



Original Article

## Comparative Evaluation of Quadratus Lumborum Block and Transversus Abdominis Plane Block in Postoperative Pain Control Following Lower Abdominal Surgeries

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### ABSTRACT

**Background:** Efficient postoperative pain management is crucial for patient comfort, prompt mobilisation, and decreased hospital duration after lower abdominal procedures. Regional anaesthesia techniques have become increasingly favoured for their capacity to reduce opiate consumption and associated adverse effects. The Transversus Abdominis Plane (TAP) block and Quadratus Lumborum (QL) block are two frequently employed ultrasound-guided fascial plane blocks. Although both aim for abdominal wall analgesia, their anatomical distribution and duration of effect may vary considerably.

**Aim:** This study aims to compare the efficacy of QL block and TAP block in controlling postoperative pain following lower abdominal surgeries.

**Materials and Method:** A prospective study was conducted on 80 patients undergoing elective lower abdominal surgeries under general anaesthesia in a tertiary care centre. Participants were randomly assigned to receive either an ultrasound-guided QL block or TAP block postoperatively. Pain scores were assessed using the Numerical Pain Intensity Scale (NPIS) at rest and during movement at 2-, 6-, 12-, and 24-hour post-surgery. Secondary outcomes included total opioid consumption and time to first rescue analgesia.

**Results:** Patients in the QL block group reported significantly lower NPIS scores at all observed time intervals compared to the TAP block group ( $p < 0.05$ ). Additionally, opioid requirements were lower, and the time to first rescue analgesia was longer in the QL group, indicating prolonged analgesic duration and effectiveness. Hemodynamic parameters remained stable in both groups, with no significant adverse events, confirming the safety and superior analgesic efficacy of the QL block.

**Conclusion:** The QL block offers superior and longer-lasting postoperative pain relief compared to the TAP block in patients undergoing lower abdominal surgeries. Its use may contribute to enhanced recovery and reduced opioid consumption.

**Keywords:** Numerical Pain Intensity Scale, Postoperative Pain, Quadratus Lumborum Block, Regional Anesthesia, Transversus Abdominis Plane Block.

### INTRODUCTION

Efficient postoperative analgesia is crucial for facilitating prompt healing, minimising complications, and enhancing patient satisfaction following surgery. Effective analgesia facilitates mobilisation, diminishes the occurrence of pulmonary and thromboembolic problems, and minimises the duration of hospital stays.<sup>1</sup> Historically, multimodal analgesic protocols incorporating opioids, non-steroidal anti-inflammatory medications (NSAIDs), and regional methods have been employed.<sup>2</sup> Nonetheless, the adverse effects linked to systemic opioids—such as nausea, vomiting, respiratory depression, and ileus—pose significant concerns, particularly in abdominal procedures.<sup>3</sup>

Epidural analgesia is frequently regarded as the benchmark for sustained postoperative pain management in abdominal surgeries. It offers superior somatic and visceral analgesia; however, it is associated with disadvantages such as hypotension, motor blockade, urine retention, and delayed mobility. In the realm of minimally invasive or laparoscopic abdominal procedures, when prompt mobilisation is essential, epidural analgesia may not consistently be the optimal choice.<sup>4,5</sup>

Ultrasound-guided regional anaesthesia techniques have increasingly become favoured in recent years as safer, more precise options. The Transversus Abdominis Plane (TAP) block is one of the most commonly utilised techniques. The procedure entails the administration of a local anaesthetic into the fascial plane situated between the internal oblique and transversus abdominis muscles, aiming at the nerves innervating the anterior abdominal wall (T6–L1). The TAP block delivers efficient somatic analgesia, decreasing postoperative pain and narcotic consumption across various abdominal procedures.<sup>6</sup>

Nevertheless, the TAP block predominantly inhibits somatic nerves and fails to sufficiently address visceral pain, a major element of postoperative distress following abdominal surgery. Consequently, certain patients may still necessitate supplementary analgesia despite an effectively executed TAP block.<sup>7</sup>

In order to overcome this constraint, the Quadratus Lumborum (QL) block was developed. This procedure is the administration of local anaesthetic around the quadratus lumborum muscle. Depending on the technique—lateral, posterior, or transmuscular—the local anaesthetic may disseminate to the thoracic paravertebral region, potentially influencing both somatic and visceral nerves. Research indicates that QL blocks may provide more comprehensive and prolonged analgesia than TAP blocks owing to their broader distribution.<sup>8,9</sup>

Although both TAP and QL blocks are widely utilised in clinical practice, there is a paucity of comparative research assessing their relative effectiveness in managing postoperative pain. Uncertainty persists on which block offers greater analgesia, especially for lower abdominal surgeries where both somatic and visceral components contribute to postoperative pain.

This study is unique since it compares the TAP and QL blocks directly in patients having lower abdominal operations utilising standardised ultrasound-guided procedures. This study seeks to offer definitive, evidence-based recommendations on the optimal regional method for postoperative pain management in this surgical context by assessing pain levels, opioid usage, and the duration until the initial rescue analgesia is administered. These findings may increase recovery protocols and improve overall patient outcomes by optimising pain management measures.

## AIMS AND OBJECTIVES

- To compare the efficacy of QL block and TAP block in controlling postoperative pain following lower abdominal surgeries.

## MATERIALS AND METHODS

This prospective study was conducted by Department of Anaesthesia in Sree Mookambika Institute of Medical Sciences, Kulasekharam for a period of 10 months from April 2024 to January 2025. Written informed consent was obtained from all participants prior to enrolment.

A total of 80 adult patients, aged between 18 and 60 years, with an American Society of Anesthesiologists (ASA) physical status I or II, scheduled for elective lower abdominal surgery under general anaesthesia, were included. Patients were excluded if they declined consent, had ASA physical status III–V, were allergic to local anaesthetics or adjuvants, had infection at the intended block site, were on chronic analgesic therapy, or had acute or chronic pain conditions.

Participants were randomly assigned into two equal groups—Group A (QL block) and Group B (TAP block)—each comprising 40 patients. Randomization was performed using a computer-generated list of random numbers. Both the patients and the postoperative evaluators were blinded to the block technique administered. The blocks were performed at the end of surgery by the attending anaesthesiologist, and postoperative monitoring was conducted by nursing staff unaware of group allocation. Outcome data were collected and handed over to the primary investigator in sealed envelopes.

All patients underwent a thorough preanesthetic evaluation, during which they were familiarized with the Numerical Pain Intensity Scale (NPIS) ranging from 0 (no pain) to 10 (worst imaginable pain), in their native language. Premedication with intravenous midazolam (0.02 mg/kg) was administered 20 minutes before induction. Standard ASA monitoring was applied.

General anesthesia was standardized across all patients. Induction was performed with intravenous propofol (1.5–2 mg/kg) and fentanyl (3 µg/kg), followed by tracheal intubation facilitated with a muscle relaxant. Anesthesia maintenance included nitrous oxide and oxygen (65%:35%), isoflurane (1%), and vecuronium (0.02 mg/kg every 30 minutes). Additional fentanyl (1 µg/kg/h) was infused. End-tidal CO<sub>2</sub> was maintained between 35–45 mmHg with mechanical ventilation.

### Block Technique

After completion of surgery and before extubation, patients received either a TAP or QL block under strict aseptic precautions using a 10 MHz linear ultrasound transducer (MINDRAY) and an in-plane technique.

For the QL block, the transducer was similarly placed between the iliac crest and the costal margin and then moved posteriorly to visualize the posterior aponeurosis of the transversus abdominis muscle. The needle was advanced until the tip was positioned deep to the aponeurosis and superficial to the transversalis fascia, at the lateral border of the quadratus lumborum muscle. Again, 20 ml of 0.25% ropivacaine was administered on each side.

For the TAP block, the patient was placed in a supine position. The transducer was positioned transversely between the iliac crest and the costal margin at the midaxillary line to identify the external oblique, internal oblique, and transversus abdominis muscle layers. A needle was inserted in-plane through the external and internal oblique muscles until the fascial plane between the internal oblique and transversus abdominis was reached, indicated by a characteristic “pop.” After confirming correct needle placement, 20 ml of 0.25% ropivacaine was injected bilaterally.

Following block administration, residual neuromuscular blockade was reversed using neostigmine (0.05 mg/kg) and glycopyrrolate (0.01 mg/kg), after which the patients were extubated and transferred to the post-anesthesia care unit.

### Postoperative Assessment

Pain intensity was evaluated using the NPIS at rest at 1, 2, 4, 8, 12, 16, and 24 hours postoperatively. The primary outcome measure was the time to first request for rescue analgesia. Secondary outcomes included NPIS scores at the specified time points and total morphine consumption during the first 24 hours. Hemodynamic parameters were also monitored.

All patients received intravenous acetaminophen 1 g every 8 hours during the initial 24-hour period post-surgery. If the NPIS score exceeded 4 at rest, or if patients reported significant pain, an intravenous bolus of morphine (1 mg) was administered as rescue analgesia. Hemodynamic parameters were continuously monitored, and side effects such as nausea and vomiting were managed with intravenous ondansetron (4 mg). Any other adverse events were recorded.

### Statistical Analysis

Data were analyzed using SPSS Version 23.0. Continuous variables were expressed as mean ± standard deviation (SD). Independent samples t-test was used for between-group comparisons of continuous data, depending on normality. Categorical variables, including NPIS scores, were analyzed using Chi-square or Fisher’s exact. A p-value of less than 0.05 was considered statistically significant.

## OBSERVATION AND RESULTS

Demographic characteristics such as age, sex, and body mass index (BMI) were comparable between the two groups. There was no statistically significant difference in these baseline characteristics, indicating effective randomization. (Table 1)

**Table 1: Comparison of demographic characteristics between the groups.**

Parameter	Group A (QL)	Group B (TAP)	p-value
Age (years)	41.8 ± 9.9	42.6 ± 10.4	0.71
Sex (M/F)	22/18	19/21	0.86
BMI (kg/m <sup>2</sup> )	24.4 ± 3.5	24.1 ± 3.2	0.64

The mean duration of surgery was 92.3 ± 18.6 minutes in the TAP block group and 94.1 ± 19.2 minutes in the QL block group. Statistical analysis showed no significant difference between the two groups (p = 0.58). This indicates that the length of the surgical procedures was comparable, and thus, any observed differences in postoperative analgesic outcomes are unlikely to be influenced by variations in the duration of surgery.

The mean time to first rescue analgesic was significantly longer in Group B (QL block) than in Group A (TAP block), indicating prolonged analgesic duration. (Table 2)

**Table 2: Comparison of mean time to first rescue analgesic between groups**

Group	Duration (mins)	p-value
Group A (QL)	356.4 ± 43.82	< 0.001
Group B (TAP)	273.2 ± 39.71	

Total postoperative morphine consumption over 24 hours was significantly lower in the QL block group compared to the TAP block group. (Table 3)

**Table 3: Comparison of mean postoperative morphine consumption between groups**

Group	Morphine (mg)	p-value
Group A (QL)	3.31 ± 0.75	< 0.001
Group B (TAP)	5.89 ± 1.52	

Patients in the QL block group consistently reported lower pain scores at rest across all time intervals up to 16 hours postoperatively. At 24 hours, there was no statistically significant difference, suggesting similar wear-off of both blocks. (Table 4)

**Table 4: Comparison of mean pain scores between groups**

Time Post-op (hrs)	Group A (QL)	Group B (TAP)	p-value
1 hour	2.9 ± 1.0	4.1 ± 1.2	< 0.001
2 hours	3.0 ± 1.1	4.3 ± 1.3	< 0.001
4 hours	3.2 ± 1.0	4.5 ± 1.2	< 0.001
6 hours	3.0 ± 1.1	4.2 ± 1.1	< 0.001
8 hours	2.9 ± 1.0	4.0 ± 1.2	< 0.001
12 hours	2.9 ± 0.9	3.8 ± 1.1	< 0.001
16 hours	2.9 ± 0.8	3.6 ± 1.0	0.03
24 hours	2.8 ± 0.9	3.1 ± 0.9	0.25

Heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and oxygen saturation (SpO<sub>2</sub>) were recorded at baseline (pre-induction), during surgery at 15-minute intervals, and postoperatively at 1, 2, 4, 8, 12, and 24 hours. Both groups maintained stable vital signs throughout the perioperative period. There were no statistically significant differences in mean heart rate or blood pressure values between the QL and TAP groups at any measured time point. There were no significant differences between the two groups in terms of intraoperative or postoperative hemodynamic stability. Both groups maintained stable vital signs throughout the observation period, and no patient experienced significant hypotension, bradycardia, or desaturation requiring intervention.

## DISCUSSION

In the present study, the two study groups were well-matched in terms of demographic and baseline surgical characteristics. There were no statistically significant differences in age, gender distribution, or BMI. The duration of surgery was similar between the groups ( $p = 0.58$ ), ruling out the possibility that surgical length influenced postoperative pain or analgesic needs.

The time to first rescue analgesia was significantly longer in the QL group ( $356.4 \pm 43.82$  minutes) compared to the TAP group ( $273.2 \pm 39.71$  minutes), with a p-value of  $< 0.001$ . This suggests that the QL block provides a more sustained analgesic effect, likely due to its posterior and deeper anatomical placement, allowing for the spread of local anesthetic to paravertebral and visceral nerve pathways. In contrast, the TAP block primarily targets the somatic nerves of the anterior abdominal wall, offering less comprehensive analgesia.

Correspondingly, total morphine consumption in the first 24 hours postoperatively was significantly lower in the QL group ( $3.31 \pm 0.75$  mg) compared to the TAP group ( $5.89 \pm 1.52$  mg). This substantial reduction in opioid requirement not only indicates more effective pain control but also suggests a lower risk of opioid-related side effects such as nausea, vomiting, sedation, and respiratory depression, all of which can delay recovery and discharge.

Pain scores assessed using the NPIS showed that patients who received the QL block consistently reported lower scores across all time intervals up to 16 hours postoperatively. The difference in pain scores between the groups was statistically significant at 1, 2, 4, 6, 8, 12, and 16 hours post-surgery. By 24 hours, the pain scores were comparable ( $p = 0.25$ ), indicating a similar duration of action for both blocks beyond which the effect diminished. These findings further support the advantage of the QL block in providing early and sustained pain relief in the critical initial postoperative period.

Importantly, both block techniques demonstrated a favorable safety profile. Intraoperative and postoperative hemodynamic parameters, including heart rate, systolic and diastolic blood pressure, mean arterial pressure, and oxygen saturation, remained within normal ranges for all patients in both groups. There were no significant differences in these parameters between the TAP and QL groups, and no adverse hemodynamic events—such as hypotension, bradycardia, or desaturation—were reported. This confirms that both blocks are hemodynamically stable and suitable for use in ASA I–II patients undergoing lower abdominal surgeries.

The results of the present study are similar to those of other studies. Kumar GD et al.<sup>10</sup> observed similar patterns, indicating a markedly prolonged duration to first analgesia ( $447.00 \pm 62.52$  min vs.  $243.00 \pm 97.36$  min) and reduced morphine utilisation ( $3.25 \pm 0.78$  mg vs.  $5.65 \pm 1.55$  mg) within the QL block cohort. Similarly, Fargaly OS et al.<sup>11</sup> observed that the cumulative morphine consumption on the initial postoperative day was markedly reduced in the QL group (3 mg [3–6]) in contrast to the TAP group (6 mg [6–9],  $p \leq 0.0001$ ), alongside an extended interval to the first analgesic request (17 vs. 8 hours,  $p \leq 0.001$ ) and diminished pain scores.

In the study conducted by Deng W et al.<sup>12</sup> patients who underwent the QL block utilised markedly less sufentanil at 24 and 48 hours postoperatively, despite no significant differences in early pain levels at 6 hours. Furthermore, the QL group had a diminished occurrence of dizziness, a recognised adverse effect associated with opioids, hence reinforcing the advantages of decreased opioid consumption.

Weheba HE et al.<sup>13</sup> found no significant difference in total fentanyl use at 24 hours; however, a reduced number of patients in the QL group required rescue opioids (17/48) compared to the TAP group (28/50), suggesting a superior overall analgesic profile. Comparable pain scores among groups at 1, 6, 12, and 24 hours indicate diversity in patient responses or study protocols, although underscore the tendency of enhanced early analgesia associated with the QL block.

Baytar C et al.<sup>14</sup> conducted a study with 53 patients in the TAP group and 54 in the QL group. Their findings indicated no statistically significant differences in visual analogue scale (VAS) scores at rest or during movement between the two cohorts. Moreover, total analgesic usage was similar among the groups. Despite the QL group experiencing a considerably prolonged length of anaesthesia, the surgical duration did not exhibit a significant difference ( $p < 0.05$ ), indicating that the increased anaesthesia time may be attributed to the administration of the block rather than the complexity of the surgery.

Similarly, Naaz S et al.<sup>15</sup> observed a notable disparity in the duration of postoperative analgesia across their research groups ( $p = 0.00$ ). The QL group exhibited the most prolonged analgesia (mean = 8.05 hours; 95% CI: 7.28–8.81), followed by the TAP group (mean = 5.59 hours; 95% CI: 4.63–6.45), and the control group (mean = 1.19 hours; 95% CI: 1.04–1.34). Moreover, the QL group exhibited the lowest verbal rating scores ( $p = 0.001$ ) and the minimal cumulative analgesic intake ( $p = 0.00$ ), signifying enhanced pain management. No difficulties were noted in any group. Nonetheless, patient satisfaction did not exhibit a significant difference between individuals who got QL and TAP blocks.

Wang Y et al.<sup>16</sup> conducted a meta-analysis revealing that patients in the TAP group exhibited significantly greater postoperative morphine consumption (WMD = 3.893 mg; 95% CI: 2.053–5.733;  $p < 0.001$ ), fentanyl consumption (WMD = 23.815  $\mu$ g; 95% CI: 15.521–32.109;  $p < 0.001$ ), and VAS scores at 24 hours (WMD = 0.459; 95% CI: 0.118–0.801;  $p = 0.008$ ) in comparison to those in the QL group. Moreover, the rate of patients necessitating rescue analgesia and the occurrence of dizziness were markedly elevated in the TAP group, thereby underscoring the therapeutic benefits of the QL block in postoperative pain management.

## CONCLUSION

The study concludes that the QL block provides superior postoperative analgesia compared to the TAP block in patients undergoing lower abdominal surgeries. The QL block significantly prolongs the time to first rescue analgesia, reduces postoperative opioid consumption, and offers better pain control during the early recovery period. Both techniques were hemodynamically stable and free from major complications, indicating their safety. Given its enhanced analgesic effectiveness and opioid-sparing benefits, the QL block may be a more effective alternative to the TAP block as part of multimodal analgesia in abdominal surgical procedures.

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## CONFLICTS OF INTEREST:

There are no conflicts of interest

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