Section: Anaesthesiology

Original Research Article

ULTRASOUND-GUIDED QUADRATUS LUMBORUM BLOCK FOR POSTOPERATIVE PAIN CONTROL IN PATIENTS UNDERGOING UNILATERAL INGUINAL HERNIA REPAIR UNDER SUBARACHNOID BLOCK: A COMPARATIVE STUDY BETWEEN QUADRATUS LUMBORUM BLOCK- 2 AND QUADRATUS LUMBORUM BLOCK-3

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Abstract

Background: Quadratus lumborum blockade (QLB) using ultrasound guidance has been introduced as an abdominal truncal block to improve postoperative analgesia in inguinal hernia surgery patients. The study aimed to compare the duration of analgesia provided by the posterior QLB (QLB-2) versus transmuscular QLB (QLB-3) in patients undergoing surgical repair of unilateral inguinal hernia. **Materials and Methods:** This non-randomized controlled trial was conducted in a tertiary care hospital over a period of 1 year. A total of 40 patients, with American Society of Anaesthesiologists (ASA) physical status I–II aged 18–50 years were included in the study. The first 20 patients received 20 ml of 0.25% bupivacaine via QLB-2 approach and the next 20 patients received 20 ml of 0.25% bupivacaine via QLB-3 block postoperatively. Duration of analgesia, postoperative VAS, and use of rescue analgesia were recorded. **Result:** Duration of the block was significantly ($p< 0.001$) longer in the QLB-3 group when compared to the QLB-2 group (19.85 ± 1.6 vs 11.2 ± 1.74 respectively). However, there was no statistically significant difference in VAS score and use of rescue analgesia between the two groups. **Conclusion:** Ultrasound-guided postsurgical transmuscular approach of QLB (QLB-3) using 20 ml 0.25% bupivacaine produced a longer duration of analgesia compared to the posterior QLB approach (QLB-2) in patients who underwent unilateral inguinal hernia repair under general anesthesia.

INTRODUCTION

Inguinal hernia repair is one of the most frequent surgical interventions worldwide with more than 20 million patients undergoing the procedure annually.[1] Chronic pain following primary inguinal hernia repair was reported to be 10-12% and recurrent pain in about 11% of all patients.[1,2] Insufficient control of acute postoperative pain is one of the main risk factors for the onset of chronic pain, which may last for months.[3] Moreover, severe postoperative pain can lead to prolonged hospitalization and delayed return to normal daily activities.[2]

Various drugs such as acetaminophen, Parecoxib, nonsteroidal anti-inflammatory drugs (NSAID), gabapentinoids, and opioids are used to control postoperative pain.[4-6] Additionally, local/ regional anesthetic techniques such as ilioinguinal-iliohypogastric nerve block, transversus abdominis plane block, erector spinae plane block, and quadratus lumborum block are also being used.[7]

The quadratus lumborum muscle block (QLB) was first described by Blanco in 2007 as a local anesthetic injection into the anterolateral junction of the quadratus lumborum muscle (QLB type 1). Some modifications of this technique were subsequently introduced: injection into the posterior segment of the quadratus lumborum muscle (QLB type 2), injection between the quadratus lumborum muscle and the fascia of the psoas muscle using the transmuscular approach (QLB type 3), and injection into the quadratus lumborum muscle (QLB type 4).[8]

Unlike the transversus abdominis plane (TAP) block, which is another truncal block, in QLB the local anesthetic spreads in the posterior abdominal wall and the paravertebral space.[9] It is claimed that this block, which is effective in T7 and L1 dermatomes,

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not only provides analgesia from the anterior abdominal wall but also can reduce visceral pain8; however, to date, there was no clear clinical proof or evidence that QLB provides visceral analgesia. Although the efficacy of QLB in abdominal surgery has been demonstrated in the literature, few studies have compared different QLB types. To the best of our knowledge, there is neither agreement about the best approach for QLB block nor their analgesic efficacy has been compared.

This study aimed to compare the duration of analgesia provided by the posterior QLB (QLB-2) versus transmuscular QLB (QLB-3) in patients undergoing surgical repair of unilateral inguinal hernia compared to the posterior QLB (QLB-2). The secondary aim was to compare the effectiveness of two different QLB approaches (posterior- QLB 2 & intramuscular QLB3) in postoperative pain control in patients undergoing inguinal hernia repair under subarachnoid block.

MATERIALS AND METHODS

This non-randomized controlled trial was conducted in Government Theni, Theni Medical Hospital after obtaining approval of the Research Ethics Committee, Govt theni medical college. The study was conducted for a duration of 18 months (April 2021 to September 2022).

Inclusion criteria: Patients aged from 18 to 50 years, ASA physical status I or II, who were scheduled for unilateral inguinal hernia repair under general anesthesia were enrolled in the study. Patients with ASA III, and IV and suffering from Cardiovascular diseases, Cerebrovascular insufficiency, Coagulation abnormality, Strangulated hernia, Renal or hepatic insufficiency, and LA hypersensitivity were excluded from the study.

Sample size calculation: Based on the previous study by Ahmed, A., et al,[10] with a study power of 80% and alpha error of 0.05, a clinical difference of primary outcome was assumed to be 40%, a minimum number of 18 patients was required for each group, this number was increased by 10% (to be 20 patients per group) to compensate for possible drop-outs. The G power 3.1.9.2 program was used for sample size calculation.

All patients undergoing Inguinal hernia repair were included in the study. Patients not meeting the inclusion criteria and those who declined to participate were excluded from the study. Written informed consent was obtained from all patients before the commencement of the study. 40 patients who met the inclusion criteria were included in this study and divided into two groups, each of 20 Patients.

GROUP A: QLB-2 group –who receives 20 ml of 0.25% bupivacaine via QLB-2 approach at the end of surgery

GROUP B-QLB-3 group – who receives 20 ml of 0.25% bupivacaine via QLB-3 approach at the end of surgery

Procedure: After shifting the patients into the operating room, monitors were attached and baseline vitals were noted. Under strict aseptic precautions subarachnoid block was performed using a 23G Quicnke needle 0.3 ml of 0.5% hyperbaric bupivacaine was injected into L3-L4 interspace. Surgery proceeded after achieving sensory block at the T6 level. At the end of the surgery, the average duration of surgery and postoperative vitals were noted. Patients were positioned in a lateral position with the procedure side facing upwards. Aseptic precautions were taken. USG was used; with a (5-8MHz) convex probe. Probe- placed in midaxillary line cranial to the iliac crest to identify 3 muscles of the anterior abdominal wall. Then scan dorsally keeping the transverse orientation until observing that the transverse abdominis muscle becomes aponeurotic. This aponeurosis was followed until the QL muscle was visualized with its attachment to the transverse process of L4 and visualize the thoracolumbar fascia at the lateral edge of the QL muscle

For Group A: The block needle (23G Quincke needle) was inserted in the plane from the lateral end of the transducer& tip of the needle was advanced towards the posterior border of QL muscle, between QL & LD muscles, 1ml saline was injected to confirm the position, then 20 ml of 0.25% bupivacaine is injected. Patients were turned to a supine position and observed for 20 minutes recovery room then shifted to the postoperative ward.

For Group B: Needle was inserted in the plane from the posterior end of the Transducer & tip was advanced towards then through the QL muscle. Target site – plane between QL &psoas major muscle 0.1ml saline was injected to confirm the position. Then 20 ml of 0.25% bupivacaine was injected. Then patients were turned to a supine position, observed for 20 minutes in the recovery room then shifted to the postoperative ward. For both groups, the time taken for performing the block was noted. In the postoperative ward, patients of both groups were observed for postoperative pain. Duration of block – the time to the first analgesic requirement was defined as the time interval between the end of the block technique and the patient's pain complaint (VAS>6). The rescue analgesic used in our study was. paracetamol 15 mg/kg intravenous infusion. All outcome measures were collected by an anaesthesiologist who was not involved in block performance

Statistical Methods: The duration of the block (hour) was considered the primary outcome parameter. Duration of technique (min), VAS score, and time of rescue analgesia (hours) were considered Secondary outcome parameters. Study Group (Group I vs Group II) was considered as an explanatory variable. Age, gender, etc., were considered study-relevant variables. For normally distributed Quantitative

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parameters the mean values were compared between study groups using an independent sample t-test (2 groups). Categorical outcomes were compared between study groups using the Chi-square test. P value <0.05 was considered statistically significant. Data were analyzed by using coGuide software.

RESULTS

A total of 40 subjects were included in the final analysis. The patient's age ranged between 18-50 years with 22 (55%) males and 18 (45%) females. Patient demographics were comparable between the 2 groups with no significant differences [Table 1].

The mean duration of technique (min) was significantly longer in Group A (8.6 ± 0.88) compared to Group B (9.25 ± 0.64) 0.011. The duration of the block (hour) was significantly (p< 0.001) longer in the QLB-3 group when compared to the QLB-2 group (19.85 ± 1.6 vs 11.2 ± 1.74 respectively) [Table 2].

The mean difference in VAS score between the two-study groups was not significant at 2 hours, 4 hours, 6 hours, 10 hours, and 12 hours. However, a significant difference was found in the VAS score at 8 hours [Table 4]. The mean difference in time of rescue analgesia (hours) between study groups was statistically not significant (P value >0.05). [Table 4]

Table 1: Comparison of demographic parameters (N=40)

Demographic parameters	Study group (Mean ± SD)		P value
	Group A (N=20)	Group B (N=20)	
Age (years)			
20-30 years	6 (30%)	7 (35%)	0.937*
31-40 years	4 (20%)	4 (20%)	
41-50 years	10 (50%)	9 (45%)	
Gender			
Male	13 (65%)	9 (45%)	0.204*
Female	7 (35%)	11 (55%)	
BMI	25.3 ± 1.51	25.23 ± 1.7	0.891†
ASA Grade			
I	15 (75%)	13 (65%)	0.490*
II	5 (25%)	7 (35%)	

*=Chi square test P value; † = Independent T Test P value

Table 2: Comparison of Duration of Surgery, Duration of Technique, and Duration of Blocks

Parameters	Study group (Mean ± SD)		P value
	Group A (N=20)	Group B (N=20)	
Duration of Surgery	64.15 ± 2.41	63.75 ± 2.81	0.632*
Side of Surgery			
Right	10 (50%)	10 (50%)	1.000†
Left	10 (50%)	10 (50%)	
Duration of technique (minutes)	8.6 ± 0.88	9.25 ± 0.64	0.011*
Duration of the block (hour)	11.2 ± 1.74	19.85 ± 1.6	<0.001*

* = Independent T Test P value; †=Chi square test P value

Table 3: Comparison of VAS Score

VAS score	Study group (Mean ± SD)		P value (IST)
	Group A (N=20)	Group B (N=20)	
2 hours	1.05 ± 0.22	1.2 ± 0.41	0.159
4 hours	1.4 ± 0.6	1.6 ± 0.82	0.384
6 hours	2.5 ± 0.61	2.8 ± 0.77	0.178
8 hours	4.5 ± 0.61	3.8 ± 0.77	0.003
10 hours	4.9 ± 0.72	4.9 ± 0.72	1.000
12 hours	6.05 ± 0.69	6.05 ± 0.69	1.000

Table 4: Comparison of Time of Rescue Analgesia (Hours)

Parameters	Study group (Mean ± SD)		P value (IST)
	Group A (N=20)	Group B (N=20)	
Time of rescue analgesia (hours)	6.8 ± 1.20	7.6 ± 1.54	0.074

DISCUSSION

Inguinal hernia repair is one of the most common surgical procedures in the world. The avoidance of chronic pain is arguably the most important clinical outcome and has the greatest impact on patient satisfaction, health care utilization, societal cost, and quality of life.[11]

In recent years, the ultrasound-guided paravertebral block, erector spinae plane block, and QLB have become popular in abdominal surgery. These techniques do not cause analgesia-related side effects, while they provide analgesia to half of the block-implemented region over a wide dermatomal area.[7] The QLB has frequently been used for perioperative pain management in abdominal surgery

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in all age groups.[12,13] however, the best approach for this block is still under debate.

Intra-abdominal surgeries such as inguinal hernia repair require visceral pain relief. The application of QLB provides wider analgesic distribution ranging from T12–L4 dermatomes.[13-15] Initially, LA was injected into the anterolateral junction of the quadratus lumborum muscle (QL block 1) Thereafter, posterior (QL block 2) and anterior (trans-muscular, QL block 3) QL block was described as alternative routes. These modified QLBs were known to provide a better analgesic effect compared to the lateral QLB. Previous randomized trials revealed that QLB-2 has associated with a more predictable spread of the LA (ventral area), a more superficial method, easier to administer, lesser complications, and long distance from the intra-abdominal viscera.[13] Several studies have suggested the advantages of posterior QLB in postoperative pain relief.[16-18] The QLB3, spreads in the lower thoracic paravertebral region below the lateral arcuate ligament and provides sensory innervation to the hip; Furthermore, minimizing quadriceps weakness.[19] A case report of pediatric patients where ultrasound-guided transmuscular QLB was used for congenital hip dislocation surgery and it was seen that QLB provides effective postoperative analgesia for congenital hip dislocation surgery.[20] Few other studies reported the same.[21,22] Although many studies have shown the effect of QLB in abdominal surgery, very limited studies have compared QLB2 and QLB 3.

The major finding of our study was that duration of the block was significantly ($p< 0.001$) longer in the QLB-3 group when compared to the QLB-2 group (19.85 ± 1.6 vs 11.2 ± 1.74 respectively). A Similar study was done by Ahmed A et al,[10] where the duration of QLB-2 and the QLB-3 block was compared and it was significantly longer in patients who received transmuscular QLB (QLB-3 group) when compared to the QLB-2 group (20.1 + 6.2 h versus 12.0 + 4.8 respectively) with a P value of < 0.001. Yetik, F., et al,[23] compared the duration of block in QLB-2 vs QLB-3 in cesarean section patients and the results were similar to the present study. However, in a study by Bagbanci O et alm,[7] no statistically significant difference was seen between QLB-2 vs QLB-3.

In our study, there was no difference in VAS scores except at 8 hours where the VAS score was significantly lesser for QLB 3 compared to QLB 2. Our findings were in sync with the study by Ahuja, V., et al.[14] In a study done by Ahmed A et al,[10] the VAS was compared between both groups over the first 24 h postoperatively; the comparison revealed a statistically significant lower VAS score in QLB-3 group immediately and 12 h postoperative. In a study done by Bagbanci O et al,[7] passive VAS at 4h and 8 h, and active VAS at 4 hours, 8 hours, and 12 hours were significantly lower in the QLB3 group compared to QLB2 ($p < 0.05$). Yetik, F et al,[23] compared postoperative analgesic effects of QLB-2 vs QLB-3 in cesarean section patients, and the VAS score were significantly lesser for QLB3 patients. The reason for this could be that we did not collect any information on the preoperative pain scores of the patients. It should be noted that the patients with higher preoperative pain may subsequently have higher postoperative pain.

In a study done by Ahmed A et al,[10] analgesic characteristics in the form of time to first analgesic request and total morphine consumption over 24 hour postoperatively were compared in both groups. The patients in the QLB-3 group showed a significantly delayed time to the first analgesic request and less morphine consumption with a P value of <0.001. Numerous studies have shown that the time to the first analgesic requirement was significantly lesser in QLB2 compared to QLB3.[7,13,14,23] However, our study did not show any statistically significant difference. The reason for the difference could be due to the different volumes of LA used in different studies. In all published literature, there is no agreement about the appropriate LA volume or concentration that can be injected for the QLB either in adults.[24-26] there needs to be standardization of the appropriate LA volume or concentration.

Limitations:

The present study had some limitations. Firstly, the spinal anesthesia administered during the surgery may have some effect postoperatively. Hence, evaluations performed in the early postoperative period when the effect of spinal anesthesia continues, might not reflect the efficacy of the block. Second, no information was collected about the preoperative pain scores of the patients. It should be noted that the characteristics of preoperative pain may affect postoperative analgesic consumption. Finally, the study was a non-randomized trial. This relatively increases the potential for confounding and bias subsequently compromising the study's validity.

CONCLUSION

Ultrasound-guided postsurgical transmuscular approach of QLB (QLB-3) using 20 ml of 0.25% bupivacaine produces a longer duration of analgesia when compared to the posterior QLB approach (QLB-2) in patients who underwent unilateral inguinal hernia repair under general anesthesia. More studies are needed on the subject to know the influence of QLB on inguinal hernia repair.

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