

**Comparison of Classic and Inguinal Obturator Nerve Blocks Applied for Preventing Adductor Muscle Contractions in Bladder Tumor Surgeries:  
A Prospective Randomized Trial**

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**Purpose:** Obturator nerve block (ONB) has been performed in surgeries of transurethral resection of bladder tumors (TUR-BT) for the prevention of the development of obturator muscle contraction. Currently, classic and inguinal approaches are frequently being used. In the present study, we aimed to compare the success rate, performance speed, and complication risks of both approaches.

**Materials and Methods:** Sixty-six patients who underwent TUR-BT under spinal anesthesia were randomly selected, and ONB was performed on the tumor location side using classic (n = 33) or inguinal (n = 33) approaches. Ten milliliters of 0.25% bupivacaine were administered using a peripheral nerve stimulator in both approaches. Two endpoints were defined in the study: Primary endpoint; the duration of the determination of the obturator nerve and number of interventions when each participant is assessed in at the end of the ONB procedure. Secondary endpoint; development of contractions, and complications each participant is assessed during the TUR-BT and 24 hours after ONB. (Clinical Trial Registration Number: ACTRN12617001050347)

**Result:** General anesthesia was applied to the five patients in the classic ONB group who detected diffuse or bilateral tumors. These patients were excluded from the study. Contractions developed in 4 patients in each group, no statistically significant difference was detected between the groups (14.3%, n = 4 versus 12.1%, n = 4) ( $P = 1.00$ ). No complications were detected in both groups during the TUR-BT and 24 hours after ONB. We found that the inguinal approach provided a statistically significant advantage regarding the number of punctures ( $1.9 \pm 0.9$  versus  $1.5 \pm 0.7$ ) ( $P = .036$ ), and duration of the procedure ( $99.1 \pm 48.4$  seconds versus  $76.0 \pm 31.9$  seconds) ( $P = .029$ ) compared with the classic approach.

**Conclusion:** Although complications and success rates were similar in both groups, the inguinal method may be a better approach because it is faster and requires fewer punctures.

**Keywords:** Obturator nerve block; transurethral resection of bladder tumor; bladder tumor; adductor spasm; nerve stimulator

## INTRODUCTION

Transurethral resection of bladder tumors (TUR-BT) are frequently performed under spinal anesthesia, and contractions may develop in adductor muscles due to electrical stimuli applied during side wall localized tumor resection. As a consequence, bladder wall perforations and pelvic organ injuries may develop. General anesthesia or obturator nerve block (ONB) may be required so as to perform the required resection<sup>(1,2)</sup>. Some studies showed that a safer surgical area could be provided with ONB applied during TUR-BT, and tumor recurrence decreased because the required resection was performed<sup>(3)</sup>.

Different methods have been tested for preventing adductor muscle contractions during TUR-BT surgeries<sup>(4-6)</sup>. Some studies suggested that ONB could be performed through blind attempts using anatomic landmarks and that it was a safe procedure<sup>(7,8)</sup>. However,

some studies reported complications due to block during the proceedings<sup>(9)</sup>. Therefore, new approaches or nerve stimulator and ultrasonography have been used to provide a safer and effective block<sup>(10,11)</sup>. At present, classic and inguinal approaches are used for ONB<sup>(10)</sup>. The obturator nerve stems from the anterior division of the ventral rami of L2-L3-L4 nerves in the lumbar plexus, contains motor and sensory nerve fibers.

The nerve descends through the psoas major muscle. It runs close the inferolateral bladder, bladder neck, and prostatic urethra, along with the inner lateral wall of the pelvis. And then it enters the upper part of the obturator foramen and the thigh.

The obturator nerve divides into anterior and posterior branches in the pelvic cavity, the obturator canal, or the thigh. The branches of obturator nerve emerges from the obturator foramen and runs among the pectineus and obturator externus muscles. The anterior branch

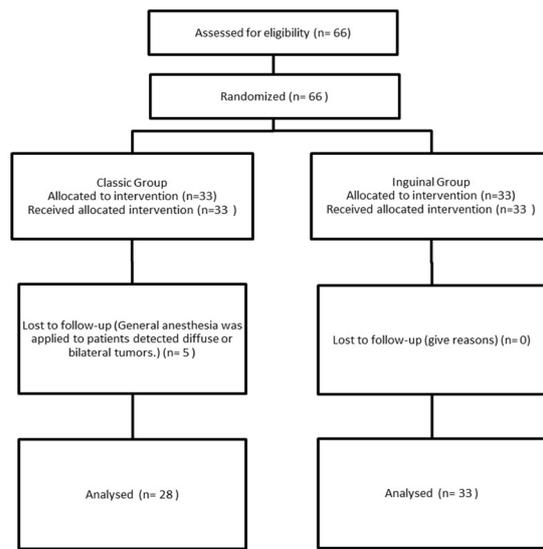
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**Figure 1.** CONSORT Flow Diagram of Study

runs between the pectineus and adductor brevis muscles, as the posterior branch runs between the adductor brevis and adductor magnus muscles<sup>(12,13)</sup>. The obturator nerve is blocked from the obturator foramen in the classic method, and between the Adductor Brevis and Adductor Magnus muscles in the inguinal method<sup>(10)</sup>. In literature, there are a numerous studies have been used with different methods, drugs, and devices for ONB. However, during the literature reviews, we have found that there are only a small number of studies on ONB application during TUR-BT with the current CONSORT guidelines. For this reason, we planned this parallel-group randomized clinical trial with current guidelines.

In the present study, we aimed to compare the success rate, performance speed, and complication risks of both classic and inguinal ONB performance.

## MATERIALS AND METHODS

### Study population

The patients who underwent TUR-BT due to bladder tumor in the Urology Clinic of Ahi Evran University Education and Training Hospital, and required ONB due to obturator muscle spasm were included in the study. The patients were informed about the study and written informed consents were obtained after the approval of the Clinical Research Ethics Committee of Turgut Ozal University Faculty of Medicine (Decision No: 99950669/104) was given. (Clinical Trial Registration Number: ACTRN12617001050347)

### Inclusion and exclusion criteria

Patients who were American Society of Anesthesiologists (ASA) risk grade I-III and aged between 18-80 years were included in the study. Patients who had undergone previous surgery in the study region and had anatomic disorders, neurologic problems such as paresthesia, muscle disease such as the motor neuron disorders and muscular atrophy, and coagulation disorders were excluded.

### Study design

This study was a prospective, double blind, parallel group, randomize clinical trial.

The patients who underwent cystoscopy under local anesthesia and had tumors on the side wall of the bladder were examined preoperatively. Sixty-six patients who matching inclusion criteria and allowed ONB to practice were included in the study within the research period allowed by the Ethics Committee(01.02. 2016-01.08.2017).

Patients were randomized for classic (n = 33) and inguinal (n = 33) ONBs by the principal investigator of the study (**Figure 1**). Simple randomization was done before study commencement by the Excel (Microsoft, Redmond, WA, USA) random number generation function. Sixty-six patients included in the study were enumerated as classical<sup>(1)</sup> and inguinal<sup>(2)</sup> and assigned to ONB 'groups and the procedures was carried out.

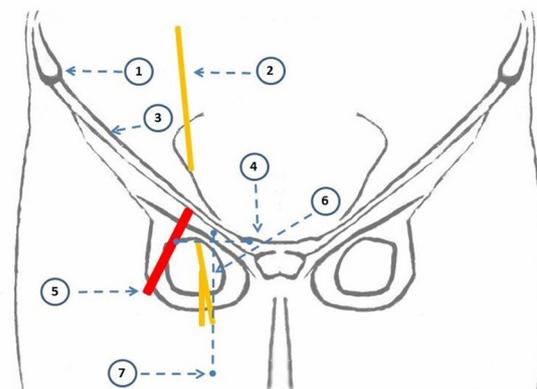
Two endpoints were defined in the study: Primary endpoint; the duration of the determination of the obturator nerve and number of interventions when each participant is assessed in at the end of the ONB procedure. Secondary endpoint; development of contractions, and complications each participant is assessed during the TUR-BT and 24 hours after ONB.

### Procedures

Age, sex, body mass index (BMI), and ASA scores were recorded. Before surgery, 500 mL intravenous 0.9% NaCl was administered to the patients. Heart rate, SpO<sub>2</sub>, blood pressure, and electrocardiography were monitored in the operating room. Spinal anesthesia was performed using 12.5 mg hyperbaric bupivacaine after insertion of a 25-gauge Quincke spinal needle from L3-4 or L4-5 in the sitting position. Patients were laid in the supine position. Development of sensory block was examined at the T10 level.

Required anatomic markings were made on the wall where the tumor was located by the approach to be applied (**Figure 2**):

In the classic method, the puncture point was marked 1.5 cm lateral of tuberculum pubis and 1.5 cm caudal. In the inguinal method, the tuberculum pubis, spina iliaca anterior superior, inguinal ligament, and femoral artery were marked. The puncture entry point was determined as the middle of the tuberculum pubis and



**Figure 2.** Obturator nerve block ((1) Spina iliaca anterior superior (2) Nervus obturatorius (3) Inguinal ligament (4) Tuberculum pubicus (5) Arteria femoralis (6) Classical approach ONB point (7) Inguinal approach ONB point)

**Table 1.** Comparison of the demographic characteristics between the groups

	Classic (n=28)	Inguinal (n=33)	P-value
Sex			
Male	25 (89.3%)	33 (100.0%)	.091*
Female	3 (10.7%)	0 (0.0%)	
Age (Year)	61.0 ± 14.0	58.6 ± 15.1	.519**
Weight(kg)	80.9 ± 13.8	81.3 ± 13.8	.907**
Height (cm)	173.1 ± 8.5	170.7 ± 4.4	.191**
BMI(kg/m <sup>2</sup> )	27.1 ± 5.0	28.0 ± 5.2	.494**
ASA			
I	6 (21.4%)	9 (27.3%)	.087***
II	16 (57.1%)	24 (72.7%)	
III	6 (21.4%)	0 (0.0%)	

\* Chi-Square Test, \*\* Independent Samples *t* Test, \*\*\* Mann-Whitney *U*

femoral artery, and 5-8 cm below the inguinal ligament. The required sterilization was applied on the surgical area. The patients were considered blind because of not seeing the surgical site during ONB administration and TUR-MT.

The peripheral nerve stimulator (Pajunk, Melsungen, Germany) was adjusted to 1.5 mA 1 Hz. Insertion was applied from the determined points using an isolated 22-gauge, 100-mm nerve stimulator needle (Pajunk, Melsungen, Germany). The needle was directed cephalad in the inguinal approach. In the classic method, the needle was perpendicularly inserted and slightly withdrawn after reaching the bone; the needle was manipulated 2-4 cm towards the medial. First, suction was performed, and then 10 mL 0.25% bupivacaine were administered when an adductor muscle contraction area was detected with the peripheral nerve stimulator between the range of 0.4-0.7 mA.

Withdrawal and remanipulation of the needle was counted as one puncture. The period between the first puncture insertion and local anesthesia injection was recorded as the practice period.

The duration of the determination of the obturator nerve of classic or inguinal ONB approaches were compared by stopwatch timing of procedure by the research assistant.

ONB was administered by the same anesthesiologists while the urologist was not in the operating room. Adductor muscle contractions and complications such as bladder perforation that occurred during the resection were recorded by a urologist who was blinded to the ONB technique. Transurethral resection of bladder tumor (TUR-BT) was performed using a 26-French bipolar resectoscope, and a 30-degree optic. We used 0.9% NaCl for irrigation. Surgery was initiated 10 minutes after the ONB. All ONB and TUR-BT procedures were performed by the same anesthesiologists and urologists. No other additional technique was performed for the prevention of adductor muscle contractions.

The ONB applied zone was evaluated by the physical examination 24 hours after the surgery. The complications such as vein injuries, hematoma, paresthesia and

motor neuronal deficit recorded by a urologist who was blinded to the ONB technique.

Age, sex, BMI, ASA classification, success rates, puncture periods, complications, and switch rates to general anesthesia were compared between the two groups.

### Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) 23.0 (IBM SPSS Inc., Chicago, IL, USA) was used in data analysis. The Chi-square test was used in the comparison of qualitative data in addition to descriptive statistical methods (frequency, percentage, mean, standard deviation). The Kolmogorov-Smirnov and Shapiro-Wilk tests were used in the evaluation of normally distributed data. The independent samples *t*-test was used to evaluate normally distributed quantitative data, and the Mann-Whitney *U* test was used in the evaluation of data with no normal distribution. Correlations of variables were evaluated using Pearson's correlation tests. Probability values less than (*P*)  $\alpha = .05$  were regarded as significant and indicating a difference between the groups.

Power analysis was performed the G\*Power 3.1.9.2 Statistical Package Program; and power (1- $\beta$ ) was found as 0.86 considering  $n_1 = 28$ ,  $n_2 = 33$ ,  $\alpha = .05$ , and effect size as  $d = .8$ .

### RESULTS

General anesthesia was applied to the five patients in the classic ONB group who detected diffuse or bilateral tumors. These patients were excluded from the study.

The demographic data are shown in **Table 1**. No statistically significant difference was detected between the groups regarding sex, age, weight, height, BMI, and ASA scores ( $P = .091$ ,  $P = .519$ ,  $P = .907$ ,  $P = .191$ ,  $P = .494$ ,  $P = .087$ ).

Although no statistically significant differences were detected regarding the development of adductor muscle contraction ( $P = 1.00$ ), a statistically significant difference was detected between the number of punctures ( $P = .036$ ), and duration of the procedure ( $P = .029$ ). The number of punctures was higher and duration of the

**Table 2.** Comparison of the groups regarding puncture-duration and procedure-development of adductor muscle contractions

	Classic (n=28)	Inguinal (n=33)	P-value
Number of punctures	1.9 ± 0.9	1.5 ± 0.7	.036*
Duration of the procedure (seconds)	99.1 ± 48.4	76.0 ± 31.9	.029*
Contraction			
No	24 (85.7%)	29 (87.9%)	1.000**
Yes	4 (14.3%)	4 (12.1%)	

\* Independent Samples *t* Test, \*\* Chi-Square Test

procedure was longer in the classic ONB group (Table 2). No complications such as vein injuries, hematoma, paresthesia and motor neuronal deficit were detected in both groups during the TUR-BT and 24 hours after ONB.

## DISCUSSION

Obturator nerve block has been used for anesthesia or postoperative analgesia in knee surgeries, in the treatment of adductor spasticity, and in the prevention of adductor muscle contractions during TUR-BT surgeries as a part of “3-in-1” blocks<sup>(14)</sup>. The obturator nerve can be blocked from different anatomic regions during its navigation in the body<sup>(15)</sup>. Block success rates vary depending on anatomic variations in the coursing of the obturator nerve<sup>(13)</sup>. Therefore, different approaches or different equipment such as nerve stimulators and ultrasonography have been tested to enable safer and more effective blocks<sup>(15)</sup>.

In their comparison study with 30 patients, Moningi et al. reported that inguinal approach was a good alternative for the classic approach. Although vascular trauma was detected in 4 patients in the classic group, the researchers concluded that both approaches were similar regarding the convenience of the practice<sup>(16)</sup>. Even though no complications and no statistical differences were detected regarding success rates in our study, we found that the inguinal approach could be performed faster and with fewer punctures.

Another study compared the classic and inguinal pubic approaches in 102 patients. The success rate (96.1% vs. 84%) was found higher, and fewer punctures were required in the inguinal group, and the authors reported that the inguinal technique was anatomically easier to perform. Two failed blocks in the inguinal group, and eight failed blocks in the classic group were detected, with no complications in either group<sup>(17)</sup>. In our study, although the success rate was higher in the inguinal group, no statistical significance was detected between the groups. We found that ONB could be performed faster with fewer punctures in the inguinal approach. Minimal contractions developed in four patients in each group, but they were not so intense as to prevent the surgical procedure or require switching to general anesthesia.

In another study, researchers found an 86% success rate and fewer complications with the classic approach using a nerve stimulator for ONB<sup>(18)</sup>. We also found similar success rates in the classic approach.

The success rate was reported as 90.5% using a nerve stimulator in the inguinal group in a study by Hızlı et al. In their study, the block could not be provided in 2 patients out of 21 in the inguinal group under ultrasonography. Bladder perforation developed in two patients<sup>(19)</sup>. Different to that study, we used a nerve stimulator only, and the success rate was found as 87.9%. Despite the fact that complete block could not be accomplished in four patients, no complications were detected.

Sharma et al. conducted a study using a nerve stimulator on 20 patients in the classic approach. A minimal contraction was observed in one patient, and complete block was accomplished in the other patients<sup>(20)</sup>. However, a mixture of 15 mL lignocaine and bupivacaine was used in that study. We used 10mL 0.25% bupivacaine in our study. A higher success rate was detected in that study compared with ours. The high success rate

could be due to the use of high-volume, high-concentration drugs.

Different methods, different drugs, and different drug concentrations were used in ONB studies, and very different success rates were obtained<sup>(2,21,22)</sup>. Higher success rates were obtained in some blind attempt ONB studies<sup>(7)</sup>. On the other hand, less local anesthetic drugs were used in studies where both nerve stimulator and ultrasonography were used to avoid systemic local anesthetic drug toxicity compared with blind attempt blocks<sup>(11,22)</sup>. Bolat et al. used 0.25% levobupivacaine in their study and found the success rate as 88.6%, which was similar to ours<sup>(18)</sup>.

Limitations: Only sixty-six patients who matching inclusion criteria could be included in the study within the research period allowed by the Ethics Committee, and thus the power analysis of study was performed. The drug was administered into the first detected region using a nerve stimulator between 0.4-0.7 mA in both approaches in our study. No other intervention was performed to identify other branches of the obturator nerve. We suggest that this was one of the reasons we had more contractions in our study. The depth of the stimulator needle at the injection site may affect the administration speed. We did not investigate the depth in our study because the needles were manipulated at different angles after penetration into the skin in both methods. Some studies found a higher depth in the inguinal approach, but they did not compare the block performance speed<sup>(17)</sup>. We suggest that more punctures were required in classic approach ONB because the obturator nerve was located deeper during the navigation from the obturator foramen; therefore, it was more difficult to determine the location.

## CONCLUSIONS

In conclusion, although the complication and success rates were similar in both methods, it seems that the inguinal method with a nerve stimulator is a better approach because it enables faster ONB with fewer punctures.

## CONFLICT OF INTEREST

The authors report no conflict of interest.

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