quality of re-TURBT is crucial because of its diagnostic and prognostic importance. It was observed that two commonly used techniques can be used during the re-TURBT procedure safely and effectively. The results of this study should be confirmed with larger volume, randomised controlled trials.

ETHICAL APPROVAL:
Before starting the research, an approval was obtained from Izmir Bozyaka Training and Research Hospital's ethics committee (IRB Number: 031504).

PATIENTS' CONSENT:
Informed consent was obtained from all volunteers participating in the study for the use of their data.

COMPETING INTEREST:
All authors declared that there is no conflict of interests.

AUTHORS' CONTRIBUTION:
DB, TC: Conceptualisation.
TC: Investigation.
GC, MBN: Data curation.
TC, OE: Writing and original draft preparation.
GC, TC: Writing, review, and editing.
DB: Supervision.
All authors read and agreed to the published version of the manuscript.

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