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Running title: QLB and posterior TAPB

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Author contribution
Yuki Aoyama (Investigation; Formal analysis; Writing-original draft; Writing–review & editing)
Shinichi Sakura (Conceptualization; Investigation; Formal analysis; Supervision; Writing-original draft; Writing–review & editing)
Shoko Abe (Investigation; Data curation; Writing–review & editing)
Minori Wada (Conceptualization; Investigation; Writing–review & editing)
Yoji Saito (Conceptualization; Supervision; Writing–review & editing)

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Data sharing statement
Will individual participant data be available (including data dictionaries)? --- Yes
What data in particular will be shared? --- Individual participant data that underlie the results reported in this article, after deidentification.
What other documents will be available? --- Study Protocol
When will data be available? --- Beginning 3 months and ending 5 years following article Publication
With whom? --- Investigators whose proposed use of the data has been approved by an independent review committee (learned intermediary) identified for this purpose.
For what types of analyses? --- To achieve aims in the approved proposal.

By what mechanism will data be made available? --- Proposals should be directed to ssakura@med.shimane-u.ac.jp. To gain access, data requestors will need to sign a data access agreement.
Analgesic effects and distribution of cutaneous sensory blockade of quadratus lumborum block type 2
and posterior transversus abdominis plane block: an observational comparative study

Running title: QLB and posterior TAPB
Abstract

Background: Posterior transversus abdominis plane block (TAPB) and quadratus lumborum block (QLB) have been developed for postoperative pain control after lower abdominal surgery. However, there is still a paucity of data regarding their effects. This prospective study observed their analgesic effects and the distribution of cutaneous sensory blockade in patients undergoing laparoscopic gynecologic surgery.

Methods: After induction of general anesthesia, patients alternately received either bilateral ultrasound-guided QLB type 2 (QLB2) or posterior TAPB using 0.375% levobupivacaine 20 ml for each side. Measurements included: visual analogue pain scores (VAS), cutaneous sensory blockade in each dermatome, demands of postoperative analgesics, and complications for up to 48h after blocks. Our primary endpoint was VAS at 24 hours after block.

Results: Forty patients completed the study. VAS at rest were significantly lower after QLB2 than after TAPB at 48 hours, but not at 24 hours. Both groups did not differ in VAS while coughing at any time point. Postoperative demands for fentanyl and other analgesics were not different for both blocks. The majority of injections produced cutaneous sensory blockade in T11 and 12 dermatomes in both groups. The median number of dermatomes blocked was limited to 3 dermatomes after either block. No severe complication related to either block was observed.

Conclusions: The analgesic effect of QLB2 and posterior TAPB was not different in patients undergoing gynecologic laparoscopic surgery. Cutaneous sensory blockade produced by QLB2 and posterior TAPB was limited to 3 dermatomal levels in the majority of the patients. However, these findings need to be confirmed in a larger comparative study.
Keywords: Anesthesia and analgesia; Regional anesthesia; Anesthesia, local; Nerve block; Pain, postoperative; Laparoscopic surgery.
Introduction

Laparoscopic gynecologic surgery is thought to be minimally invasive. Nevertheless, the patients need sufficient postoperative analgesia using opioids [1]. Opioids cause complications such as respiratory depression, postoperative nausea and vomiting. Multimodal analgesia including abdominal wall blocks can reduce opioid consumption and provide better analgesic effects [2,3]. Since the first description of ultrasound-guided (US-guided) technique [4], transversus abdominis plane block (TAPB) has become popular, and several techniques [5,6] have been developed. Among them, posterior TAPB which is conducted by injecting local anesthetic close to the lumbar triangle of the Petit may result in postoperative analgesia that is superior to and longer than lateral TAPB with the injection made more anteriorly [7,8]. Quadratus lumborum block (QLB) was introduced more recently as a technique to inject local anesthetic solution more posteriorly and along the quadratus lumborum muscle [9]. Among approaches that have been developed for QLB, the posterior approach to the QLB called QLB type 2 (QLB2) is thought to produce effective and long-lasting analgesia after abdominal surgery [9-11].

A previous retrospective study on children [12] showed that posterior TAPB produced cutaneous sensory blockade at T7-12. However, no studies we know of have examined whether posterior TAPB and QLB2 are different in sensory blocks and postoperative analgesia. Neither the distribution of cutaneous sensory blockade nor the analgesic effects of these techniques have been fully explored yet. Therefore, in this prospective study, we observed and compared the analgesic effects and the distribution of cutaneous sensory blockade in patients undergoing laparoscopic gynecologic surgery.
Materials and Methods

The study protocol was approved by the Shimane University Hospital ethical committee and registered in the University Hospital Medical Information Network Clinical Trials Registry (UMIN000021662). We obtained written informed consent from patients aged 20-70 years with American Society of Anesthesiologists physical status I and II, who were scheduled for laparoscopic gynecologic surgery. Patients who had contraindications to peripheral nerve blocks, a history of diabetes mellitus, or neurologic disease were excluded. We alternately assigned patients to either the QLB group (received QLB2) or the TAPB group (received posterior TAPB).

In the operation room, the patient’s ECG, heart rate and oxygen saturation (Spo2) were continuously monitored and non-invasive blood pressure was recorded every 5 min. General anesthesia was induced with propofol and fentanyl 2-4 µg/kg. Rocuronium was used to facilitate tracheal intubation. After tracheal intubation, patients received either QLB2 or posterior TAPB accordingly. The blocks were performed with the patient in either supine or a slightly wedged position. The anesthetist performing each block could use either a 6-13 MHz linear (S-nerve; FUJIFILM SonoSite Inc., Japan) or 2-5 MHz convex (S-nerve; FUJIFILM SonoSite Inc., Japan) transducer to perform the block. The skin was prepared with chlorhexidine and the ultrasound transducer was covered using a sterile plastic cover and gel. The transducer was initially positioned at the lateral abdomen between the iliac crest and costal margin. The ultrasound view was adjusted to show the external oblique, internal oblique, and transversus abdominis muscles. The quadratus lumborum muscle was observed posterior to the transversus abdominis muscle, as the transducer was moved more posteriorly. A 21-gauge block needle (Sonoplex 100 mm; PAJUNK, USA) was inserted from the lateral abdomen and advanced in an anterolateral to posteromedial direction in plane with the ultrasound beam (Fig. 1). For the TAPB group, the needle was
advanced to reach between the internal oblique muscle and near the posterior end of the transversus abdominis muscle. For the QLB group, the needle was inserted similarly to TAPB but advanced to reach the posterolateral aspect of the quadratus lumborum muscle and the triangle (the lumbar interfascial triangle, LIFT) between the quadratus lumborum, erector spinae and latissimus dorsi muscles (Video 1). Before surgery, each group received bilateral blocks with 20 ml of 0.375% levobupivacaine for each side. All blocks were either performed or directly supervised by an anesthetist (S.S.) with extensive experience in peripheral nerve block. The same gynecological team conducted all surgery procedures. Laparoscopic surgery was performed with a 12 mm port at the umbilicus and the right lower abdominal part, and a 5 mm port at five fingerbreadths below the umbilicus and the left lower abdominal part. Intraoperatively, general anesthesia was maintained with propofol titrated to maintain a bispectral index of 40-60 and remifentanil 0.1 µg/kg/min. When heart rate and/or blood pressure increased by more than 20% from its baseline, fentanyl 1 µg/kg was added intravenously to keep hemodynamic stability. Rocuronium was administered intermittently during the operation. After surgery, sugammadex sodium was administered to reverse muscle relaxation and the trachea was extubated when the patients were fully awake and breathing adequately. All patients received intravenous basal infusion of fentanyl 20 µg/hour starting at the end of surgery and on-demand bolus of 10 µg with 10-minute lockout time for patient-controlled analgesia. The continuous infusion of fentanyl was discontinued when a patient reported severe postoperative nausea and vomiting. Patients in the ward received loxoprofen sodium hydrate 3 times a day and other analgesics including acetaminophen and diclofenac sodium on request.

Patients were blinded to their group assignment. Anesthetists who were blinded to the group allocation conducted measurements postoperatively at 6, 12, 24 and 48-hours after blocks. Measurements included the following parameters: visual analogue pain scores (VAS) (0 mm, no pain; 100 mm, worst pain imaginable) at rest and while coughing, postoperative cumulative fentanyl consumption and use of other
analgesics, cutaneous sensory blockade at each dermatome, postoperative nausea and vomiting, and complications related to blocks. Cutaneous sensory blockade was assessed bilaterally on the anterior axillary line using ice cubes and a 22G slightly dulled needle for loss of cold sensation and for loss of pin-prick sensation, respectively.

**Statistical analysis**

We hypothesized that VAS at rest 24 hours after blocks, which was the primary outcome of this study, was lower after QLB2 than posterior TAPB. The sample number was determined based on our preliminary data showing a mean VAS of 16 mm and an SD of 14 mm at rest 24 hour after posterior TAPB and the minimum change of clinical significance in VAS that has been previously shown to be 13 mm [13]. Sample size calculation performed using G*Power (version 3.1; Cognitive and industrial Psychology, Heinrich-Heine-Universitaet, Duesseldorf, Germany) assuming α = 0.05 and β = 0.2 (80% power) showed that 20 were required in each group. Our institutional ethical committee did not give permission for a randomized controlled trial based on the fact that no prior results comparing the two techniques existed at that time. Therefore, we alternately allocated patients to either QLB group to receive QLB2 or to TAPB group to receive posterior TAPB. The study was continued until we were able to collect data from at least 20 patients for each group.

Continuous data were analyzed with the Kolmogorov-Smirnov test to determine the normality of distribution of the data. The two-tailed Student’s t-test was used for parametric statistics, and the result was expressed as mean ± SD. The Mann-Whitney U-test was applied for non-parametric statistics and the result was expressed as median (1Q-3Q). Cumulative amount of fentanyl was analyzed by repeated measures analysis of variance. The chi-square test or Fisher’s exact test were used for categorical data.
Analysis was made using SPSS 23.0 software (SPSS, Inc., Chicago, IL, USA) and p-value less than 0.05 was considered statistically significant.
Results

We recruited 42 patients (21 in each group) between April 2016 and March 2017 and all patients received their allocated interventions. One patient in each group was excluded from final analysis because of loss of follow up, and 40 patients (20 in each group) completed the study (Fig. 2). Baseline and perioperative characteristics of study patients were comparable between the two groups (Table 1). Type of surgery and the dose of fentanyl consumed intraoperatively were similar as well. Regarding postoperative pain, VAS at rest at 24 hours after block was not different between two blocks, but QLB group had lower VAS scores at rest compared with TAPB group at 48 hours after blocks (Table 2). However, at no time point was there any difference between the groups in VAS pain scores while coughing. Regarding postoperative use of analgesics, the cumulative amount of fentanyl and additional analgesic requirements were not different either (Table 3).

Sensory blockade was observed at 6 h or 12 h after all the blocks except for two TAPBs, which were conducted in different patients. The majority of blocks produced cutaneous sensory blockade in T11 and 12 dermatomes in the two groups (Fig. 3). In contrast, sensory blockade at T10 was not consistently observed in either group [21 (52.5%) vs 16 (40.0%) for QLB and TAPB, respectively; P=0.3]. A significantly higher percentage of dermatomes showed loss of pin-prick sensation in QLB group compared with TAPB group at T9 [13 (32.5%) vs 0 (0%); P<0.001] levels.

The number of dermatomes with loss of cold and pin-prick sensation, however, was comparable between QLB and TAPB at all time points except for 12 hours after block, and it decreased as time passed (Fig. 4). Only 4 (10%) and 2 (5%) blocks were associated with loss of pin-prick sensation at any dermatome at 48 hours after QLB and TAPB, respectively. No blocks produced loss of cold sensation lasting 48 hours in either group. No patient showed apparent motor block in the lower leg.
There was no serious complication attributed to the US-guided blocks including local anesthetic toxicity or visceral organ injury in either group. One patient in group QLB had hypesthesia in T12 and L1 dermatomes on postoperative day 3, but completely recovered within 2 days. Postoperative nausea and vomiting occurred similarly between the two groups (Table 3), and the continuous infusion of fentanyl was stopped between 24 and 48 hours in 6 (30%) and 5 (25%) patients in QLB group and TAPB group, respectively (P=1.0).
Discussion

In this study, we observed the analgesic effects and the distribution of cutaneous sensory blockade after QLB2 and posterior TAPB in patients following laparoscopic gynecologic surgery. During the first 48 hours after the block, only a few patients receiving QLB2 or TAPB experienced pain with a VAS over 60 at rest while they were using PCA fentanyl. Although the results of VAS pain scores showed better analgesic condition at rest with QLB2 than with TAPB at 48 hours, the requirements for fentanyl and other analgesics were not different between the two groups of patients. The results of cutaneous sensory assessment showed that a slightly greater cranial spread of sensory blockade was obtained after QLB2 than after TAPB, but only half of the patients developed sensory block over T11 even with QLB2. In addition, the number of dermatomes with cutaneous sensory blockade was virtually the same between QLB and TAPB.

Since the advent of US-guided peripheral nerve blocks, abdominal wall blocks have become popular and several techniques have been introduced. Lateral TAPB was first described by Hebbard et al. [4] and has been used in many institutions since then. However, this technique eventually turned out to produce a limited and inconsistent sensory block and analgesic effects [7,14]. The results of clinical and cadaver studies suggest that the injection site of lateral TAPB may have been too anterior or medial, and that the posterior approach may produce more consistent and superior analgesia with the blockade of lateral cutaneous branches of thoracolumbar nerves [8]. Studies comparing the analgesic effects of posterior and lateral TAPB in patients undergoing caesarean section [15] and gynecologic laparoscopic surgery [16] have shown the superior analgesic effect of posterior TAPB as compared with lateral TAPB. QLB was first described by Blanco as a technique to inject local anesthetic anterior to the quadratus lumborum muscle [9]. The technique was later named QLB1 and thereafter a new approach to QLB
using local anesthetic injected more posteriorly into a space called LIFT was introduced as QLB2. The exact mechanism of how QLB2 works is still unknown. Some researches claim that LIFT connects to the middle layer of the thoracolumbar fascia (MTLF), and this plane may allow the injected solution to spread to paravertebral space where sympathetic trunks exist. The effects on sympathetic fibers may play a role in visceral pain control [10,11].

To the best of our knowledge, this is the first clinical study assessing the distribution of cutaneous sensory blockade after QLB2 as well as posterior TAPB. Our study showed that although some patients had loss of cold and/or pin-prick sensation at T8, T9 and L2 dermatomes, the majority of patients developed cutaneous sensory blockade only at T11-12 level after either block. The results are quite different from those of studies conducted by Murouchi et al. that showed the majority of patients developed loss of cold sensation in T7-T12 dermatomes and in T10-T12 after QLB and lateral TAPB, respectively [17]. However, their technique used for QLB appears to be different from the approach used in the present study; their injection point was inside the epimysium-investing fascia of the quadratus lumborum muscle (Video 2). Although wider spread of sensory blockade, i.e., T7-L1, after QLB2 has been reported in some case reports [18,19] and an imaging study [9], previous cadaveric studies have never shown extensive spread of dye after QLB2 [20,21].

Few clinical studies have compared posterior TAPB and QLB2. Blanco et al. compared TAPB and QLB2 using patients undergoing caesarean section and found that compared with TAPB, QLB reduced postoperative opioid consumption for up to 48 hours [10]. However, their report failed to state exactly whether the TAPB position of injection was either lateral or posterior. In the present study, no reduction was found in postoperative opioid consumption after QLB2 compared with posterior TAPB. When considered together with the above-mentioned results showing similar sensory blockade in two groups, it is unlikely that QLB2 and posterior TAPB result in very different blocks. A recent cadaver study
showed that two out of three QLB2 were associated with the spread of dye within the transversus abdominis plane [20]. Because MTLF is comprised of the aponeurosis of transversus abdominis muscle and internal oblique muscle and quadratus lumborum fascia [21], some of the injectate with QLB2 might have worked as posterior TAPB.

The present study has several limitations. First, patients were not randomly divided because no prior data existed to conduct power analysis on to determine the number of patients for the randomized controlled study. Therefore, we alternately conducted either block in order of appearance. Although this was not ideal, we do not believe bias existed because: 1) there was no specific pattern in planning the surgery schedule, 2) all the blocks were conducted or supervised by the same anesthetist, and 3) measurements were blindly made. If we conducted a randomized comparative study using a larger number of patients, we might observe a difference in our primary outcome, VAS at rest 24 h after blocks, assuming $\alpha = 0.05$ and $\beta = 0.2$ (80% power), 63 patients were required in each group. However, the difference seemed to be small and appeared to be clinically negligible. Second, in this study for ethical reasons, we had no control group in which patients would have received sham or no block. Therefore, it is remotely possible that neither block has beneficial effects on postoperative pain relief. However, no block or a block with saline would not have resulted in a demonstrable sensory blockade. In addition, the efficacy of QLB2 for laparoscopic gynecological surgery have been already shown under different postoperative analgesic regimen [22]. Third, all patients received intravenous fentanyl as basal infusion postoperatively. Considering the results showing a relatively small number of requests for additional analgesics including bolus fentanyl and relatively low pain scores in both groups, the amount of fentanyl administered as basal infusion might have obscured differences between the two groups. Fourth, we only studied Japanese female patients, who might be more likely to be less obese than patients in many other countries. Conducting abdominal wall block in obese patients, especially the identification of the
In summary, the analgesic effect of QLB2 and posterior TAPB was not different in patients undergoing gynecologic laparoscopic surgery. Cutaneous sensory blockade produced by QLB2 and posterior TAPB was limited to 3 dermatomal levels in the majority of the patients. However, these findings need to be confirmed in a larger comparative study.
References


Table 1. Baseline and Perioperative Characteristics of Study Patients

<table>
<thead>
<tr>
<th></th>
<th>QLB group (n=20)</th>
<th>TAPB group (n=20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>44 ± 6</td>
<td>44 ± 8</td>
<td>0.91</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>158.7 ± 4.3</td>
<td>159.1 ± 7.6</td>
<td>0.83</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>57.5 ± 9.0</td>
<td>57.0 ± 12.0</td>
<td>0.89</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.8 ± 3.4</td>
<td>22.5 ± 4.3</td>
<td>0.77</td>
</tr>
<tr>
<td>ASA-PS (I/II)</td>
<td>9/11</td>
<td>6/14</td>
<td>0.51</td>
</tr>
<tr>
<td>Past history of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>abdominal surgery</td>
<td>6</td>
<td>3</td>
<td>0.45</td>
</tr>
<tr>
<td>Surgical time (min)</td>
<td>164 ± 63</td>
<td>165 ± 68</td>
<td>0.98</td>
</tr>
<tr>
<td>Surgical procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(TLH/LM/LSO)</td>
<td>13 / 4 / 3</td>
<td>14 / 1 / 5</td>
<td>0.31</td>
</tr>
<tr>
<td>Fentanyl administered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>during surgery (µg)</td>
<td>100 (50-210)</td>
<td>165 (100-260)</td>
<td>0.23</td>
</tr>
</tbody>
</table>

QLB, quadratus lumborum block; TAPB, transversus abdominis plane block; ASA-PS, American Society of Anesthesiologists physical status; TLH, total laparoscopic hysterectomy; LM, laparoscopic myomectomy; LSO, laparoscopic salpingo-oophorectomy. Data are presented as mean ± SD, median (1Q-3Q) or the number of patients.
<table>
<thead>
<tr>
<th></th>
<th>QLB group (n=20)</th>
<th>TAPB group (n=20)</th>
<th>Mean difference</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VAS at rest (mm)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 h</td>
<td>23.0 ± 23.3</td>
<td>31.7 ± 22.2</td>
<td>-8.8</td>
<td>-23.3-5.8</td>
<td>0.23</td>
</tr>
<tr>
<td>12 h</td>
<td>11.5 ± 16.6</td>
<td>22.3 ± 21.6</td>
<td>-10.9</td>
<td>-23.2-1.5</td>
<td>0.08</td>
</tr>
<tr>
<td>24 h</td>
<td>13.2 ± 15.7</td>
<td>21.9 ± 18.5</td>
<td>-8.7</td>
<td>-19.7-2.3</td>
<td>0.12</td>
</tr>
<tr>
<td>48 h</td>
<td>7.0 ± 12.4</td>
<td>19.3 ± 19.7</td>
<td>-12.4</td>
<td>-22.8-1.9</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>VAS while coughing (mm)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 h</td>
<td>41.0 ± 23.3</td>
<td>48.9 ± 27.8</td>
<td>-7.9</td>
<td>-24.3-8.5</td>
<td>0.34</td>
</tr>
<tr>
<td>12 h</td>
<td>37.8 ± 18.9</td>
<td>46.2 ± 25.1</td>
<td>-8.4</td>
<td>-22.6-5.8</td>
<td>0.24</td>
</tr>
<tr>
<td>24 h</td>
<td>36.6 ± 18.7</td>
<td>48.5 ± 21.9</td>
<td>-12.0</td>
<td>-25.0-1.1</td>
<td>0.07</td>
</tr>
<tr>
<td>48 h</td>
<td>30.7 ± 18.9</td>
<td>39.9 ± 24.1</td>
<td>-9.2</td>
<td>-23.1-4.7</td>
<td>0.19</td>
</tr>
</tbody>
</table>

QLB, quadratus lumborum block; TAPB, transversus abdominis plane block; CI, Confidence interval; VAS, visual analogue scale. Data are presented as mean ± SD, mean difference and 95% confidence intervals.
Table 3. Postoperative Demands for Analgesics and Complications

<table>
<thead>
<tr>
<th></th>
<th>QLB group (n=20)</th>
<th>TAPB group (n=20)</th>
<th>Mean difference</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative fentanyl consumption (µg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6 h</td>
<td>73 ± 35</td>
<td>67 ± 32</td>
<td>6</td>
<td>-16-27</td>
<td>0.70</td>
</tr>
<tr>
<td>12 h</td>
<td>210 ± 62</td>
<td>203 ± 51</td>
<td>7</td>
<td>-30-44</td>
<td>0.14</td>
</tr>
<tr>
<td>24 h</td>
<td>443 ± 127</td>
<td>454 ± 115</td>
<td>-10</td>
<td>-88-67</td>
<td>0.55</td>
</tr>
<tr>
<td>48 h</td>
<td>718 ± 261</td>
<td>684 ± 264</td>
<td>34</td>
<td>-134-202</td>
<td>0.62</td>
</tr>
<tr>
<td>Frequency of fentanyl bolus (number)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 h</td>
<td>2 (1-3)</td>
<td>1 (0-2)</td>
<td></td>
<td></td>
<td>0.14</td>
</tr>
<tr>
<td>12 h</td>
<td>1 (0-1)</td>
<td>0 (0-1.25)</td>
<td></td>
<td></td>
<td>0.55</td>
</tr>
<tr>
<td>24 h</td>
<td>0 (0-1.25)</td>
<td>0 (0-3)</td>
<td></td>
<td></td>
<td>0.62</td>
</tr>
<tr>
<td>48 h</td>
<td>0 (0)</td>
<td>0 (0-3)</td>
<td></td>
<td></td>
<td>0.62</td>
</tr>
<tr>
<td>Other analgesics (number)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 h</td>
<td>1 (0-3)</td>
<td>0 (0-1)</td>
<td></td>
<td></td>
<td>0.37</td>
</tr>
<tr>
<td>12 h</td>
<td>0 (0-1)</td>
<td>0 (0-2)</td>
<td></td>
<td></td>
<td>0.86</td>
</tr>
<tr>
<td>24 h</td>
<td>0 (0-2)</td>
<td>0.5 (0-2)</td>
<td></td>
<td></td>
<td>0.21</td>
</tr>
<tr>
<td>48 h</td>
<td>1 (0-3)</td>
<td>2 (0-4)</td>
<td></td>
<td></td>
<td>0.21</td>
</tr>
<tr>
<td>Nausea</td>
<td>16</td>
<td>14</td>
<td></td>
<td></td>
<td>0.72</td>
</tr>
<tr>
<td>Vomiting</td>
<td>8</td>
<td>7</td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
</tbody>
</table>

QLB, quadratus lumborum block; TAPB, transversus abdominis plane block. Data are presented as the mean ± SD, mean difference and 95% confidence intervals, median (1Q-3Q) or the number of patients.
Figure Legends

Fig. 1. Ultrasound image showing needle approach to quadratus lumborum block type 2 (1) and posterior transversus abdominis plane block (2).

EO, external oblique muscle; IO, internal oblique muscle; TA, transversus abdominis muscle; LD, latissimus dorsi muscle; QL, quadratus lumborum muscle; ES, Erector spinae muscle; LIFT, lumbar interfascial triangle.
Fig. 2. Patient flow diagram.

*Researchers were not available for the study.
**Fig. 3. Proportion of blockade at each dermatome.**

Proportion of sensory blockade that was observed at 6h or 12 h after the block. Twenty patients received bilateral blocks; therefore, data were collected from 40 blocks for each group. Results are presented as a percentage.

**Fig. 3A. Proportion of loss of cold sensation at each dermatome.**

No significant difference was observed.
Fig. 3B. Proportion of loss of pin-prick sensation at each dermatome.

*P=0.02, **P<0.001.
Fig. 4. Number of dermatomes with sensory blockade over time.

The box represents the 25th-75th percentiles, and the median is represented by the solid line. Error bars above and below the box mark the minimum and maximum.

Fig. 4A. Number of dermatomes with loss of cold sensation over time.

* P=0.002.
Fig. 4B. Number of dermatomes with loss of pin-prick sensation over time.

*P=0.002.
Video clips

Video 1. QLB2
The video clip shows QLB2, the approach that we used in our study. The injection point is within the lumbar interfascial triangle (LIFT).

Video 2. Intramuscular QLB
The video clip shows intramuscular QLB where injection is made inside the epimysium-investing fascia of the quadratus lumborum muscle.