

Ultrasound versus Nerve Stimulator Guided Obturator Nerve Block in Patients Undergoing Transurethral Resection of Bladder Tumor

Bidur Kumar Baral,¹ Pusparaj Poudel,¹ Mona Rajbhandari,¹ Anuj Jung Karki,¹ Gaurav Raj Dhakal²

¹Department of Anesthesiology and Intensive Care, National Academy of Medical Sciences, Bir Hospital, Kathmandu, Nepal, ²Department of Orthopedics, National Academy of Medical Sciences, National Trauma Centre.

ABSTRACT

Background: Urinary bladder cancer is more common in geriatric population. Transurethral resection of bladder tumor remains the mainstay of treatment. It is usually performed under subarachnoid block. However, obturator nerve is spared in subarachnoid block that can produce adductor jerk, which is associated with bladder injury, rupture, incomplete resection of tumor and hematoma. To overcome this jerk, selective obturator nerve block is commonly performed. Thus, we conducted this study to compare the efficacy of ultrasound and nerve stimulator-guided techniques for obturator nerve block.

Methods: This is a prospective, comparative study conducted at a tertiary care hospital in Nepal. Sixty patients, scheduled to undergo Transurethral Resection of Bladder Tumor for lateral and posterolateral wall bladder cancer under subarachnoid block were enrolled and divided into two group having thirty patients in each groups. Group I received 15 ml of 0.25% Bupivacaine to block obturator nerve by using peripheral nerve stimulator. Group II received the same amount of Bupivacaine to block obturator nerve under ultrasound guidance. We evaluated the success of the block, ease of the procedure and complications.

Results: The adductor reflex was present in 23.33% of cases with nerve stimulator guided obturator nerve block, whereas, it was 16.66% in ultrasound guided technique ($p=0.75$). The success rate of obturator nerve block was 76.66% in nerve stimulator guided technique, whereas 83.33% in ultrasound guided technique ($p=0.21$). 83.33% of obturator nerve block was found to be easy in nerve stimulator guided technique, whereas 66.66% in ultrasound guided technique ($p=0.14$). There were no major complications noted.

Conclusions: The findings of this study conclude that both ultrasound and nerve stimulator guided techniques equally abolished the adductor reflexes. Both techniques are easy to perform and safe.

Keywords: Bladder tumor, obturator nerve block, adductor reflex

INTRODUCTION

Transurethral resection of bladder tumor (TURBT) is commonly carried out under subarachnoid block (SAB). During the procedure, obturator nerve is directly stimulated, leading to adductor muscle contraction called adductor reflex. It is associated with risk of bladder injury, rupture and bleeding. The incidence of adductor reflex was up to 20%. The selective obturator nerve block (ONB) is an effective technique to prevent this reflex.¹⁻⁸

The obturator nerve block can be done with different

techniques. The success rate is 78% to 96% with peripheral nerve stimulator (PNS).^{3,8,9} However, they have increased risk of nerve injury and hematoma.

In recent years, the use of ultrasound (USG) has been advocated to improve the success rate with 93-100% and ensure the safety of patients.¹⁰⁻¹²

So we conducted this study to compare ease of block and success rate between ultrasound and nerve stimulator-guided techniques of obturator nerve block.

METHODS

Correspondence: Dr Bidur Kumar Baral, Department of Anesthesiology and Intensive Care, National Academy of Medical Sciences, Bir Hospital, Kathmandu, Nepal, Email: drbidurbaral@gmail.com, Phone: +9779851148145/ +9779846117408.

This is a prospective, comparative study carried out at a tertiary care hospital in Nepal. After ethical clearance from Institutional review board, sixty patients of American Society of Anesthesiologists Physical Status (ASA-PS) I, II and III of either sex, aged (50 -80 years), diagnosed with unilateral bladder tumor, affecting lateral and inferolateral wall, scheduled for TURBT surgery under SAB were enrolled. Purposive sampling method was used for selection of study populations. Patients with a history of allergy to local anesthetics, psychiatric illness, coagulation disorders, or skin lesions at the injection site were excluded from the study.

A detailed pre-anesthetic evaluation was done a day before surgery and written informed consent was obtained. Patients were kept nil per oral for six hours before surgery.

On arrival of the patients to the operation theater, standard monitors (non-invasive blood pressure, electrocardiography, and pulse oximeter) were attached. Intravenous (IV) access was obtained with 18 G IV cannula and the patients were preloaded with 10 ml/kg of 0.9% normal saline. Under all aseptic conditions, subarachnoid block was performed in all patients with a 26 G Quincke's needle at the L3-4 or L4-5 inter-spinous space in the sitting position. After confirming the free flow of clear cerebrospinal fluid, 0.5% hyperbaric bupivacaine 2.5 ml (12.5 mg) was administered.

Then, the patients were kept in the supine position. The sensory level of the block was checked; once the level of block reached T10, the patients were positioned with the thigh abducted and rotated externally for the ONB of the desired site. The patients were allocated to two groups (Group I and II) by using sealed envelope technique.

Group I - PNS guided ONB group, (PNS Group)

Group II - Ultrasound guided ONB group (USG Group)

In group I: the peripheral nerve stimulator (B Braun Stimuplex ®, HNS 12) and was used for the obturator nerve block. Under aseptic precautions, a 10 cm long 22G Stimuplex ®, needle (B Braun, Germany) was inserted vertically at a point 1.5 cm lateral and caudal to the pubic tubercle. When the tip of the needle touched the inferior border of the superior pubic ramus at a depth of 2-4 cm, then the needle was withdrawn and redirected further lateral in the obturator canal and observed for the contraction of adductor muscle at the medial aspect of the thigh. If there was no contraction, the needle was withdrawn and redirected. Initially, a current of 2 mA

at a frequency of 2 Hz was set. Once the needle was in contact with the obturator nerve, twitching responses of the adductor longus and gracilis muscles were observed on the posterior and medial aspects of the thigh then the current was gradually reduced until visible muscle contractions occurred at lower current levels (i.e., 0.5 mA). At this point, an injection of 0.25% Bupivacaine 15 ml was given.

In group II, - A two-dimensional ultrasound with the linear probe, 6–13 MHz (Micromaxx™ SonoSite M-Turbo, Bothell, WA, USA), was used for the nerve block. The linear probe was placed at the inguinal crease and perpendicular to the skin to identify the pectineus, obturator externus, adductor longus, adductor brevis, and adductor magnus muscles. After visualizing the pectineus and obturator externus muscles, a 10cm long 22G Stimuplex needle was inserted a few centimeters cephalad from the anterior side of the transducer and advanced in-plane with the transducer toward the fascia. Once the needle reached well within the fascia and close to the nerve, then 15 ml of 0.25% Bupivacaine was injected into the interfascial plane between the pectineus and obturator externus muscles as described by Taha's approach for proximal obturator nerve block.¹³

All the ONBs were performed by principal researcher and ease of block along with number of puncture attempts were noted. The ease of the obturator nerve block was labelled, according to the number of needle redirections required to accomplish the block. If Nerve block was successful in the first attempt, it was labeled as "easy". If it needed multiple attempts (≥ 2), it was labeled as "difficult." The number of needle redirections required to reach the end-point for injection were recorded.

Surgery was allowed to commence 20 minutes after the nerve block. During intra operative period, ASA standard I and II (ECG, HR, NIBP and SpO₂) monitoring was done. During the resection of the tumor, any occurrence of the adductor reflex (defined as jerky adduction and external rotation of the thigh at the hip joint) was noted. Absence of the reflex was considered as a successful block whereas any occurrence of intense adductor reflex during resection of lateral/postero-lateral bladder wall leading to inability to resect the tumor was considered as failure of the block. General anesthesia with muscle relaxation was given to those patients and were labelled as failure of block.

At the end of surgery, surgeon's satisfaction was asked and labelled as good, fair and worst. The complications with ONB, such as neurovascular injury, hematoma, and intravascular injection, bladder perforation were noted.

Collected data were analyzed by SPSS (Statistical Package for Social Sciences, version 20). Chi-square analysis was used to compare the ease of approach of the two techniques. Fischer’s exact test was applied when the expected value of any of the cells was less than 5. A value of $p < 0.05$ was considered statistically significant.

RESULTS

Sixty obturator nerve blocks were performed for transurethral resection of the bladder tumor meeting the inclusion criteria. There were no significant differences in the mean age of patients and duration of operation between the two groups. In both groups, the male patients were predominant (86.66% in PNS group and 76.66% in USG guided group) (Table 1).

Table 1. Background characteristics of the patients and surgery.

Variables	PNS guided ONB group (n= 30)	USG guided ONB group (n= 30)	P value
Age (years) (Mean ± SD)	62.27 (±9.10)	66.63 (±10.63)	0.08*
Sex M/F (No.)	26/4	23/7	
Duration of surgery in minutes (Mean ± SD)	43.4 (± 10.7)	41.17 (±9.68)	0.41*

* Student t-test

In PNS guided technique, 83.33% of obturator nerve block was performed in single attempt, whereas it was 66.66 % in USG guided technique while 16.66% of cases in PNS guided technique were found to be difficult, and 33.33% were difficult in USG-guided technique. The ease of the block was comparable with both methods (P = 0.14) Table 2.

Table 2. Ease of the obturator nerve block.

Ease of Block	PNS guided ONB group (%) (n= 30)	USG guided ONB group (%) (n= 30)	P value
Easy	25 (83.33)	20 (66.66)	0.14*
Difficult	5 (16.66)	10 (33.33)	

* Chi-square test

In 23.33% of the patients in PNS guided ONB group adductor reflex was noted, whereas it was seen in 16.66 % patients in USG guided technique (p=0.75). Adductor reflex in these cases were mild and did not require deferring the surgical procedure (Table 3).

Therefore, the success rate of obturator nerve block

76.66% (23/30) in PNS guided technique, whereas 83.33% (25/30) in USG guided technique.

Table 3. Adductor reflex.

Adductor reflex	PNS guided ONB group (%) (n= 30)	USG guided ONB group (%) (n= 30)	P-value
Present	7 (23.33)	5 (16.66)	0.75*

* Chi-square test

The surgeon’s satisfactions were labelled as good in 83.33 % cases of ONB in PNS guided technique where as 86.66 % in USG guided block technique and it was statistically not significant. None of the blocks were labelled as worst by surgeons (Table 4).

Table 4. Surgeon’s satisfactions.

Surgeon’s satisfactions	PNS guided ONB group (%) (n= 30)	USG guided ONB group (%) (n= 30)	P value
Good	25 (83.33)	26 (86.66)	0.71*
Fair	5 (16.66)	4 (13.33)	

* Chi-square

There was no hematoma in any of the patients. There were no major complications in any of the study populations.

DISCUSSION

Most of the bladder cancer patients belong to the geriatric age group and have various cardiac, respiratory and other metabolic comorbidities. So there is increasing risk of complications following general anesthesia (GA). The subarachnoid block is the most feasible anesthetic technique because, it is cost-effective, has better postoperative recovery, decreases the need of opioids, and improves mobility and functional recovery, and GA-related complications. The obturator nerve originated from the lumbar plexus L2 to L4 and passes near the lateral wall of the bladder. During TURBT, the electric resectors directly stimulate the obturator nerve, especially on the lateral and inferolateral wall tumors, leading to adductor muscle contraction and sudden leg movement, which is associated with the risk of bladder perforation, bleeding and incomplete tumor resections.¹⁴

Different strategies are described in the literature to prevent the stimulation of the obturator nerve, such as GA with muscle relaxants, reducing the intensity of the resector, the use of laser resectors, bipolar resectoscope, and change in the site of an inactive electrode, use of saline irrigation and periprostatic infiltrations with

varied success rate. Among them, SAB with selective obturator nerve block is an effective option to prevent adductor reflex.^{1,2,5,7}

In this study, we found the success rate of the obturator nerve block was 76.66% with peripheral nerve stimulator-guided obturator nerve block. Teymourian H and colleagues reported a success rate of 78% by using a peripheral nerve stimulator for obturator nerve block in their study. These findings were in congruence with our study.¹⁵

However, Min and Bolat et al., reported an overall success rate of 88.6% to 95.4% using a peripheral nerve stimulator, which was relatively high compared to the present study. This might be because nerve stimulation techniques rely on the needle tip being directed towards the nerve and producing the contractions. Still, sometimes, this technique spares the branches of the obturator nerve, which might lead to differences in the success rate.^{2,16}

In this study, the success rate of the Obturator nerve block was 83.33%, with USG-guided obturator nerve blocks. The study by Teymourian H et al. found a success rate of 92% with ultrasonography-guided blocks. However, Lee SH and Akkaya T et al. found a success rate of 97.2% in ultrasound-guided obturator nerve blocks. These differences might be attributed to the obturator nerve which is itself thin, embedded in an intermuscular septum, and difficult to be visualized by ultrasonography and inadequate diffusion of local anesthetics.^{15,17,18}

In our study, adductor reflex was seen in 16.66 % by using Ultrasound, whereas 23.33% in peripheral nerve stimulation guided obturator nerve block. The study by Teymourian H et al. found the adductor reflexes in 22.6% in peripheral nerve stimulator-guided obturator nerve block and 8.1% in Ultrasound-guided block. The finding is comparable with the present study.¹⁵

In our study, we could not find any difference in the number of needles redirected between the two groups, as was also noted by Manassero et al. in their study.¹⁹

In the present study, surgeon's satisfaction was found to be 83.33% in nerve locator-guided obturator nerve blocks, whereas 86.66% in sonography groups. Thallaj and Rabah et al. also observe similar findings in their study.²⁰

There were no complications observed in any of the study patients during the study period. Similar findings reported by other studies comparing Ultrasound versus

nerve stimulator-guided obturator nerve block for TURBT surgery.^{6,21}

In TURBT surgery, the complications results from poor nerve blockade and subsequent adductor reflexes. The literature revealed that the incidence of bladder perforation was found in between 0.9% to 5%.¹¹

In this study, the difference in success rates of the obturator nerve block was statistically insignificant between the two techniques ($p=0.75$). Sinha et al., in their research, have also shown a comparable success rate with the usage of a peripheral nerve stimulator and ultrasound-guided obturator nerve block and our findings are comparable with these recent studies.¹¹

Ultrasound-guided obturator nerve block technique is considered superior but can also be challenging as it requires a certain competency level it is difficult to image the obturator nerve because of its small size and embedment in muscular septum. However, obturator nerve blocks with peripheral nerve stimulators equally provide a similar success rate. The nerve stimulator technique is simple, equally effective and can be used in setups where there is a non-availability of a USG machine.

However, every procedure needs adequate practice to gain the skill and perfection, so the choice of technique depends on availability of equipment and skill of the operator.

The limitation in this study is that, the success of block was assessed by adductor reflex only. Sensory blockade couldn't be assessed because all the ONB were performed after subarachnoid block. Sensory and motor block assessment could have helped us finding out the onset and duration of nerve block.

CONCLUSIONS

The findings of this study suggest that ultrasound and nerve stimulator guided obturator nerve block are easy to perform and there is no significant difference in the success rate of the ONB between these two techniques. They are effective to abolish the adductor reflexes and provide optimal intraoperative conditions in patients undergoing TURBT surgery. However, there should be further large multicenter, randomized controlled trials with monitoring of residual ONB in the postoperative period.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

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