

## A COMPARISON OF ULTRASOUND-GUIDED ANTERIOR QUADRATUS LUMBORUM BLOCK VS LATERAL TRANSVERSUS ABDOMINIS PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN HERNIOPLASTY SURGERIES

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### Abstract

**Background:** Postoperative pain control is crucial during anaesthesia after abdominal surgery. Peripheral nerve block therapy, developed using ultrasound technology, reduces pain, analgesic use, and other complications. TAP and QLB blocks performed under ultrasound guidance provide both somatic and visceral analgesia and longer pain relief durations. This study aimed to compare the effectiveness of ultrasound-guided anterior quadratus lumborum (QLB) and transversus abdominis plane (TAP) blocks for postoperative analgesia in patients undergoing unilateral inguinal hernioplasty performed under spinal anaesthesia. **Materials and Methods:** The study was conducted on 60 patients in the Department of Anesthesiology, Government Sivagangai Medical College and Hospital, over 18 months. Patients were randomly assigned to receive either the TAP or the QLB block under ultrasound guidance. The success rate of the block was defined as the absence of pain or the need for analgesia at 2, 4, and 6 hours postoperatively. **Result:** The QL group exhibited a longer duration of analgesic effect and required less tramadol over 24 h, both with highly significant p-values. In terms of vital signs, the TA group showed statistically significant decreases in heart rate and blood pressure post-procedure ( $p < 0.0001$ , 0.015, and 0.04, respectively). The QL group also showed significant reduction in blood pressure and heart rate after the procedure. Additionally, the QL group had lower numerical rating pain scores at various time points, with statistically significant differences observed at most intervals, except for the 10th and 12th hours. **Conclusion:** These findings suggest that ultrasound-guided anterior QLB block provides superior postoperative analgesia than TAP block in patients undergoing unilateral inguinal hernioplasty.

## INTRODUCTION

According to the International Association for Study of Pain (IASP), pain is defined as an unpleasant emotional or sensory experience associated with actual or potential tissue damage<sup>1</sup>. Postoperative pain control is a key component of anaesthesia.<sup>[1]</sup> After abdominal surgeries, such as laparotomy, abdominal hysterectomy, and hernioplasty, the sensation of pain can arise from either the incision site or from internal organs or while moving, such as while walking, coughing, or straining. A multimodal strategy is necessary to prevent pain transmission and allow for early mobilisation and recovery, as pain from the incision site plays a key role.

Recently, there has been an increase in the popularity of peripheral nerve block therapy because it not only

reduces postoperative pain but also reduces the need for analgesics, minimising opioid-induced adverse effects such as ventilatory depression, nausea, vomiting, gastritis, minimising the postoperative hospital stay, and enhancing patient satisfaction etc.<sup>[2]</sup> The effectiveness and quality of peripheral nerve blocks have improved due to the development of ultrasound technology, which reduces the amount of local anaesthetic required and the likelihood of complications.

In lower abdominal procedures, transversus abdominis plane (TAP) blocks performed under ultrasound guidance are frequently used to relieve discomfort. The quadratus lumborum block (QLB) under ultrasound guidance has provided a different approach not only in terms of technique but also in covering both somatic and visceral analgesia and

providing a longer duration of pain relief because transversus abdominis plane block is limited to somatic sensory blockade.<sup>[3]</sup>

This study aimed to assess the effectiveness of ultrasonography-guided anterior Quadratus Lumborum block (QLB) versus lateral transversus abdominis plane block (TAP) for unilateral inguinal hernioplasty performed under spinal anaesthesia for postoperative analgesia.

## MATERIALS AND METHODS

This prospective, randomised study was conducted on 60 patients in the Department of Anesthesiology, Government Sivagangai Medical College and Hospital for 18 months. The study was approved by the institutional ethics committee before initiation, and informed consent was obtained from all patients.

### Inclusion Criteria

Patients aged 18–75 years, with ASA I and II, and informed consent from the patients were included.

### Exclusion Criteria

Patient refusal, III and IV ASA patients' coagulopathy infection at the injection site, and allergy to local anaesthetic drugs were excluded.

Patients were kept nil by mouth for eight hours before surgery, and intravenous ranitidine and metoclopramide were administered as premedication, crystalloids were begun in the operating room after an 18-gauge cannula was secured, baseline data including heart rate (HR), non-invasive blood pressure, and peripheral oxygen saturation were obtained using standard anaesthesia monitors that were attached, patients undergoing unilateral hernioplasty received a subarachnoid block with a 25-gauge Quincke spinal needle at the L3-L4 interspace and 15 mg of 0.5% hyperbaric bupivacaine was administered intrathecally, surgery was begun when acceptable sensory level was confirmed, after the completion of surgery and the spinal sensory level had regressed to the T8 dermatomal level, under sterile conditions QLB/TAP block using 0.4 ml/kg of 0.25% bupivacaine was carried out.

In the TA group, the patients were supine, and the lateral abdominal wall was draped between the iliac crest and the lower coastal edge, with the umbilicus in the middle. A high-frequency linear ultrasound probe was then used to identify the muscles of the anterolateral abdominal wall and a 23-gauge Quincke spinal needle was placed, progressed anteriorly along the anterior axillary line using the in-plane method, and halted in the fascial plane between the internal oblique and transverse abdominis muscles. The plane was hydro-dissected with 2 ml saline to confirm correct placement, after that bupivacaine 0.25% (0.4 ml/kg) was administered after negative aspiration.

In the QL group, once the operation was performed and the spinal level had regressed to the T8 dermatome, the patients were positioned laterally with the surgical side facing up, and the anterolateral abdomen was prepared, painted, and draped. The

three muscles of the anterior abdominal wall were initially detected under ultrasound guidance using a low-frequency curvilinear probe that was first placed superior to the ipsilateral iliac crest and then moved posteriorly to find the lateral boundary of the transversalis fascia. The 23 G spinal needle was inserted under ultrasound guidance, and the needle tip was placed between the quadratus lumborum and psoas major muscle. 0.4 ml/kg of 0.25% bupivacaine was injected into the anterior aspect of the Quadratus lumborum muscle between the QL and psoas major muscles under visualisation, after hydrodissection with 2 ml of normal saline.

After surgery, the patients were transferred to the PACU, where a different anaesthesiologist measured their pain using the NRS scale at 1, 2, 3, 5, 6, 8, 10, 12, and 24 hours. When the Numerical rating scale was > 4, intramuscular injection of tramadol hydrochloride 100 mg and the timing of the initial dose of the analgesic were recorded. The amount of postoperative analgesia required for 24 hours was noted. In addition, patients' vital parameters and postprocedural complications were monitored.

After spinal regression below the L2 dermatomal level, cold sensation was checked at the T6-L1 dermatomes on the side of the block and compared with that on the opposite side. The parameters measured were age, sex, height, weight, body mass index, duration of surgery, total block performance time, success or failure of a block, postoperative NRS score at 1, 2, 3, 4, 6, 8, 10, 12, and 24 h, analgesic duration, necessary doses of further analgesics, and complications.

**Statistical Analysis:** Statistical analysis was conducted using IBM-SPSS version 16.0 (IBM-SPSS Science Inc., Chicago, IL), and the results were considered statistically significant when the probability value was less than 0.05. The chi-square test was used to analyse categorical variables, and a paired t-test was used for both groups.

## RESULTS

The results indicated that the mean ages for groups T and Q were 52.80±16.336 years and 52.40±12.765 years, respectively, with a p-value of 0.916; the difference was not statistically significant. The height was 1.6743±0.06652 m for Group Q and 1.6543±0.07375 m for Group T, with a p-value of 0.275, which was not statistically significant.

Weight comparison revealed that group TA's findings were 65.90±9.08 kg and group QL was 64.77±7.727 kg, with a p-value of 0.702, which was not statistically significant. The Body Mass Index was 24.17±3.588 in the TA group and 23.1867±3.471 in the QL group, with a p-value of 0.285, which was not statistically significant.

The surgery took 78.0±11.641 min in the TA group and 76.5±14.333 min in the QL group, with a p-value of 0.658, which was not statistically significant. The overall performance time for the block was

4.13±1.074 min for group TA and 11.63±3.672 min for group QL, with a statistically significant p-value of less than 0.0001 compared with group TA. The QL group required more time to complete the blocks. In the comparison to group T, the analgesic effect lasted longer in group Q with a statistically significant p-value of <0.0001, group TA's analgesic duration was 416.7±58.52 minutes, whereas group QL's was 633.33±140.69 minutes. The average amount of tramadol needed by each patient over 24 hours was 163.33±55.605 mg in group TA and 103.33±49.013 mg in group QL, with a statistically significant p-value of less than 0.0001 [Table 1]. With p-values <0.0001, 0.015, and 0.04, there were some statistically significant decreases in heart rate

and blood pressure between pre- and post-procedure vital signs in the TA group. In group QL, there was a decrease in blood pressure (both systolic and diastolic) and heart rate after the procedure, with p-values of 0.010, 0.036, and 0.020, respectively, which were statistically significant, but not clinically significant [Table 2].

The numerical rating pain scores (NRS) were lower in the QL group than in the TA group at 3, 4, 5, 6, 8, 10, 12, and 24 h, and the p-values for each scale were less than 0.05, for 3, 4, 5, 6, 8, and 24 h, with statistically significant results, except for the 10th and 12th hours, which had a p-value >0.05 [Table 3].

**Table 1: Demographic data of the study**

	Group TA	Group QL	P value
Age	52.80±16.336	52.40±12.765	0.916
Height(m)	1.6543±0.07375	1.6743±0.06652	0.275
Weight(kg)	65.90±9.080	64.77±7.727	0.605
BMI (kg/m <sup>2</sup> )	24.1700±3.58812	23.1867±3.47064	0.285
Duration of surgery	78± 11.641	76.50±14.333	0.658
Duration of block performance	4.13±1.074	11.63±3.672	<0.0001
Duration of analgesia (min)	416.70±58.52	633.33±140.69	<0.0001
Average requirement of tramadol (mg)	163.33±55.605	103.33±49.013	<0.0001

**Table 2: Comparison of vitals parameters of the study**

		Group TA	P value	Group QL	P value
Systolic bp	Pre-procedure	126.97±10.091	<0.0001	126.50±12.136	0.010
	Post-procedure	114.87±12.170		119.97±12.366	
Diastolic bp	Pre-procedure	78.80±9.890	0.015	78.80±8.381	0.036
	Post-procedure	73.10±9.987		74.27±11.951	
Heart rate	Pre-procedure	77.33±10.610	0.04	79.13±9.039	0.02
	Post-procedure	71.17±10.011		73.13±9.899	

**Table 3: Comparison of numerical rating pain scores**

	Group TA	Group QL	P value
NRS 0	0	0	0
NRS 1	0	0	0
NRS 2	0.43±0.504	0.13±0.346	0.01
NRS 3	1.37±0.490	0.67±0.606	<0.0001
NRS 4	2.03±0.606	1.37±0.669	<0.0001
NRS 5	2.97±0.850	2.07±0.640	<0.0001
NRS 6	3.23±0.971	2.30±0.596	<0.0001
NRS 8	3.87±1.074	2.73±0.583	<0.0001
NRS 10	3.40±0.814	3.40±0.621	1
NRS 12	3.53±0.937	3.20±0.925	0.171
NRS 24	3.63±0.669	3.13±0.819	0.012

## DISCUSSION

In our study, to provide postoperative analgesia for patients who had undergone unilateral hernioplasty, we compared the efficacy of the anterior Quadratus Lumborum block with that of the lateral Transversus Abdominis Plane block. According to the study's findings, the Quadratus Lumborum group's analgesia lasted longer (633.33 ± 140.69 minutes) than that of the Transversus Abdominis Block group (416.7 ± 58.52 minutes). Rescue analgesic requirements were less frequent in the Quadratus Lumborum group than in the Transversus Abdominis block group in the postoperative Numerical Rating Scores from the third hour to the 24th hour. (Mean tramadol intake was

103.33 mg in the Quadratus lumborum block group and in the TAP block group it was 163.33 mg).

In a study published in 2016 by Murouchi et al., the median duration of analgesia after QLB exceeded 24 hours and was significantly longer than the duration of lateral TAPB. The quadratus lumborum block affected the T7-T12 dermatomes, whereas TAPB affected the T10-T12. They concluded that following laparoscopic ovarian surgery, the Quadratus lumborum block produced a more significant and long-lasting analgesic effect than the transverse abdominis plane block.<sup>[4]</sup>

Blanco et al, found that TAP block and QL block were equally effective for providing postoperative analgesia for 76 caesarean section patients who were admitted under subarachnoid block following the

surgery.<sup>[5]</sup> Both groups received 0.125% bupivacaine at 0.2 mL/kg on each side for a total of 0.4 mL/kg under sonographic supervision. Patient-controlled analgesia (PCA) was used to monitor morphine consumption at 1, 2, 4, 6, 12, 24, and 48 h following the procedure. At 12, 24, and 48 hours, patients in the Quadratus Lumborum group required less morphine than those in the TAP group. Accordingly, variances of 37.5%, 55%, and 48% were observed. In our study, tramadol intake in the Quadratus Lumborum plane group was much lower than that in the Transversus Abdominis Plane block group. In contrast to their research's VAS results, which indicated no differences between the two groups, our study population's Quadratus Lumborum block recipients had lower postoperative NRS ratings.

In 2017, Oksuz et al. conducted a study and found that 53 paediatric patients who underwent lower abdominal surgery, such as unilateral hernioplasty and orchidopexy, to relieve postoperative pain were compared between quadratus lumborum and transversus abdominis plane block. According to these findings, the postoperative analgesia in the QL group lasted longer (15 h) than that in the Transversus Abdominis Plane block group (10 h). The analgesic duration was  $633.33 \pm 140.69$  minutes in the Quadratus Lumborum block group and  $416.7 \pm 58.52$  minutes in the Transversus Abdominis Plane block group, according to their findings, which appeared to be linked with those of our investigation.<sup>6</sup> The FLACC (Face, Legs, Activity, Cry, CONSOL ability) score was used to assess the analgesic efficacy at 30 minutes, 1, 2, 4, 6, 12, and 24 hours between the two groups. The FLACC score in the QL group was lower than that in the transversus abdominis plane group.

In our study, the NRS pain scores and need for postoperative analgesics were evaluated across the two groups, and the QL group continuously had lower values from 3 to 24 h after surgery. In 2016, Abd El-Hamid et al. studied the analgesic efficacy of a transversus abdominis plane block with local anaesthetic wound infiltration in 60 patients who underwent open inguinal hernioplasty. The TAP block group's analgesia lasted  $489 \pm 93.2$  minutes, which is equivalent to the length of our study ( $416.7 \pm 58.52$  minutes).<sup>[7]</sup>

In a 2018 study by Yousef et al., 60 adult female patients scheduled for abdominal hysterectomy were randomly assigned to the Transversus Abdominis block (TAP) and Quadratus Lumborum (QL) groups. They concluded that the Quadratus Lumborum block was equivalent to our research in terms of postoperative VAS ratings, total morphine needs, and number of rescue analgesics required.<sup>[8]</sup> Xiancun Liu et al., (2020) studied 564 patients who had undergone lower abdominal surgery and showed that the QL block provided better pain management with less opioid consumption than the TAP block which was comparable to our study.<sup>[9]</sup> Baytar et al., 2019 conducted a study among 120 patients by comparing the Ultrasound-Guided Subcostal Transversus

Abdominis Plane Block with Quadratus Lumborum Block for postoperative analgesia in Laparoscopic Cholecystectomy surgeries.<sup>[10]</sup>

The results showed that the duration of analgesia was significantly longer in the QLLL group than in our study, but there was no statistically significant difference in the visual analogue scale scores and total analgesic consumption between the groups. They concluded that USG subcostal TAP and QL blocks similarly reduced postoperative pain scores and analgesia consumption, with high patient satisfaction. However, the subcostal TAP block could be considered preferable to the QL block because it can be applied easily and in a shorter time which correlates with our study in terms of the duration of block performance.

In 2020, a study by Abdullah et al., among 60 patients who had undergone US-guided transmuscular quadratus lumborum block for hip arthroplasty, concluded that the duration of postoperative analgesia was prolonged and the analgesic needed postoperatively was significantly reduced in the transmuscular QL block group compared to the control group.<sup>[11]</sup> Their results were found to be correlated with our study in terms of duration and efficacy of postoperative analgesia.

Muguel et al., in 2018 described from a series of two cases who received posterior QL block that there was mild hypotension in both patients which might be due to block-induced sympatholytic due to cephalad dispersion of the local anaesthetic up to the paravertebral space.<sup>[12]</sup> That, in our study, there was the slightest fall in both heart rate and blood pressure in both groups but there was no clinically significant hypotension and bradycardia that needed intervention among the patients.

## CONCLUSION

We conclude that the time needed for the initial analgesic dose shows that the quadratus lumborum block offers prolonged analgesia duration. When compared to the TAP block, the frequency of rescue analgesics and the considerable decrease in the numerical rating scale for 24 h both point towards the superior quality of analgesia provided by the QL block. Therefore, we recommend utilising quadratus lumborum block as an alternative approach for the treatment of postoperative pain.

**Limitations:** There was no control group in our study and the dermatomal extent of analgesia was not recorded. Only a small number of trials have been conducted, and further research is required to determine the precise mechanism, dermatomal extent of analgesia, and ideal location of drug deposition in the Quadratus Lumborum block.

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