Analgesic effect of the subcostal approach to transmuscular quadratus lumborum block in patients undergoing laparoscopic nephrectomy: a randomized controlled trial

CURRENT STATUS: ACCEPTED

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DOI: 10.21203/rs.2.9830/v1

SUBJECT AREAS
Anesthesiology & Pain Medicine

KEYWORDS
Quadratus lumborum block, laparoscopic nephrectomy, pain, postoperative
Abstract
Background: Quadratus lumborum block (QLB) is effective in providing analgesia for lower abdominal and hip surgeries. The subcostal approach to transmuscular QLB is a novel technique that alleviates abdominal wall and visceral pain by blocking the anterior branch of T6-L1 and the sympathetic nerve. Methods: Sixty patients who underwent laparoscopic nephrectomy were randomly divided into the subcostal approach to QLB group (QLB group, n=30) and the control group (C group, n=30). All patients underwent ultrasound-guided subcostal approach to QLB in an ipsilateral parasagittal oblique plane at the L1–L2 level. The QLB group received 0.4 cc/kg of 0.3% ropivacaine, and the C group received 0.4 cc/kg of 0.9% saline. Postoperatively, a patient-controlled intravenous anesthesia device with sufentanil was attached to all the patients. The primary outcome was sufentanil consumption within the first 24 h after surgery. The secondary outcomes included the Ramsey sedation scale (RSS) and Bruggemann comfort scale (BCS) scores 6 h (T1), 12 h (T2), and 24 h (T3) after surgery, intraoperative remifentanil consumption, number of patients requiring rescue analgesia, time to recovery of intestinal function, mobilization time after surgery, and presence of side effects. Results: Sufentanil consumption within the first 24 h after surgery was significantly lower in the QLB group than in the C group (mean standard deviation: 34.1 9.9 ug vs 42.1 11.6 ug, P=0.006). The RSS score did not differ between the two groups, and the BCS score of the QLB group at T1 and T2 time points was significantly higher than that of the C group (P0.05). The consumption of remifentanil intraoperatively and the number of patients requiring rescue analgesia was significantly lower in the QLB group (P0.05). Time to recovery of intestinal function and mobilization time after surgery were significantly earlier in the QLB group (P0.05). The incidence of postoperative nausea and vomiting was significantly lower in the QLB group (P0.05). Conclusions: Ultrasound-guided subcostal approach to QLB is an effective analgesic technique in patients undergoing laparoscopic nephrectomy as it reduces the consumption of sufentanil postoperatively.

Background
The laparoscopic technique is used more frequently in nephrectomy than in open surgeries, and it has numerous advantages, such as smaller incision and rapid recovery. However, postoperative pain
caused by pneumoperitoneum and surgical interventions for the kidneys should not be underestimated. Postoperative pain and stress response will aggravate a patient’s disease, increase the incidence of complications, and prolong postoperative recovery. As an important element of multimodal analgesia, regional block can reduce the dose of opioids, minimize side effects, and enhance the quality of recovery after surgery. \cite{1}

Quadratus lumborum block (QLB) is an emerging truncal block technique, \cite{2} which includes injecting local anesthetic (LA) into the thoracolumbar fascia (TLF) surrounding the quadratus lumborum (QL) muscle, and the analgesic effect is produced by the LA spreading along the TLF into the thoracic paravertebral space and transversalis fascia. QLB is an effective analgesia method for patients undergoing abdominal and hip surgery. \cite{3-6} Based on the different injection sites, there are four types of QLB, namely, lateral QLB, posterior QLB, transmuscular QLB, and intramuscular QLB. Transmuscular QLB, which is also called QLB3, includes the injection of LA between the QL muscle and the psoas major (PM) muscle. QLB3 can be implemented at the L4 and L2 levels using the subcostal approach. \cite{7} Hesham et al. \cite{8} have reported that the use of the subcostal approach to QLB3 can provide appropriate sensory blockade for open urological surgeries. However, no randomized controlled trials have assessed the application of the subcostal approach to QLB in patients undergoing laparoscopic nephrectomy. Thus, the current study aimed to evaluate the postoperative analgesic efficacy of subcostal approach to QLB in patients undergoing laparoscopic nephrectomy.

Methods
Sixty patients undergoing laparoscopic nephrectomy under general anesthesia were enrolled between January 2019 and March 2019 in Ningbo Medical Center Lihuili Eastern Hospital. The inclusion criteria were as follows: patients with an American Society of Anesthesiologists (ASA) physical status I–III and those aged between 35 and 65 years. Meanwhile, the exclusion criteria included patients with serious cardio-cerebral vascular diseases, allergy to LAs, infection at the puncture site, body mass index (BMI)\(\geq 35\) kg/m\(^2\), history of mental illness, and language communication disorder.
After obtaining informed consent, the patients were randomly allocated into two groups using a computer-generated random table (GraphPad Software, Inc., La Jolla, CA) (Guidelines Flow Diagram): the subcostal approach to QLB group (QLB group) and the control group (C group). Standard monitoring was performed after the patients were transported to the operating room, and the patient’s heart rate, electrocardiography results, percutaneous oxygen saturation, invasive radial arterial pressure, end-tidal carbon dioxide, and bispectral index (BIS) were assessed. Then, a peripheral vein access and right internal jugular vein access were established, and infusion of Ringer’s lactate solution was initiated intravenously.

Before the induction of general anesthesia, 0.02 mg/kg of midazolam was administered to the patients intravenously, and the patients were placed in lateral position after disinfecting the surgical area. The convex probe (2–5 HZ, Edge, Sonosite, Seattle, the USA) was positioned below the 12th rib in a parasagittal oblique plane at the L1–L2 level, which is approximately 4 cm from the posterior midline. The 12th rib, erector spinae (ES) muscle, QL muscle, and PM muscle were identified, and a 22-gauge, 80-mm needle (Kindly, Shanghai, China) was directed to the anterior part of the QL. Then, the needle tip was located between the QL and PM using the in-plane technique. After confirming the site via hydrodissection, 0.4 cc/kg of 0.3% ropivacaine (Naropin, AstraZeneca AB Company, Sodertalje, Sweden) was injected between the QL and PM muscles in the QLB group. In addition, 0.4 cc/kg of 0.9% saline was injected at the same site in the C group (Fig. 1). An experienced anesthesiologist performed all blocks. The patients, anesthesiologists, surgeons, and nurses were all blinded to the study.

After performing the block, all patients received general anesthesia. Anesthesia was induced with intravenous propofol 2–2.5 mg/kg, sufentanil 0.4 μg/kg, and rocuronium 0.8 mg/kg after tracheal intubation; next, mechanical ventilation was performed. The anesthesia was maintained by propofol 0.1–0.15 mg/kg/min and remifentanil 0.1–0.3 μg/kg/min to maintain the BIS from 40 to 60. Fifteen minutes before the end of the surgery, sufentanil 0.15 μg/kg and parecoxib 40 mg were administered intravenously for postoperative pain control. After surgery, patient-controlled intravenous anesthesia (PCIA) device with 1 μg/mL of sufentanil was attached to all the patients; the device was adjusted to
deliver 2 mL of intravenous bolus on demand, with no background infusion and 15 min lockout interval. Postoperative pain was assessed with a 10-point visual analogue scale (VAS) (0, no pain; 10, worst imaginable pain). Intravenous dezocine 5 mg was used for rescue analgesia when the VAS pain score at rest was greater than 4.

The primary outcome measure was the amount of sufentanil consumption within the first 24 h after surgery.

The secondary outcome measures were the Ramsey sedation scale (RSS) and Bruggemann comfort scale (BCS) scores 6 h (T1), 12 h (T2), and 24 h (T3) after surgery, intraoperative remifentanil consumption, number of patients requiring rescue analgesia, time to recovery of intestinal function (time from recovery to the first flatus), mobilization time after surgery, and presence of side effects (postoperative nausea and vomiting [PONV]), respiratory depression, femoral nerve block, LA systemic toxicity, and local hematoma). After performing the block, the dermatomes of the sensory block were assessed after 30 minutes using pinprick in the QLB group.

Based on a pilot study that included 12 patients, the sufentanil consumptions within the first 24 h after surgery were 28.4±4.74 µg in the QLB group and 33.3 ± 5.74 µg in the C group. The probability (power) was set at 0.8, and the type I error associated with this test for null hypothesis was 0.05. A simple size calculation (IBM Corp., Armonk, NY) showed that a total 42 patients were required (21 in each group); thus, we recruited 30 patients for each group to account for the possibility of missing data or dropouts.

The Statistical Package for the Social Sciences software version 24.0 (IBM Corp., Armonk, New York, the USA) was used in all statistical analyses.

Data were collected and entered into the computer as numerical or categorical data (IBM SPSS Statistics for Windows, version 24.0, IBM Corp., Armonk, New York, the USA). Complete descriptive statistics were recorded for each variable, including mean, standard deviation, median, and interquartile range. The Kolmogorov–Smirnov test was used to determine whether the variables were normally distributed. Independent t-test or Mann–Whitney U test was used for the intergroup comparisons accordingly. Chi-square (c²) test or Fisher exact test was used to compare qualitative
variables. Rank-sum test was used to compare skewed distribution variables. For all comparisons, a P value < 0.05 was considered statistically significant, and the differences were then identified.

Results
A total of 60 patients were included in our study. One patient in the QLB group was excluded due to block failure, and one patient in the C group was lost to follow-up. Finally, 29 patients in each group completed the study (Fig. 2). The two groups did not differ in terms of age, gender, BMI, ASA physical status, and operative characteristics (operative time and type of surgery) (Table 1).

Primary Outcome
Patients in the QLB group had lower sufentanil consumption within the first 24 h postoperatively than the C group (mean [standard deviation]: 34.1 [9.9] μg vs 42.1 [11.6] μg, t=2.829, P=0.006) (Fig. 3).

Secondary Outcomes
The Ramsey sedation scale (RSS) scores did not differ at any timepoint between the two groups, and the Bruggemann comfort scale (BCS) scores were higher in the QLB group than in the C group at all time points. However, significant differences were observed at T1 and T2 time points (Table 2). The intraoperative consumption of remifentanil was significantly lower in the QLB group than in the C group. The number of patients requiring rescue analgesia was significantly lower in the QLB group than in the C group, and the time to recovery of intestinal function and mobilization time after surgery were significantly earlier in the QLB group than in the C group (Table 3). The incidence of PONV was significantly lower in the QLB group than in the C group (Table 3). Only one patient in the QLB group presented with femoral nerve block that manifested as lower limb weakness, and the duration of femoral nerve block was approximately 10 h. Both groups did not present with respiratory depression, LA systemic toxicity, or local hematoma. Thirty minutes after the application of QLB, the dermatomes of the sensory block in the QLB group were maintained at the T4–L2, and the main blocking area was at T6–L1 (Fig. 4).

Conclusions
There are several approaches to QLB with different block planes, and the subcostal approach was first
described by Elsharkawy \cite{9} in 2016. LA was injected into the space between the QL muscle and the anterior layer of the thoracolumbar fascia or the PM muscle. The LA can spread in a cephalad direction to the paravertebral space through the arcuate ligaments. It reaches a sensory block plane between T6–T7 and L1–L2; thus, it is used in controlling postoperative pain after lower abdominal surgery \cite{10} and hip arthroplasty. \cite{11} To the best of our knowledge, this randomized prospective study is the first to investigate the use of subcostal approach to QLB in laparoscopic nephrectomy.

The lateral abdominal wall on one side is the common surgical incision site in laparoscopic nephrectomy, \cite{12} which is innervated by the anterior branches of T8–L1 spinal nerves. Transection of the skin, muscle, and peripheral nerve can cause severe postoperative pain. At present, most of the analgesic methods used in clinical settings have some disadvantages. Opioids can cause respiratory depression and nausea and vomiting. Meanwhile, epidural analgesia can cause nerve injury and epidural hematoma. \cite{13} The analgesic effect of NSAIDS is limited, and the incidence of nephrotoxicity is high. \cite{14} As an important element of the multimodal analgesia program, regional block is a type of analgesia with high safety and less adverse effects. \cite{15} Thus, we chose to perform the subcostal approach to QLB to relieve pain after surgery. The use of the subcostal approach compared with other anterior QL approaches has several advantages, which include the following: (1) It can provide a higher sensory block plane due to higher needle insertion, and the LA spreads in a cephalad direction toward the 12th rib. (2) In our study, during QLB, the tip of the needle was placed between the QL and PM muscle, and this can prevent intraperitoneal injection and kidney injury. (3) In the parasagittal oblique plane, we can observe the extent of LA spread and prevent intramuscular injection.

Our results showed that sufentanil consumption on postoperative day 1 and the number of patients requiring rescue analgesia were significantly lower in the QLB group than in the C group, which was in accordance with the study of Blanco et al., \cite{4} who first described the QLB. Moreover, such study has found that QLB significantly reduces the consumption of morphine after cesarean delivery. Baidya et al. \cite{16} have reported that QLB is associated with minimal requirement for rescue analgesics, and it
offers adequate postoperative analgesia in children undergoing pyeloplasty. LA can spread into the paravertebral space and the thoracolumbar plane in QLB. Tesarz et al. [17] have revealed that the thoracolumbar fascia contains high-density sympathetic fibers and pain receptors, and QLB can alleviate both somatic and visceral pain partially due to the blockade of these receptors. [18] Our study showed that subcostal approach to QLB blocks the sensory nerves from T4–L1, and it can provide adequate analgesia after laparoscopic nephrectomy.

The RSS scores of the two groups in our study did not differ, whereas the BCS scores were higher in the QLB group than in the C group. The result further showed that the analgesic effect of SQLB was sufficient. In addition, the intraoperative consumption of remifentanil in the QLB group was lower than that of the C group, and the result was in accordance with the findings of Naglaa et al., [19] who reported that QLB is associated with less opioid consumption. Our result indicated that the subcostal approach to QLB combined with general anesthesia can reduce the required dose of opioid intraoperatively. It can be explained by the assumption that LA spreads to the paravertebral space and the sympathetic trunk to produce analgesic effect and inhibit the stress response of surgery.

Moreover, in the present study, the time to recovery of intestinal function and mobilization time of the QLB group were significantly earlier than those of the C group, which was consistent with the results reported by Zhu et al. [20] The shorter time to the first flatus in the QLB group can be attributed to the less consumption of sufentanil postoperatively. Bowel dysfunction is a side effect induced by opioids, which include constipation and slow peristalsis in the intestine. The QLB group received adequate analgesia and had early ambulation with mild postoperative pain. Early food-taking and mobilization are two important components of enhanced recovery after surgery. [21] Thus, we speculated that the subcostal approach to QLB can promote the rehabilitation of patients after laparoscopic nephrectomy.

In the current study, the incidence of PONV was lower in the QLB group than in the C group, and it may be associated with the less consumption of opioids. Consistent with the case reported by Wikner et al. [22] and Hockett et al., [23] one patient in the QLB group presented with femoral nerve block
partly due to the spread of LA to the lumbar paravertebral space and blockade at the part of the lumbar plexus. If we injected LA between the middle layer of the thoracolumbar fascia (TLF) and the QL muscle, the incidence of femoral nerve block will decline because TLF restricted the spread of LA. However, further studies must be conducted to confirm such result.

The present study had some limitations. First, the subcostal approach to QLB was not used in patients with BMI > 35 kg/m². Thus, we did not identify the efficiency of subcostal approach to QLB in obese patients. Second, the small sample size may limit the identification of the adverse effects of subcostal approach to QLB. Third, although none of the patients in the subcostal approach to QLB group presented with LA systemic toxicity, further studies must be conducted to validate optimal LA concentrations and volumes.

Abbreviations
ES: erector spinae; LA: Local anesthetic; PM=:Psoas major; QLB=:Quadratus lumborum block;
TLF:Thoracolumbar fascia
Declarations
Ethics approval and consent to participate
This study was approved by the ethics committee of Ningbo Medical Center Lihuili Eastern Hospital, China (DYLL2018073), and the protocol was registered at the Chinese Clinical Trial Registry (ChiCTR1800020296). Initial registration date was 22/12/ 2018. All procedures performed in this study involving human participants were in accordance with the Ethical Standards of the Institutional Ethics Committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All patients signed written informed consent before surgery.

Consent for publication
Not applicable.

Availability of data and material
The datasets used during the current study are available from the corresponding author on reasonable request.
Competing interests

The authors have no conflicts of interests to disclose.

Funding

This study was supported by Medical Health Science and Technology Project of Zhejiang Provincial Health Commission 2018235388.

Authors’ contributions

Conception and design: MHZ, YQ, HJH; Data collection: JFL, QQP; Data analysis: YLM; Drafting the manuscript: MHZ, YLM and Revision of the manuscript after critical review: all authors. All authors read and approved the final manuscript.

Acknowledgements

No device or material was provided by the manufacturer. The manufacturer offered no input to the design or conduct of the study or in the decision to submit the manuscript for publication.

References

[1] Ljungqvist O, Scott M, Fearon KC. Enhanced recovery after surgery: a review. JAMA Surg. 2017;152(3):292-8.

[2] Blanco R. TAP block under ultrasound guidance: the description of a “non pops” technique. Regional Anesthesia and Pain Medicine. 2007;32(5):130.

[3] Blanco R, Ansari T, Girgis E. Quadratus lumborum block for postoperative pain after caesarean section: a randmised controlled trial. Eur J Anaesthesiol. 2015;32(11):812-8.

[4] Blanco R, Ansari T, Riad W, Shetty N. Quadratus lumborum block versus transversus abdominis plane block for postoperative after casarean delivery: a randomized controlled trial. Reg Anesth Pain Med. 2016;41(6):757-62.

[5] Ökmen K, Metin Ökmen B, Topal S. Ultrasound-guided posterior quadratus lumborum block for postoperative pain after laparoscopic cholecystectomy: A randomized controlled double blind study. J Clin Anesth. 2018;49:112-7.

[6] Ishio J, Komasawa N, Kido H, Minami T. Evaluation of ultrasound-guided posterior quadratus lumborum block for postoperative analgesia after laparoscopic gynecologic surgery. J Clin Anesth.
[7] Hironobu U, Hiroshi O, Jui-An L. Ultrasound-Guided Quadratus Lumborum Block: An Updated Review of Anatomy and Techniques. Biomed Res Int. 2017;2017:1-7.

[8] Elsharkawy H, Ahuja S, DeGrande S, Maheshwari K, Chan V. Subcostal approach to anterior quadratus lumborum block for pain control following open urological procedures. J Anesth. 2019;33(1):148-54.

[9] Elsharkawy H. Quadratus lumborum block with paramedian sagittal oblique (subcostal) approach. Anaesthesia. 2016;71(2):241-2.

[10] Ueshima H, Hiroshi O. Intermittent bilateral anterior sub-costal quadratus lumborum block for effective analgesia in lower abdominal surgery. J Clin Anesth. 2017;43:65.

[11] Ohgoshi Y, Nakayama H, Kubo EN, Izawa H, Kori S, Matsukawa M. Clinical experiences of the continuous quadratus lumborum block via paramedian sagittal oblique approach. J Clin Anesth. 2017;38:89-90.

[12] Van Poppel H, Becker F, Cadeddu JA, Gill IS, Janetschek G, Jewett MA, et al. Treatment of localised renal cell carcinoma. Eur Urol. 2011;60(4):662-72.

[13] Bos EME, Hollmann MW, Lirk P. Safety and efficacy of epidural analgesia. Curr Opin Anaesthesiol. 2017;30(6):736-42.

[14] Pazhayattil GS, Shirali AC. Drug-induced impairment of renal function. Int J Nephro Renovasc Dis. 2014;7:457-68.

[15] Lee J, Kim S. The effects of ultrasound-guided serratus plane block, in combination with general anesthesia, on intraoperative opioid consumption, emergence time, and hemodynamic stability during video-assisted thoracoscopic lobectomy: A randomized prospective study. Medicine. 2019;98(18):e15385.

[16] Baidya DK, Maitra S, Arora MK, Aqarwal A. Quadratus Lumborum Block: an effective method of perioperative analgesia in children undergoing pyeloplasty. J Clin Anesth. 2015;27(8): 694-6.

[17] Tesarz J, Hoheisel U, Wiedenhofer B, Mense S. Sensory innervation of the thoracolumbar fascia in rats and humans. Neuroscience. 2011;194:302-8.
[18] Ueshima H, Otake H, Lin JA. Ultrasound-guided Quadratus Lumborum block: an updated review of anatomy and techniques. Biomed Res Int. 2017;2017:2752876.

[19] Yousef NK. Quadratus Lumborum Block versus Transversus Abdominis Plane Block in Patients Undergoing Total Abdominal Hysterectomy: A Randomized Prospective Controlled Trial. Anesth Essays Res. 2018;12(3):742-7.

[20] Zhu Q, Li L, Yang Z, Shen J, Zhu R, Wen Y, et al. Ultrasound guided continuous Quadratus Lumborum block hastened recovery in patients undergoing open liver resection: a randomized controlled, open-label trial. BMC Anesthesiol. 2019;19(1):23.

[21] Ljungqvist O, Scott M, Fearon KC. Enhanced recovery after surgery: a review. JAMA Surg. 2017;152(3):292–8.

[22] Wikner M. Unexpected motor weakness following quadratus lumborum block for gynaecological laparoscopy. Anaesthesia. 2017;72(2):230-2.

[23] Hockett MM, Hembrador S, Lee A. Continuous quadratus lumborum block for postoperative pain in total hip arthroplasty: a case report. A A Case Rep. 2016;7(6):129-31.

Tables
Table 1 Demographic and operative characteristics
|                                | QLB group (n=29) | C group (n=29) | P    |
|--------------------------------|------------------|----------------|------|
| Age (years)                    | 49.3±10.1        | 54.2±8.3       | 0.153|
| Sex ratio (female/male)        | 13/16            | 15/14          | 0.599|
| Body mass index (kg/m$^2$)     | 24.0±2.4         | 23.4±3.1       | 0.554|
| ASA (I/II/III)                 | 13/12/4          | 14/13/2        | 0.689|
| Operative time (min)           | 63.1±13.3        | 64.7±15.5      | 0.764|
| Type of surgery                | 12/17            | 11/18          | 0.788|
| (radical/partial nephrectomy)  |                  |                |      |

Data are presented as mean ± standard deviations or number. QLB group, patients who received a combination of general anesthesia with quadratus lumborum block; C group, patients who received general anesthesia.

ASA=American Society of Anesthesiologists

Table 2 Sedation scale and comfort scale score [Score, M (IQM)]
|                     | QLB group | C group | P       |
|---------------------|-----------|---------|---------|
| Ramsay sedation scale |           |         |         |
| T1                  | 2.0 (2,3) | 3.0 (2,3) | 0.472   |
| T2                  | 2.0 (2,2) | 2.0 (2,3) | 0.671   |
| T3                  | 2.0 (2,2) | 2.0 (2,2) | 0.671   |
| Bruggemann comfort scale |         |         |         |
| T1                  | 3.0 (2,3) | 2.0 (1,3) | 0.017   |
| T2                  | 3.0 (2,3) | 2.0 (2,3) | 0.038   |
| T3                  | 3.0 (3,4) | 3.0 (2,3) | 0.293   |

Data are presented as median (IQR). IQR, interquartile range. QLB group, patients who received a combination of general anesthesia with quadratus lumborum block; C group, patients who received general anesthesia.

Table 3 Consumption of remifentanil intraoperatively, postoperative conditions, and PONV
|                                | QLB group     | C group      | P       |
|--------------------------------|---------------|--------------|---------|
| Consumption of remifentanil    | 357.3±66.7    | 445.3±72.6   | 0.002   |
| intraoperatively (ug)          |               |              |         |
| Number of patients requiring   | 6 (20.7%)     | 18 (62.1%)   | 0.001   |
| rescue analgesia (%)           |               |              |         |
| Time to recovery of intestinal | 54.7±6.6      | 62.6±6.2     | 0.002   |
| function (h)                   |               |              |         |
| mobilization time (h)          | 25.4±4.1      | 29.9±4.3     | 0.006   |
| PONV (%)                       | 8 (27.6%)     | 16 (55.2%)   | 0.033   |

Data are presented as mean ± standard deviations or median (%) number of patients. QLB group, patients who received a combination of general anesthesia with quadratus lumborum block; C group, patients who received general anesthesia.

PONV= postoperative nausea and vomiting

Figures
Figure 1

Ultrasound image of subcostal approach to transmuscular QLB. LA spread between QL and PM muscle. LA local anesthetic, QL quadratus lumborum muscle, ES erector spinae muscle, arrow shows the needle path.
Figure 2

Flowchart of this study
Sufentanil consumption within the first 24 h postoperatively for the QLB and control groups. Data are presented as individual values and mean ± standard deviations. QLB group (closed circles, n=29), patients who received a combination of general anesthesia with quadratus lumborum block; C group (closed squares, n=29), patients who received general anesthesia. (P=0.006)
Figure 4

Dermatomes of the sensory block in the QLB patient. Frequency of sensory segments blockade to sharp touch at 30 min following quadratus lumborum block.