RESEARCH PAPER

Comparative Evaluation Of Ultrasound-Guided Transversus Abdominis Plane Block Versus Quadratus Lumborum Block For Postoperative Analgesia In Elective Abdominal Surgeries

Dr. Vikas Gupta[1], Dr. Rasmeet Kour[2*]

[1] Assistant Professor, Gmc Ssh Jammu.

[2*] Associate Professor, Department Of Anaesthesia, Ascoms Jammu.

Corresponding Author: Dr. Rasmeet Kour, Associate Professor, Department Of Anaesthesia, Ascoms Jammu.

Email: dr.rasmeet@gmail.com

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Abstract

Introduction: Effective postoperative analgesia is crucial after abdominal surgeries. While tap block provides somatic pain relief, its visceral coverage is limited. The quadratus lumborum block may offer extended and superior analgesia. This study compares ultrasound-guided transversus abdominis plane (tap) and quadratus lumborum (ql) blocks regarding analgesic efficacy, opioid consumption, and postoperative outcomes in elective abdominal surgeries.

Materials And Methods: The present study was a prospective randomized study conducted on 106 asa i–ii patients undergoing elective abdominal surgery, allocated to tap or ql block (n=53 each). Blocks in both groups were performed with 20 ml of 0.25% ropivacaine administered on each side with dexamethasone 8 mg (total dose bilaterally) as an adjuvant. Primary outcome was duration of analgesia, secondary outcomes included opioid consumption, visual analogue scale (vas) scores, rescue analgesia, ambulation, and adverse effects.

Results: In the present study, baseline characteristics were comparable between groups. The ql block significantly reduced intraoperative fentanyl consumption, prolonged duration of analgesia, and decreased postoperative rescue analgesic requirements compared to the tap block. It also enabled earlier ambulation and shorter hospital stay. Pain scores were consistently lower from 2 hours onward, and patient satisfaction was higher, with comparable adverse effects in both groups.

Conclusion: Quadratus lumborum block provided superior postoperative analgesia than tap block, with prolonged analgesia, reduced opioid use, lower pain scores, and higher patient satisfaction. Despite longer performance time, it facilitated earlier ambulation and shorter hospital stay, supporting its role in multimodal analgesia for abdominal surgeries.

Keywords: Ql Block, Tap Block, Rescue Analgesia, Vas, Pain, Abdominal Surgery, Opioid Consumption.

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Introduction-

Effective postoperative pain control remains a cornerstone of perioperative care, particularly in patients undergoing elective abdominal surgeries, where inadequate analgesia can lead to delayed recovery, increased morbidity, prolonged hospital stay, and reduced patient satisfaction [1,2]. Traditionally, systemic opioids and neuraxial techniques such as epidural analgesia have been widely used; however, these modalities are associated with significant adverse effects including nausea, vomiting, respiratory depression, hemodynamic instability, and delayed mobilization [2,3]. Consequently, there has been a paradigm shift toward multimodal analgesia, with increasing emphasis on ultrasound-guided regional nerve blocks as safer and opioid-sparing alternatives [2]. Among truncal blocks, the transversus abdominis plane (TAP) block has gained popularity due to its relative simplicity and effectiveness in providing somatic analgesia to the anterior abdominal wall by targeting thoracolumbar nerves (T6–L1) [2,4].

Ultrasound guidance has further improved the precision and safety of TAP block, making it a commonly used technique in various abdominal procedures [4]. However, a key limitation of TAP block is its inability to provide adequate visceral analgesia, as it primarily blocks somatic afferents [1,5].

To overcome these limitations, the quadratus lumborum (QL) block has emerged as a promising alternative. By depositing local anesthetic adjacent to the quadratus lumborum muscle, the QL block allows spread to the thoracolumbar fascia and paravertebral space, thereby providing both somatic and visceral analgesia [1,5]. Recent studies and meta-analyses have suggested that QL block may offer prolonged duration of analgesia, reduced opioid consumption, and better pain control compared to TAP block in abdominal surgeries [1,6,7]. Despite growing evidence, the comparative efficacy of ultrasound-guided TAP block versus QL block remains inconclusive due to variability in study designs, surgical procedures, and outcome measures [6–8]. Some randomized trials have demonstrated significantly longer time to first analgesic request and lower postoperative opioid requirement with QL block, while others report comparable outcomes between the two techniques [1,7,9]. Furthermore, most available studies are limited to specific surgeries such as hysterectomy, colorectal procedures, or urological surgeries, thereby limiting generalizability [7–9]. Given the increasing adoption of enhanced recovery after surgery (ERAS) protocols and the need for optimal analgesic strategies with minimal side effects, it is essential to identify the most effective regional block for postoperative pain management. Therefore, the present study aims to comparatively evaluate ultrasound-guided transversus abdominis plane block and quadratus lumborum block in patients undergoing elective abdominal surgeries, with respect to analgesic efficacy, opioid consumption, and patient outcomes.

Materials and Methods-

This prospective, randomized, comparative study was conducted in the Department of Anaesthesiology at SSH Government Medical College, Jammu, over a period of one year from March 2024 to March 2025 after obtaining Institutional Ethics Committee approval and written informed consent from all participants. A total of 106 adult patients aged 18–65 years, of either sex, belonging to American Society of Anesthesiologists (ASA) physical status I and II, and scheduled for elective abdominal surgeries under general anesthesia were included. Patients were randomly allocated into two equal groups (n=53 each) using a computer-generated randomization sequence. Group T received ultrasound-guided transversus abdominis plane (TAP) block, while Group Q received ultrasound-guided quadratus lumborum (QL) block. All patients received standardized general anesthesia with routine intraoperative monitoring. Additional intraoperative analgesia was administered as required using intravenous (IV) fentanyl. At the end of surgery, the assigned block was performed bilaterally under ultrasound guidance using strict aseptic precautions. In both groups, 20 mL of 0.25% ropivacaine was administered on each side with dexamethasone 8 mg (total dose bilaterally) as an adjuvant. The TAP block was given in the plane between internal oblique and transversus abdominis muscles, while the QL block was administered adjacent to the quadratus lumborum muscle.

Block performance time was recorded from probe placement to completion of injection. Time to onset was defined as the interval between completion of injection and onset of sensory blockade, assessed by loss of pinprick sensation at 2-minute intervals. Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 0, 2, 4, 6, 12, and 24 hours. The primary outcome was duration of analgesia, defined as time to first rescue analgesia. Secondary outcomes included total opioid consumption, mean total rescue analgesic dose, number of rescue doses, time to ambulation, hemodynamic parameters, patient satisfaction at 24 hours, and adverse effects. Rescue analgesia was administered when VAS ≥4 using intravenous tramadol along with paracetamol. Prolonged analgesia was defined as duration >10 hours. Data were recorded and analyzed using appropriate statistical methods. Continuous variables were expressed as mean ± standard deviation and compared using Student's t-test, while categorical variables were analyzed using the chi-square test. Logistic regression analysis was performed to identify predictors of prolonged analgesia. A p-value of <0.05 was considered statistically significant.

Results-

Table 1 shows that the demographic profile of patients in both groups was comparable. The mean age in Group T (TAP) was 42.6 ± 10.8 years and in Group Q (QL) was 41.9 ± 11.2 years (p=0.72). Similarly, the mean body weight was comparable between Group T (64.5 ± 8.2 kg) and Group Q (65.1 ± 7.9 kg) (p=0.65). The distribution

of ASA physical status (I/II) was also similar in both groups (31/22 vs 29/24; p=0.69), indicating no significant baseline difference. The mean duration of surgery did not differ significantly between Group T (92.4 ± 18.6 minutes) and Group Q (95.1 ± 20.2 minutes) (p=0.48). However, the duration of hospital stay was significantly shorter in Group Q (3.9 ± 1.0 days) compared to Group T (4.8 ± 1.2 days) (p<0.01). A significantly higher proportion of patients in Group T required additional intraoperative analgesia compared to Group Q (39.6% vs 17.0%; p=0.01). Similarly, the requirement of postoperative rescue analgesia was significantly higher in Group T (84.9%) than in Group Q (56.6%) (p<0.01). Overall, both groups were comparable in baseline characteristics, while analgesic requirements and hospital stay showed significant differences favoring the QL block.

Table 1- Demographic characteristics of study participants

Parameter	Group T (TAP) (n=53)	Group Q (QL) (n=53)	p-value
Age (years, Mean ± SD)	42.6 ± 10.8	41.9 ± 11.2	0.72
Weight (kg, Mean ± SD)	64.5 ± 8.2	65.1 ± 7.9	0.65
ASA I/II n (%)	31/22	29/24	0.69
Duration of surgery (min, Mean ± SD)	92.4 ± 18.6	95.1 ± 20.2	0.48
Duration of hospital stay (days, Mean ± SD)	4.8 ± 1.2	3.9 ± 1.0	**<0.01**
Patients requiring additional intraoperative analgesia n (%)	21 (39.6%)	9 (17.0%)	**0.01**
Total patients requiring rescue analgesia n (%)	45 (84.9%)	30 (56.6%)	**<0.01**

The gender distribution was comparable between the two groups as seen in Figure 1. In Group T (TAP), 28 patients (52.8%) were male and 25 (47.2%) were female, whereas in Group Q (QL), 30 patients (56.6%) were male and 23 (43.4%) were female. The difference was not statistically significant (p=0.68), indicating that both groups were similar with respect to gender distribution.

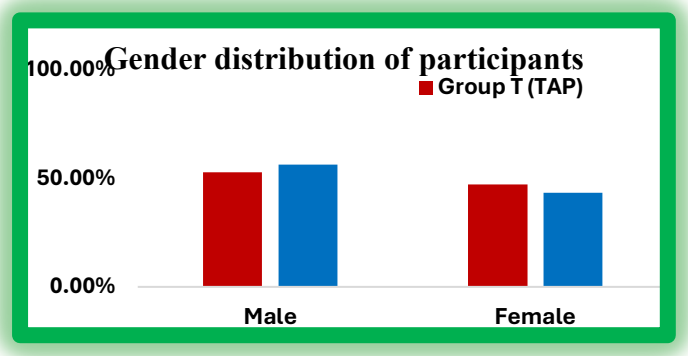

Figure 1- Gender distribution of participants

Table 2 depicts clinical characteristics of study participants. Total opioid consumption (IV fentanyl) over 24 hours was significantly higher in Group T (TAP) (98.5 ± 15.2 µg) compared to Group Q (QL) (62.3 ± 12.8 µg) (p<0.001). Block performance time was significantly shorter in Group T (8.2 ± 1.5 minutes) than in Group Q (10.6 ± 1.8 minutes) (p<0.001). However, the time to onset of block was significantly longer in Group Q (18.6 ± 3.8 minutes) compared to Group T (15.2 ± 3.1 minutes) (p<0.01). Patients in Group Q achieved earlier ambulation (10.8 ± 2.7 hours) compared to Group T (14.2 ± 3.1 hours) (p<0.001). The mean total dose of rescue analgesia (IV tramadol along with paracetamol) was significantly lower in Group Q (112.6 ± 35.1 mg) than in Group T (185.3 ± 40.2 mg) (p<0.001). Additionally, the time to first rescue analgesia was significantly prolonged in Group Q (11.2 ± 2.1 hours) compared to Group T (6.8 ± 1.5 hours) (p<0.001). Regarding the number of rescue analgesic doses in 24 hours, a higher proportion of patients in Group Q required no rescue analgesia (43.4% vs 15.1%), while more patients in Group T required multiple doses (≥2 doses), with the difference being statistically significant (p=0.01). Postoperative hemodynamic parameters showed significantly lower heart rate and mean arterial pressure in Group Q compared to Group T (p<0.01). The incidence of adverse effects such as nausea/vomiting and hypotension was lower in Group Q, although the difference was not statistically significant (p>0.05). Overall, the QL block demonstrated superior analgesic efficacy with reduced opioid requirement, prolonged analgesia, earlier ambulation, and better hemodynamic stability compared to the TAP block.

Table 2- Clinical characteristics of study participants

Parameter		Group T (TAP) (mean ± SD)	Group Q (QL) (mean ± SD)	p-value
Total opioid consumption in 24 hours (µg)		98.5 ± 15.2	62.3 ± 12.8	**<0.001**
Block performance time (min)		8.2 ± 1.5	10.6 ± 1.8	**<0.001**
Time to onset of block (min)		15.2 ± 3.1	18.6 ± 3.8	**<0.01**
Time to ambulation (hours)		14.2 ± 3.1	10.8 ± 2.7	**<0.001**
Mean total dose of rescue analgesia (mg)		185.3 ± 40.2	112.6 ± 35.1	**<0.001**
Time to first rescue analgesia (hours)		6.8 ± 1.5	11.2 ± 2.1	**<0.001**
Number of rescue analgesic doses in 24 hours n (%)	0 dose	8 (15.1 %)	23 (43.4 %)	**0.01**
	1 dose	12 (22.6 %)	20 (37.7 %)	
	2 doses	22 (41.5 %)	7 (13.2 %)	
	≥3 doses	11 (20.8 %)	3 (5.7%)	
Postoperative hemodynamic parameters	Heart rate (bpm)	88.4 ± 9.2	82.7 ± 8.6	**<0.01**
	Mean arterial pressure (mmHg)	94.5 ± 7.8	90.2 ± 6.9	**<0.01**
Incidence of adverse Effects	Nausea/Vomiting	9 (17.0 %)	4 (7.5%)	0.13
	Hypotension	2 (3.8%)	1 (1.9%)	0.56

Logistic regression analysis was performed to identify predictors of prolonged analgesia (>10 hours) as shown in Table 3. The use of the quadratus lumborum (QL) block was found to be a significant independent predictor, with patients in the QL group having 4.85 times higher odds of prolonged analgesia compared to the TAP group (OR: 4.85; 95% CI: 2.10–11.20; p<0.001). Other variables, including age greater than 50 years (OR: 1.32; 95% CI: 0.58–3.01; p=0.51), female gender (OR: 1.18; 95% CI: 0.52–2.68; p=0.69), and duration of surgery (OR: 1.05; 95% CI: 0.98–1.12; p=0.14), were not found to be statistically significant predictors of prolonged analgesia. Overall, the QL block emerged as the only significant factor associated with increased duration of postoperative analgesia.

Table 3- Regression analysis for predictors of prolonged analgesia (>10 hrs)

Variable	Odds Ratio (OR)	95% CI	p-value
QL Block (vs TAP)	4.85	2.10–11.20	**<0.001**
Age (>50 years)	1.32	0.58–3.01	0.51
Female gender	1.18	0.52–2.68	0.69
Duration of surgery	1.05	0.98–1.12	0.14

Table 4 shows that the baseline (preoperative) VAS scores were comparable between Group T (TAP) (1.2 ± 0.5) and Group Q (QL) (1.3 ± 0.6) with no statistically significant difference (p=0.48). Similarly, at 0 hours postoperatively, VAS scores were comparable between the two groups (2.1 ± 0.8 vs 1.9 ± 0.7; p=0.18). However, from 2 hours onwards, VAS scores were significantly lower in Group Q compared to Group T at all time intervals. At 2 hours, the mean VAS score was 3.4 ± 1.0 in Group T and 2.5 ± 0.9 in Group Q (p<0.01). This difference became more pronounced at 4 hours (4.6 ± 1.2 vs 3.1 ± 1.0; p<0.001) and 6 hours (5.2 ± 1.3 vs 3.6 ± 1.1; p<0.001). At later time points, Group Q continued to demonstrate significantly lower pain scores at 12 hours (3.2 ± 1.0 vs 4.8 ± 1.1; p<0.001) and 24 hours (2.8 ± 0.9 vs 3.6 ± 1.0; p<0.01). Overall, the QL block provided significantly better postoperative analgesia with

consistently lower VAS scores compared to the TAP block, particularly from 2 hours onwards.

Table 4- VAS scores of Group T and Group Q

Time Interval		Group T (TAP) (mean ± SD)	Group Q (QL) (mean ± SD)	p-value
Preoperative (Baseline) VAS score		1.2 ± 0.5	1.3 ± 0.6	0.48
Postoperative VAS Scores	0 hour	2.1 ± 0.8	1.9 ± 0.7	0.18
	2 hours	3.4 ± 1.0	2.5 ± 0.9	**<0.01**
	4 hours	4.6 ± 1.2	3.1 ± 1.0	**<0.001**
	6 hours	5.2 ± 1.3	3.6 ± 1.1	**<0.001**
	12 hours	4.8 ± 1.1	3.2 ± 1.0	**<0.001**
	24 hours	3.6 ± 1.0	2.8 ± 0.9	**<0.01**

Patient satisfaction at 24 hours was significantly higher in the QL group compared to the TAP group as visible in Table 5. A greater proportion of patients in Group Q reported excellent satisfaction (60.4%) compared to Group T (26.4%). Conversely, a higher percentage of patients in Group T reported fair/poor satisfaction (26.4%) compared to Group Q (7.5%). A moderate proportion of patients in both groups reported good satisfaction (47.2% in Group T vs 32.1% in Group Q), and the overall distribution of satisfaction levels differed significantly between the groups ($p<0.001$). These findings indicate that patients receiving the QL block experienced better overall satisfaction with postoperative analgesia compared to those receiving the TAP block.

Table 5- Patient satisfaction score (at 24 hours)

Satisfaction Level	Group T (TAP) n (%)	Group Q (QL) n (%)	p-value
Excellent	14 (26.4%)	32 (60.4%)	**<0.001**
Good	25 (47.2%)	17 (32.1%)	
Fair/Poor	14 (26.4%)	4 (7.5%)	

Discussion-

The present study demonstrates that ultrasound-guided quadratus lumborum (QL) block provides superior postoperative analgesia compared to transversus abdominis plane (TAP) block in patients undergoing elective abdominal surgeries. This is reflected by prolonged duration of analgesia, reduced intraoperative fentanyl consumption, lower postoperative pain scores, and improved patient satisfaction in the QL group. The significantly longer time to first rescue analgesia observed in the QL group in our study is in agreement with earlier findings reported by Aydın et al. [8] and Zhang et al. [9], who demonstrated prolonged analgesic duration with QL block compared to TAP block. This can be explained by the anatomical spread of local anesthetic in QL block, which extends into the thoracic paravertebral space, thereby providing both somatic and visceral analgesia, unlike TAP block which predominantly covers somatic pain pathways [3,10]. Elsharkawy et al. [10] also emphasized the wider dermatomal spread and prolonged analgesic effect of QL block, supporting our findings. In our study, total intraoperative fentanyl requirement was significantly lower in the QL group. This observation is supported by the systematic review and meta-analysis by Gao et al. [2] and Gao et al. [6], which concluded that QL block significantly reduces opioid consumption compared to TAP block. Similar findings were reported in a recent meta-analysis by Jalilzadeh et al. [7], further validating the opioid-sparing effect observed in our study. Reduced opioid requirement is clinically advantageous as it minimizes opioid-related adverse effects and promotes enhanced recovery.

Postoperative pain scores (VAS) were consistently lower in the QL group at multiple time intervals in the present study. These findings align with previous randomized controlled trials that demonstrated better pain control with QL block [8,9]. However, some studies have reported no significant difference between the two techniques in minor procedures, suggesting that the superiority of QL block may be more pronounced in major abdominal surgeries [11]. Although the time to perform the block and onset of analgesia were slightly longer in the QL group, these differences were clinically acceptable. Similar observations have been reported in previous studies, where QL block was technically more demanding but provided superior analgesic benefits [12]. Thus, the slight increase in procedural time is outweighed by improved postoperative outcomes.

Another important finding in our study was earlier ambulation and shorter hospital stay in the QL group. These results are consistent with enhanced recovery after surgery (ERAS) principles and are supported by studies demonstrating that effective regional analgesia facilitates early mobilization and reduces hospital stay [13]. Additionally, higher patient satisfaction scores in the QL group in our study are comparable with findings reported in earlier literature [14], where improved analgesia translated into better overall patient experience. Regression analysis in the present study identified QL block as an independent predictor of prolonged analgesia, while factors such as age, gender, and duration of surgery were not statistically significant. Similar findings have been reported in recent observational studies highlighting the dominant role of regional anesthesia technique in determining analgesic outcomes [15]. The incidence of adverse effects such as nausea, vomiting, and hypotension was comparable between the two groups in our study. This is in accordance with previous studies that have demonstrated similar safety profiles for both TAP and QL blocks [4,16]. The reduced opioid consumption in the QL group, however, may contribute to a lower trend of opioid-related side effects.

Conclusion-

The present study demonstrates that ultrasound-guided quadratus lumborum (QL) block provides superior postoperative analgesia compared to transversus abdominis plane (TAP) block in patients undergoing elective abdominal surgeries. The QL block was associated with significantly prolonged duration of analgesia, reduced intraoperative fentanyl requirement, lower postoperative pain scores, decreased need for rescue analgesia, and improved patient satisfaction. Although the QL block required slightly longer time for administration and onset, these limitations were outweighed by its enhanced and sustained analgesic benefits. Additionally, patients in the QL group experienced earlier ambulation and shorter hospital stay, highlighting its role in promoting faster recovery. The findings of this study support the preferential use of QL block as part of multimodal analgesia protocols for abdominal surgeries. Its opioid-sparing effect can contribute to minimizing opioid-related adverse effects and improving overall patient outcomes. Incorporation of QL block into routine clinical practice may enhance recovery pathways, reduce healthcare burden through shorter hospital stays, and improve patient satisfaction. However, adequate training and expertise in ultrasound-guided techniques are essential for optimal results. Further large-scale, multicentric studies are recommended to validate these findings and establish standardized guidelines for its widespread clinical application.

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Conflicts of interest- None

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