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A Comparison of Ultrasound Guided Versus Ultrasound with Nerve Stimulation Technique for Obturator Nerve Block in Transurethral Resection of Bladder Tumour

Olvyna D'souza[1], Suman Sahu[2], Supriya Gokhale[3], Deepika Sath[4], Samrajni Ganguly[5] Dheeraj Shamsukha[6]

[1]Professor and HOD [2,5,6]Senior Resident [3,4]Assistant Professor, Department of Anaesthesia, MGM Medical College, Kamothe, Navi Mumbai, Maharashtra 410209, India.

Abstract

Introduction: The aim of the study was to compare the effectiveness of two different techniques in blocking obturator nerve (ON) and adductor spasm during transurethral resection of bladder tumor (TURBT).

Methodology: We designed a prospective, randomized, double-blind study, in which fifty patients with American Society of Anesthesiologists Status II and III were scheduled to undergo TURBT for lateral and posterolateral bladder wall tumor were. Group I (ultrasound only group, n = 25) patients received 4 ml of bupivacaine 0.5% each at anterior, and posterior division of ON under real-time US visualization and Group II (ultrasound-nerve stimulation group, n = 25) received the same amount of bupivacaine 0.5% for each division using US-guidance with nerve stimulation-assisted technique. Block success and performance time and complications were measured along with patient and surgeon satisfaction into two groups. We did two sample independent t-test and Pearson's Chi-square/Fisher's exact test.

Results: A success rate of 88% was achieved in Group II as compared to 70% in Group I with increased block performance time in Group II (5min) versus (3 min) in Group I. A better patient and surgeon satisfaction were seen in Group II with combination of US and nerve stimulation technique. No complications were encountered.

Conclusion: We conclude that both techniques are safe and easy to perform; however, nerve stimulation along with US results in a higher success rate.

Keywords: Nerve Stimulation; Obturator Nerve Block; Obturator Reflex; Ultrasound.

Introduction

Peripheral nerve blocks are not only widely-used for surgical anesthesia but for both postoperative and nonsurgical analgesia as well. Nerve blocks are often used as an alternatives to avoid the adverse effects of other anesthetics or analgesics. The most common indication being their use to avoid complications of general anesthesia, particularly respiratory-related effects. In certain clinical situations nerve blocks have shown distinct benefits over general or neuraxialanesthesia [1]. With the advent of ultrasound imaging direct visualization of needle relative to target nerves, blood vessels, and related structures has been made possible and easily available. Ultrasound guided nerve blocks have shown to be more succesful [2], have decreased placement [3] and onset times [4] and lower requirement of anesthetic dose [5].

On the other hand, nerve stimulator guided technique utilizes a less expensive equipment and requires less extensive training than the ultrasound guided technique. However, there are concerns of a higher incidence of nerve trauma than ultrasound

Corresponding Author: Suman Sahu, Senior Resident, Department of Anesthesia, MGM Medical College, Kamothe, Navi Mumbai, Maharashtra 410209, India.
E-mail: drsumansahu@gmail.com

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guidance, because it is a "blind" technique. Combining the two techniques may bring the best of the two techniques.

During transurethral resection of lateral bladder wall lesions the obturator nerve may be stimulated resulting in spasm of the adductor muscles of the hip, which may lead to complications. Therefore, obturator nerve block (ONB) is commonly employed while performing transurethral surgeries. In this study, we compared ultrasound with nerve stimulation technique and ultrasound only technique in giving ONB to patients undergoing transurethral resection of bladder tumor (TURBT).

Methodology

Study Design and Setting

We designed a prospective randomized, double-blind study in the Department of Anaesthesiology, Mahatma Gandhi Mission Institute of Health Sciences, Navi Mumbaifrom May 2015 till April 2016. The medical college and hospital is located in Maharashtra, about an hour drive from Mumbai, Maharashtra. The study was approved by the institutional ethics committee and was done according to the Bioethical guidelines as prescribed by the Indian Council of Medical Research, New Delhi.

Sample Population and Randomization

Using previously published data, we calculated the sample size of our study [6] to be 50, to show a significant difference of atleast 5% in the successful motor block rate, keeping probability of Type 1 error at 0.05 and power of the study at 80%. During the study period, we enrolled patients aged 18 to 80 years, of either gender, belonging to the American Society of Anesthesiologists (ASA) Status II and III category who were undergoing TURBT of the lateral and postero-lateral bladder wall tumor at Mahatma Gandhi Mission Institute of Health Sciences, Navi Mumbai from May 2015 till April 2016. The diagnosis of bladder wall tumor was made after extensive investigations which included ultrasonography. The decision to perform TURBT on these patients was made by the treating surgeon. The patients were explained the purpose of the study and informed written consent was taken from them. We excluded patients who had a diagnosis of inguinal lymphadenopathy, any coagulation disorder, infection of the injection site, known hypersensitivity to local anesthetics or any pre-exisiting ON injury. Two patient groups were formed, one receiving the block under ultrasound guidance (US) and the other one receiving nerve block under ultrasound guidance with nerve stimulation (US-NS). Using random number generator software, the patients were allocated either of the two groups in 1:1 allocation ratio. The person generating the random number was not involved in the coordination of the trial.

Study Procedure

After randomization, the principal investigator evaluated all patientsand explained the procedure to them. Without giving any sedation or premedication, all patients were anesthetised to T10 level using 25 gauge spinal block with 3 ml of 0.5% hyperbaric bupivacain at the L3-L4 or L4-L5 level. Later the patients were in supine position with leg externally roatated and abducted at 30°. Under sterile conditions, the inguinal region was prepared for ultrasound probe with a linear (vascular) transducer, with a frequency range of 7–12 MHz and the anterior and posterior divisions of the ON were visualized between the muscle layers of adductor longus, adductor brevis, and adductor magnus.

Ultrasound Only Group (Group I)

To reach the anterior division of ON located between adductor longus and brevis a 22-gauge, 10 cm long locoplexneedle was advanced under US-guidance, laterally to medially and 5 ml of bupivacaine 0.5% was injected. After withdrawing the needle slightly, we redirected it towards the posterior division of the nerve, which is between adductor brevis and magnus and another volume of 5 ml of bupivacaine was injected. We monitored the spread of the anesthetic solution under real-time visualization of ultrasound.

Ultrasound with Nerve Stimulation Group (Group II)

Patients in this group received the nerve block under ultrasound guidance assisted with nerve stimulation technique. The nerve stimulator that we used in our study was Microcontroller-based nerve stimulator (LCD-GEMI-Model: DSL-007). After directing theneedle tip (22-gauge, 10 cm) towards the anterior division of ON, nerve stimulator was turned on to deliver stimulation current at 1–2 mA (2 Hz) and muscle contraction was elicited as a result.

The stimulation current was then gradually reduced to 0.5 mA. The needle was redirected toward the posterior division of ON after the current was reduced to zero. Using the same procedure as before another 5 ml of 0.5% bupivacaine was injected.

Outcome Measures

Primary outcomes of the study were to measure and compare the rate of succesful motor blockade and block performance time achieved by the two methods. Secondary outcomes were to compare the satisfaction rates of the surgeon and the patients, the onset time for both the methods, number of needle passes required during the procedure and any complications observed. The surgeon, who was masked to the group allocation of the patients, entered the operating room to start TURBT 10 minutes after the nerve blockage procedure. Before starting the surgery, the surgeon assessed the motor blockade. Motor bloackade as evaluated by the surgeon was scored as 0 = Adductor spasm, 1 = Reduced adductor spasm and 2 = No adductor spasm, which was measured at 10, 15, 20 minutes after injection, and only a score of 2 was considered as a successful block. The block was noted as failure when the spasm persisted after 20 minutes.

We calculated the success rate of motor blockade as the number of patients who had a succesful block as defined above within 20 min after block placement. We also noted the block performance time intraoperatively, which was the time between the start of sonography and needle removal at the end of block. Block onset time was defined as the time from the end of anestheticinjection until a motor block score of 2 was reached. This time was not noted for failed blocks.

Additionally, we noted the number of needle redirections which were needed to complete the nerve block. Any redirections needed to complete the bloackage were recordedas additional needle passes. Postoperatively we asked the patient and surgeon about their satisfaction with the procedure. Finally, complications like vascular injury, hematoma formation, nerve injury, phlebitis and thrombosis, visceral or organ injury and any other were noted.

Statistical Analysis

The collected data was entered in microsoft excel sheet to prepare a masterchart. Normality of the data was checked using the Kolmogorov-Smirnov test. Between group comparisons were made for quantitative variables using two-sample t-test, and the categorical variables by using Pearson's Chi-square/Fisher's exact test. Quantitative data was represented using means and standard deviations. P value less than 0.05 was considered to be statistically significant. Statistical Package for Social Sciences (SPSS) version 23 was used for data analysis and presentation.

Results

In the present study, 50 patients were randomly assigned either to the ultrasound only group (Group I) or the ultrasound-nerve stimulation group (Group II). There was no significant difference in the demographic characteristics of the two study groups as shown in Table 1. Using t-test for equality of means, the two groups were comparable in terms of age weight, and ASA status (p more than 0.05). When camparison was made with respect to the primary outcomes of the study, success rate of motor blockade

Table 1: Baseline characteristics of the patients included in the study

Variable	Group I	Group II	p value
Number of patients	25	25	
Age (years)	48.23±11.42*	47.6±9.33	0.451
Weight (kilograms)	64.88±8.43	63.44±11.72	0.0924
Males/Females	18/7	19/6	0.972
American Society of Anesthesiologists Status	2.42±0.44	2.74±0.68	0.543

*mean±standard deviation

Table 2: Comparison of both intervention and control group

Outcome variables	Group I (n=25)	Group II (n=25)	p value
Primary outcomes			
Success rate of motor blockade	18 (70%)	22 (88%)	<0.01
Block performance time (minutes)	3	5	<0.05
Secondary outcomes			
Block onset time (minutes)	13.42±4.33*	5.58±1.89	<0.001
Number of needle passes	2.28±1.48	2.93±1.16	0.487
Surgeon satisfaction	18 (70%)	23 (90%)	<0.01
Patient satisfaction	17 (68%)	24 (96%)	<0.05

*mean±standard deviation

was found to be higher in US-NS group (p value less than 0.01, Table 2). Similarly, the block performance time was higher in the intervention group (p value less than 0.05). Block onset time was found to be 5.58±1.89 minutes in the US-NS group which was statistically significantly lower than in the US group (p vlaue less thab 0.001). Surgeon and patient satisfaction was found to be statistically higher in the intervention group as comapred to the control group. No difference in the number of needle passes required to achieve motor blaockage was noted in this study sample (Table 2).

Discussion

This prospective randomized study demonstrates that US-NS enabled a more succesful, higher block performance time, less onset times and higher satisfaction of patients and surgeons as compared to US only. Previosuly, adductor muscle contraction has been reported in 20 to 55% of patients during the resection of lateral and inferolateral bladder tumors [7]. Blocking the obturator nerve, which runs close to the lateral bladder wall, can prevent this effectively. Patel et. al. showed that ONB prevented the development of obturator reflex in 28 of the 30 patients, with the two patients presenting with the accessory the obturator nerve [8]. Different approaches to ONB have been suggested since Labat's description in 1928 [9]. Since then efforts were made to improve upon the technique of nerve blocks. With the advances in imaging and wider availability, ultrasound imaging is increasingly used to guide peripheral nerve blocks. This allows real-time visualization of nerves, nearby structures, and the needle-tip to optimize block success. Mechanical nerve stimulation and electric stimulation were further steps in improving outcomes in patients undergoing peripheral nerve blocks.

Baseline data in our patients was comparable. This has helped us to remove confounders like age, gender, weight or ASA status of our study patients. Statistically insignificant differences in the mean weights of both the study groups helps to remove the confounding effect of weight because variations in weight affect metabolism of anethetic agents.The success rate of OBN using nerve stimulation technique has been reported to be 84% to 96% [10]. Bolat et al and Min et al reported a success rate of 88.6% [11] and 95% [12] for ONB using the nerve stimulator. Many factors influence this, presence of an acccesory obturator nerve being one of them. It is present in 10-30% of the cases [13] and runs parallel to the main obturator nerve along the medial side of the psoas muscle. Conflicting data about the superiority of any particular ONB technique makes the decision for an anesthetistdifficult. Recent studies have reported higher success rates of 93% to 97% in ultrasound-guided ONB procedures [14]. Some studies have reported similar outcomes with the use of either NS or US-NS techniques for peripheral nerve block [15].

Randomization and sampling has enabled us to remove some of the bias and balance out the confounfers in our study. However, small sample size is one of the limitations of our study. Due to the inherent subjective nature of the involved surgical experience in the succesful surgical outcome, the results of our study might not be applicable to other geographical locations.

Conclusion

Our results demonstrate that ultrasound-nerve stimulation technique has better objective and subjective clinical outcomes. We need studies with larger sample and at multiple sites to support our results.

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