

Comparison of inguinal versus classic approach for obturator nerve block in patients undergoing transurethral resection of bladder tumors under spinal anesthesia

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Abstract

Background: Selective obturator nerve blockade (ONB) is an effective option to prevent adductor spasm during transurethral resection of bladder tumors (TURBT) involving the lateral wall under spinal anesthesia (SA). The classic approach is less popular as the obturator nerve is deep seated and associated with vascular injury. The inguinal approach was described as a safer alternative. This randomized clinical study was undertaken to compare the ease of block, the success rate and complications of the classic pubic and superficial inguinal approach for ONB.

Materials and Methods: A total of 30 patients scheduled to undergo TURBT under SA were administered bilateral ONB. Inguinal approach recently described by Choquet was performed on one side and classic approach described by Labat was performed on the other side in random order using a nerve stimulator. The ease of block, success rate (number of attempts to accomplish the block) and complications were noted and compared between both the approaches. Chi-square analysis was performed to compare the ease of approach of the two techniques. Non-parametric analyses using Mann Whitney test was used to compare the number of attempts to accomplish the block in each approach. A value of $P < 0.05$ was considered statistically significant.

Results: The ease of block ($P = 0.09$) and the median number of attempts to accomplish the block ($P = 0.45$) were comparable between the two approaches. The incidence of vascular injury was higher in classic approach ($P = 0.056$).

Conclusions: Inguinal approach is a useful alternative to classic approach block for patients undergoing TURBT under SA.

Key words: Adductor spasm, inguinal approach, Labat approach, obturator nerve block, transurethral resection of bladder tumors

Introduction

Transurethral resection of bladder tumors (TURBT) involving the lateral wall performed with the resectoscope entails a risk for stimulation of the obturator nerve. The nerve passes in

close proximity to the lateral bladder wall and its stimulation results in adductor spasm. The complications of sudden adductor spasm such as bladder perforation, vascular injury, etc., though rare, are disastrous.^[1] Different strategies are adopted to avoid these complications during surgery such as use of general anesthesia with muscle relaxants, reducing the intensity of the current of the resectoscope, the use of laser resectors, obturator nerve blockade (ONB), etc. Selective ONB along with regional anesthesia may be an effective option to prevent adductor spasm^[2,3] and avoid the complications of general anesthesia. The classic pubic approach is commonly used for ONB. The block is technically difficult as the nerve is placed deeply. It is classified as a block with an intermediate level of difficulty. The success rate varies between 60.5% and 100% using a nerve stimulator.^[4-6] The incidence of vascular injury is also frequent due to proximity to the obturator vessels. A safer and less complicated approach is therefore desirable for a wider applicability of ONB for TURBT. Recently, Choquet *et al.*,^[7] described the inguinal approach,

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which involves blockade of anterior and posterior branches of obturator nerve at the inguinal level. The complications associated with this approach are likely to be lesser as the nerve is located superficially with no major vessels in its proximity. However, this approach is sparsely reported for TURBT.^[8]

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

Materials and Methods

After approval from our institutional review board and the written informed consent from patients were obtained, 30 patients scheduled to undergo TURBT under SA were enrolled in the study.

The exclusion criteria included patient refusal, 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. All patients had bilateral obturator nerve block using classic approach on one side and the inguinal on the other side. The type of approach for the right and left side was randomized. Allocation of patients receiving the type of block on either side was made according to the random numbers generated by the computer using Microsoft Office Excel 2007 and the function "RANDBETWEEN" 1 and 2.

On arrival to the operating room, standard anesthetic monitors were applied and patients were pre-loaded with 500 ml of 0.9% normal saline intravenously. A spinal block was performed with a 25 G Quincke needle at the L3-4 or L4-5 inter-space in sitting position. After confirming free-flow and clear cerebrospinal fluid, 0.5% hyperbaric bupivacaine (12.5 mg) was administered. Then, the patient was made supine. In the supine position, sensory blockade was checked with an alcohol swab and pin-prick test. When the sensory level block reached above T10, ONB was performed on the right and left sides according to the approach assignment for the side. All ONB were performed by a single investigator not involved in further peri-operative care of those patients. For both approaches, patient was laid supine, with the limb to be blocked at 30° abduction.

The ONB was performed using a peripheral nerve stimulator (B Braun STIMUPLEX® Dig RC Melsungen, AG, Germany). Initially, a current of 2 mA at a frequency of 2 Hz was set. Once the needle was in contact with the obturator nerve and initial muscle contraction was elicited, the current was gradually reduced until visible muscle contractions occurred at lower current levels (approx. 0.4-0.5 mA). At this point, injection of 0.25% bupivacaine was given as required for the approach. After instillation of the drug, the current was again gradually increased and re-checked for any response to stimulation with the needle *in situ*. Absence of any response to stimulation indicated that the block was effective.

Classic pubic method (of Labat)

A 21 G 10 cm long stimuplex needle (B Braun, Germany) was inserted perpendicularly at point 1.5 cm lateral and caudal to the pubic tubercle. The needle was advanced until it makes contact with the inferior border of the superior pubic ramus at a depth of 2-4 cm. The needle was then withdrawn by 3 cm and directed 45° laterally to enter the obturator foramen and the adductor muscle contraction was observed. The needle was withdrawn and redirected if there was no contraction noted. Once the adductor muscle contraction was elicited, 10 ml of 0.25% bupivacaine was injected. Every time the needle was re-directed it was counted as an attempt. The needle was aspirated for blood at each attempt. If there were no responses of adductor muscles after the tenth attempt, 15 ml of 0.25% bupivacaine was instilled blindly using the landmark approach as described by Labat and the needle was withdrawn: This was defined as a failed ONB.

Paravascular superficial inguinal approach

The tendon of the long adductor muscle at the pubic tubercle and the femoral artery (FA) were identified. For tendon identification, extreme leg abduction was required. The 21 G stimuplex 5 cm needle was inserted at 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 in a 30° cephalad direction. The needle was advanced for a few centimeters in depth along the adductor muscle. Twitching responses from the long adductor and gracilis muscles were observed on the posterior and medial aspect of the thigh. Subsequently, the needle was inserted deeper (0.5 cm to 1.5 cm) and slightly laterally over the short adductor muscle until a response from the major adductor muscle was obtained and could be visualized on the posterior-medial aspect of the thigh. 5-7 ml of local anesthetic was then administered. The needle was aspirated for blood at each attempt. If there were no contractions of the adductor muscles after the tenth attempt, 15 ml of 0.25% bupivacaine was instilled using the landmark approach and this was defined as a failed ONB.

An independent observer who was blinded to the type of approach on either side evaluated the signs of adductor spasm during operation. Occurrence of obturator sign i.e., adductor spasm during the intra-operative manipulation of the lateral bladder wall for the tumor removal, even after successful performance of the ONB with peripheral nerve stimulator was considered as a failure. Patients who had adductor spasm during the intra-operative period were administered general anesthesia with non-depolarizing muscle relaxants.

The ease of approach was classified according to the number of attempts required to accomplish the block as follows: Number of attempts 2 or less – easy, number of attempts >2 – difficult, number of attempts >10 – failed. The ease of block and success rate (number of attempts to accomplish the block) were noted and compared between both approaches. The complications with ONB such as hematoma, nerve injury, visceral injury and intra-vascular injection were noted and compared with both the approaches.

Statistical analysis

The analysis was performed using the SPSS version 13.0 (SPSS Inc., Chicago, IL). Sample size was calculated based on our initial pilot study whose data was not included in the study. In our pilot crossover study of 12 patients, the observed difference in the success rate between the two approaches was 8%. We assumed that 15% difference in the success rate would be considered as non-inferiority of one technique over the other for the calculation of the sample size^[9] was determined that a sample size of 31 subjects achieves 97% power at a 5% significance level using a two sided test of correlated proportions with a maximum allowable difference of 15% and an actual difference of 8% for non-inferiority. Therefore, 30 patients were enrolled for this crossover study.

Continuous data were presented as mean \pm SD or number of patients and categorical data as frequency of occurrence and percentages. Chi-square analysis was performed to compare the ease of approach of the two techniques. Fischer exact test was applied when the expected value of any of the cells was less than 5. Non-parametric analyses using Mann-Whitney test was used to compare the number of attempts to accomplish the block in each approach. A value of $P < 0.05$ was considered statistically significant.

Results

The demographic profile was depicted in Table 1. The ease of block, success of block and vascular complications with both approaches were depicted in Table 2. The ease of the block was comparable with both the approaches ($P = 0.09$). Overall, the median number of attempts to accomplish the block was same in

Table 1: Demographic profile

Demographic parameters	Data
Total number of patients	30
Male:female	27:3
Mean Age in years	58.6 (S.D.12.13) (Range 32-83)
Mean Weight in kgs.	72 (S.D.8.46) (Range 50-86)

S.D.= Standard deviation, kgs = Kilograms

Table 2: Comparison of ease of block, number of attempts and vascular complications with both approaches

Parameter	Classic	Inguinal	P value
Ease of block (%)			
Easy	9 (53.3)	17 (36.7)	0.09
Difficult	16 (56.7)	11 (43.3)	
Failed	5 (16.0)	2 (6.7)	
No. of attempts median (IQR)	3.0 (2.0-4.75)	3.0 (2.0-5.5)	0.45
Vascular complications (%)	4 (13.3)	0	0.056

IQR = Interquartile range

both groups ($P = 0.45$). There were no complications associated with inguinal approach, whereas there were four instances of vascular puncture ($P = 0.056$) with the classic approach. There was no evidence of hematoma in any of the patients. One episode of adductor spasm occurred on the side where ONB could not be performed successfully by classic approach. There were no major complications in any of the patients.

Discussion

The results of this study show that inguinal approach can be a safe and easy alternative to the classic approach for obturator nerve block.

The origin of the obturator nerve is from lumbar plexus L2 to L4. It contains both motor and sensory nerve fibers.^[10]

It runs close to the prostatic urethra, bladder neck and inferolateral bladder wall within the pelvic cavity.^[11] The irrigating fluid used during the transurethral procedure distends the lateral bladder wall resulting in a close relationship with the obturator nerve. The electric resectors stimulate the obturator nerve thus causing contraction of the adductor muscles of the thigh.

The incidence of severe adductor muscle spasm in patients undergoing transurethral surgery for large intra-urethral prostatic adenomas or laterally located bladder tumors was reported to be around 20%.^[12] This spasm may sometimes result in disastrous consequences such as bladder perforation,^[13] incomplete tumor resections, obturator hematomas^[1] and sometimes perforation of the viscus.

General anesthesia with muscle relaxants as a method for prevention of adductor spasm in patients undergoing TURBT is commonly advocated.^[14] However, there are reports of severe adductor spasm not obliterated even with the use of general anesthesia with muscle relaxants.^[15] Other methods like reducing the intensity of the resector,^[16] the use of laser resectors,^[17] reverse in the polarity of the electric current,^[12] change in the site of inactive electrode,^[18] use of saline irrigation^[19,20] and periprostatic infiltrations,^[11] have been used with varied success. SA with selective obturator nerve block is a suitable option for elderly patients coming for such surgeries.^[2,11]

Different approaches for the block had evolved in the last decade. The simplified version of the classic approach is the commonly used for ONB using a nerve stimulator, but this 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.^[21] Choquet *et al.*, described the inguinal approach.^[7] This blocks the superficial branches and therefore associated with lesser risk of complications.

We compared the ease of block, success rate and complications of the classic pubic approach and superficial inguinal approach for obturator block in patients under SA for transurethral resection of bladder lateral wall tumor. The compliance rate for the classic approach in un-anaesthetized patients for the classic approach was low due to the pain during the attempts. Therefore, all blocks were performed after institution of SA. The success rate (number of attempts to accomplish the ONB) with the inguinal approach was comparable to the classic approach in our study. The ease of block was better with the inguinal approach though statistically not significant. The reported success rate with classic approach using peripheral nerve stimulator varies between 60.5% and 100%.^[4,6] The novice performing the classic approach may result in higher failure rate. It was reported that the inguinal approach was quite superficial and comparatively easier to perform. In this study, the investigator was experienced with classic approach and relatively novice in performing the ONB by inguinal approach. Moreover, in our study, every time the needle was redirected, it was counted as an attempt. This could have resulted in more attempts to achieve successful block than reported earlier. It is also possible that the small size and flatness of the branches of the obturator nerve would have increased the number of attempts for successful accomplishment of the block.

Though not statistically significant, the complications were more with classic block in our study.^[21] The complications of the block depend upon the site and depth of insertion. The orientation of the needle for the classic pubic approach is towards

the pelvic cavity. Further advancement of the needle in cephalad direction could penetrate the pelvic cavity, perforating the bladder,^[2,13] rectum and spermatic cord. Inadvertent puncture of the obturator vessels could result in increased chances of intravascular injection and hematoma formation. In 10% of patients, an abnormal anastomosis is present between the external iliac and obturator arteries (corona mortis) behind the pubic bone. Puncture of corona mortis in such cases may lead to increased bleeding that can be difficult to control.^[22] The needle insertion site with the inguinal approach is away from intra-pelvic contents, resulting in lower risk of complications like hematoma and allows adequate compression if it occurs.

Another limitation is that all blocks were performed after SA. The success of the block was assessed by loss of the adductor muscle contractions after instillation of the local anesthetic rather than the sensory loss with pin prick test or swab technique.

The classic pubic approach requires good landmarks-palpation of the pubic tubercle, which may sometimes be technically difficult in obese patients resulting in more complications. Ultrasound guided block has the advantage of better success rate and fewer complications when used alone or supplemented.^[23,24] Use of ultrasound along with peripheral nerve stimulators would increase the efficacy of obturator nerve blocks by inguinal approach,^[25] also due to its increased anatomical variability.^[26] Nerve stimulation guided blocks are still commonly used in most of the places due to the non-availability of ultrasound. However, Sinha *et al.*, in their study have shown comparable success rate with the usage of peripheral nerve stimulator and ultrasound guided techniques.^[27] Ultrasound guided ONB can also be challenging. It was difficult to image the obturator nerve even with ultrasound guidance because of its small size, flatness and depth of the posterior branch.^[28,29] Hence, this was considered an intermediate skill level block. It is also true that for a novice anesthesiologist, user of ultrasound would be more difficult. Rather, the inguinal approach for obturator nerve block would be a simple approach for a novice. Regional blocks with peripheral nerve stimulator still hold the key to increase the effectiveness of the block.^[5,11,30] This aids in greater accuracy and use of smaller volumes of local anesthetic thus enhancing the safety of this block. A cross-over study design was considered as a bilateral block would be required for all patients and using both techniques on the same subject would provide an advantage of avoiding the inter-subject variations such as weight and *body mass index* and the anatomical differences that are usual potential confounding factors for comparing the two approaches.

An equivalent success rate with the inguinal approach would be a preferable choice for a novice for successfully performing the block without any major complications.

Obturator nerve block is the best method to attenuate adductor spasm. Inguinal approach is a safer alternative to classic approach block for patients undergoing TURBT under SA.

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