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Monopolar Vs. Bipolar TURBT: analysis of safety, efficacy and histopathological outcome

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ABSTRACT

To prospectively compare monopolar and bipolar TURBT for its perioperative safety and efficacy along with the histopathological outcome of the biopsy specimen.

The 96 consecutive eligible patients between July 2015 and August 2017, who were planned for TURBT, were randomized into two equal groups: group A] monopolar TURBT and group B] Bipolar TURBT. Patient's perioperative, histopathological and 1 year check cystoscopy data were collected and analysed.

The baseline characteristics of the two groups were statistically similar. The operative time ($p=0.51$), post-operative haemoglobin ($p=0.30$) and duration of catheterization ($p=0.63$) were similar between the two groups. Pathological stage, grade and cautery artefacts affecting histopathological diagnosis were similar between the two groups. The obturator jerk, bladder perforation and need for blood transfusion were reported more with monopolar TURBT, but did not differ significantly with bipolar TURBT. Four and 6 patients required re-TURBT as detrusor muscle was not identifiable in the resected tissue in monopolar vs. bipolar group, respectively.

Bipolar TURBT is as efficient and safe as monopolar TURBT regarding intraoperative safety and histopathological quality of resected tissue.

KEYWORDS: Bladder tumor; TURBT; Histopathology; Bipolar.

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INTRODUCTION

Transurethral resection of bladder tumor (TURBT), aimed at complete resection of all macroscopic tumor and getting deep muscle for biopsy, is mainstay in the management of bladder cancer, of which, deep muscle biopsy is important in deciding whether treatment is sufficient or not^{1,2}. Monopolar current, for long, is the standard for the TURBT in hypotonic fluid with intraoperative haemorrhage, obturator jerk and bladder perforation as potential complications.^{3,4} Bipolar resection in saline in recent years gained acceptance for TURBT. Some recent studies reported lower incidence of blood loss, negligible risk of TUR syndrome, early catheter removal etc, with bipolar TURBT compared to monopolar TURBT.^{2,5,6} However, two recent randomized controlled trials (RCT) found no significant difference between monopolar and bipolar TURBT with respect to bleeding, obturator jerks and bladder perforation.^{7,8} The use of bipolar energy for TURBT is associated with concern related to histopathological accuracy of biopsy specimen owing to higher energy delivered to bipolar resection loop and its associated cautery artefacts.^{2,9,10} Some studies showed that bipolar TURBT has better detrusor sampling rate and equivalent histopathological accuracy compared to monopolar TURBT.^{11,12}

We planned a prospective randomized study comparing monopolar and bipolar TURBT for its perioperative safety and efficacy along with histopathological outcome of biopsy specimen.

MATERIAL AND METHODS:

Consecutive patients attending the urology outpatient department between March 2016 and August 2017, who satisfied eligibility criteria (inclusion/exclusion criteria), were enrolled in this institutional ethics committee approved prospective randomized study. Inclusion criteria were: a) primary bladder tumor ≤ 5 cm in greatest dimension b) age ≥ 18 years, and c) planned for TURBT. Patients, with a) bladder tumor > 5 cm in greatest dimension, b) uncorrected coagulopathy, c) active urinary tract infection, d) history of TURBT in past, e) neurogenic bladder and f) history of urethral stricture/ urethral surgery, were excluded from the study. Initial evaluation included detailed clinical history, physical examination, urinalysis (urine culture, if indicated), urine cytology for three consecutive days, hemoglobin, ultrasound of kidney ureter and bladder to assess tumor size and number, CT urography, if indicated. Eligible patients were randomly divided into two equal groups using computer generated randomization table: group A) monopolar TURBT and group B) Bipolar TURBT.

Surgical procedure:

All procedures were performed under regional anesthesia by urologists, well versed with either technique.

Monopolar TURBT was performed using a 26F continuous flow resectoscope, 30-degree lens, standard tungsten cutting wire loop, and 1.5% glycine as irrigant, whereas for Bipolar TURBT, a 26F continuous flow resectoscope, bipolar cutting loop (Gyrus ACMI plasmakinetic system), 30-degree lens and 0.9% saline as irrigant were used. Power settings in both monopolar and bipolar TURBT were 160W for cutting and 80W for coagulation. In either procedure, after resection of superficial tumor, deep muscle biopsy was taken from entire base. Both superficial tumor and deep muscle biopsy were sent for histopathological examination in separate containers. The modality of resection was not disclosed to the pathologists.

At the end of the procedure, 22Fr 3way Foley catheter was kept in situ and bladder irrigation with normal saline started. All patients received intravesical Mitomycin-C 40 mg in 40 ml saline within 6 hours of surgery and it was kept in bladder for 1 hour and again bladder irrigation started. Bladder irrigation was stopped by urology resident on duty once urine become clear and catheter removal was done 12-18hours after the irrigation was stopped. Patient followed up at 3 week postoperative and further treatment planned as per histopathological examination findings. Patients, in whom biopsy sample did not reveal identifiable detrusor muscle, were subjected to re-TURBT. All low risk patients did not receive any further treatment, whereas intermediate and high risk non-muscle invasive urothelial carcinoma patients did receive induction (80 mg Bacillus Calmette-Guerin (BCG) weekly for 6 weeks starting 3-4 weeks after TURBT) and maintenance (80 mg BCG weekly for 3 weeks at 3, 6 and 12 months follow up) intravesical BCG. Also, all non-muscle invasive urothelial carcinoma patients were followed up with 3monthly check cystoscopy for 1 year.

Perioperative data recorded were operative time (time for which resectoscope was inside the urethra), duration of bladder irrigation, postoperative hemoglobin (morning after surgery), duration of catheterization, pathologic stage and WHO grade, cautery artefact interfering in pathological diagnosis, recurrence during 1 year follow up on check cystoscopy, and complication, if any.

Statistical analysis:

We arranged the recorded parameters on a Microsoft excel spreadsheet (Microsoft, Seattle, WA USA) and analyzed it by SPSS version 21.0 (IBM, Armonk, NY, USA) software package. Continuous data were expressed as mean \pm SD of the group and analyzed by the two-tailed Student *t*-test. Categorical data were expressed as number (percentage) and analyzed by Chi-square test and Fisher's exact test. P values <0.05 were considered statistically significant.

RESULTS

Of 138 patients screened, who underwent TURBT during the study period, 96 satisfied the eligibility criteria and were randomly enrolled into two groups: monopolar TURBT (n=48) and bipolar TURBT (n=48) (figure1).

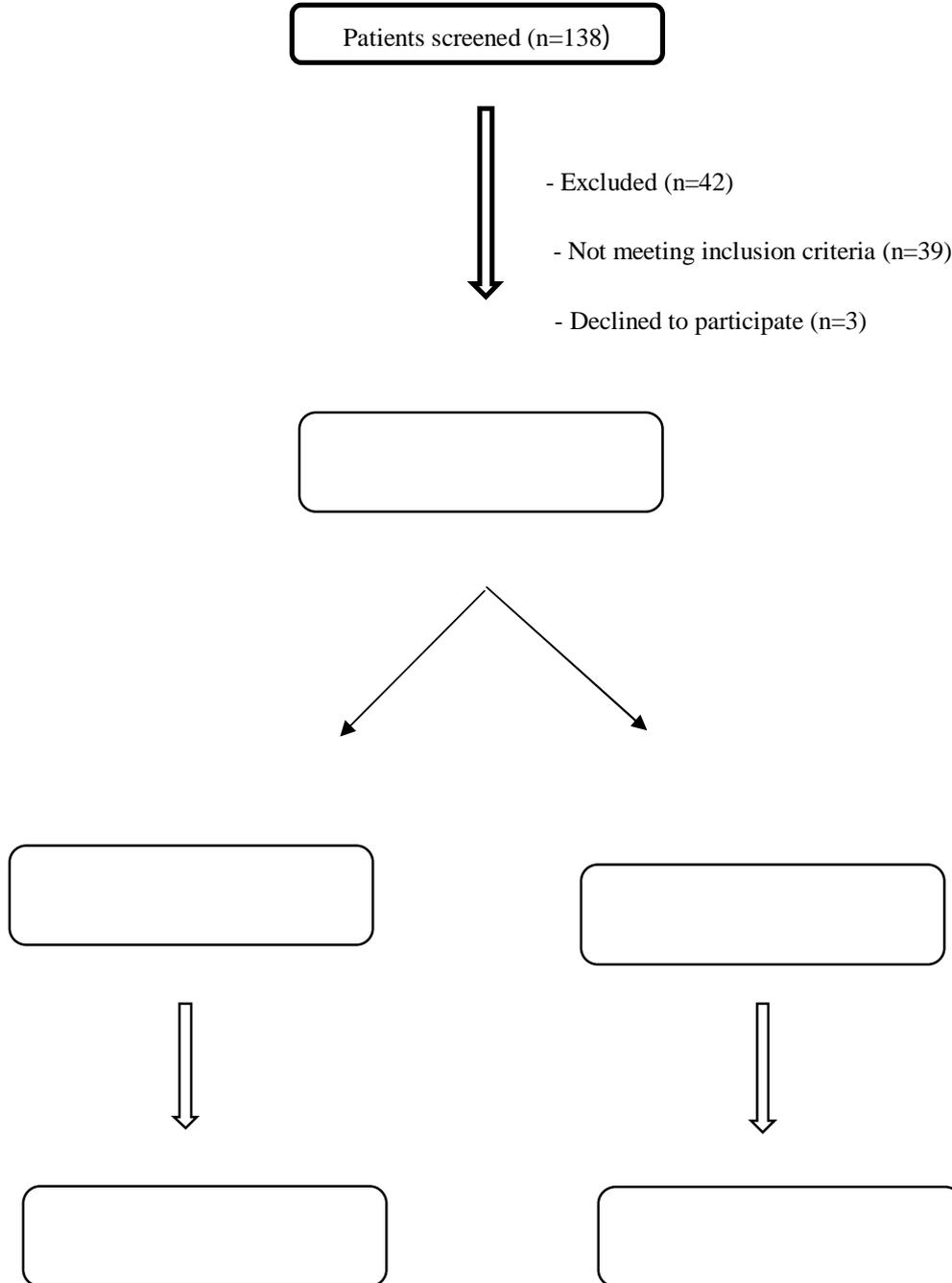


Figure 1: Allocation and dispersion of patients

Table 1: Baseline characteristics

| | Monopolar TURBT (n=48) | Bipolar TURBT (n=48) | p value* |
|---|---------------------------|-------------------------|----------|
| Age (Years) | 51.66±12.47 | 53.95±13.27 | 0.38 |
| Tumor size (Cms) | 3.58±0.91 | 3.44±0.85 | 0.42 |
| Number of tumors | 1.33±0.55 | 1.16±0.37 | 0.08 |
| Positive urine cytology [number(percentage)] | 16(33.33) | 14(29.16) | 0.83# |
| Hemoglobin (gm/dl) | 10.84±0.92 | 11.05±0.99 | 0.28 |

*Student t-test, # Fisher’s exact test, P<0.05 considered statistically significant

Baseline characteristics (the mean age, size of tumor, number of tumors, urine cytology and hemoglobin concentration) were similar between the two groups with no significant difference noted among them (table 1).

Table 2: Perioperative data and complications

| | Monopolar TURBT (n=48) | Bipolar TURBT (n=48) | p value* |
|--|--|-------------------------|----------|
| Operative time (minutes) | 37.85±14.91 | 39.83±14.50 | 0.51 |
| Hemoglobin (gm/dl) | 10.47±0.95(43) | 10.68±1.01(45) | 0.30 |
| Duration of catheterization (hours) | 21.08±3.12 | 21.37±2.86 | 0.63 |
| Pathologic stage | PTa | 12 | 0.84** |
| | pT1 | 31 | |
| | pT2 | 5 | |
| | Detrusor muscle not identifiable in specimen | 4 | 6 |
| WHO grade | Low | 20 | 0.59** |
| | High | 28 | |
| Cautery artefact interfering in pathological diagnosis | 1 | 3 | 0.61# |
| Obturator jerk | 14 | 6 | 0.13# |
| Blood transfusion | 5 | 3 | 0.71# |
| Bladder perforation | 4 | 1 | 0.36# |

*Student t-test, **Chi-square test, # Fisher’s exact test, P<0.05 considered statistically significant

The perioperative data of the two groups are summarized in (table 2). Although intraoperative endoscopic vision was better with bipolar device probably due to less adherence of tumor to the resection loop, the mean operative time was similar (p=0.51). The duration of catheterization, fall in the mean hemoglobin concentration was not significantly different between the two groups. The obturator jerk, bladder perforation and need for blood transfusion were reported more with monopolar TURBT, but did not differ significantly with bipolar TURBT.

On histopathology, the two groups were statistically similar in respect to pathological stage and grade. Although deeper cautery artefact noted more among bipolar group (figure 2, 3), it did not reach significant level. Adequate material was found in all deep muscle biopsy specimen for diagnosis except 4 case in monopolar and 6 cases in bipolar group where diagnosis required re-TURBT to get muscle biopsy. All muscle invasive urothelial cancer patients (8 in monopolar and 5 in bipolar group) were advised radical cystectomy with or without neoadjuvant chemotherapy.

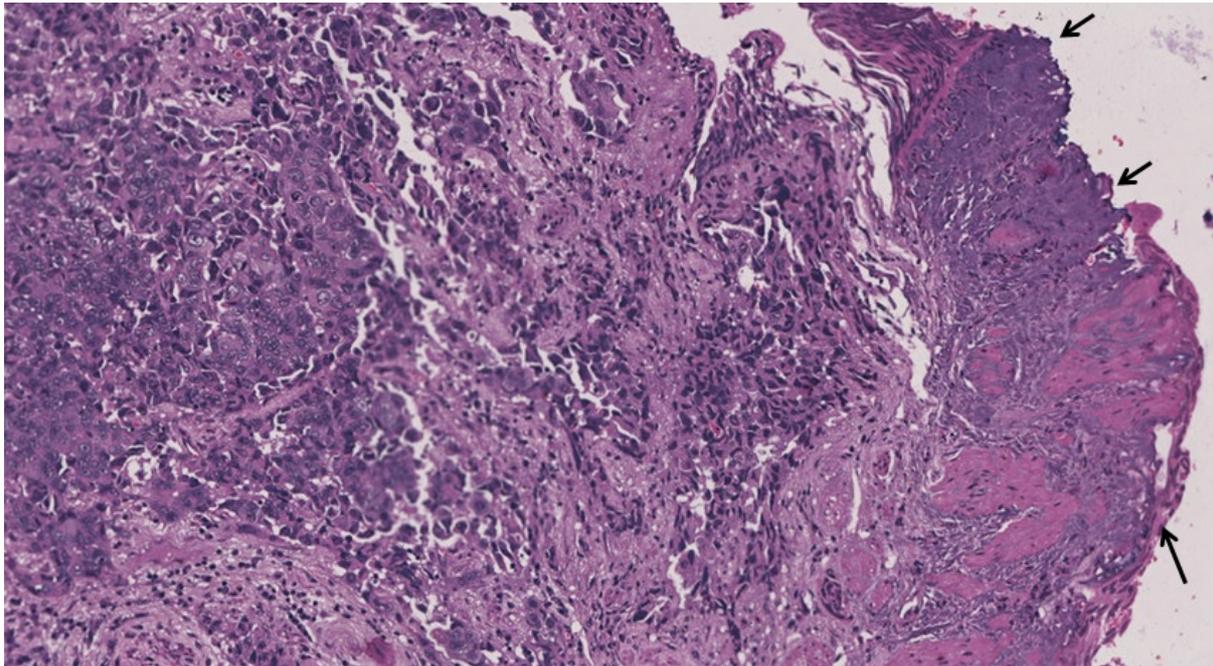


Figure 2: Monopolar TURBT: Cautery effect seen as basophilic discoloration around the muscle

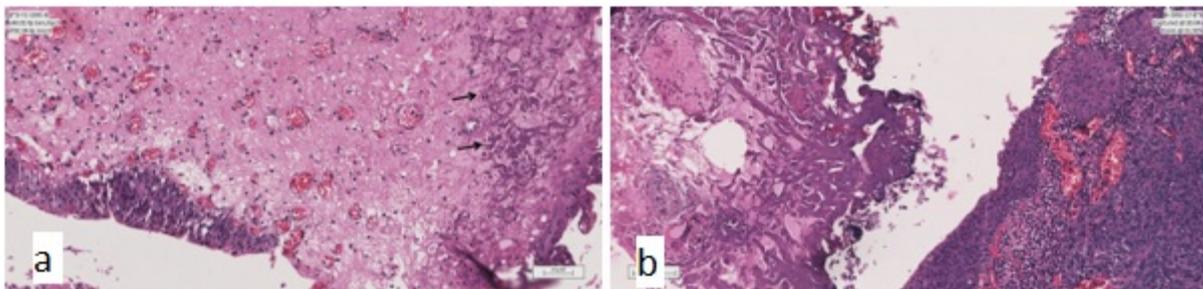


Figure 3: Bipolar TURBT: a] Mild cautery effect seen in lamina propria, b] Maximal effect was seen in tissue but is not affecting tumor morphology

Check cystoscopy was normal in all patients with non-muscle invasive cancer at 3 months follow up. One patient of monopolar group at 6 months, 1 patient from each group at 9months and 2 patients from monopolar and 1 patient from bipolar group had recurrence at 12 months follow up.

DISCUSSION Monopolar TUR is still considered the gold standard for the surgery of prostate and bladder tumor. Bipolar resection, with 0.9% saline as irrigant, is developed as an alternative for TUR of prostate and bladder tumor.³ In recent years, it is shown that bipolar TURBT is associated with similar or lesser risk of blood loss, obturator jerks, duration of irrigation, catheterization and hospitalization compared to monopolar TURBT.^{2,5-8}

Sugihara T et al in analysis of 8188 pairs of national population based data of monopolar and bipolar TURBT observed significantly lower incidence of severe bladder injury (0.3 vs. 0.6%), other complications (4.6 vs. 5.8%) and slightly shorter postoperative stay (mean, 6.4 vs. 6.7 days) with bipolar TURBT. They found no differences in postoperative hemostasis procedures, transfusion and anesthesia duration between the two procedures.⁶ Pu XY et al reviewed record of 121 bipolar TURBTs with follow up of 3-5.5 years' duration and observed that with the median age of 61 years and mean tumor size was 1.9 cm in diameter, the mean operative time was 25 ± 16 minutes and the mean postoperative hospitalization period was 3 days. 2.5%, 1.7%, 4.9% and 4.1% patients had hematuria requiring blood transfusion, bladder perforation, adductor contraction and urethral strictures, respectively.¹³ Xishuang S et al in their comparative study observed that compared to monopolar TURBT, plasmakinetic TURBT and Holmium TURBT had lesser intraoperative and postoperative complications, including obturator nerve reflex, bladder perforation, bleeding and postoperative bladder irritation. Catheterization and hospitalization time were also lesser with plasmakinetic TURBT and Holmium TURBT, whereas there were no significant differences in the overall recurrence rate among the three groups.¹⁴ Two RCT reported similar outcome with monopolar and bipolar TURBT with respect to obturator jerks, bleeding and bladder perforation.^{7,8} Cui Y et al in a meta-analysis found that bipolar TURPT is associated with statistically similar rates of obturator nerve reflex, bladder perforation and blood transfusion, decreased resection time, catheterization time and change in haemoglobin compared to monopolar TURBT. Also, the grade of cautery artefact was similar or even lower with bipolar TURBT.¹⁵ Bolat D et in a randomized comparative study including 130 patients found no significant difference between monopolar and bipolar TURBT with respect to complete tumor resection rate (89.2% vs 78.5%, $p=0.152$), the muscle tissue sampling rates (64.6% vs 72.3%, $p=0.345$) and thermal tissue damage (7 vs 3, $p=0.194$). However, the obturator jerk (21.5% vs 4.6%, $p=0.013$) and bladder perforation (21.5% vs 6.1%, $p=0.039$) was significantly higher in Monopolar TURBT group.¹⁶ In our study, we observed similar operative time and fall in hemoglobin between the two groups. Though, the transfusion, obturator jerk and bladder perforation were reported higher with monopolar TURBT, it did not reach to a significant level.

One concern that remains with bipolar resection is the risk of cautery artefact to biopsy specimen impairing accurate diagnosis. Wang DS et al compared 11 bipolar TURBT specimen with that of monopolar TURBT and observed similar histopathological outcome that was sufficient for accurate diagnosis.¹⁷ Yang SJ et al in retrospective analysis of 115 TURBT, observed similar degree of thermal artefact with monopolar and bipolar resection.² Bach T et al in their initial experience with regular size bipolar resection loop did not find any compromise in the histopathological quality of resected tissue compared to monopolar resection.³ Saini A et al in their study including 61 patients observed equivalent histopathological accuracy between monopolar and bipolar TURBT. Teoh JY et al in their randomized comparative study observed better detrusor muscle sampling rate with bipolar TURBT compared to monopolar TURBT.¹¹ We, in our study, did not find any difference in histopathological findings (Stage/grade) between monopolar and bipolar TURBT. We had 4 and 6 patients with detrusor muscle not identifiable in biopsy specimen and cautery artefact interfering in pathological diagnosis in 1 and 3 patients in monopolar and bipolar TURBT groups, respectively.

CONCLUSION

Bipolar TURBT is as efficient and safe as monopolar TURBT regarding intraoperative safety and histopathological quality of resected tissue.

CONFLICTS OF INTEREST

The authors have nothing to disclose

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None

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