Obturator Nerve Block Performed Blinded Versus by Ultrasound-guidence for Transurethral Resection of Bladder Tumors: A Randomized Controlled Trial

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Purpose: The primary outcome of this study is to compare the success rates of ONB techniques performed either with ultrasound guidance or with the blind technique. The second outcome is to compare the incidences of perioperative bleeding and the presence of recurrent tumors in the control cystoscopy performed in the 3rd postoperative month in both groups.

Materials and Methods: The study was conducted in the urology operating room of Mugla Sitki Kocman Training and Research Hospital between December 2019 and March 2023. A total of 122 patients were included in the study: 22 females with a mean age of 56.63 ± 12.99 years and 100 males with a mean age of 63.18 ± 8.00 years. In one group (group 1), ONB was performed under ultrasound guidance by the same anesthesiologist, and in another group (group 2), ONB was performed blindly based on anatomical signs by the same urologist.

Results: Adductor muscle contraction was not observed in 53 patients (91.4%) in group 1 and in 49 patients (76.6%) in group 2 (p = 0.027).

Conclusion: The success rate of ONB was higher when using an ultrasound-guided technique than when using a blind technique.

Keywords: adductor spasm; bladder tumor; obturator nerve block; ultrasound-guided obturator nerve block

INTRODUCTION

Patients with bladder malignancy are usually elderly and have various comorbidities. Therefore, spinal anesthesia is preferred in bladder tumor operations. Due to electrical stimuli applied during the resection of tumors localized to the lateral bladder wall, the tumor may not be completely resected due to contractions in the adductor muscles and related complications such as bleeding, bladder wall perforation, and pelvic organ injuries.[1–3] There are some reports that when obturator nerve block (ONB) is applied before transurethral resection of the bladder (TUR-BT), a safer surgical field is provided, and tumor recurrence is reduced because the tumor can be completely resected.[4,5]

The obturator nerve originates from the ventral branches of the lumbar plexus at lumbar levels 2–4. It penetrates the iliopsoas muscle and enters the pelvis distally from the medial edge of the psoas major muscle. Passing through the obturator foramen, it divides into an anterior branch between the adductor longus and brevis muscles on the inner surface of the thigh and a posterior branch between the adductor brevis and magnus muscles. There are also different variants of the obturator nerve. In 75% of patients, it divides into two terminal branches in the obturator canal. In 10% of patients, it branches before reaching the obturator canal and 15% after entering the thigh. More rarely, the anterior and posterior branches run behind the adductor brevis muscle. In 20%, the L2–4 anterior branches of the accessory obturator nerve separate directly from the obturator nerve trunk.[6] An ONB can be performed with different approaches depending on the obturator nerve's variable anatomical structure. Previous studies have compared blind techniques with nerve stimulator techniques or ultrasound-guided techniques concerning efficacy, and others have compared different anatomical landmark approaches for successful ONB.[7–10] Few studies have focused on unsuccessful blocks and ONB-related complications.[11]

The current study compared the success rates of ONB techniques performed with different approaches: In the first group, ONB was performed with ultrasound guidance, and in the second group, ONB was performed with the blind technique in patients who underwent unilateral bladder tumor resection surgery.

MATERIALS AND METHODS

Study population

Study participants were patients who would undergo transurethral resection due to lateral bladder tumor from December 2019 to March 2023. Patients aged 18–70 years, with American Society of Anesthesiology (ASA) physical status I or II, patients with unilateral bladder tumor and tumors located in the lateral bladder who were scheduled for elective TUR-BT surgery were included in the study. Patients with tumors disrupting

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Table 1. Demographic variables of the groups.

	Univariate		Multivariate	
Gender	**Group 1**	**Group 2**	**95% CI**	**OR**
Female/Male	9/49 (15.5%/84.5%)	3/51 (20.3%/79.7%)	0.867	0.918(0.340-2.481)
Age (years)	62.50± 7.39	61.55 ± 10.91	0.431	1.019(0.973-1.066)
BMI (kg.m-^{2})	25.05±2.80	25.46 ± 2.99	0.204	0.891(0.746-1.065)

OR: Odds ratio, CI: Confidence interval

the integrity of the bladder, bladder floor tumors, bilateral or diffuse tumors, coagulation disorder, known motor or sensory deficiencies in the lower extremities, uncooperative patients, patients with a muscle-invasive bladder tumor or more advanced-stage tumor, patients who were not diagnosed with primary bladder tumor, who had previously undergone TUR-BT and were diagnosed with bladder cancer, patients with known allergies to local anesthetics, and or localized infection at the procedure site were excluded, as were uncooperative patients. The patients' enrollment algorithm has been illustrated in **Figure 1**. The ONB blocks were performed per protocol.

Study design

This prospective, single-blind, randomized, controlled study was conducted in the urology operating room of Mugla Sitki Kocman Training and Research Hospital between December 2019 and March 2023 after receiving University Ethics Committee approval in accordance with the principles outlined in the Declaration of Helsinki. The study was registered with the United States Clinical Trials Registry (trial ID: NCT04638569).

Block procedure

Group 1: The block procedure was performed under USG guidance. During the preoperative anesthesia visit, consent for anesthesia, ONB block, and surgery were obtained. After the patients were taken to the operating room, standard monitoring was initiated (electrocardiography, blood pressure, peripheral oxygen saturation), and peripheral intravenous access was provided on the dorsum of the hand. Patients were placed in a sitting position for spinal anesthesia. Spinal anesthesia was

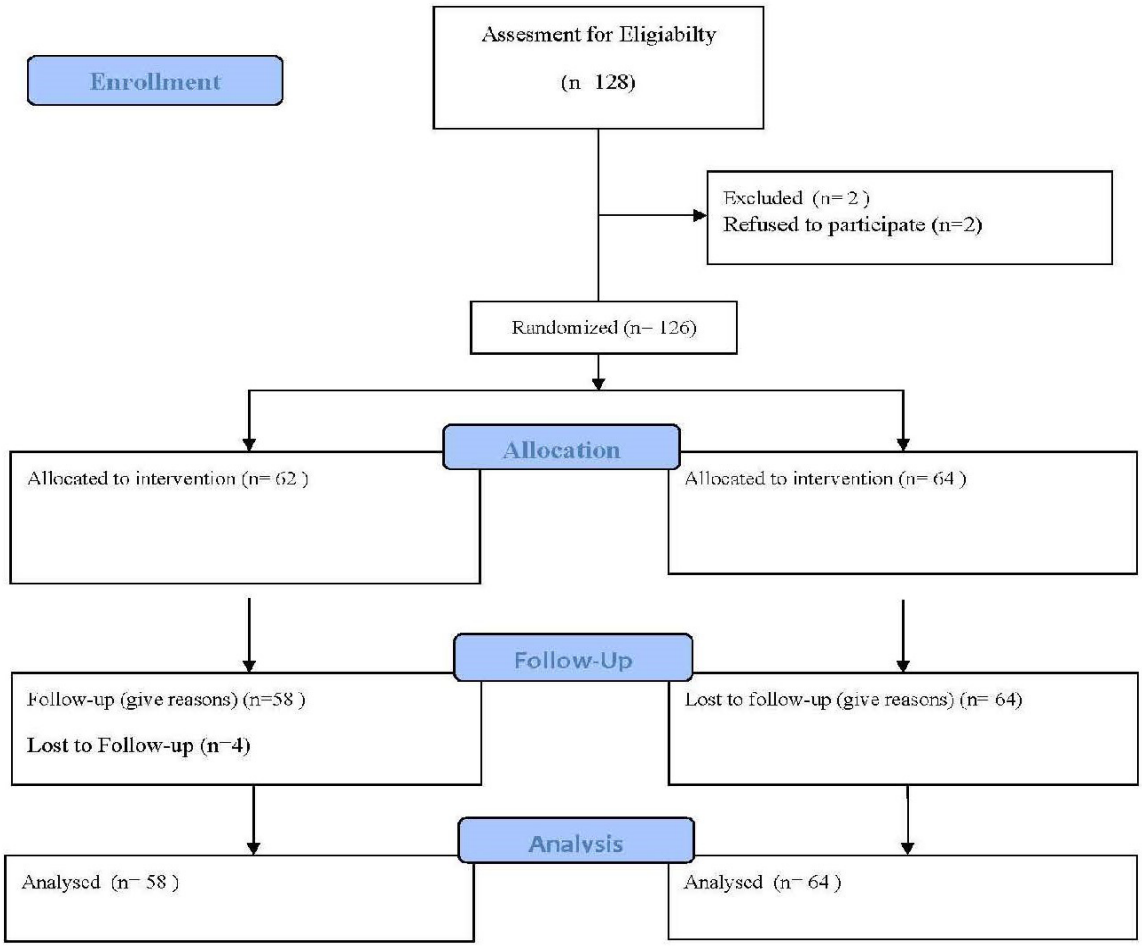

Figure 1. Consort diagram

Table 2. Comparison of blocking time and operation time.

	Group 1	Group 2	*P*
Block Time (min)	2.28 ± 0.99	1.38 ± 0.88	< 0,.001*
Operation Time (min)	43.36 ± 5.87	43.9 ± 6.32	0.872**

*: *p* value is obtained with
**: *p* value is obtained with Mann Whitney test

performed with 13 mg bupivacaine and 20 µg fentanyl. After spinal anesthesia was completed, the patients were randomly divided into two groups using a random number table created by a professional statistician who did not participate in the study.

In group 1 ONB was performed with ultrasound-guidance. The leg on the patient's tumor side was extended and turned slightly outward, and the block site was sterilized with a 2% chlorhexidine solution. The ultrasound probe was placed in the middle of the tuberculum pubis and the middle of the femoral artery, 5–6 cm below the inguinal ligament, and injections of 5 mL of 0.5% bupivacaine were administered into the anterior and posterior branches of the obturator nerve with a block needle. All ultrasound-guided ONBs were performed by the same anesthesiologist (EY) in group 1.

Group 2: The block procedure was performed using the blind technique based on anatomical landmarks. After spinal anesthesia, the patient was placed in the lithotomy position. The needle was inserted 1.5 cm lateral and 1.5 cm caudal to the tuberculum pubis. Then, 10 mL of 0.5% bupivacaine was injected, and the main branch of the obturator nerve was blocked.

All blind block procedures were performed by the same urologist (IA) in group 2. All patients were placed in the lithotomy position 1 minute after completion of the block, and the operation was only conducted after the sensory block at the level of T10 was achieved. Intraoperative adductor muscle spasm was defined as an "unsuccessful block." All TUR-BT procedures were performed using the Plasma Kinetic System (Gyrus ACMI, MN, USA) with bipolar energy, a 26 french (fr) outer diameter resectoscope, and a 30 and/or 70-degree optic. Demographic data such as age, gender, and ASA classification scores, and time needed for the block procedure, operation time, presence of intraoperative adductor muscle contraction, and intraoperative complications were recorded. Block application sites were re-examined 24 hours after the operation, and postoperative complications such as hematoma, paresthesia, vascular injury, and motor neuronal disorder were followed up by a urologist blind to the study groups and recorded if present. All the procedures were performed with a bi-polar resection system (Plasmakinetic system; Gyrus). En-bloc resection was performed in suitable cases, and other tumors were resected in fractions (the exophytic part of the tumor, the underlying bladder wall, and the edges of the resection area). The presence of detrusor muscle in the specimen is required in all cases except for TaG1/low-grade tumor, as recommended by the European Urology Guidelines. The surgeon evaluated the completeness of the tumor resection. Cases in which it was decided that the resection was not complete based on pathology results were excluded from the study. All patients were screened for tumor recurrence via control cystoscopy at the postoperative third month.

Table 3. Frequencies of muscle contraction among groups and multivariable logistic regression analysis for muscle contraction among groups.

	Univariate		Multivariate		
	Muscle contraction Absent	Muscle contraction Present	*p*	95% CI	OR
Group 1	53 (91.4%)	5 (8.6%)	0.027	3.245(1.097-9.594)	0.333
Group 2	49 (76.6%)	15 (23.4%)	0.025		

p value is obtained with chi-square test
OR: Odds ratio, CI: Confidence interval

Outcome assessment

The primary outcome was the ONB success rate, which was evaluated by the absence of adductor muscle contraction. The secondary outcome was tumor recurrence, which was assessed via control cystoscopy in the third postoperative month. Perioperative complications related to the block approaches were also evaluated.

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Sample size calculation

The sample size of the study was calculated using the G*power 3.1.9 program based on a pilot study with 10 patients in each group. Adductor muscle spasm was present in 10% of patients in group 1 and 30% in group 2 in the pilot study. It was determined that there should be at least 58 patients in each group with an effect size (w) = 0.259, power = 80%, and alpha = 0.05. Considering possible dropouts, we decided to include at least 62 patients per group. Patients used for power analysis were not included in the study.

The presence of Normal Dispersion in numerical variables was evaluated with kurtosis and skewness values, the Shapiro Wilk Test, and the Q-Q graph. For normally distributed variables, means and standard deviations were calculated and analyzed using independent t-tests. Proposed relationships between categorical variables were assessed with the Chi-square test and Fisher's Exact Test, and numbers of observations and corresponding percentages were recorded. Analyses were performed using SPSS version 28 (SPSS Inc. Chicago, IL, USA). $p < 0.05$ was considered statistically significant.

Table 4. Tumor recurrence rates among groups.

	Group1	Group2	*P*
Tumor recurrence			
Absent	47 (81%)	38 (59.4%)	0.009
Present	11 (19%)	26 (40.6%)	

p value is obtained with chi-square test

Table 5. Intraoperative and postoperative complications among groups.

	Group 1	Group 2	*P*
İntraoperative Comp			0.618
Absent	57 (98.3%)	62 (96.9%)	
Present	1 (1.7%)	2 (3.1%)	
Postoperative Comp			
Absent	57 (98.3%)	61 (95.3%)	
Present	1 (1.7%)	3 (4.7%)	

p value is obtained with chi-square test

RESULTS

A total of 138 patients were screened for inclusion in the study. Eleven refused to participate, and data from five were lost during follow-up. Ultimately, 58 patients in group 1 and 64 in group 2 were analyzed.

Demographic factors, including gender, age, body mass index, and total operation time, were similar in the two groups ($p > 0.05$) (**Table 1**). The mean times needed for the block procedure were 2.28 min in group 1 (ultrasound group) and 1.38 min in group 2 (blind group) ($p < 0.001$) (**Table 2**).

Table 3 shows the frequencies of adductor muscle contraction in the two groups. In group 1, no muscle contraction was observed in 53 patients, but contraction was present in 5 (8.6%). In group 2, no muscle contraction was observed in 49 patients, but contraction was present in 15 (23.4%). The difference was statistically significant ($p = 0.027$).

Table 4 shows relationships between the group and tumor recurrence determined via control cystoscopy in the third postoperative month. In group 1, there was no tumor recurrence in 47 patients, but recurrence was observed in 11 patients (19.0%). In group 2, there was no tumor recurrence in 38 patients, but recurrence was observed in 26 patients (40.6%). The difference was statistically significant ($p = 0.009$).

Bleeding was detected in 3 patients in the intraoperative period: 1 patient in group 1 and 2 patients in group 2. Postoperatively, hypotension was observed in 1 patient in group 2, bleeding was observed in 1 patient in group 1, and urinary retention was observed in 1 patient in group 2. Bleeding complications were resolved with simple surgical intervention. Hypotension responded well to fluid replacement. Relationships between the group and both intraoperative and postoperative complications were not significant (**Table 5**).

DISCUSSION

The present study investigated the efficacy of ONB performed with either ultrasound guidance or using anatomical landmarks with respect to block success and tumor recurrence by the third postoperative month. Block success, which was evaluated by the presence of adductor muscle contraction, was significantly higher in the ultrasound group than in the blind group. The tumor recurrence rate was significantly lower in the ultrasound group than in the blind group. Intraoperative and postoperative complications were similar in both groups. Our standard anesthesia method for lateral bladder wall tumors is spinal anesthesia followed by obturator block. We use a bipolar resection system to prevent obturator reflex in all patients. Excessive expansion of the bladder is avoided during resection in all patients.

The obturator nerve can be blocked from any location along its anatomical course using different techniques. A nerve block can be performed via a nerve stimulator or an ultrasound, or it can be performed blindly by using anatomical landmarks. The level at which the obturator nerve is blocked, and the method used affect the success and complication rates associated with the block. Previous overall ONB success rates of 60%–88% have been reported with different approaches.[12,13] In the current study, the block success rate was 76.6% with the blind technique, which is acceptable based on previous studies. Notably, however, the success rate was 91.4% with ultrasound guidance.[14]

A recent meta-analysis compared various ONB approaches to prevent obturator nerve reflex and related complications. ONB performed with a nerve stimulator was superior to ultrasound guidance or a blind technique with respect to preventing muscle contractions.[15] Despite this result, ultrasound guidance has become very popular in regional anesthesia practice in the last decade, as it facilitates practical, time-saving procedures compared with using a nerve stimulator. In the present study, the duration of ONB was only 1.38 min in the blind group and it was 2.28 min in the ultrasound group. The short duration and ease of the blind technique may seem favorable to surgeons, but the difference between 1.38 min and 2.28 min is clinically insignificant. In addition, ultrasound guidance provides a real-time view of the relevant anatomical structures, increasing the block procedure's safety.

In a meta-analysis conducted by Deng et al.,[11] performing spinal anesthesia combined with ONB in TUR-BT patients reportedly reduced the incidence of bladder perforation. Tatlısen et al.[16] reported a rate of bladder perforation of 3.2% in patients who underwent ONB performed via a blind technique. Akata et al.[17] reported a life-treating arterial injury and bladder perforation in a patient who underwent ONB performed by a nerve stimulator. No instances of bladder perforation were evident in the current study. Perioperative bleeding was only observed in 1 patient in the ultrasound group and three patients in the blind group. Our findings are consistent with a recent meta-analysis by Wu et al.,[15] who reported that an ultrasound-guided technique was the optimum approach to preventing bladder perforation.

Tekgül et al.[18] evaluated the effects of ONB on the short-term recurrence rate of bladder tumors on the lateral wall. They reported that although recurrence rates were similar in ONB and non-block groups, the time to recurrence was prolonged in the ONB group. Similarly, the meta-analysis as mentioned earlier by Deng et al.[11] indicated that ONB reduced the rate of tumor recurrence. In the present study, the tumor recurrence rates were 19.0% in the ultrasound group and 40.6% in the blind group. We believe that the most probable reason for this result is the success rate of ONB via ultrasound guidance. It is known that residual tumor tissue after TUR-BT operations increases the rate of tumor recurrence. A successful ONB facilitates an obturator nerve reflex-free TUR-BT operation and will likely lead to better tumor excision.

The most important limitation of the study was the short follow-up period. A longer follow-up period may yield more reliable information on the effects of ONB on tumor recurrence rates. The use of a nerve stimulator is a popular choice for ONB. The lack of a group in which ONB was performed via a nerve stimulator could be viewed as a study limitation. In the current study, however, we aimed to compare the success rates of the methods that are presumably the most popular approaches used by anesthesiologists and surgeons. Therefore, a nerve stimulator technique was not our focus of interest.

CONCLUSIONS

The success rate of ONB was higher when using an ultrasound-guided technique than when using a blind technique. Although the complication rates were sim-

ilar in the two groups, the tumor recurrence rate was significantly lower in the ultrasound group than in the blind group.

CONFLICT OF INTEREST

All authors have completed the ICMJE uniform disclosure form. The authors declare that they have no conflict of interest.

AVAILABILITY OF DATA AND MATERIALS

All data included in this study are available upon request by contact with the corresponding author.

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