










The efficacy of post-laparoscopic analgesia on chronic pain after cholecystectomy operation

 Mehmet Fatih Erol,¹  Sinan Arıcı,²  Korgün Ökmen,³  Berkay Demir,⁴  Mehmet Emrah Bayam,¹
 Uğur Duman,¹  Belkız Aylu,¹  Muhammed Doğangün,⁵  Deniz Tihan¹

¹Department of General Surgery, Bursa Training and Research Hospital, Bursa, Türkiye

²Department of General Surgery, Bursa Hayat Hospital, Bursa, Türkiye

³Department of Anesthesia and Reanimation, Bursa Training and Research Hospital, Bursa, Türkiye

⁴Department of General Surgery, Malatya Hulusi Efendi State Hospital, Malatya, Türkiye

⁵Department of General Surgery, Sakarya Training and Research Hospital, Sakarya, Türkiye

ABSTRACT

Introduction: It has been reported that chronic pain syndrome occurs with an incidence of up to 41%. In this study, it was aimed to reveal the effect of analgesia methods applied in patients who underwent laparoscopic cholecystectomy with the formation of neuropathic pain in the early and late post-operative period.

Materials and Methods: A total of 246 individuals who had undergone laparoscopic cholecystectomy have been analyzed retrospectively. The patients were divided into two groups. In the first group of patients, 100 mg tramadol hydrochloride was administered intravenously at 12-h intervals for analgesia in the first 24 h post-operatively. In the second group, analgesia was provided by applying a post-operative quadratus lumborum block (QLB). The primary outcomes of the study were based on the Visual Analog Scale (VAS) score, Leeds assessment of neuropathic symptoms and signs (LANSS) pain scale, and short form 36 (SF-36) rating scale and the secondary outcomes were based on post-operative time, analgesia method, and length of hospital stay.

Results: When the VAS, SF-36, mental component score, and S-LANSS pre-operative values were compared, there was no statistical difference between the groups ($p < 0.05$), while VAS, S-LANSS scores in the 6th month follow-up denoted significance, respectively, ($p < 0.001$ and $p = 0.004$). No correlation was found between gender ($p = 0.234$), age ($p = 0.193$), operation time ($p = 0.790$), and S-LANSS scores, which are thought to be determining factors in the development of neuropathic pain. A negative correlation was detected between weight and S-LANSS scores ($n = 246$, $p = 0.035$, Pearson Rho: -0.135).

Conclusion: Considering the results of this study, it can be said that QLB is an effective method for the occurrence of neuropathic pain in both early and late post-operative periods.

Keywords: Analgesia, Chronic pain syndrome, Neuropathic pain, Quadratus lumborum block

Introduction

Post-operative pain is an acute event that begins with a surgical incision, decreases in time, ends with wound healing, and can be of different severity depending on the

intervention site. Inadequate and incomplete treatment of acute post-operative pain may lead to chronic disease.^[1] The first 24–72 h after the surgery can be elaborated as the most severe stage of post-operative pain. However, there



Received: 22.06.2023 Revision: 22.06.2023 Accepted: 26.06.2023

Correspondence: Sinan Arıcı, M.D., Bursa Özel Hayat Hastanesi, Genel Cerrahi Kliniği, Bursa, Türkiye

e-mail: sinan.arici@gmail.com



This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

are also patients in whom post-operative pain can persist for days or even weeks and develop into chronic pain. It is always difficult to define when pain becomes chronic. Various timescales have been proposed, usually more than 6 months, as well as pain that is unlikely to improve or pain that lasts longer than the normal recovery time. Good management of pain control after surgical interventions is very important for patient satisfaction, rapid recovery, and prevention of chronic pain.^[2]

Quadratus lumborum block (QLB) is a fascial plane block and was first described by Blanco.^[3] The drug distribution in the paravertebral area from the unilateral T4 level to the L1 level was demonstrated in a study conducted on volunteers.^[4] Quadratus lumborum muscle block originates from the iliac crest, extends from the upper 4th lumbar vertebrae, and terminates in the 12th rib with its transverse processes.^[5] The applied local anesthetic spreads to the paravertebral area adjacent to the quadratus lumborum muscle from the fascia plane between the major psoas muscle and provides analgesia in related dermatomes.^[6]

QLB was originally developed as an alternative to the transversus abdominis plane (TAP) block. Although different methods of QLB have been defined in the literature QLB is performed with the patient in the lateral position, holding the USG probe transversely, while the needle is visible, and the local anesthetic is injected into the quadratus lumborum muscle. The surgeon ensures that local anesthetic has been shown to spread to the paravertebral area at the T4–L1 level.^[4] There is no risk of vascular puncture in the epidural and paravertebral block. QLB is positioned with its potential lower risk of hemodynamic change and neurological damage compared to epidural block. The mechanism of QLB has not been fully elucidated but it was determined that an injection made in this region spreads from the thoracic paravertebral space to the retroperitoneal lumbar paravertebral region.^[5]

Following Blanco's QLB, Sauter et al.^[7] identified the shamrock sign and described it as an alternative technique for QL lumbar plexus space. Børglum et al. have described transmuscular QLB^[8] using the shamrock sign. The original Blanco QLB is defined by the administration of local anesthetic to the anterolateral border of the musculus quadratus lumborum and is named QL I. The second methodology is conducted through injecting the local anesthetic to the border of the musculus quadratus adjacent to the musculus erector spina and is called QL

II. QL II has been successfully used in the perioperative analgesia of pediatric pyeloplasty cases.^[5] In transmuscular quadratus lumborum block, the local anesthetic is injected to the landmark of musculus quadratus localized between the quadratus lumborum and the psoas major muscle with the help of USG.^[3,4] However, there are not a sufficient number of published studies of this block for different surgical procedures in the literature.

The indications of QLB can be elaborated as: T6-L1 abdominal wall incisions, explorative laparotomy, large bowel resection, ileostomy opening, open or laparoscopic appendectomy, laparoscopic cholecystectomy, cesarean section, total abdominal hysterectomy, open prostatectomy, kidney transplantation, percutaneous nephrolithotomy and in any operation that causes intra-abdominal visceral pain. It has been shown with case reports that it is beneficial in surgeries such as total hip arthroplasty.^[9]

The efficient management of post-operative is crucial for a successful discharge process. If pain is not well controlled, it may lead to a prolonged hospital stay, a decrease in the quality of life, and an increase in the development of chronic pain. Control of post-operative pain not only provides patient comfort, but also prevents respiratory and gastrointestinal system dysfunction, enables early mobilization, and reduces mortality and morbidity.^[10]

Study Hypothesis

It has been reported that chronic pain syndrome (pain occurring at the operation scar site and persisting for more than 6 months after surgery) occurs with an incidence of 41%. Studies investigating the effect of different types of analgesic methods investigated the chronic nature of pain regarding the treatment.^[10]

In this study, it was aimed to reveal the effect of analgesia methods applied in patients who underwent laparoscopic cholecystectomy with the formation of neuropathic pain in the early and late post-operative period. In addition, we have investigated the effectiveness of different types of analgesic methods on chronicity.

Materials and Methods

A total of 246 individuals who had undergone laparoscopic cholecystectomy between January 2016 and June 2019 have been analyzed retrospectively. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and

with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all participants. The ethics committee approval has been granted at December 04, 2019 with protocol number 2011–KAEK–25 2019/12–18.

Demographic data of the patients were recorded. The patients were divided into two groups. The amount of opioid agents used during the operation was recorded in both patient groups. In the first group of patients, 100 mg tramadol hydrochloride was administered intravenously at 12-h intervals for analgesia in the first 24 h postoperatively. In the second group, analgesia was provided by applying a post-operative QLB. Patients were called for follow-up at 6th months postoperatively. The primary outcomes of the study were based on the Visual Analogue Scale (VAS) score, Leeds assessment of neuropathic symptoms and signs (LANSS) pain scale, and SF-36 rating scale and the secondary outcomes were based on the post-operative time, analgesia method, and length of hospital stay.

Inclusion Criteria

Patients with American Society of Anesthesiologist Score of I–III, aged between 18 and 65 years who underwent laparoscopic cholecystectomy have been included in the analysis.

Exclusion Criteria

Patients with uncontrolled arterial hypertension, uncontrolled diabetes mellitus, metabolic disorders, bleeding diathesis, and mental retardation have been excluded from the analysis. Antidepressant use was also another exclusion criteria.

QLB

The patients were taken to the block room and the procedure zone has been disinfected in the lateral position. The convex probe (3–5 MHz, MyLab30; Esaote, Florence,

Italy) was placed transversely at the intersection of the iliac crest and posterior axillary line. A 22-gauge, 80-mm needle (Quincke SonoPlex Pajunk, Geisingen, Germany) was inserted between the thoracolumbar fascia filaments observed between the quadratus lumborum muscle and the psoas muscle. After confirming the location by hydro dissection, 0.3 mg/kg bupivacaine at a concentration of 0.25% was injected between the anterior thoracolumbar fascia located in front of the quadratus lumborum muscle.

Statistical Analysis

Analysis has been conducted through IBM SPSS 22.0 statistical program. The Chi-square test was utilized to compare descriptive statistical methods (frequency, percentage, mean, standard deviation, median, and min-max) and qualitative data. The suitability of the data to normal distribution was evaluated with the Kolmogorov-Smirnov test (the data were found not to be normally distributed). While the Friedman test was used for in-group comparison, the Mann-Whitney U-test for the intergroup comparison was used. Pearson correlation test was used for correlation analysis. $P < 0.05$ was accepted as significant.

Power Analysis

In our pilot study, the VAS score of 10 patients has been determined as 3 ± 1.2 in the 6th month of treatment. Within the scope of this study, it was planned to include a total of 246 patients, as 123 per group, when the VAS values were assumed to be 20% lower in the patients who were performed neural block 95% power and α :error of 0.05.

Results

The demographic characteristics of the patients are elaborated in Table 1. When the table was examined, no statistically significant difference has been observed in terms

Table 1. Baseline demographic data of patients

	QLB (n=123)	Control (n=123)	p
Age	44 (21–60)	43 (20–59)	0.704
BMI (kg/m ²)	24.95 (22–32.00)	26.2 (18–36)	0.234
Gender M/F	52 (43.3%)/71 (56.7%)	54 (44.8%)/69 (55.2%)	0.887
Opioid consumption (µg)	100 (50–170)	115 (50–150)	0.726
Duration of surgery	60.4±12.7	59.9±12.5	0.823

Median (Min; max) values; BMI: Body mass index; M: Male; F: Female.

of age, gender, body mass index (kg/m²), opioid consumption, and duration of surgery between QLB group (n=123) and control group (n=123) (p>0.05).

When the VAS, short form 36, mental component score (MCS), and S-LANSS pre-operative values were compared, there was no statistical difference between the groups (p<0.05), while VAS, S-LANSS scores in the 6th-month follow-up denoted significance, respectively (p<0.001 and p=0.004) (Table 2).

No correlation was found between gender (p=0.234), age (p=0.193), operation time (p=0.790), and S-LANSS scores, which are thought to be determining factors in the development of neuropathic pain. A negative correlation was detected between weight and S-LANSS scores (n=246, p=0.035, Pearson Rho: -0.135).

Discussion

Post-operative pain management plays a crucial role in ensuring optimal patient outcomes. Effective pain control not only enhances patient comfort but also prevents complications such as thromboembolic events, respiratory depression, bowel dysfunction, nausea, vomiting, urinary retention, and sleep disturbances. Inadequate pain management can lead to prolonged hospital stays, decreased quality of life, and increased risk of chronic pain development. Therefore, it is essential to implement strategies that not only alleviate pain but also minimize post-operative complications.^[11,12]

QLB has demonstrated promising results in the treatment of chronic pain following abdominal hernia repair. Carvalho et al. reported a case study where bilateral QLB-2 was administered to a patient with chronic pain after abdominal hernia repair. The block resulted in a significant reduction in the VAS score from 8–9 to 0 within approximately 1 h. One month later, the patient reported localized pain only in the periumbilical region, with VAS scores of 2/6 and 3/4 at 6 months. The ease of application and effectiveness of QLB-2 makes it a favorable option for chronic pain management.^[13]

In our study, we compared the pre-operative values of VAS, SF-36, MCS, and S-LANSS between the two groups and found no statistically significant differences (p<0.05). However, in the 6th-month follow-up, we observed significant improvements in VAS and S-LANSS scores (p<0.001 and p=0.004, respectively). Furthermore, a negative correlation was identified between weight and S-LANSS scores (n=246, p=0.035, Pearson Rho: -0.135).

He et al. reported that subfascial QLB block exhibited superior analgesic effects in the early post-operative period and resulted in less lower limb weakness following laparoscopic cholecystectomy.^[14]

Existing literature includes studies investigating the short-term and long-term effects of QLB in various surgical procedures. Blanco et al. reported the efficacy of QL in post-operative pain control for patients undergoing cesarean section under spinal anesthesia.^[15] In another study, Blanco et al. compared QL with transverse abdomi-

Table 2. Comparison of VAS, SF-36, and LANSS scores between groups

	QLB (n=123)	Control (n=123)	p*
VAS			
Pre-operative	32±12.1	30±17.4	0.798
6 month	39±13	26±12.5	<0.001
SF 36			
Pre-operative	31±2.5	30±2.8	0.812
6 month	41±43	40.6±5.2	0.724
MCS			
Pre-operative	33.7±5	32.6±3.6	0.905
6 month	40.4 ±5.5	39.6±4.2	0.784
S-LANSS			
Pre-operative	6.44±6.1	7±5.2	0.734
6 month	13.6±7.6	9.44±4.3	0.004

MCS: Mental component score; PCS: Physical component score; p<0.05 was accepted as statistically significant.

nal plane block and found QL to be more effective in post-operative pain management for cesarean section patients.^[16] QL has also been employed for pain control in abdominal and hip surgeries.^[17-20] Baidya et al. successfully used QL for post-operative pain management in pediatric patients undergoing pyeloplasty.^[9]

QLB was initially introduced by Blanco as an alternative to TAP block.^[3] The technique involves injecting local anesthetic between the quadratus lumborum muscle and the local fascia while visualizing the needle under ultrasound guidance in the lateral patient position. While different methods for QLB have been described, studies indicate that the local anesthetic spreads to the paravertebral area at the T4-L1 levels.^[19]

Blanco proposed QLB as a viable alternative to TAP block for post-operative pain management in cesarean section patients, highlighting its advantages of avoiding vascular puncture, lower risk of hemodynamic changes, and potential neurological damage compared to epidural blocks. Kadam suggested QLB as an alternative to TAP block in abdominal surgeries.^[19] However, more research is needed to further explore the effectiveness of QLB in post-operative analgesia management after upper abdominal surgery and nephrectomy.^[21,22]

Green et al. showed that QLB from laparoscopic ovarian surgery causes widespread and long-lasting analgesic effects. It showed that there was a statistically significant difference after 150 mg ropivacaine injection compared to the lateral transverse abdominis plane block.^[23]

QLB has proven to be a successful technique in various patient populations for post-operative pain management and anesthesia. This versatile approach has been applied in a range of surgical procedures, including explorative laparotomy, large bowel resection, ileostomy opening, open or laparoscopic appendectomy, laparoscopic cholecystectomy, cesarean section, total abdominal hysterectomy, open prostatectomy, kidney transplantation, percutaneous nephrolithotomy or nephrolithotripsy, and total hip arthroplasty. In addition, QLB has found utility in extracorporeal shock wave lithotripsy procedures, further demonstrating its potential across different surgical contexts.^[12]

Conclusion

Considering the results of this study, it can be said that QLB is an effective method on the occurrence of neuropathic pain in both early and late post-operative periods.

Disclosures

Ethics Committee Approval: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all participants. The ethics committee approval has been granted on December 4, 2019 with protocol number 2011-KAEK-25 2019/12-18.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – M.F.E., K.Ö.; Design – S.A., M.D., B.D.; Supervision – M.F.E., N.D.T.; Materials – M.D., B.D.; Data collection and/or processing – B.A., M.E.B.; Analysis and/ or interpretation – K.Ö., U.D.; Literature search – U.D., B.A.; Writing – S.A., K.Ö.; Critical review – N.D.T., M.E.B.

References

1. Verma K, Malawat A, Jethava D, Jethava DD. Comparison of transversus abdominis plane block and quadratus lumborum block for post-caesarean section analgesia: A randomised clinical trial. *Indian J Anaesth.* 2019 Oct;63(10):820-826.
2. Miculescu A. Chronic pain patient and anaesthesia. *Rom J Anaesth Intensive Care.* 2019 Apr;26(1):59-66.
3. Blanco R. Tap block under ultrasound guidance: the description of a "no pops" technique. *Reg Anesth Pain Med.* 2007;32:130.
4. Dam M, Moriggl B, Hansen CK, Hoermann R, Bendtsen TF, Børglum J. The pathway of injectate spread with the transmuscular quadratus lumborum block: a cadaver study. *Anesth Analg.* 2017;125:303-12.
5. Carline L, McLeod GA, Lamb C. A cadaver study comparing spread of dye and nerve involvement after three different quadratus lumborum blocks. *Br J Anaesth.* 2016;117:387-94.
6. Baidya DK, Maitra S, Arora MK, Agarwal A. Quadratus lumborum block: an effective method of perioperative analgesia in children undergoing pyeloplasty. *J Clin Anesth.* 2015;27:694-6.
7. Sauter AR, Ullensvang K, Niemi G, Lorentzen HT, Bendtsen TF, Børglum J, et al. The Shamrock blockade-the minimum effective local anaesthetic volume for a new ultrasound-guided lumbar plexus technique. *Eur J Anaesthesiol.* 2015;32:1-7.
8. Børglum J, Moriggl B, Jensen K, Lønnqvist PA, Christensen AF, Sauter Axel, et al. Ultrasound-guided transmuscular quadratus lumborum blockade. *Br J Anaesth.* 2013;111.
9. Baidya DK, Khanna P, Maitra S. Analgesic efficacy and safety of thoracic paravertebral and epidural analgesia for thoracic surgery: a systematic review and meta-analysis. *Interact Cardiovasc Thorac Surg.* 2014;18:626-35.

10. Jain S, Nazir N, Mustafi SM. Preemptive low-dose intravenous ketamine in the management of acute and chronic postoperative pain following laparoscopic cholecystectomy: a prospective randomized control study. *Med Gas Res* 2022;12:141–5.
11. Ueshima H, Hiroshi O. Incidence of lower-extremity muscle weakness after quadratus lumborum block. *J Clin Anesth* 2018;44:104.
12. Yayik AM, Celik EC, Ahiskalioglu A. An unusual usage for ultrasound guided quadratus lumborum block: pediatric extracorporeal shock wave lithotripsy. *J Clin Anesth* 2018;46:47–8.
13. Carvalho R, Segura E, Loureiro MD, Assunção JP. Quadratus lumborum block in chronic pain after abdominal hernia repair: case report. *Braz J Anesthesiol* 2017;67:107–9.
14. He WQ, Li YJ, Li YS, Zhang XH, Cao J, Lu KZ, et al. Advantages of transmuscular quadratus lumborum block via subfascial approach versus extrafascial approach for postoperative analgesia after laparoscopic cholecystectomy: a randomized controlled study. *Clin J Pain* 2022;38:730–8.
15. Blanco R, Ansari T, Girgis E. Quadratus lumborum block for postoperative pain after caesarean section: a randomised controlled trial. *Eur J Anaesthesiol* 2015;32:812–8.
16. Blanco R, Ansari T, Riad W, Shetty N. Quadratus lumborum block versus transversus abdominis plane block for postoperative pain after cesarean delivery: a randomized controlled trial. *Reg Anesth Pain Med* 2016;41:757–62.
17. La Colla L, Uskova A, Ben-David B. Single-shot quadratus lumborum block for postoperative analgesia after minimally invasive hip arthroplasty: a new alternative to continuous lumbar plexus block? *Reg Anesth Pain Med* 2017;42:125–6.
18. Mullins CF, O'Brien C, O'Connor TC. Novel use of combination of electromyography and ultrasound to guide quadratus lumborum block after open appendectomy. *BMJ Case Rep* 2017;2017:bcr-2017-219680.
19. Kadam VR. Ultrasound-guided quadratus lumborum block as a postoperative analgesic technique for laparotomy. *J Anaesthesiol Clin Pharmacol* 2013;29:550–2.
20. Cardoso JM, Sá M, Reis H, Almeida L, Sampaio JC, Pinheiro C, et al. Type II Quadratus Lumborum block for a sub-total gastrectomy in a septic patient. *Braz J Anesthesiol [Article in Portuguese]* 2018;68:186–9.
21. Lai R, Luo Q, Lai J, Lu X, Xu M. Ultrasound-guided quadratus lumborum block for perioperative analgesia in robot-assisted partial nephrectomy: a randomized controlled trial. *Trials* 2021;22:840.
22. Visoiu M, Yakovleva N. Continuous postoperative analgesia via quadratus lumborum block - an alternative to transversus abdominis plane block. *Paediatr Anaesth* 2013;23:959–61.
23. Green MS, Hoffman CR, Iqbal U, Ives OO, Hurd B. Transmuscular quadratus lumborum block reduces length of stay in patients receiving total hip arthroplasty. *Anesth Pain Med* 2018;8:e80233.