

Bladder injury secondary to obturator reflex is more common with plasmakinetic transurethral resection than monopolar transurethral resection of bladder cancer

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Introduction Transurethral resection (TUR) is the most common surgical technique for the diagnosis and initial treatment of bladder cancer. In this study, we evaluated two surgical techniques in terms of bladder injury due to obturator reflex in patients that underwent TUR for non-muscle invasive bladder cancer (NMIBC).

Material and methods 93 patients who underwent TUR for bladder cancer were analyzed. Fifty patients underwent monopolar resection and 43 patients underwent plasmakinetic resection. Standard TUR were performed with conventional Storz monopolar resection using a U-shaped cutting loop, 120V cutting/80V coagulation settings, 5% mannitol fluid was used for irrigation. For bipolar resection, an Olympus ESG-400 plasmakinetic loop bipolar device using a U-shaped cutting loop, 160V cutting/80V coagulation settings and normal saline for irrigation was used.

Results In the monopolar resection group; obturator reflex was seen in 4 (8%) patients. Bladder perforation caused by the obturator reflex was seen in 4 (8%) patients, but hemorrhage and other major complications were not seen in this group. In the bipolar resection group; obturator reflex was seen in 15 (34%) patients. Bladder perforation caused by the obturator reflex was seen in 10 (23%) patients.

Conclusions Bipolar transurethral resection of bladder tumor was not superior to monopolar resection with respect to obturator reflex and bladder perforation. We conclude that we do not yet have enough experience concerning the long-term complications and major complications associated with bipolar resection of bladder cancer.

Key Words: bladder injury ↔ obturator reflex ↔ plasmakinetic ↔ transurethral resection ↔ monopolar

INTRODUCTION

Bladder cancer is the most common urinary tract malignancy and 75-80% of cases are non-muscle invasive (NMIBC) at time of diagnosis [1]. Transurethral resection (TUR) is the most common surgical technique for the diagnosis and initial treatment of bladder cancer. The aim of TUR is removing all visible lesions in the bladder, including part of the underlying muscle tissue. Recently published papers suggested that the newer bipolar TUR technology has similar surgical outcomes, but less complications comparing with monopolar TUR.

Nowadays, two kinds of resectoscopes, monopolar and bipolar, are available for use [2]. The most common disadvantage of monopolar resection is transurethral resection syndrome, caused by the absorption of hypotonic irrigation fluid and the resultant electrolyte imbalance [3]. However, this syndrome is not seen in the plasma kinetic resection because this procedure requires normal saline [4]. Therefore mortality and morbidity are lower in plasma kinetic resection than in monopolar resection [5, 6]. Other potential risks for both resections are bladder injury due to obturator reflex, hemorrhage, urethral stenosis, long catheter-

ization time, long hospital stay and thermal hazard of the pathologic specimens.

The obturator nerve passes in close proximity to the inferolateral bladder wall, bladder neck and lateral prostatic urethra. The obturator reflex can occur when the obturator nerve is directly stimulated by the electrical current transmitted by the resectoscope, especially when the tumor is localized at the lateral wall of the bladder, where the obturator nerve runs in close proximity during its intrapelvic course [7].

However, no high level of evidence exists and the exact role of bipolar transurethral resection of bladder tumor (TURBT) remains undefined. In this study we evaluated two surgical techniques in terms of bladder injury due to obturator reflex in patients with non-muscle invasive bladder cancer (NMIBC) who underwent treatment with TUR.

MATERIAL AND METHODS

Between March 2014 and September 2014, 93 patients who underwent TUR for bladder cancer in the Katip Çelebi University Atatürk research and training hospital were analyzed. Fifty patients underwent monopolar resection and 43 patients underwent plasma kinetic resection. All patients had primary bladder tumor localized to the lateral wall. Patients with prior history of TUR and tumors localized on the other walls of the bladder were excluded from the study. Resection type was chosen by the surgeon and all operations were performed by a specialist surgeon. For each resection type, age, sex, tumor size, localization, stage, grade, presence of obturator reflex, perforation and hemorrhage, complete or incomplete resection status, hospitalization time and catheterization time were recorded. Due to the lack of data, resection times were not recorded or analyzed.

All patients received spinal anesthesia for each type of resection. All tests was performed to predict obturator reflex for each patient. Obturator nerve blockade was not performed for any patients before the operation. At the end of the operation, standard 22 Fr three-way catheterization and saline irrigation were performed. Saline irrigation was finished after the operation when efflux was clear and the catheter was removed when the urine was clear.

Patients underwent TUR with standard conventional Storz monopolar resection using a U-shaped cutting loop and an Olympus ESG-400 plasma kinetic loop bipolar device with using U-shape cutting loop. Standard monopolar resections were performed using standard 120V cutting/80V (max 300V cutting/200V cautery) coagulation settings and for irrigation, 5% mannitol fluid was used. Plasma kinetic bipolar resections were performed with 160V

cutting/80V (max 320V cutting/200V cautery) coagulation settings and for irrigation, normal saline was used. In both groups, 26 French sheath with continuous flow was used.

The Chi-squared test was used to evaluate the results between each group. Statistical analyses were done with SPSS for Windows version 22 (SPSS, Chicago, IL, USA), and $p < 0.05$ was considered statistically significant.

RESULTS

The mean age of all patients was 63.95 ± 11.95 (range: 30-92 y) years. In the monopolar resection group, mean age was 63.48 ± 12.03 years and in the bipolar resection group, 64.51 ± 11.97 years. Seventy-eight (83.9%) of all patients were male and 15 (16.1%) were female. For all patients, mean tumor size was 3.47 ± 1.82 cm. Fifty-five (59.1%) were Ta stage, 34 (36.6%) patients were T1 stage and 4 (4.3%) patients were T2 stage. Thirty-two (34.4%) patients were G1, 35 (37.6%) were G2, and 26 (28%) were G3 (Table 1). Mean catheterization time was 4.47 ± 1.7 days and mean hospitalization time was 1.8 ± 1.2 days. Seven of the cases underwent incomplete resection because of presence of the obturator reflex. Eighty-six of the cases underwent complete resection. 79 (84.9%) patients had no bladder wall perforation during the operation, and 14 (15.1%) patients had bladder wall perforation during the operation because of the obturator reflex.

In the monopolar resection group; 44 patients were male and 6 patients were female. Mean tumor size was 3.68 ± 1.77 cm. Thirty-two patients (64%) were Ta stage and 18 (36%) patients were T1 stage.

Table 1. Patients' characteristics

	bTUR	mTUR	p value
No. of patients	43	50	
Mean age	63.48	64.51	0.17
Sex			0.24
No. male	34 (80%)	44 (88%)	
No. female	9 (20%)	6 (12%)	
Tumor stage			0.07
TA	23 (53%)	32 (64%)	
T1	16 (37%)	18 (36%)	
T2	4 (10%)	0	
Tumor grade			0.001
G1	15 (35%)	17 (34%)	
G2	9 (20%)	26 (52%)	
G3	19 (45%)	7 (14%)	

Table 2. Intra- and postoperative parameters

	bTUR	mTUR	p value
Obturator reflex			0.001
yes	15 (35%)	4 (8%)	
no	28 (65%)	46 (92%)	
Perforation			0.04
yes	10 (23%)	4 (8%)	
no	33 (77%)	46 (92%)	
Hemorrhage			0.27
yes	1 (0.02%)	0	
no	42 (99.9%)	50 (100%)	
Major complication			
yes	1 (0.02%)	0	
no	42 (99.9%)	50 (100%)	
Catheterization time	4.62	4.34	0.17
Hospitalization time	2.09	1.58	0.001
Resection			0.16
complete	38 (88%)	48 (96%)	
incomplete	5 (12%)	2 (4%)	

In terms of grade; 17 (34%) patients were G1. 26 (52%) patients were G2 and 7 (14%) patients were G3. The obturator reflex was seen in 4 (8%) patients. Bladder perforation caused by the obturator reflex was seen in 4 (8%) patients. but hemorrhage and other major complications were not seen in this group. Mean catheterization time was 4.34 ± 1.62 days and mean hospitalization time was 1.58 ± 1.03 days. Two (4%) patients had an incomplete resection because of the obturator reflex and 48 (96%) patients were treated with complete resection (Table 2).

In the bipolar resection group 34 patients were male and 9 patients were female. Mean tumor size was 3.23 ± 1.87 cm. Twenty-three (53%) patients were Ta stage. 16 (37%) patients were T1 stage and 4 (0.9%) patients were T2 stage. Fifteen (34%) patients were G1. 9 (20%) patients were G2 and 19 (44%) patients were G3. The obturator reflex was seen in 15 (34%) patients. Bladder perforation caused by the obturator reflex was seen in 10 (23%) patients and in one of them. the major complication of external iliac vein injury and hemorrhage occurred. Mean catheterization time was 4.62 ± 1.79 days and mean hospitalization time was 2.09 ± 1.17 days. Five (11.6%) patients had an incomplete resection because of the obturator reflex and 38 (88.4%) patients were treated with complete resection (Table 2).

There were statistically significant differences between the two groups in terms of obturator reflex

and bladder wall perforation, however, there was no statistical significance between other parameters such as hemorrhage, catheterization time, hospitalization time, and complete or incomplete resection. The full data is shown in Tables 1 and 2.

DISCUSSION

TUR is the gold standard for the diagnosis and treatment of NMIBC. For these purposes, monopolar and bipolar resection can be applied. The aim of the initial resection is to remove all visible tumors along with an underlying muscle layer of the bladder. In the monopolar resection, prolonged operation time can increase the risk of TUR syndrome because of the mannitol irrigation, but in the bipolar resection this risk is lower due to the use of saline solution for irrigation. Electrolyte imbalance in bipolar resection is lower than in monopolar resection [8]. In tumors located on the lateral side of the bladder, the obturator reflex can be seen during the resection. Thus, unexpected complications may occur during the operation due to this jerk. To date, many studies comparing monopolar resection and bipolar resection exist in the literature. Most of the studies suggested that resection with bipolar energy is superior to monopolar resection for transurethral resection of prostate. However, there is a limited number of studies about transurethral resection for NMIBC. Some studies supported the idea that bipolar resection is superior to monopolar resection, and some reported no differences between the two resection types.

Del Rosso et al. reported the analysis of 127 patients who underwent transurethral resection for NMIBC. Sixty-seven of them underwent bipolar plasma kinetic energy transurethral resection and 65 of them, conventional monopolar transurethral resection. In this study no significant differences in the mean change of hemoglobin and serum sodium levels were observed. Mean catheterization time was 1.3 days and 2.3 days for bipolar plasmakinetic energy transurethral resection of the bladder and monopolar transurethral resection of the bladder, respectively. The mean hospital stay was shorter in the bipolar plasmakinetic energy transurethral resection of the bladder. Bladder perforation was reported in two cases for the monopolar transurethral resection of the bladder group and obturator nerve reflex occurred in a single case for both procedures. No significant differences in the overall recurrence-free survival rate were observed when comparing the two procedures [8]. In our study, the obturator reflex and bladder perforation was higher in bipolar group, however, there was no statistical significance be-

tween other parameters such as hemorrhage, catheterization time, and hospitalization time.

Pu XY et al. reported the analysis of 121 cases that underwent bipolar transurethral resection for NMIBC. In their study, the mean operative time was (25 ± 16) minutes and the mean postoperative hospitalization period was 3 days. Three (2.5%) patients had hematuria requiring blood transfusion and 2 (1.7%) patients had bladder perforation. Adductor contraction was noted in 6 patients (4.9%), and urethral strictures occurred in 5 patients (4.1%). As a result of these findings, they concluded that transurethral resection of bladder tumors with bipolar plasmakinetic energy is safe and effective in the treatment of superficial bladder tumors [9]. Xishuang et al. reported the result of 173 patients with primary non-muscle invasive bladder cancer who underwent endoscopic surgery. Among them, 51 patients underwent conventional monopolar-TURBT, 58 patients underwent plasmakinetic-TURBT, and 64 patients underwent Holmium laser-TURBT. There was no significant difference in operative duration among the three groups. Compared with the CM-TURBT group, both PK-TURBT and HoL-TURBT groups had less intraoperative and postoperative complications, including obturator nerve reflex, bladder perforation, as well as bleeding and postoperative bladder irritation. According to this data, both PK-TURBT and HoL-TURBT might prove to be preferable alternatives to CM-TURBT for management of non-muscle invasive bladder cancer [10].

Sugihara et al. analyzed 8188 patients in their study. This is the most important study comparing monopolar transurethral bladder tumor resection and bipolar resection because of the high number of patients. This work was associated with a significantly lower incidence of severe bladder injury (0.3% vs. 0.6%, OR 0.57), other complications (4.6% vs. 5.8%, OR 0.78), slightly shorter postoperative stay (mean 6.4 vs. 6.7 days, difference - 3.3%) and slightly lower total costs (mean \$4,628 vs. \$4,727; difference -1.1%, all $p < 0.05$) in resection with bipolar resection than monopolar resection. There were no differences in postoperative hemostasis procedures, transfusion and operation time [11].

In the study of Venkatramani et al., 147 patients were randomized, including 75 in the monopolar arm and 72 in the bipolar arm. The incidence of obturator jerk was greater in the bipolar arm (60% vs. 49.2%, $p = 0.27$). There was no significant difference between secondary outcomes. The only significant difference was a lower incidence of severe cautery arti-

fact in the bipolar arm (25% vs. 46.7%, $p = 0.0096$). This study shows that bipolar transurethral resection of bladder tumor was not superior to monopolar resection with respect to obturator jerk, bladder perforation, and hemostasis [12].

In our study, we consider that there are no differences between tumor size, hemorrhage, major complication, complete or incomplete resection, catheterization time and hospitalization time. However, the results in terms of obturator reflex and bladder perforation due to this jerk are statistically significant. In one case, we had to convert to open surgery due to external iliac vein injury because of the obturator jerk. Bladder tumors localized in the lateral wall must be resected carefully with plasmakinetic energy and combined obturator nerve block with spinal anesthesia must be performed before the start of resection to prevent unexpected complications. The obturator nerve impulse can be more easily elicited with bipolar resection and plasmakinetic energy, and can be seen easier than in monopolar resection. We suspect that the resection loop is getting warmer than in monopolar energy, so the risk of occurrence of major complications is higher in the bipolar resection with plasmakinetic energy than in monopolar resection when the obturator reflex is seen.

Our study limitations are that we did not analyze the serum electrolyte levels, pathological outcomes and long-term oncological outcomes. We would like to call particular attention to the risk of obturator reflex with bipolar resection that can cause life-threatening major complications such as external iliac vein injury.

CONCLUSIONS

Bipolar transurethral resection of bladder tumor was not superior to monopolar resection with respect to obturator reflex and bladder perforation. We consider that spinal anesthesia combined with obturator nerve block is necessary when the tumor is localized to lateral wall of the bladder, to prevent the obturator jerk. In this way, a major complication risk due to this reflex can be decreased. Finally, we conclude that bipolar resection of the prostate can be safe and more efficient than monopolar resection, but we do not yet have enough experience with the long-term complications and major complications associated with this procedure. Further, large, population based studies are needed to obtain this knowledge.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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