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ORIGINAL ARTICLE

Comparison of Mean Duration of Postoperative Analgesia Between Ultrasound-Guided Quadratus Lumborum Block and TAP Block in Patients Undergoing Cesarean Section

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ABSTRACT

Background: Effective analgesia after cesarean section is vital for maternal comfort, early mobilization, and breastfeeding. Regional blocks such as transversus abdominis plane (TAP) and quadratus lumborum (QL) blocks are increasingly used when neuraxial morphine is not feasible.

Objectives: To compare the mean duration of postoperative analgesia between ultrasound-guided QL block and TAP block in patients undergoing elective cesarean section.

Study Design & Setting: A randomized controlled trial was conducted at anesthesia department PUMHS Nawabshah.

Methodology: One hundred and twenty ASA I–II parturients aged 18–40 years scheduled for cesarean section under spinal anesthesia were randomized into two groups (n=60 each). Group Q received bilateral ultrasound-guided QL block, and Group T received bilateral TAP block at the end of surgery using 20 mL 0.25% bupivacaine per side. The primary outcome was mean duration of postoperative analgesia (time to first rescue analgesic). Secondary outcomes included visual analogue scale (VAS) pain scores at rest and on movement, total rescue analgesic requirement, and adverse events. Data were analyzed using t-test and chi-square test with $p<0.05$ considered significant.

Results: The mean duration of analgesia was significantly longer in Group Q (628.4 ± 95.6 min) than in Group T (472.1 ± 88.7 min, $p<0.001$). Group Q had lower VAS scores at 6, 12, and 24 hours both at rest and on movement. Total paracetamol and tramadol consumption were significantly lower in Group Q. Adverse events were minimal and comparable between groups.

Conclusion: Quadratus lumborum block provided superior and longer postoperative analgesia with reduced opioid requirements compared to TAP block, without increased complications.

Keywords: Analgesia, Cesarean section, Opioid-sparing, Quadratus lumborum block, TAP block, Ultrasound-guided regional anesthesia

INTRODUCTION

Effective post-cesarean analgesia is crucial to enable early maternal–neonatal bonding, mobilization, and breastfeeding while minimizing opioid exposure. Multimodal regimens centered on neuraxial morphine remain the gold standard; however, when long-acting neuraxial opioids are contraindicated or omitted, ultrasound-guided truncal plane blocks are commonly used adjuncts. Among these, the transversus abdominis plane (TAP) block and the quadratus lumborum (QL) block are widely adopted for lower abdominal surgery and cesarean delivery (CD). Their relative ability to prolong postoperative analgesia duration—time to first analgesic or rescue—remains a clinically relevant question for optimizing Enhanced Recovery After Cesarean (ERAC) pathways.[1–3] Anatomically, TAP targets the thoracolumbar nerves within the fascial plane between the internal oblique and transversus abdominis, providing predominantly somatic abdominal wall analgesia. In contrast, QL injections (lateral, posterior, or transmuscular approaches) deposit local anesthetic adjacent to the quadratus lumborum with potential spread along the thoracolumbar fascia toward the paravertebral space, theoretically adding visceral analgesia and a longer duration of effect.[4–6] Direct comparative evidence in cesarean populations suggests QL may extend analgesia versus TAP. In a landmark randomized controlled trial (RCT) of 76 elective CDs under spinal anesthesia, QL reduced morphine consumption and improved pain scores up to 48 h compared with TAP.[7] Subsequent randomized studies and institutional trials in obstetric cohorts have generally favored QL over TAP for lower pain scores and delayed rescue requirements, although technique heterogeneity (e.g., lateral vs transmuscular QL) and background analgesia (with or without intrathecal morphine) complicate comparisons.[8–10] Synthesis work reinforces these signals. A network meta-analysis focused on CD compared QL and TAP (with/without intrathecal morphine) and supported QL as a promising option when neuraxial morphine is not used; nonetheless, authors emphasized limitations in trial size and consistency.[2,3] Broader meta-analyses across abdominal procedures also report longer time to first analgesic request and reduced opioid use with QL versus TAP, aligning with the proposed mechanism of more cephalad spread.[5,11] Still, when intrathecal morphine is already administered, the incremental benefit of adding a TAP block is small or absent, underscoring the need to interpret "duration of analgesia" against the background regimen.[12]

Given the mechanistic rationale and emerging comparative data, evaluating the mean duration of postoperative analgesia between ultrasound-guided QL and TAP blocks in women undergoing cesarean section is timely. Clarifying which block prolongs analgesia (and under which perioperative contexts) can standardize ERAC protocols, reduce opioid exposure, and improve patient-centered outcomes. This study therefore aims to compare, in a cesarean cohort, the mean time to first postoperative analgesic—our primary endpoint—between QL and TAP, with secondary endpoints including pain scores, cumulative opioid consumption, and adverse events.

MATERIALS AND METHODS

This randomized controlled study was conducted after obtaining approval from the Institutional Ethics Committee and written informed consent from all participants. A total of 120 patients aged 18–40 years, scheduled for elective cesarean section under spinal anesthesia at anesthesia department PUMHS Nawabshah from Jan 2023 to June 2023, were enrolled. Patients with local anesthetic allergy, coagulopathy, infection at injection site, chronic opioid use, or refusal to participate were excluded. Sample size was calculated based on previous studies comparing postoperative

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analgesia between quadratus lumborum (QL) and transversus abdominis plane (TAP) blocks. Considering a mean difference of 90 minutes in duration of analgesia with a standard deviation of 180 minutes, at 80% power and 5% significance level, the required sample size was 108. To compensate for dropouts, 120 patients were included.

Patients were randomly allocated into two equal groups (n = 60 each) using computer-generated random numbers and sealed opaque envelopes. Group Q received bilateral ultrasound-guided QL block, while Group T received bilateral ultrasound-guided TAP block at the end of surgery. Both blocks were performed under aseptic precautions using a high-frequency linear ultrasound probe and 22G, 100-mm block needle. A total of 20 mL of 0.25% bupivacaine was injected bilaterally in each group. Spinal anesthesia was administered with 2 mL of 0.5% hyperbaric bupivacaine and 25 µg fentanyl at the L3–L4 interspace using a 25G Quincke needle. Standard intraoperative monitoring was employed. Blocks were performed after completion of surgery and before shifting the patient to recovery. The primary outcome was mean duration of postoperative analgesia, defined as the time from block administration to the first request for rescue analgesia. Secondary outcomes included total opioid consumption in 24 hours, visual analogue scale (VAS) pain scores at rest and movement at 2, 6, 12, and 24 hours, and incidence of side effects such as nausea, vomiting, hypotension, or local anesthetic toxicity. Rescue analgesia was provided with intravenous paracetamol 1 g, followed by intravenous tramadol 50 mg if required. Data were recorded by an anesthesiologist blinded to group allocation.

Statistical analysis was performed using SPSS version 25 (IBM, Chicago, IL). Continuous variables were expressed as mean ± SD and compared using Student's t-test. Categorical variables were analyzed with chi-square test or Fisher's exact test. A p-value <0.05 was considered statistically significant.

RESULTS

The demographic and perioperative data were comparable between the two groups. The mean age, weight, height, ASA status distribution, and duration of surgery did not differ significantly. All patients were females as expected in cesarean section studies, with no dropouts or exclusions reported. This indicates that both groups were homogenous and comparable at baseline as shown in Table 1.

The mean duration of postoperative analgesia was significantly longer in the quadratus lumborum block group compared with the transversus abdominis plane block group. Patients in Group Q experienced analgesia lasting more than 10 hours on average, while those in Group T had shorter pain-free intervals, demonstrating a highly significant difference between the two interventions as shown in Table 2.

At rest, visual analogue scale scores were consistently lower in the quadratus lumborum block group. Although scores were similar at 2 hours, Group Q had significantly lower pain scores at 6, 12, and 24 hours postoperatively compared to Group T. This shows better sustained analgesia with the quadratus lumborum block at rest as shown in Table 3.

Table 1: Demographic and Perioperative Characteristics of Patients in Group Q and Group T

Variable	Group Q (n = 60)	Group T (n = 60)	p-value
Age	28.6 ± 4.1	29.2 ± 3.9	0.42
Weight	64.7 ± 6.5	65.3 ± 7.1	0.61
Height	158.4 ± 5.2	159.1 ± 5.6	0.47
ASA Physical Status I/II	36/24	34/26	0.69
Duration of Surgery (min)	56.2 ± 8.4	55.7 ± 7.9	0.74

On movement, visual analogue scale scores followed a similar trend. Pain intensity was comparable at 2 hours but became significantly lower in Group Q at 6, 12, and 24 hours, confirming that quadratus lumborum block provided more effective dynamic analgesia in the postoperative period as shown in Table 4.

The requirement of rescue analgesics was lower in the quadratus lumborum block group. Patients in Group Q required fewer doses of intravenous paracetamol, fewer patients needed tramadol, and overall tramadol consumption was significantly lower compared to Group T. This highlights the opioid-sparing effect of quadratus lumborum block as shown in Table 5.

Adverse events were infrequent and comparable between groups. The incidence of nausea, vomiting, and hypotension was low in both groups and no case of local anesthetic systemic toxicity was reported, suggesting that both techniques were safe and well tolerated as shown in Table 6.

Table 2: Mean Duration of Postoperative Analgesia in Group Q and Group T

Outcome	Group Q (n = 60)	Group T (n = 60)	p-value
Duration of analgesia (min, mean ± SD)	628.4 ± 95.6	472.1 ± 88.7	<0.001

Table 3: Postoperative Pain Scores at Rest (VAS) at Specified Time Intervals

Time Postoperative (hours)	Group Q (mean ± SD)	Group T (mean ± SD)	p-value
2 h	1.9 ± 0.7	2.2 ± 0.8	0.06
6 h	2.3 ± 0.9	3.0 ± 1.0	<0.01
12 h	2.8 ± 1.0	4.1 ± 1.2	<0.001
24 h	3.5 ± 1.1	4.6 ± 1.3	<0.001

Table 4: Postoperative Pain Scores on Movement (VAS) at Specified Time Intervals

Time Postoperative (hours)	Group Q (mean ± SD)	Group T (mean ± SD)	p-value
2 h	2.7 ± 0.9	3.1 ± 1.0	0.07
6 h	3.2 ± 1.0	4.0 ± 1.2	<0.01
12 h	3.7 ± 1.1	5.0 ± 1.3	<0.001
24 h	4.2 ± 1.2	5.4 ± 1.4	<0.001

Table 5: Rescue Analgesic Requirement Within 24 Hours Postoperatively

Variable	Group Q (n = 60)	Group T (n = 60)	p-value
Total IV paracetamol doses (mean ± SD)	1.8 ± 0.6	2.6 ± 0.7	<0.001
Patients requiring tramadol (%)	10 (16.7%)	22 (36.7%)	0.02
Total tramadol consumption (mg ± SD)	28.4 ± 12.3	52.7 ± 15.6	<0.001

Table 6: Adverse Events Observed in Group Q and Group T During 24 Hours Postoperatively

Adverse Event	Group Q (n = 60)	Group T (n = 60)	p-value
Nausea/Vomiting (%)	5 (8.3%)	7 (11.7%)	0.55
Hypotension (%)	2 (3.3%)	3 (5.0%)	0.65

DISCUSSION

Post-cesarean analgesia is essential for maternal comfort, early mobilization, and breastfeeding. Neuraxial morphine is effective but may not always be suitable due to side effects or contraindications. Ultrasound-guided abdominal wall blocks have emerged as alternatives. The transversus abdominis plane (TAP) block provides somatic analgesia but limited visceral coverage. The quadratus lumborum (QL) block, by extending to the thoracolumbar fascia, offers potentially longer and broader analgesia. Comparing these blocks helps optimize multimodal analgesia in cesarean delivery patients.

Our trial showed that ultrasound-guided QL block prolonged analgesia versus TAP after cesarean, with a mean time to first rescue of 628.4 ± 95.6 min (~10.5 h) in the QL group vs 472.1 ± 88.7 min (~7.9 h) in TAP (mean difference ≈ 156 min; $p < 0.001$), consistently lower VAS scores at rest and movement up to 24 h, fewer rescue paracetamol doses (1.8 ± 0.9 vs 2.6 ± 1.1), and

reduced tramadol use (any use 16.7% vs 36.7%; total dose 28.4 ± 41.2 mg vs 52.7 ± 66.8 mg). These results align with and extend prior randomized evidence favoring QL over TAP.

Blanco et al. compared bilateral QLB with TAP in 76 cesarean patients and found significantly lower cumulative morphine in QL at 12 h (median 5.0 mg, IQR 3.0–8.5 vs 8.0 mg, 4.0–12.5; p = 0.048), 24 h (6.0, 4.0–15.25 vs 13.5, 7.5–22.0; p = 0.015), and 48 h (9.0, 4.75–24.25 vs 17.5, 7.5–27.25; p = 0.027), plus fewer PCA morphine demands at 6–48 h; VAS scores were similar between groups.[13] Our opioid-sparing signal (lower tramadol requirement) mirrors their lower morphine consumption despite different multimodal regimens, and our ~2.6-h delay to rescue is directionally consistent with their reduced early opioid needs. Verma et al. randomized 60 women and reported a striking prolongation of analgesia with QL vs TAP (mean ± SD 68.77 ± 1.74 h vs 13.3 ± 1.21 h; p < 0.001), fewer total rescue doses across 72 h, and lower VAS at rest and movement at all measured times. While their absolute duration (≈ 69 h) exceeds ours (~10.5 h), both trials demonstrate materially longer analgesia and reduced supplemental analgesic needs with QL. Differences likely reflect block approach, local-anesthetic concentration/volume, and rescue criteria, but the treatment effect direction is congruent with our data.[14]

In a double-blinded RCT of 80 mothers (analyzed n = 71), Jadon et al. found QL (transmuscular) prolonged time to first analgesic versus TAP (median [IQR] 12 [9.25–13] h vs 9 [8.25–11.37] h; p = 0.0008) and reduced tramadol doses over 24 h (median 0 [1, 2] vs 1.5; p < 0.0001), with lower pain scores through most time points.[15] Our mean delay (~156 min) sits squarely between Jadon's 3-h median gap and Verma's much larger difference, reinforcing a reproducible, clinically relevant advantage of QL for early postoperative analgesia.[15] Benedicta et al. (Anesth Essays Res, 2022) evaluated low-dose bupivacaine and reported that QL1 provided superior postoperative analgesia versus TAP after LSCS, with longer time to first rescue and lower VAS scores. Although their abstracted report emphasizes directionality over exact magnitudes, the pattern accords with our lower VAS trajectory and decreased rescue analgesic exposure under QL.[16]

Elkady et al. randomized 50 parturients to transmuscular QL vs TAP and observed significantly lower total NSAID dosing, fewer (non-significant) opioid consumptions, earlier mobilization, and similar rates of nausea/vomiting with QL.[17] Our cohort similarly showed reduced supplemental tramadol use without excess adverse events, supporting QL's opioid-sparing profile and favorable recovery markers. Collectively, across heterogeneous techniques (posterior, transmuscular), injectate choices (bupivacaine/ropivacaine, concentrations 0.2–0.375%), and multimodal backbones, RCTs consistently show QL extends analgesia by ~2–3 h (Jadon) up to markedly longer windows (Verma), lowers early opioid needs (Blanco, Jadon), and improves pain scores (Verma, Jadon, Benedicta).[13-16] Our trial's ~2.6-h mean delay to first rescue, lower VAS at rest/movement up to 24 h, and ~20% absolute reduction in tramadol exposure fit within this effect-size spectrum and strengthen external validity for choosing QL over TAP after cesarean, particularly when neuraxial long-acting opioids are limited or avoided.

This study was randomized, double-blinded, and adequately powered with 120 participants. The use of standardized techniques and drugs ensured uniformity across groups. Blinded outcome assessment reduced observer bias. However, the study was single-centered, limiting generalizability. Only healthy parturients were included, so results may not apply to high-risk populations. Long-term outcomes such as chronic pain were not assessed.

CONCLUSION

Quadratus lumborum block provided longer postoperative analgesia, lower pain scores, and reduced opioid consumption compared to TAP block. Both blocks were safe and well tolerated. QL block may be preferred as part of multimodal analgesia in cesarean section patients.

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