



COMPARATIVE STUDY OF CLASSIC APPROACH VERSUS INGUINAL APPROACH FOR OBTURATOR NERVE BLOCK IN PATIENTS UNDERGOING TRANSURETHRAL RESECTION OF BLADDER TUMOURS UNDER SPINAL ANAESTHESIA

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ABSTRACT

Introduction:

Sudden inadvertent occurrence of adductor muscle contraction during transurethral resection of bladder tumour operation under spinal anaesthesia is a common incidence, which may lead to various complications. Obturator nerve block is considered the most effective method to counteract these problems. The aim of this clinical study was to compare the ease of block, the success rate, failure rate and complications of the classic pubic and superficial inguinal approach for obturator nerve block under spinal anaesthesia for transurethral resection of bladder wall tumour.

Patients and Methods:

50 patients of either sex, aged between 30 to 75 years with ASA physical status I & II, undergoing transurethral resection of bladder tumour operation were selected for the study. All 50 patients were given bilateral obturator nerve block using classic pubic approach on one side and the inguinal on the other side after performing spinal anaesthesia. The type

of approach for the right and left side was randomized. Total no of approaches were divided into group 'P' (for pubic approach) and group 'I' (for inguinal approach).

Results:

In this study, it was found that the inguinal approach is better and safer than the classic pubic approach in terms of – needle insertion depth (group P 6.79 ± 1.2 cm and group I 3.79 ± 0.70 cm), number of attempts (group P 4.17 ± 2.26 and group I 3.16 ± 2.27), ease of block (54% easier in group I as against 30% in group P) , success rate of pubic approach was 84% against 90% in inguinal approach and complications like vessel puncture (group P= 14% and group I =0%). Incidence of failure in group P was 2/50 or 4% and group I was 1/50 or 2%), which was statistically insignificant.

Conclusion:

In terms of success and failure rate, there were no significant differences between the pubic and inguinal approaches but in terms of needle insertion depth, number of attempts and ease of obturator nerve blocks, there were significant differences in favour of the inguinal approach. So, it was concluded that to prevent obturator jerk during transurethral resection of bladder tumours operation, obturator nerve block by inguinal approach is a safer and better option than pubic approach.

Keywords: Transurethral resection of bladder tumour, Obturator nerve block, Bupivacaine.

INTRODUCTION

During transurethral resection of bladder tumour (TURBT) under spinal or epidural anaesthesia, electrical resection of the lateral wall tumour mass in the bladder by resectoscope may cause sudden and violent adductor muscle contraction, leading to potentially dangerous complications such as bladder wall perforation, vascular and visceral injury, obturator hematomas and incomplete tumor mass resection.^{1,2} Different strategies are adopted to avoid this complication during surgery such as use of general anaesthesia with muscle relaxants, reducing the intensity of the current of the resectoscope, use of obturator nerve block (ONB) as methods for prevention of adductor spasm in patients undergoing TURBT.³ Most of the patients coming for TURBT are elderly patients with multiple comorbidities involving the cardiovascular and respiratory system. Administration of general anaesthesia in these patients is not devoid of certain risks. The use of spinal anaesthesia with ONB in these elderly patients helps us to avoid general anaesthesia and in turn reduces potential airway related

complications. However, there are reports of severe adductor spasm not obliterated even with the use of general anaesthesia with muscle relaxants.⁴

Selective ONB is considered as the safest and most effective method to resolve these problems. In 1922, Labat described the course and branches of obturator nerve and came up with a novel way of blocking it with local anaesthetic injection.⁵ Because of lack of clear anatomic landmarks, the block complexity, patient discomfort and inconsistent results, the classic pubic method (described by Labat in 1922) remained forgotten until 1967, when the method was simplified by Parks.⁶ At present, this classic pubic approach of Labat is still commonly followed for ONB using a nerve stimulator, although the success rate varies (60.5-91.7%).^{7,8} In 1993, the interadductor approach was described, in which a needle is inserted behind the upper end of the adductor longus muscle.⁹ Recently, a simple and reliable new method, inguinal approach (Paravascular superficial inguinal approach) to block the anterior and posterior branches of obturator nerve at the inguinal level, was described by Choquet et al in which the needle is inserted at the mid-point of the femoral arterial pulse and the inner side of the adductor longus muscle on the inguinal crease.¹⁰ Although in the modern age ultrasound guided nerve blocks have become popular for their high success rate, the use of nerve stimulator is still highly prevalent in developing countries for economical reasons.

MATERIALS AND METHODS

After obtaining approval from institutional ethical committee, this prospective, single blind, randomised controlled trial was conducted under the Department of Anesthesiology at the Urology OT in IPGME&R, Kolkata. Study population was 50 patients of either sex, aged between 30 to 75 years, ASA physical status I & II, undergoing transurethral resection of bladder tumour operation. Complete pre-anaesthetic evaluation was performed in each of the 50 patients including detailed history taking, thorough physical check-up, assessment of spine, airway examination as well as routine pre-anaesthetic investigations like complete haemogram, fasting blood sugar (FBS) and post prandial blood sugar (PPBS), serum urea, creatinine, ECG 12 leads & chest x-ray-PA View. Written informed consent was obtained from all the patients prior to including them in the study during pre-anesthetic check-up.

Patient's refusal to subarachnoid block, any contraindication to subarachnoid block including infection at the site of injection, autonomic dysfunction, coagulopathy, neurological disorders, stenotic heart diseases, spinal deformity, haemodynamically compromised patients,

patients receiving β -blockers, chronic analgesic therapy or antiplatelet drugs or anticoagulants, and those having known allergy to study drugs were excluded from the study.

Proportion of successful obturator nerve block was the primary outcome measure on the basis of which sample size had been calculated for the study. Assuming a success rate of 75% for the classic approach and an improvement of 20% for the inguinal approach, it is calculated that 49 blocks would be required per group in order to detect this level of difference with 80% power and 5% probability of type I error. Hence, 50 subjects were chosen with each subject contributing one instance of pubic and one instance of inguinal approach to obturator nerve block. All 50 patients were given bilateral obturator nerve block using classic pubic 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 software. Total no of approaches were divided into two groups-group 'P' for pubic and group 'I' for inguinal approach.

The patients were given alprazolam 0.5mg at the night and tablet ranitidine 150 mg two hours before surgery and routine fasting protocol were followed. Sedation was avoided before application of nerve blocks.

On arrival to the operating room, standard anaesthetic 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 of clear cerebrospinal fluid, 2.5 ml of 0.5% hyperbaric bupivacaine (12.5 mg) was administered. Then, the patient was made supine and the 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 or left sides according to the approach assignment for the side. All ONB was 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 abducted at 30°.

In the classic pubic approach, the nerve stimulator needle was inserted at a point 1.5 cm lateral and 1.5 cm inferior to the pubic tubercle. For the inguinal approach, the needle was inserted at the midpoint of the femoral artery and the inner margin of the adductor longus muscle 0.5 cm below the inguinal crease. If the adductor muscle contraction did not occur by the 10th attempt, it was defined as a failed block. Puncture frequency, success rate and the presence of adductor muscle contraction during operation were evaluated. The block was

defined as successful when adductor muscle contraction occurred within ten attempts and muscle contraction does not occur during the operation.

The ONB was performed using a peripheral nerve stimulator (B Braun STIMUPLEX® Dig RC Melsungen, AG, Germany). Initially, a current of 2-3 mA at a frequency of 2 Hz was set. Once the needle was in contact with the obturator nerve, the initial muscle contraction was elicited. At this point, stimulating current was reduced gradually until visible muscle contraction occurred at lower current levels (approx. 0.4 -0.5 mA). At this point 10 ml of 0.25% bupivacaine was injected. 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.

A period of approximately 15 minutes was allowed for the local anaesthetic to take effect.

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 or success rate (number of attempts to accomplish the block) was noted and compared between both approaches. The number of needle attempts and the needle depth were recorded. The complications with ONB such as obturator hematoma, nerve injury, visceral injury and intra-vascular injection was noted and compared with the both approaches.

An independent observer who was blind 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 resection of tumour by electrocautery of the lateral bladder wall mass, 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 muscle relaxants.

Adverse effects such as hypotension, bradycardia, nausea or vomiting, pruritus were recorded during the operation and recovery. Data regarding systolic blood pressure(SBP), diastolic blood pressure(DBP), mean arterial pressure(MAP), peripheral oxygen saturation(spO2) and heart rate (HR) were monitored continuously and were recorded every 5 minutes for first 15 minutes and then every 15 minutes until the end of surgery. Hypotension was defined by a decrease in SBP >20% of the baseline value, and bradycardia was defined as heart rate <50 beats/ min. which was managed by Inj. Atropine 0.5mg IV bolus. Hypotension was managed

by Inj. Mephentermine 3-6mg IV bolus (titrated to patient response) along with fluids (both crystalloids and colloids).

□ 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 is no contraction. 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 was no responses of adductor muscles after the tenth attempt, 15 ml of 0.25% bupivacaine was injected blindly using the landmark approach as described by Labat and the needle was withdrawn and this was defined as a failed ONB.

□ Inguinal approach (by Choquet) →

The tendon of the long adductor muscle at the pubic tubercle and the femoral artery (FA) pulsation were identified. For tendon identification, extreme leg abduction was required. The 21 G Stimuplex 5 cm needle was inserted 0.5 cm below from 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 was 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 can be visualized on the posterior-medial aspect of the thigh. After that 10 ml of 0.25% bupivacaine was injected. The needle was aspirated for blood at each attempt. If there was no contractions of the adductor muscles after the tenth attempt, 15 ml of 0.25% bupivacaine was injected using the landmark approach and this was defined as a failed ONB.

STATISTICAL ANALYSIS

Data were summarized by routine descriptive strategies namely mean and standard deviation for numerical variables and counted as percentages for categorical variables. Numerical

variables were compared between groups by Students independent Sample-t test if normally distributed, or by Mann-Whitney ‘U’ test if otherwise. Chi-square test or Fischer’s exact test were employed for intergroup comparison of categorical variables. Analysis was two tailed and P <0.05 was considered statistically significant.

RESULTS

This prospective single blind randomised study was conducted on 50 adult patients of 30-75 yrsage,of either sex, belonging to the ASA physical status class I and II who underwent elective TURBT under spinal anaesthesia with ONB, in the urology operation theatre complex of IPGMER & SSKM Hospital in the time period between March 2015 – August 2016. Allocation of patients receiving the type of block on either side was made according to the random numbers generated by the computer software. According to the approach to obturator nerve block, the study patients were divided into 2 groups- Group P (Pubic approach) and Group I (Inguinal approach).

DEMOGRAPHIC PROFILE

Table 1 shows the distribution of age, weight and height of the 50 participants. Demographic profile shows no significant statistical difference.

Table 1: Demographic data

Demographic parameters	Sample size(n)	Mean	Standard deviation
AGE (yrs)	50	58.60	7.712
WEIGHT (kg)	50	63.32	9.086
HEIGHT (mts)	50	1.69	0.045

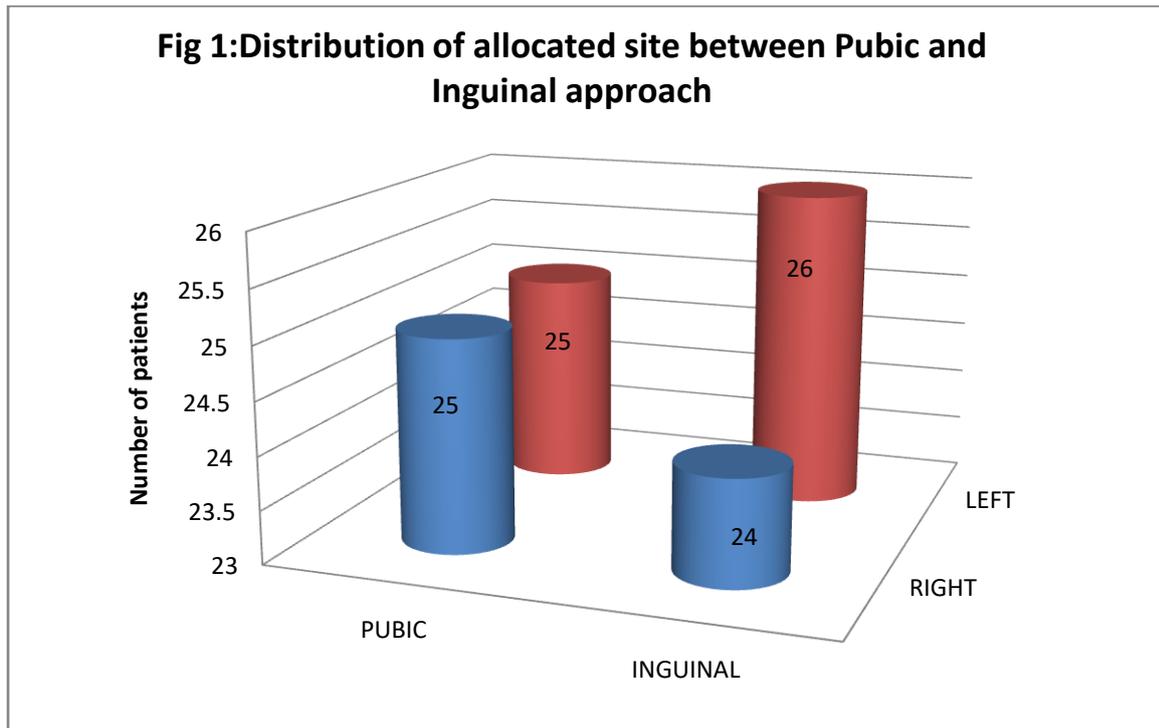
ALLOCATION OF SITE (RT/LT) OF ONB

Table 2 and figure 1 shows the distribution of allocated site (rt/lt) of ONB among the 50 patients posted for TURBT operation under spinal anaesthesia. For Pubic approach of ONB, the allocated site was 25 times in right side and 25 times in left side and for Inguinal approach 24 times in right side and 24 times in left side. This was statistically not significant (p value 1.000).

Table 2:

Data analysed	RIGHT	LEFT	Total
PUBIC	25	25	50
INGUINAL	24	26	50
Total	49	51	100

Figure 1:



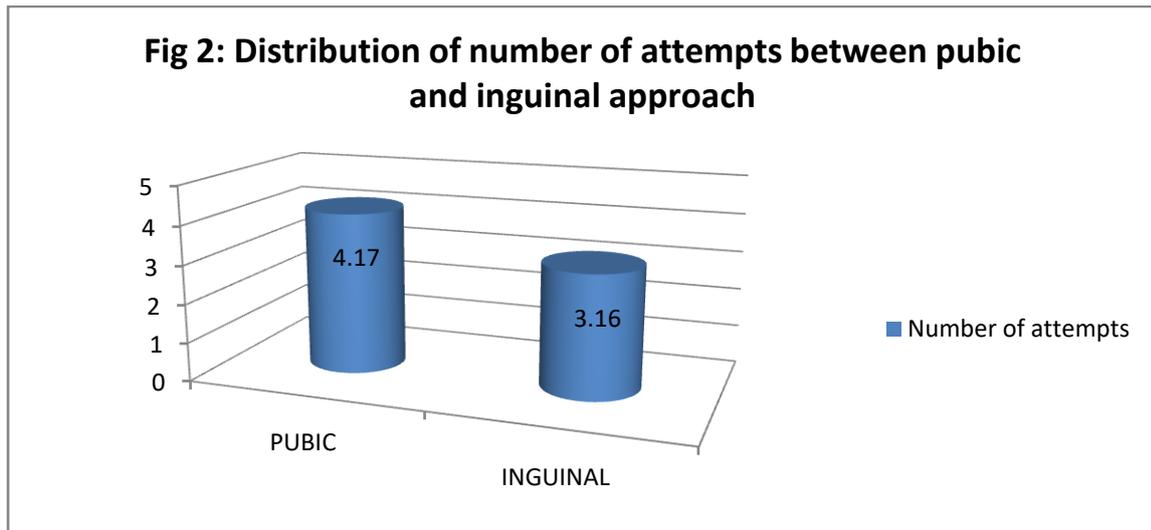
NUMBER OF ATTEMPTS

Table 3 and figure 2 shows the distribution of number of attempts for ONB between Group P and Group I. The variable (number of attempts) was not normally distributed by Kolmogorov-Smirnov goodness-of-fit test. Applying the Wilcoxon's matched pairs signed rank test, it was found that there was significant statistical difference between the groups ($p=0.024$). Here valid N means the total number of successful block.

Table 3:

Number of attempts	Valid N	Mean	Standard Deviation	P value
Group P	42	4.17	2.262	0.024
Group I	45	3.16	2.276	

Figure 2:

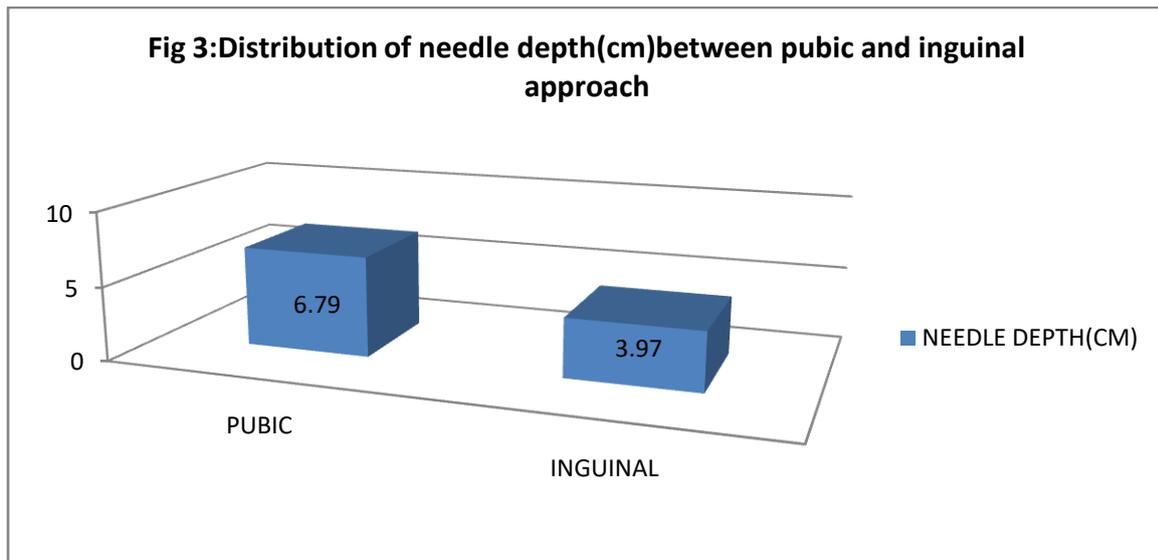


NEEDLE DEPTH Table 4 and figure 3 show the distribution of needle depth (cm) between group P and I. The variable was normally distributed by Kolmogorov-Smirnov goodness-of-fit test. Applying Student's paired t test for comparison of numerical variables between Pubic approach and Inguinal approach, there was significant statistical difference (p value 0.0001).

Table 4:

Needle Depth(cm)	Valid N	Mean	Standard Deviation	P value
Group P	50	6.79	1.200	0.0001
Group I	50	3.97	0.706	

Figure 3:



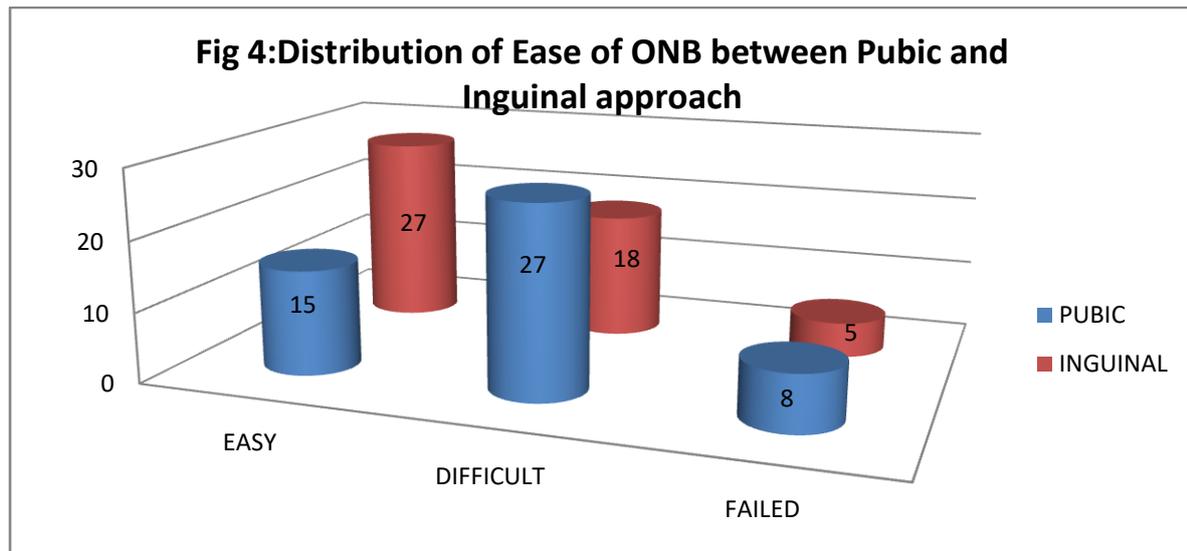
EASE OF OBTURATOR NERVE BLOCK(ONB):

Table 5 and figure 4 shows the distribution of ease of obturator nerve block between Group P and Group I. The data obtained from the study were statistically analysed by Kappa statistical method and were found to be indicator of poor agreement. Extent of agreement between two approaches, i.e. Kappa statistic 0.155(95% CI 0.066-0.296), indicating poor agreement. Fifty-four percent easy by Inguinal approach as against 30% easy by Pubic approach.

Table 5:

	Inguinal Easy	Inguinal Difficult	Inguinal Fail	Row
PUBIC Easy	7	6	2	15
PUBIC Difficult	16	8	3	27
PUBIC Fail	4	4	0	8
Totals	27	18	5	50

Figure 4:



SUCCESS RATE

Table 6 shows the success rate in both the approaches. The success rate of inguinal approach was 90% (45/50) whereas it was 84% (42/50) for pubic approach. Statistically this was insignificant (p value = 0.5536).

Table 6:

	Number of successful blocks	Number of failed blocks	Success rate
Pubic approach (n=50)	42	8	84%
Inguinal approach (n=50)	45	5	90%

INCIDENCE OF FAILURE

Table 7 shows the distribution of incidence of failure between the group P and group I. The statistical analysis was done by Fisher exact test and was found to be not significant (p value 1.000).

Table 7:

Failure	Yes	No	Total no of approach
Group P	2 (4%)	48 (96%)	50
Group I	1 (2%)	49 (98%)	50
Total	3	97	100

COMPLICATIONS

Table 8 shows the distribution of incidence of complications associated with ONB and surgery between the Pubic and Inguinal approaches and it shows that only 7 instances of vessel puncture in pubic approach. Table 9 and figure 5 shows the distribution of incidence of vessel puncture between the Pubic and Inguinal approaches. Fisher's exact test was done and p value was found to be significant ($p=0.0125$).

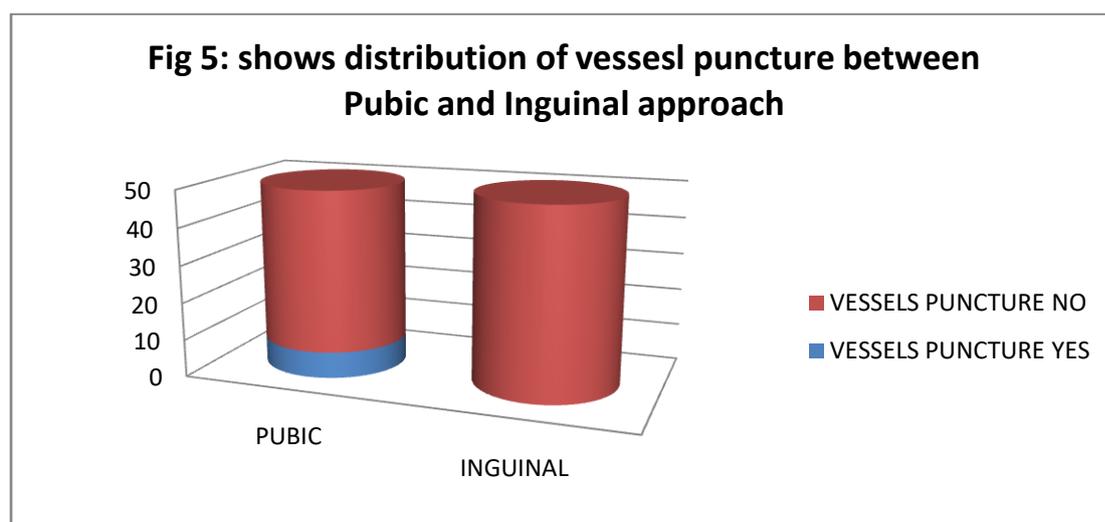
Table 8

COMPLICATIONS	PUBIC APPROACH		INGUINAL APPROACH	
	present	not present	present	Not present
Vessel puncture	Yes (7)			No
Visceral injury		No		No
Haematoma		No		No
Bladder wall perforation		No		No
Obturator nerve injury		No		No
Incomplete tumour mass resection		No		No

Table9

ONB	Vessel puncture(yes)	Vessel puncture (no)	Total
Group P	7 (14%)	43 (86%)	50
Group I	0 (0%)	50 (100%)	50
Total	7	93	100

Figure 5



DISCUSSION

During TURBT surgery under central neuraxial block, the electrical stimulation transmitted by resectoscope through the lateral or inferolateral wall of the urinary bladder leads to occurrence of contraction of adductor longus muscle which is innervated by obturator nerve.^{1,11} The obturator nerve contains both motor and sensory nerve fiber and is situated in close proximity of the urinary bladder. Due to this inadvertent and unanticipated occurrence of adductor contractions or obturator jerks, the resectoscope may injure and perforate the wall of the bladder. Injuries to pelvic viscera and blood vessels leading to severe haemorrhagic shock has been described.¹ Incomplete tumour mass resection, postponement of surgery or conversion to open procedure has also occurred.

Various methods have been tried to resolve this problem. Administration of general anaesthesia with muscle relaxation is a reasonable choice to eliminate contraction of the adductor muscles during TURBT.³ Cesur et al studied the role of succinylcholine in the

prevention of obturator nerve reflex during TURBT.¹² Succinylcholine was found to be fully effective abolishing the obturator nerve reflex in all the patients.

However, administration of general anaesthesia with muscle relaxation in patients with bladder tumour is not without risk. Firstly, majority of the patients belong to geriatric age group and may have coexisting significant cardiac, respiratory and metabolic comorbidities.¹³

Secondly there are reports of obturator jerk occurring, even if the patients were under GA with muscle relaxation. In 2004, So reported cases of TURBT where adductor muscle contraction occurred in spite of giving general anaesthesia with muscle relaxant in patients undergoing transurethral resection of bladder tumours.⁴

Other techniques to prevent the occurrence of obturator jerk during TURBT include reducing the intensity of the resector current, avoiding overdistension of the bladder (so that obturator nerve is away from the lateral bladder wall), use of laser resectors, nerve cooling, reversal of polarity of the electric current, change in the site of inactive electrode, use of saline irrigation, and periprostatic infiltration with local anaesthetics.^{14,15,16,17} However they have not been proved to be uniformly effective and hence not used routinely in clinical practice.

Local obturator nerve blockade has been used extensively in the management of adductor spasm.¹⁸ Spinal anaesthesia with selective blockade of the obturator nerve may be the most viable option as it can avoid major complications related to co-morbidities in these patients. Spinal/epidural anaesthesia by itself cannot prevent the occurrence of obturator jerk. Hence selective unilateral or bilateral ONB is considered the safest and most effective method to tackle the problem of obturator reflex, when TURBT is planned under spinal anaesthesia.^{5,7}

Labat et al in 1922, first described the classic pubic approach to obturator nerve block which is a landmark guided technique and it required identification of pubic tubercle.⁵ This method was simplified by Park et al in 1967.⁶

Kobayashi et al in 1991 performed obturator nerve block by use of insulated needle and peripheral nerve stimulator.¹⁹ Thus, the evolution of ONB came through many stages – interadductor approach, paravascular superficial inguinal approach and ultimately leading to the introduction and advent of ultrasound guided nerve blocks. As the availability of ultrasound in the operating theatres are still limited, nerve stimulator guided blocks remain the commonly practised technique.

The quest for a novel approach to overcome the difficulties of classic pubic approach has led to the advent of a new inguinal approach and various studies have shown that the needle insertion point is away from any major vessels and it does not necessarily require the palpation of pubic tubercle.¹⁰ In comparison, the inguinal approach is performed at a distance from the pelvis and large vessels, blocking the superficial branches, thus this technique may minimize the risk of complications and allows compression in the case of hematoma.¹⁰

In the present study it was found that the inguinal approach is better and safer than the classic pubic approach in terms of – needle depth (group P-6.79±1.2cm and group I- 3.79±0.70 cm), number of attempts (group P 4.17±2.26 and group I 3.16±2.27) , ease of block (54% easy in group I as against 30% in group P) , success rate of pubic approach was 84% against 90% in inguinal approach. Rate of complications like vessel puncture was also minimal in inguinal approach (group P= 14% and group I =0%). Incidence of failure was similar in both the groups (group P =4% and group I = 2%).

Studies by Moningi et al and Youn et al also show the superiority of inguinal approach in terms of needle depth, number of attempts, ease of block, success rate and rate of complications.^{11,20}

Bolat et al, in 2015 performed a prospective randomised controlled study on 70 patients undergoing TURBT to study the Impact of nerve stimulator-guided obturator nerve block on the short-term outcomes and complications, where they did not find any complications.

The study had some obvious limitations. Firstly, the pubic approach is known to be an intermediate level skill block which is dependent on experience of the performer where increase in experience causes decrease in the incidence of complications. Here the ONB was performed by a resident anaesthesiologist which might have had a greater incidence of failure and vascular puncture in the pubic approach group. Secondly ultrasonography guided technique of localisation of obturator nerve was not done as this equipment was not available during the study period. There may have been a better outcome in terms of higher success rate, lesser number of attempts, shorter procedure time and no incidence of vascular injury.

CONCLUSION

So, it may be concluded from the findings of the present study, that in comparison between pubic approach and inguinal approach to obturator nerve block, the inguinal approach is better, safer and easier to perform. Success rate is also higher in inguinal approach.

So,inguinal approach could be a better and safer option than pubic approach to block the obturator nerve during TURBT.

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