

Impact of nerve stimulator-guided obturator nerve block on the short-term outcomes and complications of transurethral resection of bladder tumour: A prospective randomized controlled study

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Abstract

Introduction: In this prospective randomized controlled study, we investigated the efficacy of obturator nerve block (ONB) on adductor muscle spasm and related short-term outcomes and complications in patients who underwent transurethral resection of lateral wall-located bladder tumours (TURBT).

Methods: Between July 2014 and February 2015, 70 patients scheduled to undergo TUR of lateral bladder wall tumours were enrolled in the study. All patients were preoperatively evaluated by cystoscopy and imaging tools and selected according to localized tumours on the lateral bladder wall. Patients were randomly allocated to Group SA (35 patients who underwent only spinal anesthesia) and Group ONB (35 patients who underwent spinal anesthesia combined with ONB by the nerve stimulator). An independent observer, blinded to the approach, evaluated the obturator signs, including adductor muscle contraction, bladder perforation, and completeness of the resection during the TURBT procedure.

Results: The differences between groups regarding mean operation time, tumour size, and number were not statistically significant ($p > 0.05$). Adductor muscle contraction was detected in 40% of patients in Group SA and 11.4% in Group ONB. This difference was statistically significant ($p = 0.021$). Complete bladder perforation was detected in 2 patients in Group SA, whereas no perforation was observed in Group ONB. There was no case of severe bleeding in both groups.

Conclusions: We found that ONB performed after spinal anesthesia was effective in preventing intraoperative complications due to adductor muscle spasm while performing TURBT. Our study limitations include its small sample size, since we only enrolled patients with primary lateral wall-localized bladder tumour. Also, we excluded patients who underwent bipolar TURBT.

Introduction

Bladder cancer is the ninth most commonly diagnosed cancer worldwide, with more than 380 000 new cases a year.¹ Transurethral resection of bladder tumours (TURBT) is a crucial procedure in its diagnosis and treatment.²

In the TURBT procedure, the obturator nerve passes through the obturator foramen of the pubis and innervates the adductor muscles of the thigh. It originates from the lumbar plexus of L2 to L4 and contains both motor and sensory nerve fibres. Within the pelvic cavity, it runs close to the prostatic urethra, bladder neck, and inferolateral bladder wall.³

Rodriguez and colleagues found that 46.8% of all bladder tumours are located at the lateral wall of the bladder.⁴ When the bladder is distended with irrigation fluid, the obturator nerve is very close to the lateral bladder wall. While performing TURBT of the lateral wall-located bladder tumours, one can perform an electrosurgical resection to stimulate the adjacent obturator nerve leading to adductor contraction and leg jerking.³ Involuntary movement of the legs due to adductor spasm can cause incomplete tumour resection, bladder perforation, and extravesical dissemination of the cancer cells and vascular injuries.^{3,5}

In this prospective randomized controlled study, we investigated the effect of obturator nerve block (ONB) on adductor spasm and short-term complication rates in the patients who underwent TURBT for bladder tumours on the lateral bladder wall.

Methods

In this prospective, randomized study, we enrolled 70 patients to this study. Each patient had an American Society of Anesthesiologists (ASA) physical status I to IV and were scheduled to undergo TUR of inferolateral bladder wall tumours from July 2014 to February 2015. Approval was obtained

from our institutional ethical committee and written informed consent was obtained from all study participants.

All patients were preoperatively evaluated by cystoscopy and imaging tools, such as ultrasound, and computed tomography. Patients were selected according to localized tumours on the inferolateral bladder wall. We excluded patients with a known allergy to local anesthetics and patients with previous surgery or scars in the ONB region, coagulopathy, pregnancy and neuromuscular disease.

In the operating room, patients were monitored by continuous electrocardiography, non-invasive blood pressure, and pulse oximetry. Patients were pre-loaded with 10 mL/kg of 0.9% isotonic solution intravenously. To maintain the oxygenation, patients received 4 L/min of oxygen via a facemask. All patients were pre-medicated with 1 to 2 mg midazolam intravenously before the spinal anesthesia. Using shuffled sealed envelopes with anesthesia allocations inside, we randomly allocated patients to the spinal anesthesia group (Group SA, $n = 35$) or the spinal anesthesia combined with ONB group (Group ONB, $n = 35$).

In Group SA, spinal anesthesia was performed with 10 to 15 mg 0.5% hyperbaric bupivacaine by 25G Quincke needle at L3/L4 or L4/L5 space with patients in the seated position. Afterwards, patients were immediately placed into the supine position and the sensory blockade was checked with a pin-prick test. When the block reached the T10 level, patients were placed into the lithotomy position and the surgery was started.

In the case of Group ONB, ONB was performed unilaterally or bilaterally according to tumour position following verification of the level of spinal anesthesia with the patient in lithotomy position. A 10-mm Teflon-insulated needle (21G Stimuplex A, B. Braun Melsungen AG, Germany) using a nerve stimulator (B. Braun Melsungen AG, Germany) was inserted perpendicularly 2 cm inferiorly and 2 cm laterally to the pubic tubercle. As per the traditional approach, we adjusted the current power of the nerve stimulator to 1.5 to 2 mA and current periods to 0.1 ms. Consequently, the needle was inserted through the skin to the inferior ramus of the pubic bone. It was then slightly pulled back and redirected anterolaterally, contacting the nerve in a depth of 2 to 4 cm; 10 mL 0.25% levobupivacaine was administered at 0.3 to 0.5 mA when contraction was observed at the adductor muscle groups and after aspiration was negative.⁶

Surgery was initiated after 10 minutes following injection. The same anesthesia staff performed the ONBs and the same urologist, blinded to the ONB, operated on patients in both groups and evaluated the obturator signs. No additional techniques were used to prevent adductor muscle contractions during surgery other than ONB.

The TURBT procedure was performed by a 26-French monopolar resectoscope with 30-degree optic and glycine irrigation solution. If the adductor spasm was severe enough

to disturb the surgeon's resection, it was deemed a severe adductor muscle contraction. However, if there was an adductor muscle spasm but not severe enough to disturb the surgeon, it was deemed a moderate adductor muscle contraction.

Statistical analysis was performed using SPSS (SPSS Inc, Chicago, IL) version 21.0. Descriptive data were given as mean \pm standard deviation. Continuous variables were compared with an independent sample t-test, and categorical variables were compared with the Fischer's exact test. Statistical significance was set at $p < 0.05$.

Results

We tallied patient demographics, including age, weight, male/female ratios and ASA scores (Table 1). The differences between the groups regarding mean operation time, tumour size, and tumor number were not statistically significant (Table 2).

Adductor muscle contraction was detected in 40% of the patients in Group SA and 11.4% in Group ONB and this difference was statistically significant ($p = 0.021$). While severe degree adductor spasm was observed in 17.1% of patients in Group SA, this rate was 2.8% in Group ONB.

Subserosal injury was observed 31.4% and 11.4% in Groups SA and ONB, respectively. In 2 patients (5.7%) in Group SA, complete bladder perforations were detected, whereas no complete perforations were observed in Group ONB. The perforations in Group SA were extraperitoneally and patients were managed conservatively. Complete tumour resection was performed in 77.1% and 97.1% of patients in Groups SA and ONB, respectively ($p = 0.028$) (Table 3). Patients with incomplete resection underwent re-operation under general anesthesia 6 weeks later. There was no bleeding requiring transfusion in both groups.

Discussion

Sudden adductor muscle spasm can occur when the obturator nerve is directly stimulated by the electrical current trans-

Table 1. Patient demographics

	Group SA (n = 35)	Group ONB (n = 35)	p value
Age, years, mean \pm SD	67.7 \pm 10.5	70.1 \pm 12.2	0.398*
Weight, kg, mean \pm SD	72.1 \pm 10.9	70.9 \pm 15.2	0.712*
Gender, male/female	29/6	30/5	0.743*
ASA score, n (%)			0.680†
1	3 (8.6)	2 (5.7)	
2	24 (68.6)	22 (62.9)	
3	8 (22.9)	10 (28.6)	
4	-	1 (2.9)	

*Independent sample t-test; †Fischer's exact test; SD: standard deviation; ASA: American Society of Anesthesiologists; ONB: obturator nerve block; SA: spinal anesthesia.

Table 2. Patient perioperative outcomes

	Group SA (n = 35)	Group ONB (n = 35)	p value
Operation time, minutes, mean \pm SD	29.6 \pm 12.0	29.1 \pm 13.3	0.888*
Tumour size, mm, mean \pm SD	3.6 \pm 1.9	3.9 \pm 2.8	0.692*
Tumour number, n, mean \pm SD	1.8 \pm 1.3	2.1 \pm 1.8	0.359*

*Independent sample t-test; SD: standard deviation; ONB: obturator nerve block; SA: spinal anesthesia.

mitted by the resectoscope. This is especially true when the surgeon is operating at the lateral wall of the bladder, where the obturator nerve is close during its intrapelvic course.⁷ Prentiss and colleagues reported a 20% incidence of severe adductor muscle contraction in patients undergoing TUR for large intra-urethral prostatic adenomas and laterally located bladder tumours.⁸ Tatlisin and Sofikerim demonstrated that 63 of 114 patients experienced adductor spasm elicited by obturator stimulation during TURBT.⁹

Different strategies, such as partial filling of the bladder during resection, reducing the intensity of the current of the resectoscope, resecting the tumour on thinner slices, using bipolar or laser resectoscopes, and using general anesthesia with muscle relaxants, are adopted to avoid complications during surgery.^{10,11} Bipolar and laser systems are expensive and not available at many centres. The use of general anesthesia and muscle relaxants for TURBT are not recommended, because most patients with bladder tumour are heavy smokers (about 50% of cases).^{12,13} In addition, the median age at diagnosis for patients (men and women) is 73 years, so cardiopulmonary conditions are serious limitations for general anesthesia in these patients.¹⁴ In many patients, spinal anesthesia is a better choice in TURBT.¹⁵ In our clinic, spinal anesthesia is the standard anesthetic technique for TURBT. General anesthesia is given only to uncooperative patients, patients failing spinal anesthesia or when adductor spasms occur. However, spinal anesthesia is also ineffective in preventing the adductor spasm. Patel and colleagues divided patients scheduled for TURBT into spinal anesthesia and spinal anesthesia with ONB groups. They found that almost all patients in the spinal anesthesia group developed adductor spasm of varying degree disturbing the surgeon.¹⁶ In our study, moderate and severe adductor muscle spasms were observed in 22.9% and 17.1%, respectively, of patients in the spinal anesthesia group, and in 8.6% and 2.8% of patients in the ONB group.

Literature search yields many studies showing the efficacy of ONB in preventing the adductor muscle contraction and related complications during the resection of the lateral wall localized bladder tumours.^{3,4,9,16} ONB can be performed using multiple techniques with various success rates. The success rate of the transperineal ONB using the “blind ana-

Table 3. Comparison of intraoperative findings between groups

	Group SA (n = 35)	Group ONB (n = 35)	p value
Adductor muscle contraction, n (%)			0.021*
No	21 (60)	31 (88.6)	
Moderate	8 (22.9)	3 (8.6)	
Severe	6 (17.1)	1 (2.8)	
Bladder perforation, n (%)			0.680*
No	22 (62.9)	31 (88.6)	
Subserosal injury	11 (31.4)	4 (11.4)	
Complete perforation	2 (5.7)	–	
Complete resection, n (%)			0.028*
Yes	27 (77.1)	34 (97.1)	
No	8 (22.9)	1 (2.9)	

*Fischer's exact test; ONB: obturator nerve block; SA: spinal anesthesia.

tom approach” is 83.8 to 85.7%.^{5,9,17} There are many ways to increase the efficacy of ONB. The success rate is 84% to 96% using the “nerve stimulation technique.”¹⁶⁻¹⁹ In our study we used the “nerve stimulation technique,” described by Parks and Kennedy in 1967.⁶ Using this technique, our success rate was 88.6% and this rate was attributed to the accessory obturator nerve or its abnormal branching. An accessory obturator nerve is present in about 10% to 30% of the population.^{6,20} It lies parallel to the main obturator nerve along the medial side of the psoas muscle, passing ventral to the superior pubic ramus behind the femoral vein and joins the anterior part of the main obturator nerve. It is debatable whether stimulation of the accessory obturator nerve can occur during TUR.⁵

Failure of the blockade can also be due to operator error. In experienced hands, location of the obturator nerve may be easy and the blockade can be done successfully. Different blockade techniques have been developed to minimize operator-dependent failure. Given the complex anatomy in the pelvic region, the use of traditional methods that rely on anatomical landmarks to identify and block the obturator nerve carries the risk of failure or incomplete blockage.²¹ In these situations, transvesical ONB can be considered. This nerve block may be performed by the guide of nerve stimulation or anatomic landmarks.²²⁻²⁴ Moreover, more recent studies reported that the use of an ultrasound in regional anesthesia is associated with higher success rates as 93% to 97.2% in ultrasound-guided ONB procedures.^{21,25} Akkaya and colleagues demonstrated a new methodological approach based on a sono-anatomic study to visualize the obturator nerve. They reported patient satisfaction rates as high as 93%.²⁶ These rates show that ultrasound-guided ONB is more successful than a nerve stimulator technique.

Adductor muscle contraction and leg jerking due to the obturator nerve stimulation during TURBT can lead to bleeding, incomplete resection of tumour, hematoma, bladder

perforations, and extravesical spread of tumour. These conditions may increase patient morbidity and mortality.^{5,9,16} In our study, complete bladder perforation was observed in 2 patients in Group SA, while no perforation was seen in Group ONB. No severe bleeding was detected in both groups. Residual tumour tissue following TURBT increased recurrence rates and shortened the tumour-free interval. Jancke and colleagues showed that 26% of patients had residual tissue following complete resection of their non-muscle invasive bladder tumours and these patients suffered from significantly higher recurrence rates when compared to the others.²⁷ Tekgül and colleagues reported overall recurrence rates of 27.8% and 18.8% in patients with spinal anesthesia only and in combination with ONB, respectively. However, this difference was not statistically significant.²⁸ In our study, we did not investigate recurrence-free rates. As well as, complete resection rates significantly increased after the ONB. Tumours were incompletely resected in 22.9% and 2.9% of the patients in Groups SA and ONB, respectively. Patients with incomplete resection underwent re-operation under general anesthesia 6 weeks later.

Although ONB with a nerve stimulator should be considered in association with spinal anesthesia in patients who are at high risk for general anesthesia, it is quite an invasive approach, technically difficult, and requires a longer needle. The direction of the needle is toward the pelvic contents, which increases the chances of complications.¹⁰ For example, poor nerve blockade can rarely lead to intra-operative obturator jerks that can cause bladder perforation.³ In addition, the obturator artery accompanies the obturator nerve through the foramen. Damage to the artery and arterial bleeding can occur there when advancing the needle. Cesur and colleagues reported a case of difficulty localizing the nerve and a hematoma.²⁹ Akata and colleagues reported that an incomplete ONB led to obturator jerk, which caused damage to the obturator artery and major bleeding.⁵ In our study no complications were observed due to the ONB.

Our study limitations include its small sample size, since we only enrolled patients with primary lateral wall-localized bladder tumour. Also, we excluded patients who underwent bipolar TURBT.

Conclusion

ONB with a nerve stimulator in combination with spinal anesthesia is an effective and safe way to prevent adductor muscle contraction and related intraoperative complications in patients during TURBT. Bigger, prospective, randomized studies are needed to support our study.

Competing interests: The authors declare no competing financial or personal interests.

This paper has been peer-reviewed.

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