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A comparative study of ultrasonography versus peripheral nerve stimulator-guided obturator nerve block for transurethral resection of bladder tumor under spinal anesthesia

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ABSTRACT

Background: Transurethral resection of bladder tumor (TURBT) is usually done spinal anesthesia but it does not prevent the obturator reflex leading to bladder perforation, bleeding, or incompletely resection of resection of the tumor which could be prevented by obturator nerve block (ONB) in TURBT. **Aims and Objectives:** The aim of our study is to compare the effectiveness of ONB by peripheral nerve stimulator (PNS) and ultrasonography (USG) in TURBT and also compare morbidity between USG- and PNS-guided ONB in TURBT under spinal anesthesia. **Materials and Methods:** Sixty patients were randomly divided into two groups. Group (1) patients had a PNS-guided ONB and Group (2) patients had ONB-guided ONB. The presence or absence of adductor muscles reflexes was recorded. Bladder perforation and bleeding during surgery were also recorded. **Results:** A success rate of 90% was achieved in the Group (2) compared to 66% in Group (1) which was clinically significant with P = 0.049. Complete bladder perforation was detected in four patients in Group (1) whereas no perforation was observed in Group (2). Bleeding was observed in both groups but severe bleeding was present in five patients in Group (1) and required a blood transfusion. **Conclusion:** We concluded that USG-guided ONB is more efficient and safer as compared to PNS-guided ONB.

Key words: Obturator nerve; Transurethral resection of bladder tumor; Spinal anesthesia; Peripheral nerve stimulator; Ultrasonography

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INTRODUCTION

Peripheral nerve blocks remain a well-accepted component of comprehensive anesthetic care.[1]

Selective obturator nerve block (ONB) was first described by Labat in 1922.[2] Various techniques of ONB have been described since then.[3-5] ONB is used to provide pain relief in obturator neuralgia, in relief of adductor muscle spasm, associated with hemi or paraplegia among patients suffering from cerebrovascular pathologies, medullary injuries, multiple sclerosis, treatment of painful hip joint conditions and in urological surgery to suppress the obturator reflex during transurethral resection of the lateral bladder wall tumor.[6] Obturator nerve passes in proximity to the bladder neck, inferolateral bladder wall and prostatic urethra.[7]

Although spinal anesthesia is frequently used during TURBT, this does not prevent the obturator jerk reflex. On the other hand, in TURBT, ONB can stop the obturator reflex to prevent complications such as bleeding, bladder perforation, and insufficient tumor resection.[7-11]

Many patients in our tertiary care facility undergo surgery for bladder cancer. These patients tend to be elderly and have a number of comorbid conditions. In these patients,

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spinal anaesthesia is preferred over general anaesthesia. The only shortcoming with spinal anaesthesia is sparing of the obturator nerve which passed close to the lateral wall of bladder tumor can get stimulate due to electric current resulting sudden adductor muscle contraction with potential complication of bladder rupture or injury during transurethral resection of bladder tumor (TURBT). In order to avoid this complication obturator nerve block is given along with sub arachnoid block. Obturator nerve block is performed either blind or with the help of peripheral nerve stimulator or USG, with different success rates. In the present study we compared the Peripheral Nerve Stimulator (PNS) with USG for the success of Obturator nerve block in terms of adductor muscle spasm during procedure, blood loss during surgery and complication (bladder perforation).

Aims and objectives

We compare Peripheral Nerve Stimulator with USG for effectiveness of obturator nerve block during TURBT under SAB by using following parameters:

a. Adductor muscle spasm during surgery
b. Blood loss during surgery
c. Bladder perforation during surgery (if any)

MATERIALS AND METHODS

The present study is a randomized prospective and observational study. After getting approval from the "Institutional Ethics Committee," it was conducted in the Department of Anaesthesiology, Super Speciality Hospital, Shyam Shah Medical College Rewa, Madhya Pradesh, from January 2021 to September 2022 on 60 patients, during the period of study.

Inclusion criteria

The following criteria were included in the study:

1. All the adult patients of either sex posted for TURBT
2. ASA physical status Grade I and II patients.

Exclusion criteria

The following criteria were excluded from the study:

1. Not satisfying inclusion criteria
2. Patient with advanced cardiac and respiratory insufficiency
3. Allergy to local anesthesia
4. Pre-existing neurologic deficits
5. Infection over injection site
6. Patient with coagulation disorder.

Method

After the Institution Ethical Committee approval and informed patient consent, 60 patients after randomization by lottery method were assigned in one of the two groups as follows:

Both groups will receive 10 mL 2% lignocaine HCl.

Group 1: The drugs were injected after locating obturator nerve with PNS

Group 2: The drugs were injected after locating obturator nerve with USG.

A detailed perioperative evaluation including medical history, physical examination, vital signs, laboratory tests, and concurrent medical assessment was done for all the patients.

In the operation theater, an intravenous catheter was secured and patients were monitored for heart rate, non-invasive blood pressure, electrocardiogram, and oxygen saturation.

All patients after aseptic preparation received subarachnoid block in lumbar 3–4 or 4–5 space in a sitting position. About 12–15 mg of heavy 0.5% bupivacaine was injected into the subarachnoid space. The dose of injection bupivacaine for subarachnoid block was decided after taking into consideration about patient characteristics such as age, height, and weight. After the completion of the block, patients were laid in the supine position and assessed for sensory motor block. When the sensory block level reached about T10, ONB was performed according to the group assignment.

ONB

By PNS technique

In Group 1- patient lies supine, with the limb to be block kept at 30 degree abduction, patient pubic and upper thigh was aseptically prepared and a 22 gauge 8 cm long block needle attached to peripheral nerve stimulator (PNS) which is set at 2 mA current was inserted 1.5 cm lateral and perpendicular inferior to pubic tubercle to hit ramus and redirect needle caudally and medially to enter obturator foramen where obturator canal houses the nerve, 10 ml of 2% lignocaine HCl was slowly injected into the muscle interphase after negative aspiration if adductor muscle twitching was noted even at 0.5 mA.

By USG technique

In Group 2, after the patient lies supine, the affected leg was slightly abducted and rotated externally without knee flexion. Patient pubic and upper thigh aseptically prepared. Using a two-dimensional (2D) ultrasound linear probe 6–13 MHz under sterile conditions, the anteromedial aspect of the thigh was canned.

The probe was positioned on and was parallel to the inguinal ligament, and probe is advanced medially along the crease to identify the adductor muscles and their fasciae. The anterior branch is sandwiched between the pectineus and adductor brevis muscles. The block needle is advanced to initially position the needle tip between the pectineus and adductor brevis muscles. At this point, 5 mL of local anesthetic solution is injected. The needle is advanced further to position the needle tip between the adductor brevis and adductor magnus muscles and another 5 mL of local anesthetic solution is injected. It is important for the local anesthetic solution to spread into the index fascial space and not to be injected into the muscles.

During the operative procedure, the primary end point of the study was adductor muscle spasm (adductor reflex) defined as jerky adduction and external rotation of the thigh at hip joint. Bleeding and bladder perforation were the secondary end points. Adductor muscle spasm divided into three grades.

Grade I: No adductor muscle spasm during surgery
Grade II: There was an adductor muscle spasm but not severe enough to disturb the surgeon
Grade III: Adductor muscle spasm severe enough to disturb surgeon's resection.

Grade I considered as successful ONB and Grades II and III were included as block failure.

Bleeding

Bleeding was classified into three categories

- Mild: Difference of pre-operative and post-operative hemoglobin level upto1 g/dL
- Moderate: Difference of pre-operative and post-operative hemoglobin level 1–2 g/dL
- Severe: Difference of pre-operative and post-operative hemoglobin level more than 2 g/dL.

RESULTS

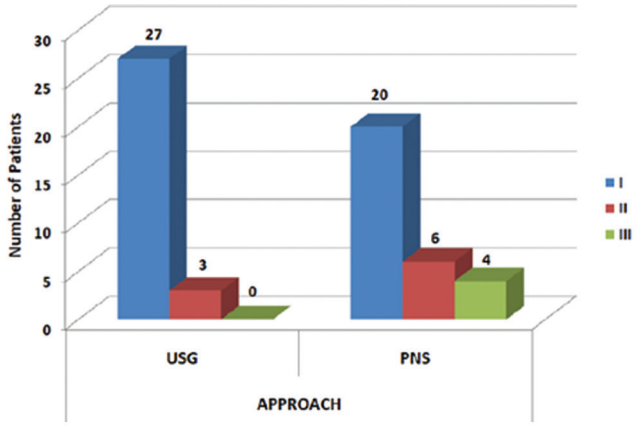
The patients were randomly divided into two groups of 30 patients in each group in which Group I had PNS-guided ONB and Group II had USG-guided ONB. Recorded parameters were tabulated and appropriate statistic test were applied.

In our study, the total population was 60, and we found that most of the patients were found in age distribution between 61 and 70 years in both the approaches, with an insignificant P=0.748 and the majority of male patients were present in both the approaches such as 96.7% in USG approach and 100% in PNS approach with the insignificant P=0.313.

Distribution of adductor muscle spasm during surgery

Adductor muscle spasm during surgery	Approach		Total
	USG	PNS	
I			
n	27	20	47
%	90.0	66.7	78.3
II			
n	3	6	9
%	10.0	20.0	15.0
III			
n	0	4	4
%	0.0	13.3	6.67
Total			
n	30	30	60
%	100.0	100.0	100.0

USG: Ultrasonography, PNS: Peripheral nerve stimulator, Chi square=6.04; *P*=0.049

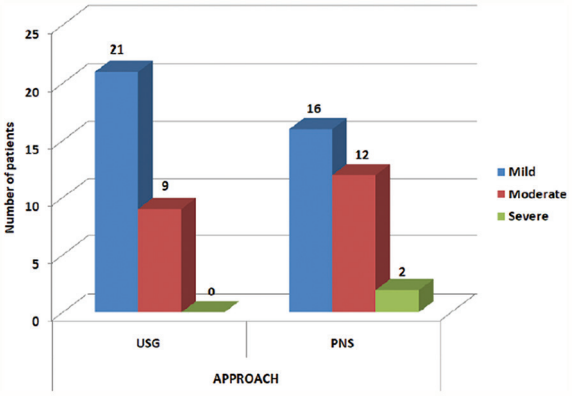


In our study, we consider adductor muscle spasm Grade I as a successful ONB, and Grade II and III are included in block failure. Hence, out of 60 patients, adductor muscle spasm Grade I found in 90% in USG group patients and 66.7% in PNS group patients with P=0.049 which was clinically significant. About 10% of patients in the USG group and 20% of patients in the PNS group had Grade II adductor muscle spasm. About 13.3% of patients in PNS group had Grade III adductor muscle spasm whereas no patient in the USG group had Grade III adductor muscle spasm.

Comparison of bleeding rate between two groups

Bleeding	Approach		Total
	USG	PNS	
Mild			
n	21	16	37
%	70.0	53.3	61.7
Moderate			
n	9	12	21
%	30.0	40.0	35.0
Severe			
n	0	2	2
%	0.0	6.7	3.3
Total			
n	30	30	60
%	100.0	100.0	100.0

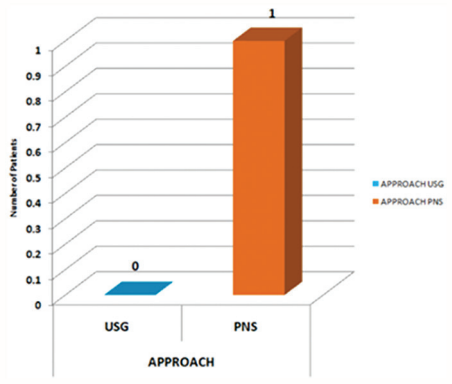
USG: Ultrasonography, PNS: Peripheral nerve stimulator, Chi square=3.10; *P*=0.212



Comparison of bladder perforation between two groups

Bladder perforation	Approach		Total
	USG	PNS	
No			
n	30	29	59
%	100.0	96.7	98.3
Yes			
n	0	1	1
%	0.0	3.3	1.7
Total			
n	30	30	60
%	100.0	100.0	100.0

USG: Ultrasonography, PNS: Peripheral nerve stimulator, Chi square=1.02; *P*=0.313



DISCUSSION

Peripheral nerve blocks are cost-effective anesthetic techniques used to provide anesthesia while avoiding airway instrumentation and hemodynamic consequences of general anesthesia. Patient satisfaction, growing demand for cost-effective anesthesia, and a favorable post-operative recovery profile have resulted in increased demand for regional anesthetic techniques.

A well-accepted peripheral nerve block technique involves US-guided placement of LA adjacent to anatomic structures with known perineural proximity (e.g., fascia and vasculature). Nerve stimulation techniques rely on the needle tip being directed toward the nerve itself and are particularly useful when a nerve is difficult to image sonographically. The ON is one such nerve that can be both, difficult to stimulate electrically and image sonographically.

Stimulation of the ON by electric current during TURBT causes sudden jerk (obturator reflex) due to contraction of adductor muscles. This could result in a deep cut or bladder perforation that causes heavy bleeding. As a result, the bladder tumor may not completely be removed and may spread. To avoid the adductor jerk and its associated complications, various procedures have been reported in the literature, including the use of general anesthesia combined with muscle relaxants, ONB, superficial resection with low current, and cutting with a bipolar resectoscope. Over the past 10 years, various strategies for the ONB have developed.

Till now, limited studies have been undertaken to compare US-guided and nerve-stimulation techniques to perform ONB. In the present study, we aimed to compare the ONB efficacy and success rates, performed under US guidance (Group II) and with PNS (Group I), in patients undergoing TURBT under spinal anesthesia.

The adductor reflex, which is characterized by jerky adduction and external rotation of the thigh at the hip joint, served as the study's primary endpoint during the surgical procedure. Bladder perforation and bleeding were the secondary endpoints.

Adductor muscle spasms divided into three grades: -

- Grade I: No adductor muscle spasm during surgery
- Grade II: There was an adductor muscle spasm, but it was not significant enough to disturb the surgeon
- Grade III: Adductor muscle spasm severe enough to disturb surgeon's resection.

In our study we consider Grade I as a Successful obturator nerve block and Grade II and Grade III were included as obturator nerve block failure.

In our study, we found that patients in Group I that is PNS, only 66% patients had no adductor muscle spasm and TURBT procedure can perform under spinal anaesthesia.

In Group II Patients in which Obturater nerve block was given with USG, the success rate of block was 90% Min et al., and Bolat et al., in their study using nerve stimulator to do ONB reported an overall success rate of 95.4% and 88.6% respectively. Recent studies reported more success rate of 97.2% for nerve stimulation in combination with sonography. In our study success rate in Group I PNS guided obturator nerve block was about 66% and in group II USG guided obturator nerve block was about 90%.

Dick et al., in a study evaluated the occurrence of bleeding was 13% while Collado et al., have reported 3.4% of patients needed blood transfusion. Malik et al., reported 25% of patients in their study required transfusion after TURBT. In a study done by Teymourian H et al sever bleeding was seen in 17.7% of ultrasound-guided ONB in compare with 41.9% in control group. In our study severe bleeding was seen in 6.7% in Group I PNS whereas no bleeding was found in Group II USG obturator nerve block.

The incidence of bladder perforation, a major complication, was 3.3% in Group I whereas there was no incidence in Group II. Various studies found bladder perforation rates ranging from 0.9% to 5%, while Teymourian H et al found 1.6% and 12.9% in sonography guided ONB and control groups, respectively. On comparing with our study bladder perforation was 3.3% in Group I PNS and no bladder perforation was found in Group II USG. This indicates that in Group II USG guided obturator nerve block patients due to blockage of obturator nerve TURBT was perform without any interruption and there was no incidence of bladder perforation and lesser requirement of blood transfusion.

Limitations of the study

In many peripheral hospital setup USG machine is still not available and they mainly rely on PNS for obturator nerve block.

CONCLUSION

1. ONB with spinal anesthesia is a safe and reliable technique for the prevention of obturator jerk during TURBT
2. The result of our study concludes that both techniques USG and PNS are safe and easy to perform ONB. However, USG has a higher success rate and less morbidity as compared to PNS
3. PNS can be a good option to perform ONB in places where USG machines are not available.

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Authors' Contributions:
MS- Definition of intellectual content, literature survey, prepared first draft of the manuscript, implementation of the study protocol, data collection, data analysis, manuscript preparation, and submission of the article; **APS-** Concept, design, clinical protocol, manuscript preparation, design of study, statistical analysis, and interpretation; **KKP-** Coordination and manuscript revision.

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