



A Different Obturator Nerve Block Approach Using Nerve Stimulation Device Under Fluoroscopy Guidance in the Transurethral Resection of Lateral Bladder Wall Tumors

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Abstract

Aim: This study aims to define the efficacy and safety of a different obturator nerve block technique using fluoroscopy and nerve stimulation device during transurethral resection of bladder tumor (TUR-BT).

Methods: Sixty patients with lateral bladder wall tumors who had TURBT were retrospectively analyzed for the formation of obturator reflex. Thirty patients received spinal anesthesia (SA) and 30 patients received SA combined with an obturator nerve block (ONB). ONB was performed in the lithotomy position. A percutaneous needle was advanced to the superolateral portion of the obturator foramen under fluoroscopic guidance. The nerve was localized with a nerve stimulation device and 5 mL of 2% prilocaine was injected to perineural area. Additionally, the tumor base was marked intravesically by resectoscope with fluoroscopy and 5 mL of %2 prilocaine was administered to nearby tissue. Obturator reflex formation reflex-related related complications were compared between the two groups.

Results: The results of our study yielded a statistically significant difference in the favor of ONB compared to SA alone for the occurrence of obturator reflex (13% vs 43%, $p=0.020$), bladder perforation (0% vs 23.3%, $p=0.002$), and absence muscle tissue in the pathological specimen (10% vs 40%, $p=0.01$).

Conclusion: ONB with the help of a nerve stimulation device, directed by fluoroscopy is effective to prevent obturator reflex and related complications.

Keywords: Fluoroscopy, obturator nerve, reflex, urinary bladder neoplasms

Introduction

Transurethral resection of bladder tumors (TURBT) is the first step for the diagnosis and treatment of bladder cancer (1). TURBT aims to remove all visible tumors in the bladder together with the underlining muscle tissue. Complete resection of the tumor for appropriate staging and further treatment planning is crucial for bladder cancer (2). However, nearly 50% of all bladder tumors are located at the lateral bladder wall where the risk for obturator reflex-related muscular jerk exists (3). The obturator reflex is one of the most serious complications of TURBT which can cause perforation of the bladder wall, increase the

risk of TUR syndrome, lead to incomplete tumor resection, tumor dissemination and hemorrhage (4). Obturator reflex is reported to occur in 20% to 55% of patients during resection of lateral bladder wall tumors (5,6). The cause of this muscle reflex is the proximity of the obturator nerve to the posterolateral thigh. To prevent adductor muscle contraction, the use of muscle relaxants under general anesthesia is usually sufficient. However, in cases where spinal anesthesia (SA) is preferred, obturator nerve blockade (ONB) is reported to be necessary and useful to prevent this undesired event (7). Other precautions to prevent ONB are incomplete bladder filling, using low

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electrical current and intermittent resection of the tumor (6,7).

The complicated anatomical structure of the region and the difficulty of approaching to nerve trace makes it often difficult for many urologists to use ONB in daily practice (3,8). ONB is usually performed by anesthesiologists with the guidance of ultrasound in the supine position (4,5).

In this study we try to define a urologist friendly technique to perform ONB as urologists are familiar to target a needle with the aid of fluoroscopy. Additionally a nerve stimulation device further increases the accuracy of the procedure.

Methods

Study Design

In this study, was approved by, and ethics committee approval was obtained from Istinye University Clinic Researches Ethics Committee (no: 2017-KAEK-120, decision no: 2/2020.K-085).

Overall, 134 patients undergone TUR-bladder tumor (BT) from January 2015 to December 2018 as part of their routine medical care were evaluated. Of these, sixty patients with an inferolateral bladder wall tumor had undergone TUR BT with SA or SA with ONB were enrolled into the study. Patients using neurological medications or having neurologic deficits and patients who are not eligible for SA were excluded from the study. Thirty patients in the study group were operated with the ONB technique (ONB group). And 30 patients who were operated under SA without nerve block (SA group) were included as control group.

Data of the patients was prospectively collected as the policy of our institution and was retrospectively evaluated from the electronic database of our clinic. A specific matching procedure was not performed.

For each group, age, sex, tumor size, localization of the tumor, stage, grade, presence of obturator reflex, bladder perforation, hemorrhage, major complications, presence or absence of muscle tissue in pathology specimen, complete or incomplete resection status, and operation time were evaluated. In case of full thickness bladder perforation, the procedure was quitted after bleeding control. Severe bleeding was controlled endoscopically, and the procedure was postponed for another session. Complications were recorded according to the Clavien classification system (9). For the ONB group, fluoroscopy time and time spent for ONB was also evaluated. For patients who had no muscle tissue on pathologic evaluation and who had high-grade tumor or tumor size larger than 3 cm, a second TUR BT was performed.

Obturator Nerve Block Technique

Under the guidance of fluoroscopy (General Electric GE OEC Brivo 850), ten cm Teflon-insulated needle (21G Stimuplex A, B. Braun Melsungen AG, Germany) allowing both current transfer into deep tissues and application of local anesthesia through its channel, was inserted below the inguinal ligament, lateral to the pubic tubercle and advanced through the superolateral portion of the obturator foramen (Image 1, Image 2). For better localization of the obturator nerve, a nerve stimulation device (Stimuplex HNS 12, B. Braun Melsungen AG, Germany) was used. The nerve stimulator adjusted to 2 mA electric current. Adductor muscular contractions were observed when the needle was around 4-6 cm

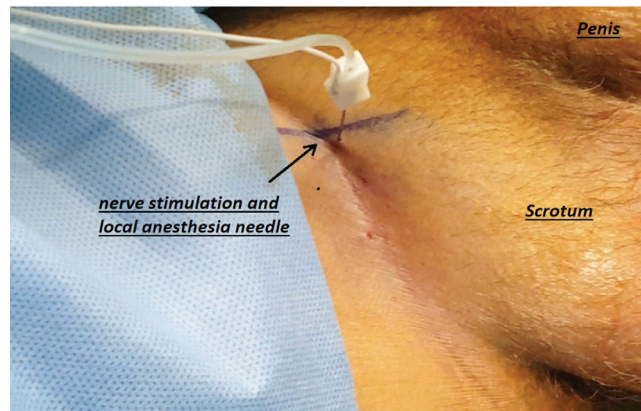


Image 1. Insertion of the nerve stimulation and local anesthesia needle

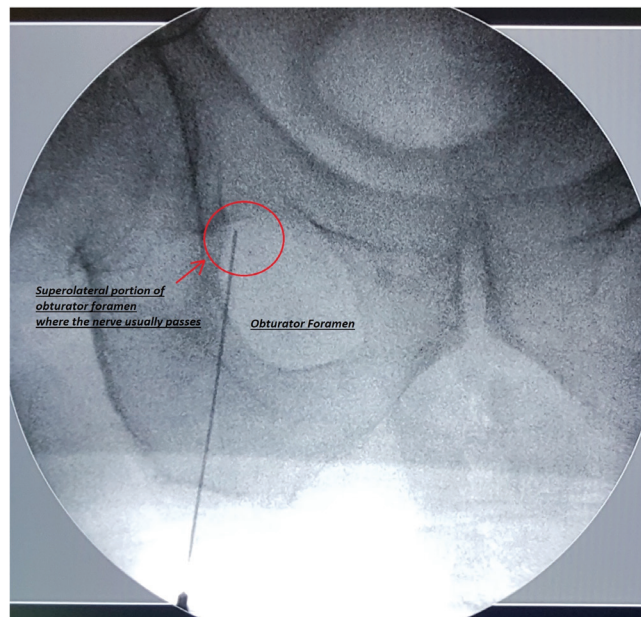


Image 2. Targeting obturator nerve at superolateral position of obturator foramen

depth in all cases. The setting was reduced to 0.5-0.2 mA for the precision of the localization. When the position of the obturator nerve was confirmed with muscle jerks at low stimulation current, 5 mL of 2% prilocaine was administered. This resulted in the immediate cessation of the adductor muscle jerks.

After the first injection, the resectoscope was placed inside the bladder to the possible resection sites where obturator reflex can be triggered (in most cases at the base of the tumor at the lateral bladder wall). The position of the resectoscope was identified under fluoroscopic view and local anesthesia needle was re-advanced to that space (Image 3). After negative aspiration, 5 mL of 2% prilocaine was administered as close as possible to the tip of the resectoscope. In the control group, no additional procedure was done after spinal anesthesia.

TUR BT Technique

All of the patients underwent SA as the first step. Standard preparation and dressing for operation were completed with the patient in the lithotomy position. The procedure began with routine cystoscopy. Localization of the tumor at the lateral bladder wall was confirmed. The number and size of the tumor were noted. The operation was performed using a bipolar resectoscope of Olympus ESG-400 plasma kinetic U-shaped cutting loop with 120V cutting/80V coagulation settings with normal saline for irrigation.

Statistical Analysis

Chi-square and Fisher's Exact test was used to compare perioperative categorical variables as gender, tumor stage,

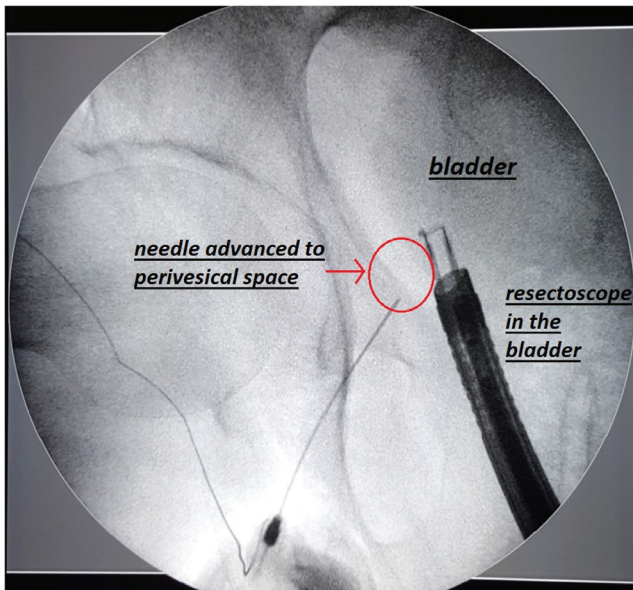


Image 3. Advancement of the needle to perivesical space nearby the tumor base

obturator reflex formation, incomplete resection, bladder perforation and absence of muscle tissue on pathological examination between the two groups. Mann-Whitney U test was performed to determine the association between the two groups and perioperative continuous variables as age, fluoroscopy time, ONB time, OT time, tumor size. A p value of <0.05 was defined as statistically significant.

Results

The mean age and gender of the patients were similar for both groups. There was no statistical difference between the groups regarding tumor size, tumor grade and stage (Table 1).

Operative outcomes are summarized in Table 2. Obturator reflex was statistically significantly lower in the ONB group 4/30 (13%) than in the SA group 13/30 (43%) ($p=0.020$). For patients whom the obturator reflex occurred, the procedures could be completed with slight muscular jerks in all patients of the ONB group, whereas complete tumor resection was impossible because of excessive bleeding or deep bladder wall perforation in 4 (13%) procedures of the SA group. This parameter revealed no significant difference between the groups ($p=0.112$).

There was one patient with subserosal bladder perforation (3.33%) in the ONB group. In the SA group, different degree of bladder perforations (2 full-thickness, 5 subserosal) were observed in 7/30 of the cases (23.3%). This parameter yielded a statistically significant difference ($p=0.02$). In terms of hemorrhage, no statistically significant difference was defined between the ONB ($n=0$, 0%) group and the SA group ($n=30$, 10%) ($p=0.237$). The absence of muscular tissue in the final pathological analysis was determined in 3 cases (10%) in the ONB group and 12 cases (40%) in the SA group. The difference was statistically significant ($p=0.001$).

There were no major surgical complications in both groups. The duration of the operation was not

	Group ONB (n=30)	Group SA (n=30)	p
Age (years), mean \pm SD	65.1 \pm 12	64.3 \pm 9.8	0.43
Gender (male/female)	20/10	22/8	0.78
Tumour size, (cm), mean \pm SD	2.66 \pm 1.9	2.53 \pm 1.6	0.21
Tumour Stage, n (%)	-	-	0.97
Ta Low Grade	16 (53.3%)	14 (46.6%)	-
Ta High Grade	3 (10%)	3 (10%)	-
T1 Low Grade	2 (6.6%)	3 (10%)	-
T1 High Grade	6 (20%)	6 (20%)	-
T2 High Grade	3 (10%)	4 (13.3%)	-

ONB: Obturator nerve block, SA: Spinal anesthesia, SD: Standard deviation

statistically significantly different between the two groups ($p=0.45$). The average time for administration of ONB and for fluoroscopy was 7.2 minutes and 14.5 seconds, respectively. The postoperative evaluation did not reveal any local anesthesia-related complications such as seizure, bradycardia, anaphylaxis, or dysrhythmia.

Table 2. Intraoperative findings

	Group ONB (n=30)	Group SA (n=30)	p
Operation time, (minutes), mean \pm SD	48.3 \pm 6.9	49 \pm 7	0.45
Obturator nerve block time, (minutes)	7.2	-	-
Floroscopy time, (seconds)	14.5	-	-
Obturator reflex formation, n (%)	4 (13%)	13 (43%)	0.020*
Incomplete resection, n (%) due to bladder perforation due to severe bleeding	0 (0%) - -	4 (13%) 2 (6.5%) 2 (6.5%)	0.112 - -
Bladder perforation, n (%) Subserosal Full-thickness	1(3.3%) 1(3.3%) -	7 (23.3%) 5 (16.6%) 2 (6.6%)	0.002** - -
Hemorrhage, n (%)	0 (0%)	3 (10%)	0.237
Absence of muscle tissue in pathology, n (%)	3 (10%)	12 (40%)	0.001***

*Obturator reflex formation was significantly lower in the ONB group with Fisher's Exact test
 **Bladder perforation was significantly lower in the ONB group with Fisher's Exact test
 ***Absence of muscle tissue in pathology was significantly lower in the ONB group with Fisher Exact test. ONB: Obturator nerve block, SA: Spinal anesthesia, SD: Standard deviation, n: Number

Discussion

BTs are located on the lateral bladder wall in nearly 50% of the cases (3). The risk of occurrence of obturator reflex is reported as 20% to 55% in these cases (4-6). This may cause unwanted contractions in thigh muscles which may result in some serious complications changing from slight bladder perforation to injuries of the adjacent iliac vessels (4-8,10). There are also reports for the probability of extravescical tumor spillage and extreme bleeding which may prevent proper tumor resection or sometimes even completion of the procedure (11,12). Extravesical tumor spillage can lead to requirement for more radical treatment modalities (13).

Resection of the tumor under general anesthesia with active use of muscle relaxants may be the most effective way of preventing the obturator nerve reflex (4). There are some reports which showed that even under general anesthesia obturator reflex may happen (14). If SA is preferred, there are some precautions in the literature to prevent the obturator reflex. Resection in a half-filled

bladder, using intermittent or low energy settings, and bipolar cauterization are some of these (6,7,15). The safest method to prevent the reflex for patients with SA is reported to be the application of obturator nerve block (4,5,11,14,15).

Many studies are reporting safe and efficient techniques for ONB (16). Using anatomical landmarks or ultrasonography was found to be efficient to localize the obturator nerve. Feigl et al. (8) defined detailed anatomical landmarks for the perfect application of the needle on a detailed evaluation in cadaveric samples. Shah et al. (17) reported the use of nerve stimulation devices increases the success rate of ONB from 76% to 90% and decreases the procedure time 50%.

Khorrami et al. (18) reported a transvesical application of ONB for urologists. They used a long nerve stimulating needle which they advanced through the working channel of a cystoscope, puncturing the bladder mucosa and transpassing bladder wall layers lateral to the ureteric orifice. They secured the position of the obturator nerve with a nerve stimulation device and used the same needle to apply local anesthesia around the nerve fiber. A few years later they reported their technique was also effective without the use of nerve stimulating device. They used intravesical anatomical landmarks and injected the local anesthetic to three separate points between the ureteric orifice and bladder neck at equal distances (19). Today ONB procedure is still not widely accepted among urologists. This may be because of the complexity of the defined anatomical landmarks for the application of the nerve block or the need for ultrasonography or puncturing of bladder mucosa to find the exact position of the nerve. Additionally, most of the studies were conducted by experienced anesthesiologists (4,14,17).

In our study, we tried to define a urologist friendly technique. We used fluoroscopy to localize the obturator foramen and obturator nerve which passes from the superolateral part of the obturator foramen. Nerve stimulation device which was recommended to improve the success of the obturator nerve block was used to confirm the precise localization of the nerve.

After the first injection was completed, we made a second injection to the perivesical space that was localized with the help of a resectoscope inside the bladder. We either tried to mark the riskiest point that will trigger the obturator reflex, or we placed the resectoscope to the tumoral base that resection will be made. This place is visualized by fluoroscopy and the local anesthesia needle was advanced closer to that area. The second injection was used because our previous experiences showed us obturator block was sometimes ineffective with the block of the obturator nerve at a single site. This failure may be

related to the possible presence of accessory obturator nerve (5,8). To overcome the risk of the obturator nerve anatomical variations we decided to perform a perivesical anesthetic block. In this way the block was made to the surrounding tissue of resection site independent from the route of nerve. Perivesical local anesthetic application was also used by Khorrami et al. (18) and proven to be effective (19). Our study confirmed the same findings but even proposed a wider range of freedom of selecting the injection site compared to intravesical application route used by Khorrami et al. (18) as our technique has the advantage for the surgeon to perform the block when the patient is in the lithotomy position, it is possible to repeat the injection throughout the operation if needed. Additionally, this technique enables to perform the block not before but during the operation if a previously unexpected lateral bladder wall tumor is observed intraoperatively or muscular jerk occurs during the resection.

Bladder perforation may be one of the most serious complications caused by obturator jerk. This has the potential to cause dissemination of tumor cells or sometimes inability to complete the resection. In a large series reported by Collado et al. (12), 2821 patients who had superficial BT were evaluated and it was found that 36 patients (1.3%) had bladder perforation, of which 30 were extraperitoneal and six were intraperitoneal. Four of them required open correction. In the literature, ONB was reported to decrease bladder perforation significantly (5,11,15). These results were concordant with our findings. Although we experienced slight obturator jerk in 4 cases, all these 4 cases were completed with careful low energy intermittent resection as recommended in previous studies (20,21). However, for patients in whom ONB was not performed 4 procedures could not be completed due to full-thickness bladder perforation and severe bleeding. We think this finding is remarkable. The presence of muscular tissue in the final pathological analysis is an important issue. Our study revealed higher complete resection rates and higher detrusor muscle rates on pathologic specimens in patients who underwent ONB. Like our study, Erbay et al. (22) reported that complete tumor resection and the presence of detrusor muscle tissue in the pathological specimen ratios were significantly higher in ONB applied patients. They also concluded that the postoperative recurrence of BT was found to be significantly higher in the non-ONB group (22). This seems to be an important advantage of ONB.

Urologists are well adapted to use fluoroscopy from endourologic procedures. Although our technique may be criticized as it causes exposition of radiation which is not necessary in a TUR BT operation, we calculated

average fluoroscopy time as 14.5 seconds. There are studies reporting the average ureteric stone procedures fluoroscopy time to be 78 seconds (23). More recent studies are reporting 34.86 seconds covering all urological procedures and they mention the average use of fluoroscopy by endourology trained faculty is 68.35 seconds (24). Although our procedure needed far less radiation exposure duration, we still had strict adherence to the ALARA principle (as low as reasonably achievable). Compared with other obturator nerve block techniques, this block is encouragingly fast and easy to perform. The advantage of lithotomy position enables the application of the ONB not as a routine but on-demand which is either the presence of a tumor on the lateral wall or facing an unexpected reflex throughout the procedure.

Study Limitations

The retrospective design and the low patient number of the study is a weakness. A prospective randomized study with a higher patient population seems to be essential to provide more reliable information. Direct comparison with ultrasound-guided nerve block techniques would provide better information about the efficacy of the technique. Furthermore, a comparison with patients who underwent general anesthesia for this kind of bladder cancer would be useful.

Conclusion

This study defines a different obturator nerve block technique which enables urologists to perform the procedure during the operation without changing the position of the patient. Easy orientation with fluoroscopy guidance and using lithotomy position seem to be the main advantages. Further studies are required to determine the relative efficacy and safety of this technique to previously described approaches.

This study showed that SA combined with ONB prevents the obturator reflex during TUR BT, reduces the risk for bladder perforation and is associated with higher muscle tissue rates on the pathological specimens. Routine application of ONB along with SA during such operations may provide a better operative outcome.

Authorship Contributions

Concept: C.S., T.K., Design: C.S., T.K., Data Collection or Processing: C.S., Analysis or Interpretation: C.S., T.K., Literature Search: C.S., Writing: C.S.

Conflict of Interest: No conflict of interest was declared by the authors.

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