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Original Research Article

Comparison of Quadratus Lumborum Block versus Transverse Abdominis Plane Block in Lower Abdominal Surgeries

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Abstract

Introduction: Effective postoperative analgesia is essential after lower abdominal surgeries to improve recovery and reduce opioid-related adverse effects. This study compared the analgesic efficacy of ultrasound-guided quadratus lumborum block (QLB) and transversus abdominis plane (TAP) block.

Materials and Methods: A prospective randomized comparative study was conducted on 70 patients undergoing elective lower abdominal surgeries. Patients were allocated into two groups (n=35 each): Group QLB received ultrasound-guided quadratus lumborum block, and Group TAP received transversus abdominis plane block. Postoperative pain scores, duration of analgesia, rescue analgesic requirement, total analgesic consumption, and complications were assessed.

Results: Both groups were comparable in baseline characteristics. Patients receiving QLB showed significantly lower postoperative VAS scores at 2, 4, 6, 12, and 24 hours compared with TAP block ($p<0.05$). Duration of analgesia was longer in the QLB group (14.6 ± 3.4 hours vs 9.1 ± 2.7 hours; $p<0.001$). Rescue analgesic requirement (51.4% vs 85.7%; $p=0.002$) and total analgesic consumption (58.4 ± 25.6 mg vs 94.7 ± 32.8 mg; $p<0.001$) were significantly lower with QLB. Both techniques had comparable safety profiles.

Conclusion: Quadratus lumborum block provides superior and prolonged postoperative analgesia compared with TAP block in lower abdominal surgeries, with reduced analgesic requirement and comparable safety.

Keywords: Quadratus lumborum block; Transversus abdominis plane block; lower abdominal surgery; Postoperative analgesia; Regional anesthesia; Opioid-sparing analgesia.

Introduction

Postoperative pain remains a major concern following lower abdominal surgeries and can significantly affect patient recovery, mobility, hospital stay, and overall satisfaction. Effective perioperative analgesia is therefore an essential component of surgical care. Although opioids provide effective pain relief, their use is associated with several adverse effects, including sedation, nausea, vomiting, respiratory depression, and delayed recovery [1].

Hence, multimodal analgesic strategies incorporating regional anesthesia techniques have gained importance for providing effective pain control while reducing opioid consumption and opioid-related complications [2]. Ultrasound-guided fascial plane blocks have become widely accepted as important components of multimodal analgesia due to their safety, simplicity, and opioid-sparing benefits. The abdominal wall receives sensory innervation mainly through the anterior branches of thoracic and lumbar spinal nerves (T6–L1), which travel through fascial planes between abdominal muscles. Blocking these nerves within appropriate anatomical planes provides effective analgesia following abdominal procedures [3].

The transversus abdominis plane (TAP) block is one of the most commonly used regional anesthesia techniques for postoperative analgesia after abdominal surgeries. McDonnell et al. first described the analgesic efficacy of TAP block, demonstrating that local anesthetic deposition between the internal oblique and transversus abdominis muscles results in blockade of sensory nerves supplying the anterolateral abdominal wall

and reduces postoperative analgesic requirements [4]. TAP block has subsequently been widely used for gynecological, colorectal, urological, and general surgical procedures. However, its analgesic effect is primarily directed toward somatic pain from the abdominal wall, with limited efficacy against visceral pain due to restricted spread toward deeper structures [5].The quadratus lumborum block (QLB), initially described by Blanco, is a newer fascial plane block technique developed as an extension of truncal regional anesthesia [6]. It involves injection of local anesthetic around the quadratus lumborum muscle, allowing spread through the thoracolumbar fascia and potential extension into the paravertebral region. This broader distribution may result in blockade of both somatic and visceral pain pathways, providing more extensive analgesia following abdominal surgery [7].Different approaches of QLB, including lateral, posterior, anterior, and transmuscular techniques, have been described, with variations in local anesthetic spread and dermatomal coverage. Ultrasound guidance has improved the safety and accuracy of QLB by allowing clear visualization of anatomical landmarks and precise deposition of local anesthetic. QLB has demonstrated effective postoperative analgesia in various populations, including adults, pediatric patients, and obstetric patients undergoing abdominal procedures [8,9].The analgesic benefits of QLB have led to its increasing incorporation into enhanced recovery after surgery (ERAS) protocols. Studies have reported prolonged analgesic effects with QLB, often lasting 24–48 hours after administration. Continuous catheter techniques and addition of adjuvant drugs have also been explored to extend the duration of analgesia [9].Several studies have compared QLB with TAP block to determine their relative effectiveness. Blanco et al. reported that QLB provided superior postoperative analgesia with reduced opioid consumption compared with TAP block after cesarean delivery [10]. Similarly, Öksüz et al. demonstrated better postoperative pain control with QLB compared with TAP block in children undergoing lower abdominal surgery [11]. Comparative studies have suggested potential advantages of QLB due to its wider spread and possible visceral analgesic effect [10,11].However, the available evidence remains inconclusive, as some studies have reported comparable analgesic outcomes between QLB and TAP block. Differences in surgical procedures, block approaches, local anesthetic volume, and patient characteristics may influence the observed outcomes. Therefore, further clinical evaluation is required to determine whether QLB provides a clinically meaningful advantage over TAP block in lower abdominal surgeries. Considering the importance of effective opioid-sparing analgesia in enhanced recovery protocols, identification of an optimal regional anesthesia technique is clinically relevant. A block providing prolonged analgesia with reduced opioid requirements may improve postoperative recovery and patient outcomes. Therefore, the present study entitled “Comparison of Quadratus Lumborum Block versus Transverse Abdominis Plane Block in Lower Abdominal Surgeries” was undertaken to compare the analgesic efficacy of these two ultrasound-guided regional techniques with respect to postoperative pain scores, duration of analgesia, rescue analgesic requirement, opioid consumption, and associated complications.

Materials and Methods

This prospective, randomized comparative study was conducted in the Department of Anaesthesiology at tertiary care centre. Written informed consent was obtained from all participants after explaining the study protocol, procedure, potential benefits, and possible complications.

Study Population: A total of 70 patients scheduled for elective lower abdominal surgeries under general anesthesia were enrolled in the study. Patients were randomly allocated into two groups of 35 patients each:

- Group QLB (n=35): Patients received ultrasound-guided quadratus lumborum block.
- Group TAP (n=35): Patients received ultrasound-guided transversus abdominis plane block.

Randomization was performed using a computer-generated random allocation sequence. Allocation concealment was maintained using sealed opaque envelopes.

Inclusion Criteria

Patients fulfilling the following criteria were included:

- Age between 18 and 60 years
- American Society of Anesthesiologists (ASA) physical status I and II
- Patients undergoing elective lower abdominal surgeries
- Patients willing to participate and provide written informed consent

Exclusion Criteria

Patients were excluded if they had:

- Refusal to participate in the study
- Known allergy or hypersensitivity to local anesthetic agents
- Coagulopathy or bleeding disorders
- Infection at the site of block administration
- Significant hepatic, renal, cardiac, or neurological disease

- Chronic pain or long-term opioid use
- Pregnancy
- Contraindication to regional anesthesia techniques

Preoperative Assessment: All patients underwent detailed preoperative evaluation, including history, physical examination, airway assessment, routine hematological and biochemical investigations, and anesthetic risk assessment. Baseline demographic characteristics including age, sex, weight, height, ASA physical status, and type and duration of surgery were recorded. Patients were instructed regarding the use of the visual analogue scale (VAS) for postoperative pain assessment. A 10-point VAS score was used, where 0 represented no pain and 10 represented the worst imaginable pain.

Anaesthetic Technique: All patients were kept fasting according to standard preoperative fasting guidelines. Standard monitoring including electrocardiography, non-invasive blood pressure monitoring, pulse oximetry, and end-tidal carbon dioxide monitoring was applied. General anesthesia was induced with appropriate doses of intravenous anesthetic agents and neuromuscular blocking drugs. After endotracheal intubation, anesthesia was maintained using inhalational anesthetic agents along with oxygen and air mixture. Intraoperative analgesia was provided according to institutional protocol.

At the end of surgery, patients received the assigned ultrasound-guided regional block before emergence from anesthesia.

Ultrasound-Guided Quadratus Lumborum Block (Group QLB): Patients in Group QLB received an ultrasound-guided quadratus lumborum block using a low-frequency curvilinear ultrasound probe. The patient was positioned in the lateral or supine position, and the quadratus lumborum muscle was identified posterior to the transverse process.

After aseptic preparation, a needle was advanced under ultrasound guidance, and after confirmation of correct needle placement, local anesthetic solution was injected. A predetermined volume of [drug and concentration] local anesthetic was administered bilaterally. The spread of local anesthetic around the quadratus lumborum muscle was confirmed under ultrasound visualization.

Ultrasound-Guided Transversus Abdominis Plane Block (Group TAP): Patients in Group TAP received an ultrasound-guided TAP block. A high-frequency linear ultrasound probe was placed between the costal margin and iliac crest to identify the external oblique, internal oblique, and transversus abdominis muscles. Under ultrasound guidance, the needle was advanced into the plane between the internal oblique and transversus abdominis muscles. After confirmation of correct placement, the same volume and concentration of local anesthetic solution was injected on both sides.

Postoperative Assessment: Patients were monitored in the postoperative recovery unit and assessed at predetermined time intervals. The following parameters were recorded:

- Postoperative pain intensity using VAS score at 0, 2, 4, 6, 12, and 24 hours
- Time to first rescue analgesic requirement
- Total rescue analgesic consumption during the first 24 hours
- Hemodynamic parameters (heart rate and blood pressure)
- Postoperative nausea and vomiting
- Any complications related to block administration

Rescue analgesia was administered when the VAS score was ≥4. The total requirement of rescue analgesics during the postoperative period was recorded.

Outcome Measures

Primary Outcome: The primary outcome of the study was comparison of postoperative analgesic efficacy between QLB and TAP block, assessed by postoperative pain scores and duration of analgesia.

Secondary Outcomes

Secondary outcomes included:

- Time to first rescue analgesic requirement
- Total postoperative analgesic consumption
- Hemodynamic stability
- Incidence of nausea and vomiting
- Block-related complications

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS.27statistical software. Continuous variables were expressed as mean ± standard deviation or median with interquartile range depending on data distribution. Categorical variables were presented as frequencies and percentages. Comparison of continuous variables between groups was performed using the independent t-test or Mann–Whitney U test as appropriate. Categorical variables were analyzed using Chi-square test or Fisher's exact test. Repeated measurements of postoperative pain scores were analyzed using appropriate repeated measures statistical tests. A p-value <0.05 was considered statistically significant.

Results

A total of 70 patients undergoing elective lower abdominal surgeries were included in the study and were randomly allocated into two groups of 35 patients each. Group QLB received ultrasound-guided quadratus lumborum block, whereas Group

TAP received ultrasound-guided transversus abdominis plane block. All patients completed the study protocol and were included in the final analysis.The demographic and perioperative characteristics of patients were comparable between both groups. The mean age of patients was 42.8 ± 10.2 years in Group QLB and 43.5 ± 9.7 years in Group TAP, with no statistically significant difference between the groups (p=0.775).

The distribution of male and female patients was similar between the groups, with males comprising 40.0% and 42.9% of patients in the QLB and TAP groups, respectively, while females constituted 60.0% and 57.1%, respectively (p=0.804).

The mean body weight was comparable between the groups (64.5 ± 8.4 kg in Group QLB vs 65.2 ± 9.0 kg in Group TAP; p=0.738). The distribution of ASA physical status was similar, with ASA I patients comprising 57.1% of patients in the QLB group and 54.3% in the TAP group, whereas ASA II patients constituted 42.9% and 45.7%, respectively (p=0.798). The mean duration of surgery was 94.2 ± 18.5 minutes in Group QLB and 95.6 ± 20.1 minutes in Group TAP (p=0.764). No statistically significant differences were observed in demographic and perioperative variables, indicating adequate comparability between the two groups (Table 1).Postoperative pain intensity was assessed using the visual analogue scale (VAS) at predetermined postoperative time intervals. The comparison of postoperative VAS pain scores between the two groups is presented in (Table 2) and illustrated in (Figure 1). Patients receiving QLB demonstrated consistently lower postoperative pain scores compared with patients receiving TAP block. The mean VAS score immediately after surgery was comparable between groups (2.1 ± 0.9 in Group QLB vs 2.3 ± 1.0 in Group TAP; p=0.382). However, at subsequent postoperative time intervals, patients in the QLB group showed significantly lower pain scores compared with the TAP group. At 2 hours postoperatively, the mean VAS score was 2.3 ± 0.8 in Group QLB compared with 3.0 ± 1.0 in Group TAP (p=0.002). At 4 hours, the mean VAS score was 2.5 ± 0.9 in the QLB group and 3.5 ± 1.1 in the TAP group (p<0.001). Similarly, at 6 hours, pain scores remained significantly lower in the QLB group (2.7 ± 1.0 vs 3.8 ± 1.2; p<0.001). At 12 hours postoperatively, patients receiving QLB continued to demonstrate lower pain scores compared with TAP block (2.9 ± 1.1 vs 4.1 ± 1.3; p<0.001). At 24 hours, the mean VAS score was 3.2 ± 1.1 in Group QLB compared with 4.4 ± 1.3 in Group TAP (p<0.001). Overall, QLB provided significantly better postoperative pain control compared with TAP block during the first 24 hours after surgery (Table 2; Figure 1).

The duration of analgesia and rescue analgesic requirement between the two groups are presented in (Table 3) and depicted graphically in (Figure 2). Patients receiving QLB experienced significantly prolonged analgesia compared with those receiving TAP block. The mean duration of analgesia was significantly higher in the QLB group (14.6 ± 3.4 hours) compared with the TAP group (9.1 ± 2.7 hours; p<0.001).

The median duration of analgesia was 15 hours (IQR: 12–17) in Group QLB compared with 9 hours (IQR: 7–11) in Group TAP, showing a statistically significant difference (p<0.001). Rescue analgesic requirement during the first 24 postoperative hours was significantly lower in the QLB group. Rescue analgesia was required in 18 patients (51.4%) in the QLB group compared with 30 patients (85.7%) in the TAP group (p=0.002). The total analgesic consumption during the postoperative period was significantly reduced in patients receiving QLB (58.4 ± 25.6 mg) compared with those receiving TAP block (94.7 ± 32.8 mg; p<0.001). The mean number of rescue analgesic doses was also lower in the QLB group (1.3 ± 0.5) compared with the TAP group (2.2 ± 0.7; p<0.001) (Table 3; Figure 2).Hemodynamic parameters and postoperative adverse effects are presented in (Table 4) and illustrated in (Figure 3). Heart rate and mean arterial pressure remained comparable between both groups throughout the intraoperative and postoperative periods. The mean intraoperative heart rate was 78.4 ± 8.6 beats/min in the QLB group and 79.2 ± 9.1 beats/min in the TAP group (p=0.711). The postoperative heart rate at 6 hours was also comparable between groups (82.1 ± 9.2 beats/min in Group QLB vs 83.6 ± 9.5 beats/min in Group TAP; p=0.512). The mean intraoperative arterial pressure was 84.6 ± 7.8 mmHg in Group QLB and 85.1 ± 8.2 mmHg in Group TAP, with no statistically significant difference (p=0.795).

The incidence of postoperative nausea and vomiting was comparable between the two groups, occurring in 4 patients (11.4%) in the QLB group and 6 patients (17.1%) in the TAP group (p=0.501). Sedation was observed in 2 patients (5.7%) receiving QLB and 3 patients (8.6%) receiving TAP block (p=0.642). No block-related complications, including hematoma, infection, neurological.

Table 1: Demographic and Perioperative Characteristics of Study Participants (n=70)

Parameter	Group QLB (n=35)	Group TAP (n=35)	p-value
Age (years), Mean ± SD	42.8 ± 10.2	43.5 ± 9.7	0.775
Male, n (%)	14 (40.0)	15 (42.9)	0.804
Female, n (%)	21 (60.0)	20 (57.1)	
Weight (kg), Mean ± SD	64.5 ± 8.4	65.2 ± 9.0	0.738
ASA status, n (%)			0.798
ASA I	20 (57.1)	19 (54.3)	
ASA II	15 (42.9)	16 (45.7)	
Duration of surgery (min), Mean ± SD	94.2 ± 18.5	95.6 ± 20.1	0.764

Table 2: Comparison of Postoperative VAS Pain Scores between Groups

Time interval	Group QLB (n=35) Mean ± SD	Group TAP (n=35) Mean ± SD	p-value
0 hour	2.1 ± 0.9	2.3 ± 1.0	0.382
2 hours	2.3 ± 0.8	3.0 ± 1.0	0.002
4 hours	2.5 ± 0.9	3.5 ± 1.1	<0.001
6 hours	2.7 ± 1.0	3.8 ± 1.2	<0.001
12 hours	2.9 ± 1.1	4.1 ± 1.3	<0.001
24 hours	3.2 ± 1.1	4.4 ± 1.3	<0.001

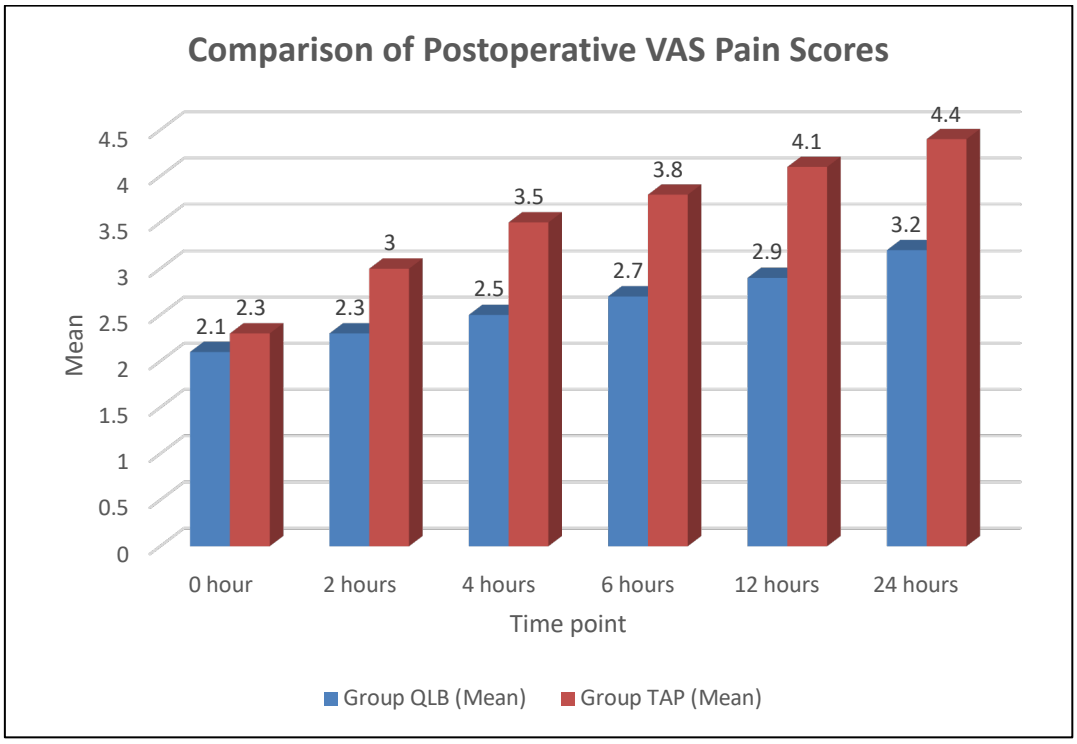

Figure 1: Comparison of Postoperative VAS Pain Scores between Groups

Table 3: Duration of Analgesia and Rescue Analgesic Requirement

Parameter	Group QLB (n=35)	Group TAP (n=35)	p-value
Duration of analgesia (hours), Mean ± SD	14.6 ± 3.4	9.1 ± 2.7	<0.001
Median duration (IQR)	15 (12–17)	9 (7–11)	<0.001
Rescue analgesia required, n (%)	18 (51.4)	30 (85.7)	0.002
Total analgesic consumption (mg), Mean ± SD	58.4 ± 25.6	94.7 ± 32.8	<0.001
Number of rescue doses, Mean ± SD	1.3 ± 0.5	2.2 ± 0.7	<0.001

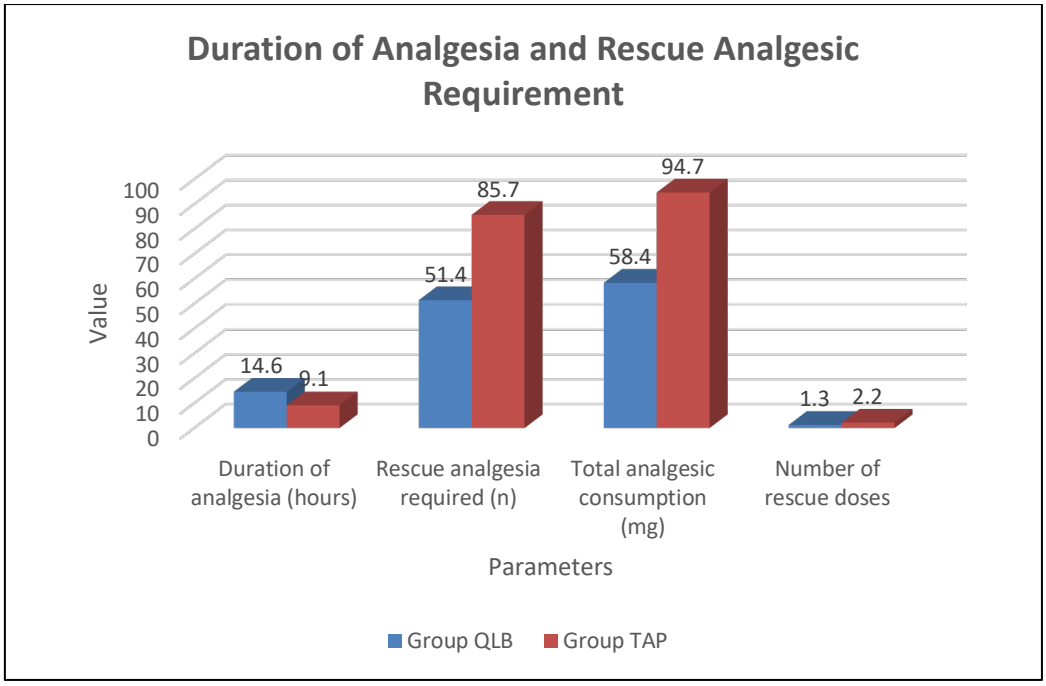

Figure 2: Duration of Analgesia and Rescue Analgesic Requirement

Table 4: Hemodynamic Parameters and Postoperative Adverse Effects

Parameter	Group QLB (n=35)	Group TAP (n=35)	p-value
Mean HR intraoperative (beats/min)	78.4 ± 8.6	79.2 ± 9.1	0.711
Mean HR postoperative 6 h (beats/min)	82.1 ± 9.2	83.6 ± 9.5	0.512
Mean arterial pressure intraoperative (mmHg)	84.6 ± 7.8	85.1 ± 8.2	0.795
Postoperative nausea and vomiting, n (%)	4 (11.4)	6 (17.1)	0.501
Sedation, n (%)	2 (5.7)	3 (8.6)	0.642
Block-related complications	0	0	—

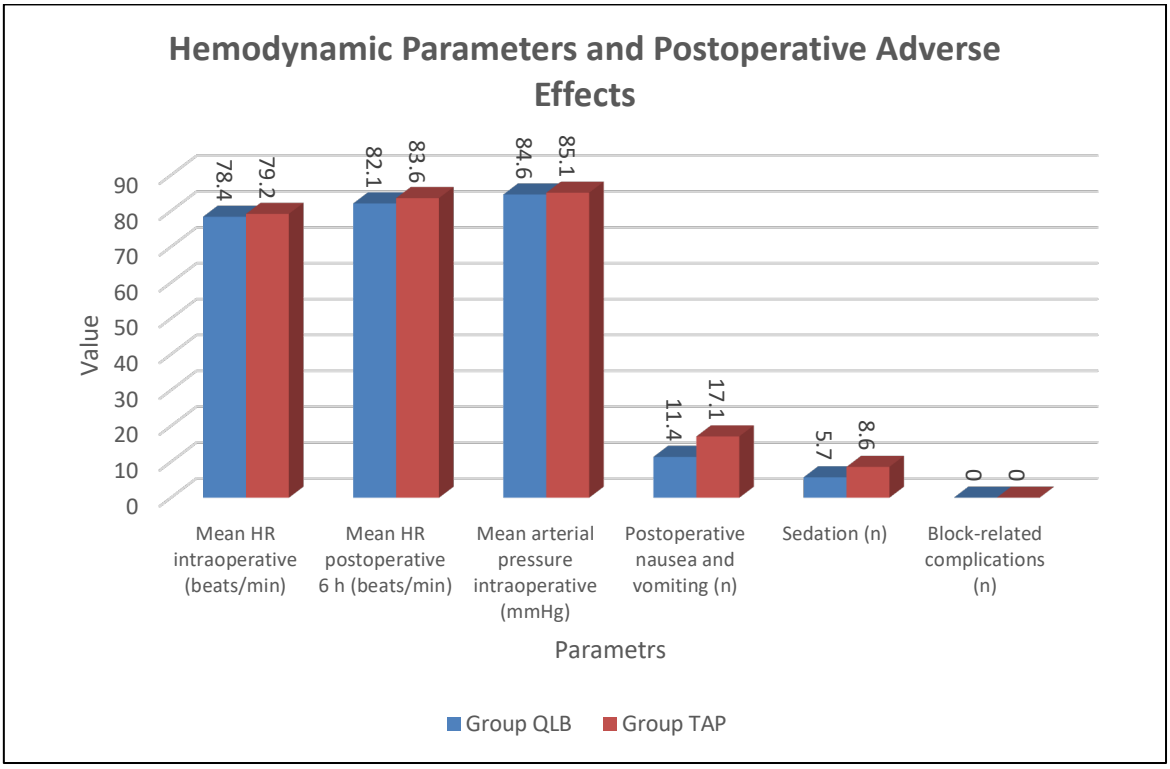

Figure 3: Hemodynamic Parameters and Postoperative Adverse Effects

Discussion

Postoperative pain management is an important component of perioperative care, particularly after lower abdominal surgeries where pain may arise from both somatic and visceral components. The present study compared the analgesic efficacy of ultrasound-guided quadratus lumborum block (QLB) and transversus abdominis plane (TAP) block in 70 patients undergoing lower abdominal surgeries. In our study, QLB demonstrated superior postoperative analgesic efficacy compared with TAP block, with significantly lower postoperative pain scores, prolonged duration of analgesia, and reduced rescue analgesic requirement. In the present study, postoperative pain scores assessed using the visual analogue scale (VAS) were significantly lower in the QLB group compared with the TAP group at 2, 4, 6, 12, and 24 hours after surgery. The mean VAS score at 24 hours was 3.2 ± 1.1 in the QLB group compared with 4.4 ± 1.3 in the TAP group ($p<0.001$), indicating better sustained analgesic efficacy with QLB. The improved analgesic effect of QLB may be attributed to its wider spread of local anesthetic through the thoracolumbar fascia and potential extension into the paravertebral space, resulting in blockade of both somatic and visceral pain pathways. In contrast, TAP block primarily provides somatic analgesia by blocking nerves supplying the anterior abdominal wall. Similar findings were reported by Blanco et al. [10], who compared QLB and TAP block after cesarean delivery and found that QLB provided significantly better postoperative analgesia with lower pain scores and reduced opioid consumption. The authors suggested that the superior analgesic effect of QLB was due to its wider dermatomal spread and involvement of visceral afferent pathways. Similarly, Murouchi et al. [12] evaluated QLB in patients undergoing laparoscopic surgery and reported that QLB produced a wider sensory blockade extending from T7 to T12 dermatomes and provided analgesia lasting beyond 24 hours, supporting the prolonged analgesic effect observed in our study. In the present study, the duration of analgesia was significantly longer in patients receiving QLB (14.6 ± 3.4 hours) compared with TAP block (9.1 ± 2.7 hours; $p<0.001$). The prolonged analgesic duration suggests a more effective and sustained block with QLB. Murouchi et al. [12] reported that QLB provided prolonged analgesia after laparoscopic surgery, with significantly longer sensory blockade compared with TAP block. They demonstrated that QLB resulted in persistent analgesic effects due to wider local anesthetic spread and slower absorption from the fascial plane. The pharmacological basis of prolonged analgesia was also explained by Thomas and Schug [13], who highlighted that the duration of action of local anesthetics depends on tissue distribution, local concentration, and duration of exposure at the nerve site. The wider fascial distribution achieved with QLB may therefore contribute to prolonged postoperative pain relief. In our study, rescue analgesic requirement was significantly lower in the QLB group. Rescue analgesia was required in 18 patients (51.4%) in the QLB group compared with 30 patients (85.7%) in the TAP group ($p=0.002$). Furthermore, total analgesic consumption during the first 24 postoperative hours was significantly lower with QLB (58.4 ± 25.6 mg vs 94.7 ± 32.8 mg; $p<0.001$).These findings indicate that QLB provides a significant opioid-sparing effect and may be beneficial as part of multimodal analgesia protocols. Baidya et al. [14] evaluated QLB in pediatric patients undergoing pyeloplasty and reported effective postoperative analgesia with reduced requirement of rescue analgesics, supporting the analgesic efficacy of QLB across different surgical populations. Murouchi et al. [12] also demonstrated reduced analgesic requirements with QLB after laparoscopic surgery and reported favorable ropivacaine pharmacokinetics, with lower peak plasma concentration compared with TAP block (1.0 ± 0.5 μg/mL vs 1.8 ± 0.4 μg/mL; $p=0.0003$), suggesting effective analgesia with safe local anesthetic distribution. TAP block is an established and widely used regional technique for abdominal surgeries due to its technical simplicity and effectiveness in controlling incisional pain. However, its major limitation is reduced efficacy against visceral pain due to restricted spread beyond the abdominal wall. In our study, although TAP block provided satisfactory analgesia, patients experienced higher pain scores and greater analgesic requirements compared with QLB.

The mean duration of analgesia was shorter in the TAP group (9.1 ± 2.7 hours) compared with QLB (14.6 ± 3.4 hours). Abdallah et al. [15] performed a meta-analysis evaluating TAP block after transverse lower abdominal incisions and reported that TAP block significantly reduced opioid consumption, particularly during the first 24 hours after surgery. However, the authors highlighted variability in analgesic duration depending on the technique used. They reported that posterior TAP block reduced morphine consumption by 9.1 mg during 12–24 hours and 5 mg during 24–48 hours postoperatively. The findings of the present study suggest that while TAP block provides effective somatic analgesia, QLB may offer additional advantages due to its broader sensory coverage and possible visceral analgesic effect. In the present study, both QLB and TAP block demonstrated a favorable safety profile. Hemodynamic parameters remained stable throughout the perioperative period, with no significant differences between groups. Postoperative nausea and vomiting were comparable between groups (11.4% in QLB vs

17.1% in TAP; p=0.501). No block-related complications such as hematoma, infection, neurological deficit, or local anesthetic toxicity were observed. These findings are consistent with previous studies demonstrating that ultrasound-guided fascial plane blocks are safe when performed with appropriate technique and monitoring.

Limitations of the Study: The study was conducted with a relatively small sample size and a single-center design, which may limit the generalizability of the findings. Further multicentric studies with larger patient populations and longer follow-up are required to validate the comparative efficacy of QLB and TAP block.

Conclusion

Ultrasound-guided quadratus lumborum block provides superior postoperative analgesia compared with transversus abdominis plane block in patients undergoing lower abdominal surgeries. QLB results in prolonged duration of analgesia, reduced rescue analgesic requirement, and lower postoperative pain scores with a comparable safety profile. Therefore, QLB may be considered an effective opioid-sparing regional analgesic technique as a part of multimodal pain management strategies.

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