



COMPARISON OF EASE OF BLOCK AND SUCCESS RATE OF INGUINAL AND CLASSIC APPROACHES OF OBTURATOR NERVE BLOCK USING PERIPHERAL NERVE STIMULATOR IN PATIENTS UNDERGOING TRANSURETHRAL RESECTION OF BLADDER TUMOURS INVOLVING LATERAL WALL UNDER SPINAL ANAESTHESIA.

Anaesthesiology

Dr. Surabhi Varshney Resident, Department of Anaesthesiology, King George Medical University, Lucknow - Corresponding Author

Vinita Singh MD Professor, Department of Anaesthesiology, King George Medical University, Lucknow

Dinesh Kaushal MD Professor, Department of Anaesthesiology, King George Medical University, Lucknow

ABSTRACT

Introduction: Transurethral resection of bladder tumours (TURBT) involving lateral wall has high risk of obturator nerve stimulation during procedure leading to adductor spasm which can be avoided by selective obturator nerve block (ONB). The classic approach requires more skill and has increased chances of vascular injury. The inguinal approach is a safer alternative. This randomised study was conducted to compare ease of block and success rate between both approaches.

Methods: Total 50 patients scheduled to undergo TURBT having bilateral bladder wall tumours were enrolled for the study after ethical approval from Institutional Ethics Committee and written, informed consent from patients. Power 80%, confidence 95%. In all patients ONB was performed by classic approach on one side and inguinal approach on other side using a nerve stimulator after giving spinal anaesthesia. Primary criteria-ease of block and success rate, secondary criteria-complications were compared between both approaches. Wilcoxon signed rank test was used to compare ease of block and Chi square test to compare success rate and complications. $P < 0.05$ was considered statistically significant.

Results: Ease of block ($P < 0.001$) and success rate ($P = 0.001$) were higher with inguinal approach whereas vascular injury ($P = 0.079$) and intraoperative adductor spasm ($P = 0.008$) were higher in classic approach.

Conclusion: The inguinal approach for ONB seems to be technically easier, safer and with higher success rate than classic approach.

KEYWORDS:

Adductor spasm, obturator nerve block, transurethral resection of bladder tumors.

INTRODUCTION

Obturator nerve block (ONB) has been used in urological surgery to block the adductor spasm that occurs due to stimulation of obturator nerve during Transurethral Resection of Bladder Tumours (TURBT) involving the lateral wall. TURBT is the first line treatment to diagnose, stage and treat visible tumours. Direct stimulation of the obturator nerve causes a sudden and violent adductor muscle spasm as it passes very close to bladder wall which can lead to serious complications such as bladder wall perforation, laceration of vessel wall, incomplete tumour resection and obturator haematomas.^{1,2} Various prevention strategies have been proposed such as muscle relaxation, reduction in the intensity of resector, the use of laser resectors, shifting to saline irrigation, peri-prostate infiltrations, and/or endoscopic transparietal blocks.³⁻⁷ But none of them is fully effective. Neither general anaesthesia with neuromuscular blocking drugs nor subarachnoid and epidural anaesthesia have demonstrated to be completely effective for the prevention of this adductor muscle spasm. Selective ONB remains the safest and most effective alternative to this problem.^{8,9} Nowadays, spinal anaesthesia combined with obturator nerve block is good choice thus preventing adductor spasm and avoiding the complications of general anaesthesia.^{10,11}

A technique commonly used for ONB is the *classic pubic approach* first described by Labat in 1922.¹² It is technically difficult as the nerve is placed deeply and in close proximity to obturator vessels leading to increased chances of puncture and haematoma formation. The success rate varies between 60.5% - 91.7% using a nerve stimulator.^{2,13,14} So, a safer and lesser complicated approach was desirable and was described by Choquet et al in 2005¹⁵ known as *inguinal approach*. It involves blockade of anterior and posterior branches of obturator nerve at the inguinal level. The complications with it are less likely as the nerve is located superficially with no major vessels in proximity.

This randomized clinical study was undertaken to compare the ease, success rate and complications of the classic pubic and superficial inguinal approach for ONB in patients undergoing TURBT under spinal anaesthesia (SA). We hypothesised that if ease of block is comparable to the classic approach, the new inguinal approach with a lower potential for complications would be a useful alternative to the classic Labat approach.

Material and methods:

The study was conducted in the operation theatre of urology department of K.G.M.U, Lucknow after ethical approval and written and informed consent from the patients. 50 patients scheduled to undergo TURBT and having bilateral bladder wall tumours were enrolled in the study. All the patients included were ASA grade 1 and 2. The exclusion criteria included patient refusal, ASA grade 3 or above, inguinal lymphadenopathy, perineal infection or hematoma at the needle insertion site, previous surgery or scars in the region, patients on anti-coagulants or anti-platelet drugs, coagulopathy and pre-existing obturator neuropathy. Patients were divided into two groups with $n = 50$ each for classic (GROUP P) and inguinal approach (GROUP I) and randomly distributed using computer generated tables. In operation theatre, standard monitors applied to the patient, 18G catheter secured and pre-loading done with 500ml of 0.9% Ringer's lactate intravenously. Spinal block was given with a 25G Quinke's needle at the L3-L4 interspace in sitting position. After confirming free flow and clear cerebrospinal fluid, 0.5% hyperbaric bupivacaine (12.5mg) was given and patient made supine. Sensory blockade was checked with a pin-prick test. ONB was performed after the sensory level block reached T10. All the patients were given bilateral obturator nerve block using classic approach on one side and the inguinal on the other. The type of approach for each side was randomized using computer generated tables.

All blocks were performed by single investigator who did not participate in further perioperative care of patients. The patient was laid supine and limb to be blocked was 30° abducted in both the approaches. ONB was performed using peripheral nerve stimulator (B. Braun Stimuplex, Germany). Initially, 2-3 mA current was given at a frequency of 2 Hz. As the needle came in contact with the obturator nerve and initial muscle contraction noticed, current was gradually reduced until visible muscle contractions occurred at lower current levels (approx 0.3-0.5mA). Now, at this point, 0.25% bupivacaine was given according to the approach. The current was again gradually increased and rechecked for any response to stimulation with the needle *in situ*. No response to the stimulation indicated that the block was effective.

CLASSIC PUBIC METHOD (LABAT APPROACH):

With the limb in 30° abduction pubic tubercle was palpated and a point

1.5 cm lateral and caudal to this was marked. A Stimuplex needle of 21G and 10 cm long was inserted perpendicular to this point. The needle was advanced until it made contact with a bony structure that is, inferior border of superior pubic ramus at a depth of 2-4 cm. The needle was then withdrawn by 3 cm and redirected 45° laterally to enter the obturator foramen. As the needle enters the foramen, a give way feeling is elicited and the adductor muscle contractions observed. The needle was withdrawn and redirected if no contraction noted. At the point when adductor muscle contractions were elicited, needle was aspirated for blood and then 10ml of 0.25% bupivacaine was injected. Every time the needle was withdrawn and redirected, it was counted as an attempt. If no response of adductor muscles after the tenth attempt was observed, 15ml of 0.25% bupivacaine was instilled blindly by the landmark approach described by LABAT and the needle was withdrawn. This was defined as a *Failed ONB*.

SUPERFICIALINGUINALAPPROACH:

On palpating the medial side of thigh, the femoral artery (FA) and the tendon of the long adductor muscle at the pubic tubercle were identified. The mid-point of the line drawn over the inguinal fold from the pulse of the FA to the tendon of the long adductor muscle was marked. The stimulex needle of 21G and 5cm was inserted in a 30° cephalad direction. It was advanced along the adductor muscle for a few centimeters. Initial twitching responses were seen on the posterior and medial aspect of thigh from the long adductor and gracilis muscle. As the needle was inserted deeper (0.5 to 1.5 cm) and laterally over the short adductor muscle, a twitching response from the major adductor muscle was obtained on poster-medial aspect of thigh. Now, 5-7 ml of 0.25% bupivacaine was administered. The needle was aspirated for blood at each attempt.

Failed ONB- when no contractions of adductor muscle were observed even after the tenth attempt, 15ml of 0.25% bupivacaine was given using the landmark approach and this was defined as Failed ONB.

An observer blinded to the approach used on either side, evaluated any adductor muscle spasms during operation. Occurrence of **Obturator sign** (i.e adductor spasm) intraoperatively was considered as *Failed cases*.

The ease of block was classified according to the number of attempts required to achieve the block as follows: <=2 attempts-easy, 3-10-difficult and >10-failed. Any complications such as vascular puncture, haematoma, nerve injury, visceral injury, and intravascular injection were noted and compared between both approaches.

The collected data was subjected to statistical analysis to obtain the results.

Statistical Analysis:

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 Statistical Analysis Software. The values were represented in Number (%) and Mean ± SD. The sample size has been calculated using the formula proposed by Fleiss (1981). In our pilot study, 30 patients were taken into study and 15% difference in the success rate was considered to be significant. We assumed 30% difference in the success rate to be significant.¹⁶ Thus at 95% confidence and 80% power, the calculated minimum sample size was 47. After making arrangement for contingency, we intended to keep the sample size at 50.

Wilcoxon signed rank test was used to compare ease of block. Chi square test was used to compare success rate and number of complications between both the groups. P value <0.05 was considered to be statistically significant.

Results:

All the patients who took part in the study were males of the age group 50-85 years. (Table 1).

Table 1: Age Profile of Patients

SN	Age group (Years)	No. of patients	Percentage
1.	50-59	12	24
2.	60-69	18	36
3.	70-79	16	32
4.	>80	4	8
Age (Mean ± SD) (Range)		66.80 ± 8.42 (50-81)	

There was significant difference in number of attempts taken (P= 0.001) and ease of block (P<0.001) between both the approaches. The inguinal approach had higher success rate (P= 0.001) with fewer complications. There were 3 incidences of vascular puncture (P=0.079) and 9 incidences of intraoperative adductor spasm (P= 0.008) in classic approach. (Table 2). None of the patients had any major complication. The cases having intraoperative adductor spasm were given general anaesthesia.

Table 2: Comparison of ease of block, median time taken, success rate and complications between classic and inguinal approach.

PARAMETERS	CLASSIC APPROACH (n=50)	INGUINAL APPROACH (n=50)	SIGNIFICANCE OF DIFFERENCE
NO. OF ATTEMPTS (MEAN ± SD) RANGE	3.50 ± 2.74	2.02 ± 1.51	t=3.634, P=0.001
EASE OF BLOCK			
EASY	21 (42%)	38 (76%)	χ ² =4.001, P<0.001
DIFFICULT	25 (50%)	12 (24%)	
FAILED	4 (8%)	0	
TIME TAKEN FOR BLOCK (min) (MEAN ± SD) RANGE	4.08 ± 3.60 (1-15)	2.03 ± 1.88 (1-12)	t=3.343, P=0.002
SUCCESS RATE			
SUCCESSFUL	37 (74%)	49 (98%)	χ ² =12, P=0.001
TOTAL FAILED (>10 ATTEMPTS + PRESENCE OF ADDUCTOR SPASM)	13 (26%)	1 (2%)	
COMPLICATIONS			
VASCULAR PUNCTURE	3 (6%)	0	χ ² =3.079, P=0.079
ADDUCTOR SPASM	9 (18%)	1 (2%)	χ ² =7.111, P=0.008

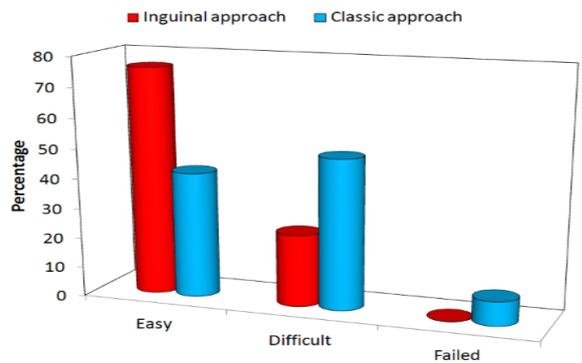


Fig 1: Comparison of ease of block between classic and inguinal approach

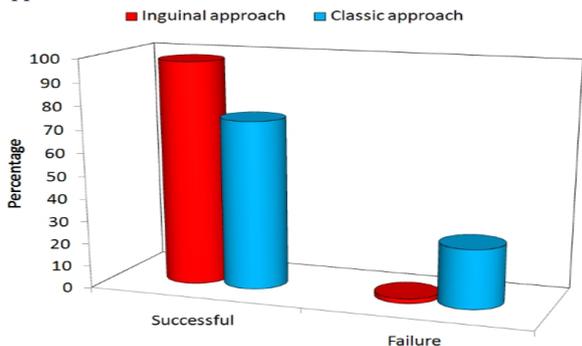


Fig 2: Comparison of success rate between classic and inguinal approach

Discussion:

The result of our study demonstrated inguinal approach for ONB to be safer and easier compared to the classic approach. The obturator nerve originates from anterior primary rami of L2 to L4 which is a part of lumbar plexus and is a mixed nerve i.e. it contains both motor and sensory fibres.¹⁷ It runs close to the prostatic urethra, bladder neck and

inferolateral bladder wall within the pelvic cavity.¹⁸ During the transurethral surgery, bladder is irrigated with fluid resulting in an even closer relationship of lateral bladder wall with the obturator nerve. The resectoscoped for surgery might stimulate the nerve causing adductor muscle spasm and complications like bladder perforation¹⁹, incomplete resection of tumour, obturator haematoma and sometimes perforation of the viscus.

For avoiding these problems, general anaesthesia with muscle relaxants has been proposed as a method of prevention of adductor spasm but there are reports that adductor spasm was not obliterated even with the use of general anaesthesia with muscle relaxants.²¹ SO PC et al²² have reported cases showing intraoperative adductor spasm even with general anaesthesia with muscle relaxant. Also majority of these patients are of elderly age group having associated cardiovascular and respiratory problems as well. Therefore, spinal anaesthesia with selective obturator nerve block is a better option for these patients.^{10,18}

The reported incidence of severe adductor muscle spasm is around 20% in patients undergoing transurethral surgery for large intra-urethral prostatic adenomas or laterally located bladder tumours.³

Researchers have suggested many other ways to prevent spasm like use of laser resectors, reducing the intensity of current, reversing the polarity, nerve cooling etc. but none has proved to be completely efficacious and are not routinely used.^{3,7} Various approaches have been used for ONB. The blind technique by classic approach was described by Labat et al in 1922.¹² This approach requires palpation of pubic tubercle. It is invasive and requires a longer needle.¹⁶ Pubic tubercle is palpated which may be at times difficult even for the experienced anaesthesiologist. In difficult cases, needle may pass above the pubic ramus and damage the surrounding structures like bladder, rectum and spermatic cord.²²

Kobayashi et al used the nerve stimulator guided ONB for the first time in 1991.²³

Choquet et al¹⁵ described the inguinal approach in 2005 which blocks the superficial branches of the obturator nerve and is performed at a distance from pelvis and large vessels thus causing lesser risk of complications.

In our study, we compared the ease of block, success rate and complications of the classic pubic approach and superficial inguinal approach of ONB. All blocks were performed after giving spinal anaesthesia due to the pain during the attempts. The cases were classified into easy, difficult and failed based on number of attempts i.e. ≤ 2 , 3-10 and >10 respectively. The cases requiring ≤ 10 attempts with no intraoperative adductor spasm were considered to be successful. The success rate with the inguinal approach was better than classic approach in our study and was statistically significant ($P=0.001$). The ease of block was better with the inguinal approach and statistically significant ($P<0.001$). Moningiet al²⁴ and Jo YY et al¹⁶ have also shown better success rate, lesser puncture frequency and lesser complications with inguinal approach as compared to classic approach in patients undergoing TURBT.

Sometimes in obese patients and in patients with anatomic variability, it becomes difficult to palpate the pubic tubercle. Ultrasound guided ONB is reported as a useful and safe method in these cases²⁵. Sinha et al²⁶ have shown comparable success rate between peripheral nerve stimulator and ultrasound guided techniques. Even with ultrasound guidance, it can be difficult to block the nerve because of its small size, flatness and depth of the posterior branch.^{27,28} Hence, this was considered as an intermediate skill level block. Regional blocks with peripheral nerve stimulator (PNS) still are a better option.^{10,14,29} This aids in greater accuracy and use of smaller volumes of local anaesthetic thus enhancing the effectiveness of the block. We have also used PNS in our study. Moningiet al²⁴ have also used PNS in their study to compare two approaches of ONB. It was reported that inguinal approach was quite superficial and comparatively easier to perform.

In our study, time taken to achieve the block ranged from 1 to 15 min. It was 2.03 ± 1.88 min in inguinal approach as compared to 4.08 ± 3.60 min in classic approach. Statistically, the difference was significant ($p=0.002$).

The complications of the block depend on site and depth of insertion of needle. In classic approach, the needle direction is towards the pelvic cavity. Advancing the needle further in cephalad direction could penetrate the pelvic cavity, perforate the bladder^{10,19}, rectum and spermatic cord. Accidental puncture of obturator vessels could lead to intravascular injection and haematoma formation. Regarding the complications, there were 3 incidences of vascular puncture by classic approach and none by inguinal approach which was not significant ($P=0.079$). Intraoperative adductor spasm was present in 9 cases by classic approach and in 1 case by inguinal approach and was statistically significant ($P=0.008$). Therefore, considering haemorrhagic complications in ONB with classic approach, careful approach is mandatory to avoid the damage to surrounding structures and vessels. In comparison, ONB using inguinal approach is performed at a distance from the pelvis and large vessels, thus reducing the chances of complications and allows compression in case of haematoma formation as shown in our study also.

We considered a cross-over study design because bilateral block is given to all patients and using both techniques on the same subject would avoid the variations in weight and body mass index of patients and the anatomical differences which could be confounding factors for comparing the two approaches.

There were certain limitations in our study. Firstly, it was a relatively small sample size study and to increase the reliability of our findings, further study is needed with a bigger sample size. Also, since the classic approach has been considered as an intermediate skill level block, so the ease of block is very much dependent on the skill of performing anaesthesiologist.

Conclusion:

The inguinal approach for ONB seems to be technically easier and safer as compared to classic approach. Though both approaches can provide adequate blockade of obturator nerve for the completion of transurethral resection of bladder wall tumours, the success rate with inguinal approach is more than the classic approach for ONB with minimal risk of complications. Further studies to confirm the empiricity of results are recommended.

References:

- Akata T, Murakami J, Yoshinaga A. Life-threatening haemorrhage following obturator artery injury during transurethral bladder surgery: A sequel of an unsuccessful obturator nerve block. *Acta Anaesthesiol Scand*. 1999; 43:784-8.
- Schulman MS, Vellayapan U, Monaghan TG: Simultaneous bilateral obturator nerve stimulation during transurethral electrovaporization of the prostate. *J Clin Anaesth* 1998; 10:518-521.
- Prentiss RI: Massive adductor muscle contraction in transurethral surgery: Cause and prevention; development of new electrical circuit. *Trans Am Assoc Genitourin Surg* 1964; 56:64-72.
- Shiozawa H, Aizawa T, Ito T, Miki M. A new transurethral resection system: Operating in saline environment precludes obturator nerve reflex. *J Urol* 2002; 168:2665-7.
- Biserte J: Treatment of superficial bladder tumours using the argon laser. *Acta Urol Belg* 1989; 57:697-701.
- Brunken C, Qiu H, Tauber R: Transurethral resection of bladder tumours in physiological saline. *Urologe* 2004; 43:1101-1105.
- Hobika JH and Clarke BG: Use of neuromuscular blocking drugs to counteract thigh adductor spasm induced by electrical shocks of obturator nerve during transurethral resection of bladder tumours. *J Urol* 1961; 85:295-296.
- Atanassoff PG, Weiss BM, Brull SJ: Lidocaine plasma levels following two techniques of obturator nerve block. *J Clin Anaesth* 1996; 8:535-539.
- Kakinohana M, Taira Y, Saitoh T, Hasegawa A, Gakiya M, Suhagara K. Interadductor approach to obturator nerve block for transurethral resection procedure: Comparison with traditional approach. *J Anaesth* 2002; 16:123-126.
- Tatlisen A and Sofikerim M. Obturator nerve block and transurethral surgery for bladder cancer. *Minerva Urol Nefrol* 2007; 59:137-41.
- Deliveliotis C, Alexopoulos K, Picramenos D, Economacos G, Goulandris N, Kostakopoulos A. The contribution of the obturator nerve block in the transurethral resection of bladder tumors. *Acta Urol Belg* 1995; 63:51-4.
- Labat G: *Regional Anaesthesia: Its Technique and Clinical Application*. WB Saunders, 1922.
- Gasparich JP, Mason JT, Berger RE. Use of nerve stimulator for simple and accurate obturator nerve block before transurethral resection. *J Urol* 1984; 132:291-3.
- Macaloud D, Trueck S, Meuret P, Heck M, Vial F, Ouologuem S et al. Postoperative analgesia after total knee replacement: The effect of an obturator nerve block added to the femoral 3-in-1 nerve block. *Anesth Analg* 2004; 99:251-4.
- Choquet O, Capdevila X, Bournourine K, Feugas JL, Bringuier-Branchereau S, Manelli JC. A new inguinal approach for the obturator nerve block: Anatomical and randomized clinical studies. *Anesthesiology* 2005; 103:1238-45.
- Jo YY, Choi E, Kil HK: Comparison of the success rate of inguinal approach with classical pubic approach for obturator nerve block in patients undergoing TURB. *Korean J Anaesthesiol*. 2011 Aug; 61(2):143-147.
- Brown DL: *Atlas of Regional Anesthesia*. 4th ed. Philadelphia, PA: WB Saunders; 1992.
- Ong EL, Chan ST: Transurethral surgery and the adductor spasm. *Ann Acad Med Singapore* 2000; 29:259-62.
- Frachet O, Cordier G, Henry N, Tligui M, Gattegno B, Sebe P. Bladder perforation during transurethral resection of bladder tumour: A review. *Progres en urologie: Journal de l'Association française d'urologie et de la Societefrancaise d'urologie* 2007; 17:1310-2.

20. Berglund RK, Herr HW. Surgery for bladder cancer. In: Walsh PC, editor. *Campbell's Urology*. 8th ed. Philadelphia: WB Saunders; 2002. 2375-85.
21. So PC: Two case reports of obturator nerve block for transurethral resection of bladder tumour. *Hong Kong Med J* 2004; 10:57-9.
22. Nysora.com New York: NYSORA, Inc ; 1996. Available from: <http://www.nysora.com/techniques/nerve-stimulator-and-surface-based-ra-techniques/lower-extremity/3028-obturator-nerve-block.html>.
23. Kobayashi M, Takeyoshi S, Takiyama R, Seki E, Tsuno S, Hidaka S et al: A report on 107 cases of obturator nerve block. *Masui* 1991; 40:1138-43.
24. Moningi S, Durga P, Ramachandran G et al: Comparison of inguinal versus classic approach for obturator nerve block in patients undergoing transurethral resection of bladder tumours under spinal anaesthesia. *Journal of Anaesthesiology Clinical Pharmacology* 2014; 30(1): 41-5.
25. Smith HE, Borowski W, Bohm M et al: Ultrasound guided selective block of the anterior branch of the obturator nerve for transurethral resection of bladder tumour. 2016 September; 9(5):351-55
26. Sinha SK, Abrams JH, Houle TT, Weller RS. Ultrasound guided obturator nerve block: An interfascial injection approach without nerve stimulation. *Reg Anesth Pain Med* 2009; 34:261-4.
27. Soong J, Schafhalter-Zoppoth I, Gray AT. Sonographic imaging of the obturator nerve for regional block. *Reg Anesth Pain Med* 2007; 32:146-51.
28. Saranteas T, Paraskeuopoulos T, Alevizou A, Kouskouri A, Zogojannis J, Anagnostopoulou S et al. Identification of the obturator nerve divisions and subdivisions in the inguinal region: A study with ultrasound. *Acta Anaesthesiol Scand* 2007; 51:1404-6.
29. McNamee DA, Parks L, Milligan KR. Post-operative analgesia following total knee replacement: An evaluation of the addition of the obturator nerve block to combined femoral and sciatic nerve block. *Acta Anaesthesiol Scand* 2002; 46:95-9.