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Original Article

Monopolar versus Bipolar Transurethral Resection of Non-Muscle Invasive Bladder Cancer

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ABSTRACT

Background: Recently, the bipolar current has been used as an alternative technique to conventional monopolar current which was used traditionally in trans-urethral resection of bladder tumor [TURBT].

The aim of the work: To evaluate the safety and efficacy of monopolar versus bipolar TURBT in the management of primary non-muscle-invasive bladder cancer [NMIBC].

Patients and Methods: This prospective study was conducted on 80 patients [70 males and 10 females] aged 36 years or older, presented with primary bladder mass from March 2016 to March 2020 at the Urology Department of Al-Zahraa University Hospital. Patients were classified randomly into two groups: group [A] included 40 patients who had M-polar TURBT, and group [B] included 40 patients who had B-polar TURBT. The main studied outcomes were the frequency of intraoperative and postoperative complications, as well as the rate of recurrence after 12 months of follow-up.

Results: There was no statistical difference between the two groups regarding demographic data of patients and characters of the tumor. Intra-operatively, there was a significant difference between both groups regarding obturator reflex, which was higher in M-polar TURBT group than B-polar TURBT group [25% vs. 5%; P= 0.013] respectively. Operative time was shorter in the B-polar TURBT group than M-polar TURBT, but with no statistically significant difference. There was a mild drop in hemoglobin & hematocrit value in M-polar TURBT than the B-polar TURBT, but with no statistically significant difference. There was no significant difference in the recurrence rate of both groups after one year of follow-up.

Conclusion: Our study revealed that B-polar TURBT is more safe and effective in the management of primary bladder tumors.

Keywords: Monopolar; Bipolar transurethral resection; Non-muscle invasive bladder cancer

INTRODUCTION

Bladder cancer is the second commonest malignancy of the urinary system after prostate cancer [1]. Nearly, 75-80% of urothelial cancer present as [NMIBC], while 20-25% present as muscle invasive tumor [2]. TURBT is the essential step for the management of [NMIBC], in order to reach actual diagnosis and clear all tumors in the bladder involved part of the underlying muscle [3].

Many resectoscopes are divided roughly into monopolar and bipolar instruments. The bipolar technique is one of the most recent advancements in Urology [3]. Configuration of the current pathway is considered the essential difference between monopolar and bipolar instruments. The Bipolar one is able to act in a conductive fluid medium [normal saline] in contrast to the conventional non-conductive irrigation fluid [glycine, sorbitol and mannitol]. Recently, the plasma-kinetic resectoscope has

been incorporated, mainly for transurethral resection of the prostate [4, 5].

In bipolar resectoscope, power is passed from the loop electrode into the normal saline, promoting it to evaporate and form an interface layer of gas around the loop. The addition of voltage to the gas causes excitation of the sodium ions to form plasma, a highly energized state of matter [6].

THE AIM OF THE WORK

Although many clinical trials were conducted to compare the between both techniques [mono-polar vs. bipolar], no consensus guidelines are available until now; in addition, few studies were from developing countries. Therefore, this study aims to comparison between plasmakinetic bipolar resectoscope and traditionally monopolar in the transurethral resection of primary NMIBT as regard safety & efficacy.

PATIENTS AND METHODS

This study is a prospective randomized study that included 80 patients [70 males and 10 females] aged 36 years or older with urinary bladder mass. They were selected from Urology out-patient clinic at Al-Zahraa University Hospital, from March 2016 to March 2020. Patients presented with de novo primary vesicle tumor were included in the study, whilst, invasive bladder cancer, recurrent cases, urethral stricture, active urinary tract infection [UTI] and uncontrolled hypertension or bleeding diathesis were excluded from this study.

Preoperative assessment

Patients were randomly classified into two groups. Group [A] included 40 patients underwent M-TURBT and Group [B] included 40 patients underwent B-TURBT. All cases were evaluated before operation by full history taking, physical examination, laboratory investigations: Urine analysis and culture & sensitivity if indicated, CBC, coagulation profile, fasting and post-prandial blood sugar, renal & liver function tests, and serum sodium & potassium level. Radiological evaluation included renal ultra-sonography, contrasted CT scan, and chest x-ray. Patients with infected urine were treated with antibiotics after culture and sensitivity. Pre-operatively, patients must discontinue anti-coagulants and antiplatelet drugs 5-7 days. Patients on warfarin should be replacing by low molecular weight heparin. All patients will achieve an international normalized ratio [INR] of < 1.5 within 4-5 days of stopping warfarin. Intravenous broad spectrum antibiotics were given one hour before the procedure.

Procedures

The patient placed in dorsal lithotomy position after induction of general or spinal anesthesia. Digital rectal exam [DRE] under anesthesia was done before starting the procedures. The technique initiated by pan - urethrocystoscopy, evaluating the urinary bladder mass & its size, shape, and location, and determining any other abnormalities.

The traditional monopolar technique was performed through a Storz 26-F resectoscope with continuous flow, 1.5% glycine was used as the irrigant. The generator was programmed to70W for both cutting and coagulation. While in bipolar technique, it was carried out by the Storz transurethral resection in saline with a continuous-flow 26-F resectoscope, and 0.9% normal saline was used as the irrigant. The generator was adjusted to 70 W for cutting and 80 W for coagulation from ERBE VIO 300 D, generator machine.

In both groups, after total resection of all vesical masses, good homeostasis was done and a 22-F triple-way catheter was fixed. DRE was done again at the end of the procedure. Any Intraoperative complications as, obturator jerk, perforation, and TUR syndrome were noted. If initial resection isn't complete as the specimen not includes muscle or T1 stage, transurethral resection should be repeated 2 to 6 weeks from the initial resection for adequate staging of the tumor.

The removed tumors were referred to Pathology unit, fixed in saline and formalin, to examined specimen for cancer stage and grading. Irrigation of bladder was done till

urine became clear, the urethral catheter removed and patient discharge when became stable. Measurement of hemoglobin [Hb], hematocrit level, serum sodium [Na] and potassium were completed within 24 hours postoperatively. Age of patients, sex, tumors size, site, shape and number, time of resection [from the start of resection till the removal of resectoscope sheath], the intra and post-operative complications, changes in Hb, and Na, time of catheterization, hospital stay, pathological stage, WHO grade, and rate of recurrence all were recorded. Postoperative intravesical immunotherapy was given to all cases every week for six weeks started one month after resection.

Follow-up: The patients were followed after 3, 6, 9 and 12 months from the first resection by pelvi-abdominal ultrasonography, urine cytology, and cystoscopy.

Data Collection and Analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0. [SPSS Inc., Chicago, IL, USA]. Quantitative data were presented as means standard deviation [SD]. Qualitative data were evaluated as frequency and percentage. The following tests were performed: Independent-samples t-test of significance was used when comparing between two means, chi-square [x2] test of significance was used in order to compare proportions between qualitative parameters, the confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: <0.05 as significant, and P-value >0.05 as insignificant.

Ethical considerations

A written consent was signed by all cases that included in this research and they informed about the procedure and the rate of its success and potential complications. Approval of the International Review Board [IRB] was obtained.

RESULTS

There were no statistically significant difference regarding demographic data and tumor characteristic between the studied groups [Table 1 & 2].

There were mild drop in HB level and hematocrit value in Group A, but without significant difference, and no patient required blood transfusion [Table3].

The hospital stay and catheterization time were significantly reduced in B-polar [TURBT] than M-polar [TURBT] [Table 4].

There was no statistically significant difference in two studied groups regarding intraoperative & postoperative complications except for obturator jerk that was higher in M-polar group than B-polar group [Table 5].

There was no significant difference between either groups as regard to recurrence rater after one year follow-up with US & cystoscopy every 3 months [Table 6].

Table [1]: Demographic data and tumour character

		M-POLAR TURBT [n=40]	B-POLAR TURBT [n=40]	Test	p-value
Sex	Males Females	33 [82.5%] 7 [17.5%]	36 [90%] 4 [10%]	x_2=0.949	0.330
Age [years]	Mean+SD Range	57.90+9.05 38-75	60.13+7.29 45-75	*t*=1.467	0.23
Tumor characters	Single Multiple	29 [72.5%] 11 [27.5%]	32 [80%] 8 [20%]	x_2=1.370	0.504
Tumor size [cm]²	Mean±SD Range	1.87±0.56 1-2.5	2.06±0.58 1-3	*t*=1.490	0.140
Time of operation [min]	Mean±SD Range	35.38±7.63 20-50	33.63±7.76 25-45	*t*=1.017	0.312

Table [2]: Comparison between M-polar TURBT and B-polar TURBT according to their location

	M-POLAR TURBT [n=40]			B-POLAR TURBT [n=40]			P1	P2	P3
	No.	Size	Time	No.	Size	Time			
Rt. Lateral wall	10 [25%]	1 -2.5	25-50	15 [37.5%]	1 -2	30-45	0.231	> 0.05	> 0.05
Lt. Lateral wall	12 [30.0%]	1 -2	20-40	15 [37.5%]	1 - 2.5	25-50	0.481	> 0.05	> 0.05
Ant. Wall	4 [10.0%]	1 -1.5	25-35	2 [5.0%]	1 -2	20-40	0.399	> 0.05	> 0.05
Trigonal	3 [7.5%]	1.5-2	20-30	1 [2.5%]	1.5	25	0.308	> 0.05	> 0.05
Domal	1 [2.5%]	1	30	1 [2.5%]	1.2	35	1.000	> 0.05	> 0.05
Basal	10 [25%]	1 -2.5	20-50	6 [15.0%]	1 -3	25-45	0.267	> 0.05	> 0.05
Involvement of ureteric orifices	1 [2.5%]	1.5.	30	2 [5.0%]	1	25	0.559	> 0.05	> 0.05

P1: Comparison between two groups according location, P2: Comparison between two groups according size, P3: Comparison between two groups according time.

Table [3]: Comparison between pre & post-operative hemoglobin, haematocrit and sodium level

		M-POLAR TURBT [n=40]	B-POLAR TURBT [n=40]	t-test	p-value
Hemoglobin [gm/dl]					
Preoperative	Mean±SD Range	13.37±1.24 10.5-14	13.65±1.06 11.4-15.2	1.086	0.281
Postoperative	Mean±SD Range	12.81±1.17 10.0-13.2	13.15±1.11 11-14.8	1.333	0.186
Reduction	Mean±SD Range	0.56±0.72 0.5-1.7	0.50±0.44 0.1-1.5	0.450	0.654
Hematocrit [gm%]					
Preoperative	Mean±SD Range	44.37±5.32 39-48	44.31±6.13 40-47	0.047	0.963
Postoperative	Mean±SD Range	39.76±4.65 33-43	40.80±4.90 35-45	0.974	0.333
Reduction	Mean±SD Range	4.61±4.48 2-8	3.57±3.21 1-7	1.193	0.236
Sodium [MEQ/L]					
Preoperative	Mean±SD Range	142.00±2.08 136-145	142.20±1.98 135-147	0.195	0.661
Postoperative	Mean±SD Range	140.78±2.51 133-142	140.74±2.37 134-144	0.055	0.956
Reduction	Mean±SD Range	1.22±0.69 0.5-1.8	1.42±0.51 0.2-1.3	1.555	0.124

Table [4]: Comparison between two groups according to their post-operative time of catheterization and hospital stay

		M-POLAR TURBT [n=40]	B-POLAR TURBT [n=40]	t-test	p-value
Time of cathetralization [day]	Mean±SD Range	3.13±0.70 3-4	2.73±0.42 2-3	3.099	0.003*
Time of hospitalization [day]	Mean±SD Range	4.53±1.70 3-5	3.57±1.42 3-5	2.741	0.008*

Table [5]: Comparison between two groups according to intra and post-operative complications

	TURBT M-POLAR [n=40]	TURBT B-POLAR [n=40]	x2	p-value
Intraoperative complications				
Obturator jerk	10 [25.0%]	2 [5.0%]	6.916	0.013*
Bladder perforation	0 [0.0%]	0 [0.0%]	----	-----
TUR syndrome	0 [0.0%]	0 [0.0%]	----	-----
Postoperative complications				
Hematuria	7 [17.5%]	6 [15.0%]	0.091	0.763
Clot retention	0 [0.0%]	0 [0.0%]	----	-----
Blood transfusion	3 [7.5%]	1 [2.5%]	1.039	0.308

x^2: Chi-square test; p-value>0.05 NS; *p-value <0.05 S.

Table [6]: Number, site, grade and stage of recurrence in both groups at 3, 6, 9 and12 months [By US and cystoscopy]

		M-POLAR TURBT [n=40]	B-POLAR TURBT [n=40]	x2	p-value
Recurrence at 3 months		4 [10.0%]	3 [7.5%]	0.155	0.694
Site	Another site recurrence Same site of primary tumor	4 [100%] 0 [0%]	1 [33.3%] 2 [66.7%]	3.202	0.074
Grade	Same grade Progression	4 [100%] 0 [0%]	3 [100%] 0 [0%]	0.00	1.00
Stage	Same stage Progression	4 [100%] 0 [0%]	3 [100%] 0 [0%]	0.00	1.00
Recurrence at 6 months		**3 [7.5%]**	**4 [10.0%]**	**0.155**	**0.694**
Site	Another site recurrence Same site of primary tumor	1 [33.3%] 2 [66.7%]	2 [50.0%] 2 [50.0%]	0.167	0.683
Grade	Same grade Progression	3 [100%] 0 [0%]	4 [100%] 0 [0%]	0.00	1.00
Stage	Same stage Progression	3 [100%] 0 [0%]	4 [100%] 0 [0%]	0.00	1.00
Recurrence at 9 months		**4 [10.0%]**	**3 [7.5%]**	**0.155**	**0.694**
Site	Another site recurrence Same site of primary tumor	1 [25.0%] 3 [100%]	0 [0%] 3 [100%]	0.750	0.387
Grade	Same grade Progression	4 [100%] 0 [0%]	3 [100%] 0 [0%]	0.00	1.00
Stage	Same stage Progression	4 [100%] 0 [0%]	3 [100%] 0 [0%]	0.00	1.00
Recurrence at 12 months		**3 [7.5%]**	**3 [7.5%]**	0.00	1.00
Site	Another site recurrence Same site of primary tumor	2 [66.7%] 1 [33.3%]	1 [33.3%] 2 [66.7%]	0.558	0.455
Grade	Same grade Progression	2 [66.7%] 1 [33.3%]	3 [100%] 0 [0%]	0.999	0.318
Stage	Same stage Progression	1 [33.3%] 2 [66.7%]	3 [100%] 0 [0%]	2.502	0.114

x^2: Chi-square test; p-value>0.05 NS

DISCUSSION

Bladder tumor is the commonest malignancy in urinary system; approximately, 75–80% of patients are NMIBCs at the time of diagnosis [7]. The mainstay method for the management of NMIBC is TURBT. Initial resection aims to resect all tumors involving the underlying muscle of the bladder [8].

TURBT was done previously using conventional monopolar electro cautery loop and non-saline irrigation fluid, which carries

the risk of absorption of hypotonic fluid and electrolyte disturbance [9]. Also, the obturator reflex may produce when the resectoscopes electrical current stimulates the obturator nerve directly, especially if the tumor is placed on the bladder's lateral wall [10].

Many researches have been demonstrated favorable outcomes for B-[TURBT], including less incidence of bladder perforation due to minimal depth, improved homeostasis, and a shorter hospital stay [11]. The essential benefit of bipolar electro cautery is that it causes minimal charring and blackening of tissue. Also, it provides maximal anatomical visibility, allowing for controlled resection while avoiding damage to surrounding organs. Other benefit of bipolar power is evident by managed patients with high-risk tumors, as those with pacemakers or pregnancy [12].

TUR syndrome after M-TURBT is rarely recorded, with incidence of about 2% [13]. In our study there is no TUR syndrome occurred in both groups; this seems to be due to the less open venous channels, small size tumor, and short time of resection, despite scientific evidence of a slight decline in sodium levels in monopolar TURBT and bipolar TURBT, no one of the patients experienced manifestation of diluted hyponatremia. Furthermore, no significant statistical reduction was detected in the level of sodium. These results agree with **Venkatramani *et al.*** that found no significant difference in clinical TUR syndrome between monopolar and bipolar tumor excision [14]. Also, **Botal *et al.*** reported that B-[TURBT] has no significant advantage than M-[TURBT] in decrease the occurrence of TUR syndrome [15]. However, **Avallone *et al.*** demonstrated less incidence of TUR syndrome in B-[TURBT], due to the use of saline for flushing mainly [16].

Bladder damage in TURBT is uncommon, but it carries a substantial risk of extravesical tumor seeding [17]. In this study, bladder perforation was not detected in any case in both groups; these data agree with **Mashni *et al.*** that recorded no development of bladder perforation, with no significant different between M-polar and B-polar TURBT [18], and **Liem *et al.*** reported no statistical difference between M-polar and B-polar TURBT regarding bladder perforation [19]. However, our results disagree with Sugihara *et al.* that found the rate of vesical damage considerably higher in M polar-TURBT compared to B-polar TURBT [0.3 % vs. 0.6 %], indicating the superiority of the B polar-TURBT [20]. Also, Mansour *et al.* found that monopolar resection had a 13.2 % perforation rate, which was considerably greater than the 2.4 % for bipolar resection [P= 0.02] [21], and **Yanjie *et al.***, in nine RCTs included 1193 patients , reported that there was significantly reduced in bladder perforation in B-[TURBT] than M-[TURBT] [P=0.002] [22].

In our study, obturator reflex was elevated in the M polar-TURBT group, affecting ten [25%] cases vs. 2 [5%] patients in the B polar-TURBT group, which was statistically significant [P=0.013], this might be due to that the most of patients in our study had lateral wall urinary bladder mass. These data agree with **Mansour *et al.*** who observed a substantial decrease in nerve stimulation incidence from 26.5 percent with M polar-TURBT to 4.8 percent with B polar-TURBT [P=0.01] [21], and **Manish *et al.*** who found that the incidence of obturator jerk was less in bipolar group but without significant difference [p= 0.073] [23]. However, our results do not agree with **Ozer *et al.*** who reported that the obturator reflux was statistically higher in the B polar-TURBT group; with the obturator reflex observed in 15 [34%] patients vs. four [8%] [P= 0.001] [24]. Also, Venkatramani *et al.* found that the incidence of obturator jerk was higher in the B-TURBT [60 vs. 49.2 %, P= 0.27] [14].

Multiple investigations have found that regardless of the type of energy employed, the resection time was the same in both M-polar and B-polar resectoscopes [24]. In our study, there was a minimal shorter operative time in B-polar than M-polar without a significant difference between the two groups. These data agree with **Venkatramani *et al.*** found no significant variation in resection time in their study [14]. Also, **Liem *et al.*** believes that there is no great disparity in operative time between the two groups, possibly because B-TURBT employs a smaller loop, which takes longer

than M-TURBT [19]. However, previous research has shown that B-TURBT has a much shorter operative time than M-TURBT. This is due to the ability of quick hemostasis to create a clean surgical region. Furthermore, adherence of residual debris to the resectoscope is less common in B-TURBT, and if it does occur, it is swiftly removed without the need for manual removal as slowly as in M-TURBT [8], and Teoh *et al.* did a systematic review on 1360 patients which found that a shorter resection time I B-[TURBT] than M- [TURBT] [25].

In our study, we observed mild hematuria more in monopolar than bipolar and blood transfusion to three cases in monopolar and to one case in bipolar but without statistically significant difference [p= 0.308], our results agree with Gupta et al, that recorded less postoperative hematuria in bipolar which was statistically non-significant, and not clinically significant as there was no need for coagulation or blood transfusion in either group [26], and Fagerstrom *et al.* detected when compared to the monopolar method, bipolar resection has a more efficient property of cutting while concurrently managing bleeding [27]. Also, **Venkatramani *et al.*** did not find blood loss to be significantly different between monopolar and bipolar groups [14].

In our study, there was a mild drop in hemoglobin and hematocrit level in M-polar than B-polar without significant difference between the two groups; these data agree with **Geavlete *et al.*** which reported a lower hemoglobin decline in B-TURBT, but the need for blood transfusion was not statistically different between the two groups [28], and **Venkatramani *et al.*** who reported no significant difference between M-TURBT and B-TURBT for the drop in Hb level and hematocrit value [14]. In contrast, Yang *et al.* reported a significant drop in Hb level with M-TURBT vs. B-TURBT, [p=0.038], which was not reflected in the transfusion rate [29]. Also, Hashad *et al.* reported the postoperative drop in Hb concentration in the B-TURBT group was substantially smaller [mean 0.55 [g/dL] compared to the M -TURBT group [mean 1.24 g/dL; P < 0.001]. There was also a significant difference [in favor of B-TURBT] in the mean postoperative hematocrit decline between the groups [30]. Also, Mao et al, showed that M-[TURBT] had a greater decrease in postoperative Hg level than G-[TURBT] [P=0.02] [31].

There is universal agreement that the use of bipolar resection reduced the catheterization time and hospital stay due to better control of intraoperative bleeding [20]. In our study, the catheterization and hospitalization time were significantly lower in the B-TURBT group vs. the M-TURBT group [p = 0.003 & 0.008] respectively. These data agree with Hashad *et al.* that recorded a statistical difference in the mean post-operative catheterization and hospital stay in favor of B-TURBT [30], and **Del Rosso *et al.*** also reported a significant reduction in the catheterization and hospital time with B-TURBT, vs. the monopolar [8]. Conversely, **Ozer *et al.*** recorded that the mean catheterization and hospital stay was reduced in the monopolar vs. in the bipolar, but this was not statistically significant [24]. Also, **Liem *et al.*** discovered no statistically significant difference between the two groups as regarded hospitalization and catheterization time [19].

In our study, there was no difference between the two groups regarding the rate of recurrence of bladder tumors over the 1-year follow-up. Our results agree with Xie *et al.* that observed no difference between the M-TURBT and B- TURBT groups [32]. Also, in other study by Del Rosso *et al.*, there was no different in the recurrence-free survival rate when comparing the two procedures [8].

The main strength of the present study is the prospective nature and long-term follow up of the patients. In addition, the variation of bladder cancer presentation makes a valuable comparison between various subcategories.

Conclusion: B polar-TURBT is considered the most safe and effective alternative technique than M polar-TURBT for the treatment of primary NMIBT.

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