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Effectiveness of Anterior Quadratus Lumborum Block Versus Intravenous Paracetamol for Pain Management in Laparoscopic Cholecystectomy

Laparoskopik Kolesistektomide Ağrı Yönetiminde Anterior Quadratus Lumborum Bloğunun İntravenöz Parasetamole Karşı Etkinliği

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ABSTRACT

Objective: Laparoscopic procedures are widely preferred in gallbladder surgery; however, effective postoperative analgesia remains an important clinical concern. This study was designed to evaluate whether bilateral ultrasound-guided anterior quadratus lumborum block (QLB) offers improved postoperative pain control compared with intravenous (IV) paracetamol in patients undergoing laparoscopic cholecystectomy.

Method: Sixty adult patients scheduled for elective laparoscopic cholecystectomy and meeting the inclusion criteria were retrospectively analyzed. Patients were allocated into two groups: those receiving anterior QLB (n=29) and those treated with IV paracetamol alone (n=31). Postoperative outcomes assessed during the first 24 hours included visual analog scale (VAS) pain scores, total opioid consumption, Richmond Agitation–Sedation Scale (RASS) scores, and the incidence of nausea, vomiting, and shoulder pain.

Results: Pain intensity and opioid requirements measured at 30 minutes, and at 2, 4, 12, and 24 hours after surgery were consistently lower in the QLB group than in the IV paracetamol group ($p<0.001$ at all evaluated time points). In addition, patients who received anterior QLB demonstrated a calmer and more stable emergence from anesthesia, as reflected by significantly lower RASS scores ($p<0.001$). The frequency of postoperative nausea, vomiting, and shoulder pain did not differ significantly between the groups.

Conclusion: Bilateral anterior quadratus lumborum block provides more effective postoperative analgesia than intravenous paracetamol in laparoscopic cholecystectomy and is associated with a marked reduction in opioid consumption. These findings support the use of anterior QLB as a valuable component of multimodal analgesia strategies for this surgical population.

Keywords: Laparoscopic cholecystectomy, opioid analgesics, quadratus lumborum block, postoperative pain

ÖZ

Amaç: Safra kesesi cerrahisinde laparoskopik teknikler yaygın olarak kullanılmakla birlikte, postoperatif ağrının etkin şekilde kontrolü halen önemli bir klinik sorun olmaya devam etmektedir. Bu çalışmada, laparoskopik kolesistektomi uygulanan hastalarda bilateral ultrason rehberliğinde anterior quadratus lumborum bloğunun (QLB), intravenöz (IV) parasetamole kıyasla postoperatif ağrı kontrolü üzerindeki etkinliğinin değerlendirilmesi amaçlandı.

Yöntem: Elektif laparoskopik kolesistektomi planlanan ve dahil edilme kriterlerini karşılayan toplam 60 erişkin hasta retrospektif olarak incelendi. Hastalar anterior QLB uygulanan grup (n=29) ve yalnızca IV parasetamol uygulanan grup (n=31) olmak üzere iki gruba ayrıldı. Postoperatif ilk 24 saat içinde görsel analog skala (VAS) ağrı skorları, toplam opioid tüketimi, Richmond Ajitasyon-Sedasyon Skalası (RASS) skorları ile bulantı, kusma ve omuz ağrısı varlığı değerlendirildi.

Bulgular: Postoperatif 30. dakika ile 2., 4., 12. ve 24. saatlerde ölçülen VAS skorları ve opioid tüketimi, anterior QLB uygulanan hastalarda IV parasetamol grubuna kıyasla anlamlı derecede daha düşük bulundu (tüm zaman noktalarında $p<0,001$). Ayrıca QLB grubundaki hastaların anesteziden daha sakin ve stabil şekilde uyandıkları gözlendi ve bu durum daha düşük RASS skorları ile doğrulandı ($p<0,001$). Postoperatif bulantı, kusma ve omuz ağrısı insidansı açısından gruplar arasında anlamlı fark saptanmadı.

Sonuç: Laparoskopik kolesistektomi uygulanan hastalarda bilateral anterior quadratus lumborum bloğu, IV parasetamole kıyasla daha etkili postoperatif analjezi sağlamakta ve opioid gereksinimini belirgin şekilde azaltmaktadır. Bu bulgular, anterior QLB'nin multimodal analjezi yaklaşımlarında değerli bir seçenek olduğunu göstermektedir.

Anahtar sözcükler: Laparoskopik kolesistektomi, opioid analjezikler, quadratus lumborum bloğu, postoperatif ağrı

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INTRODUCTION

Laparoscopic cholecystectomy is a minimally invasive surgical technique commonly used to treat gallbladder diseases. Although it results in less postoperative pain than open surgery, pain management remains a significant clinical challenge. Postoperative pain has both somatic and visceral components and is influenced by factors such as intra-abdominal gas insufflation, port entry sites, and gallbladder resection (1). In particular, abdominal distention due to pneumoperitoneum and trauma to surrounding tissues contribute to increased pain perception in patients (2).

Effective postoperative pain management is crucial for accelerating recovery and minimizing complications (3). In recent years, regional anesthesia techniques have played a key role in improving pain control. The quadratus lumborum block (QLB) has emerged as a promising technique for laparoscopic surgeries, as it provides extensive analgesia by targeting deeper, posterior, and dorsal regions (4,5). In contrast, intravenous (IV) paracetamol (also known as IV acetaminophen) is widely used as a systemic analgesic due to its minimally invasive nature and effective pain-relieving properties (6).

This study aimed to test the hypothesis that anterior QLB provides superior analgesia compared with IV paracetamol in patients undergoing laparoscopic cholecystectomy. The secondary objective was to compare postoperative outcomes between patients receiving QLB and IV paracetamol, including visual analog scale (VAS) pain scores, Richmond Agitation–Sedation Scale (RASS) scores, incidence of postoperative nausea and vomiting (PONV), shoulder pain, and postoperative opioid consumption.

MATERIAL and METHODS

Patient Selection and Study Design

This retrospective cohort study was conducted between June 2023 and February 2024 at Health Sciences University Gazi Yaşargil Training and Research Hospital. Ethical approval was obtained from the Ethics Committee of the University of Health Sciences, Gazi Yaşargil Training and Research Hospital Clinical Ethicala Committee (Approval Date: September 13, 2024; No. 172). The study adhered to the principles of the 2013 Declaration of Helsinki. Informed consent was obtained from all participants. Patients over 18 years of age and weighing more than 50 kg were included in the study.

Procedure

Preoperative period

Demographic data, including age, gender, and body mass index (BMI), were recorded for all patients. Participants were instructed on the use of VAS (0 = no pain, 10 = unbearable pain) for postoperative pain assessment. Thirty minutes before surgery, two 20-G intravenous cannulas were inserted into the antecubital region. Patients in the QLB group received a plane block 20–30 min before surgery in the preoperative block preparation room, following intravenous sedation with 1 mg midazolam (Zolamid®, Vem Pharmaceuticals, Ankara, Türkiye) and 50 µg fentanyl (Talinat®, Vem Pharmaceuticals, Ankara, Türkiye).

Group Quadratus Lumborum Block (anterior-transmuscular technique)

For perioperative analgesia, patients in the QLB underwent an ultrasound-guided QLB using the anterior-transmuscular approach. The quadratus lumborum muscle was identified between the transverse abdominis aponeurosis and the psoas major muscles. Under real-time ultrasound guidance, a 20-G, 100-mm needle (Stimuplex® Ultra 360®, Braun, Germany) was inserted along a osterolateral to anteromedial trajectory, with its tip positioned between the quadratus lumborum and psoas major muscles. A total of 40 mL 0.25% bupivacaine (Buvasin®, Vem Pharmaceuticals, Ankara, Tükiye; 2.5–3 mg kg^{-1}) was administered bilaterally into the fascial plane. Sensory blockade was assessed every 10 min using a thermal discrimination test. The block was considered successful if sensory loss to cold was observed in the T10–L1 dermatomes within 20 minutes.

Intravenous Analgesia group

Patients in the IVA group received a standardized preoperative analgesic regimen of 1000 mg of IV paracetamol (Parol®, Atabay Pharmaceuticals, Türkiye), administered 20–30 min before surgery in the preoperative waiting area. Following this, patients were transferred to the operating room for the induction of general anesthesia. Anesthesia was induced using 0.1 mg kg^{-1} midazolam, 2 to 3 mg kg^{-1} propofol (Propofol® 2% Fresenius®, Fresenius Kabi, Bad Hamburg, Germany), 2 µg kg^{-1} fentanyl (Talinat®, Vem Pharmaceuticals, Ankara, Türkiye), and 0.6-mg kg^{-1} rocuronium (Curon®, Mustafa Nevzat Pharmaceuticals, Istanbul, Türkiye), all administered intravenously. Once sufficient muscle relaxation was confirmed, patients were intubated using an appropriately sized endotracheal tube. General anesthesia was maintained with sevoflurane at 1 minimum alveolar concentration, delivered at a 2 L min^{-1} fresh gas flow rate in a 50% oxygen–air mixture. If the mean arterial pressure increased by ≥20% during surgery, additional analgesia (1 µg kg^{-1} IV fentanyl) was administered, and this requirement was recorded.

Postoperative period

Upon extubation, patients were evaluated for agitation, and the duration of surgery and anesthesia was recorded. Sedation and agitation levels were assessed using the RASS, a 10-point scale ranging from -5 to +4. Scores from −1 to −5 indicate increasing levels of sedation, while scores from +1 to +4 indicate escalating agitation. A score of zero denotes a calm and alert state (7).

Postoperative pain was assessed using the VAS at 30 min, 2, 4, 12, and 24 h postsurgery. Visual analog scale scores were considered primary outcome data (8). As part of the standard postoperative analgesic regimen, all patients received 1000-mg IV paracetamol every 8 h. If a patient reported a VAS score ≥4, a 100 mg IV dose of tramadol (Contramal®, Grunenthal GmbH, Germany, licensed by Abdi İbrahim Pharmaceuticals, Istanbul, Türkiye) was administered and recorded. If pain relief was insufficient after 30 minutes, an additional 100 mg tramadol dose was given. Total tramadol consumption over the first 24 hours postsurgery was documented.

Patients were also monitored for PONV using a 3-point scale (0 = *none*, 1 = *nausea only*, and 2 = vomited) (9). If a patient scored ≥1 on the PONV scale, they were treated with 4 mg IV ondansetron. Additionally, the presence of postoperative shoulder pain was routinely assessed and documented.

Statistical analysis

Data analysis was conducted using SPSS 16.0 for Windows (SPSS Inc., Chicago, Illinois). Continuous variables were reported as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square test was used to compare categorical variables between groups. The Shapiro–Wilk test assessed the normality of continuous variables. Normally distributed data were analyzed using the Student's *t* test, while nonnormally distributed data were evaluated using the Mann–Whitney *U* test. A p value <0.05 was considered statistically significant.

RESULTS

Among the 60 patients included in the study, 44 were female, and 16 were male, with a mean age of 44.2 ± 10.7 years. The mean durations of surgery and anesthesia were 57.0 ± 7.3 and 75.2 ± 6.9 min, respectively. No significant differences were observed between the two groups regarding age, gender, BMI, surgical duration, or anesthesia duration (p>0.05; Table I).

Postoperative opioid consumption was significantly higher in Group I than in Group Q (p<0.001). However, no significant differences were noted between the groups in terms of postoperative side effects, including nausea, vomiting, or shoulder pain (p=0.176 and p=0.864, respectively; Table II).

When comparing postoperative pain scores, Group Q exhibited significantly lower VAS scores at 30 min, 2 h, 4 h, 12 h, and 24 h postoperatively compared with Group I (p<0.001). Additionally, patients in Group Q demonstrated a smoother emergence from anesthesia, with lower agitation levels, whereas those in Group I exhibited significantly higher agitation scores (p<0.001; Table III).

Table I. Comparison of Demographic and Clinical Characteristics of the Patients

Parameters	Group QLB (n=29)	Group IVA (n=31)	All patients (n=60)	p
Gender n (%)				
Female	21 (35)	23 (38.3)	44 (73.3)	0.87
Male	8 (13.3)	8 (13.3)	16 (26.7)	
	(mean ± SD)	**(mean ± SD)**	**(mean ± SD)**	
Age (year)	42.5 ± 10.5	45.8 ± 10.7	44.2 ± 10.7	0.23*
Body mass index (kg m^{-2})	26.3 ± 3.7	28.0 ± 3.0	27.9 ± 3.7	0.056*
Anesthesia duration (min)	76.4 ± 5.3	74.1 ± 8	75.2 ± 6.9	0.30**
Surgical time (min)	56.8 ± 5.4	57.2 ± 8.8	57.0 ± 7.3	0.72**

*Student t test p value; **Mann Whitney U test p value. **QLB:** Quadratus lumborum block, **IVA:** Intravenous analgesia.

Table II. Comparison of Groups in Terms of Postoperative Characteristics

Parameters	Group QLB (n=29)	Group IVA (n=31)	All patients (n=60)	p
POOC (mg) median (Q25-75)	0 (0-0)	300 (200-300)	50 (0-300)	**<0.001***
PONV n (%)	9 (15)	15 (25)	24 (40)	0.17**
Shoulder Pain n (%)	12 (20)	14 (23.3)	26 (43.3)	0.76**

QLB: Quadratus lumborum block; **IVA:** Inravenous analgesia; **POOC:** Postoperative opioid consumption; **PONV:** Postoperative nause and vomiting; *****Mann Whitney U test p value; ******Chi Square p value.

Table III. Comparison of Postoperative RASS and VAS Values of the Patients

Parameters	Group QLB (n=29) median (Q25-Q75)	Group IVA (n=31) median (Q25-Q75)	All patients (n=60) median (Q25-Q75)	p*
RASS	4 (4-4)	3 (2-4)	4 (3-4)	**<0.001**
VAS 30th second	2 (1-2,5)	4 (4-5)	3 (2-4)	**<0.001**
VAS of 2nd hour	2 (1-2)	4 (4-5)	3 (2-4)	**<0.001**
VAS of 4th hour	2 (1-2)	3 (3-4)	2.5 (2-3)	**<0.001**
VAS of 12th hour	1 (0-1)	3 (2-3)	2 (1-3)	**<0.001**
VAS of 24th hour	1 (0-1)	2 (2-3)	1 (1-2)	**<0.001**

*Mann Whitney U test p value; **QLB:** Quadratus lumborum block; **IVA:** Inravenous analgesia; **RASS:** Richmond agitation sedation scala; **VAS:** Visual analog scale.

DISCUSSION

This study aimed to evaluate whether anterior QLB provides superior postoperative analgesia compared with IV paracetamol in patients undergoing laparoscopic cholecystectomy. Our findings confirmed that anterior QLB significantly reduces postoperative pain, decreases opioid consumption, and facilitates a more stable emergence from anesthesia.

Several studies have examined the efficacy of QLB in laparoscopic cholecystectomy. Vamnes et al. conducted a study on 70 patients undergoing laparoscopic cholecystectomy, dividing them into three groups: anterior QLB with a local anesthetic, anterior QLB with isotonic saline, and IV analgesia. Their results showed no significant differences in postoperative opioid consumption or pain scores among the groups, but PONV was lower in the QLB group (10).

In contrast, Brandao et al. investigated the analgesic effects of anterior QLB, its role in surgical recovery, and its influence on the neuroendocrine response to trauma in 51 patients undergoing laparoscopic cholecystectomy. Their findings indicated that anterior QLB significantly reduced the inflammatory response to surgical stress, leading to lower postoperative pain scores (11). Similarly, Ökmen et al. conducted a randomized controlled study involving 60 patients undergoing laparoscopic cholecystectomy. Patients were divided into two groups: one group received a posterior QLB along with intravenous patient-controlled analgesia (IV PCA), while the other group received isotonic saline instead of local anesthetic for the QLB, also with IV PCA. The results showed that patients in the QLB group had significantly lower postoperative VAS pain scores and required less opioid consumption compared to the control group. However, there were no significant differences between the groups in terms of postoperative side effects (such as nausea or vomiting) or sedation levels (12).

Beyond laparoscopic cholecystectomy, the effectiveness of QLB has been assessed in other surgical populations. Ökmen et al. investigated anterior QLB in 60 patients undergoing percutaneous nephrolithotomy (PNL). One group received anterior QLB plus IV patient-controlled morphine, while the other received only IV morphine. The results demonstrated that anterior QLB led to lower postoperative VAS scores and opioid consumption, supporting its efficacy as an analgesic option in PNL (13). He et al. evaluated anterior QLB in 63 patients undergoing laparoscopic partial nephrectomy, finding that opioid consumption and pain scores in the first 24 h were lower in the QLB group, whereas PONV rates remained similar between the groups (14). Additionally, Huiyu et al. assessed anterior QLB in 100 patients undergoing total laparoscopic hysterectomy (TLH), comparing it with a placebo (15). Their findings suggested that while bilateral anterior QLB reduced pain scores during the first postoperative hour, its overall clinical significance in TLH was limited.

In addition to anterior QLB and IV paracetamol, a variety of analgesic options have been utilized in laparoscopic cholecystectomy, including nonsteroidal anti-inflammatory drugs (NSAIDs), local anesthetic infiltration at port sites, transversus abdominis plane block, and PCA with opioids. The NSAIDs, such as ketorolac and diclofenac, have been shown to reduce postoperative pain and opioid consumption, though they carry potential risks such as gastrointestinal bleeding and renal impairment (16). Transversus abdominis plane block is another regional technique that offers somatic analgesia, though its effectiveness in controlling visceral pain is limited compared to QLB (17). Patient controlled analgesia allows for individualized pain control but often results in higher total opioid use and associated side effects (18). Compared with these methods, anterior QLB offers the advantage of both somatic and visceral pain control with lower opioid requirements. Our findings align with those of previous studies, demonstrating that anterior QLB effectively reduces postoperative pain and opioid consumption in laparoscopic cholecystectomy. Moreover, patients who received anterior QLB exhibited a more stable emergence from general anesthesia. Regarding PONV, our results were consistent with some studies, showing no significant differences between the groups.

This study has several limitations. First, the retrospective design introduces inherent risks of selection bias and confounding variables. Second, the sample size was relatively small, and the study was conducted at a single center, limiting the generalizability of the findings. Third, the assessment of pain was based on the subjective visual analog scale, which may vary between patients. Finally, long-term outcomes such as chronic pain or functional recovery were not evaluated.

CONCLUSION

Our study confirms that anterior QLB provides superior analgesia and significantly reduces postoperative opioid consumption compared with IV paracetamol in laparoscopic cholecystectomy. Given its effectiveness in postoperative pain management and opioid-sparing benefits, anterior QLB represents a valuable analgesic strategy for patients undergoing laparoscopic cholecystectomy.

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AUTHOR CONTRIBUTIONS

Conception or design of the work: ST, OU, HTS

Data collection: ST, MD, AT

Data analysis and interpretation: ST, OU, MEE

Drafting the article: ST, ÖB

Critical revision of the article: ST, HTS, ÖB

The author (ST, HTS, MEE, MD, AT, OB, OU) reviewed the results and approved the final version of the manuscript.

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