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ORIGINAL ARTICLE

A triple-blinded randomized trial comparing spinal morphine with posterior quadratus lumborum block after cesarean section

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ABSTRACT
Background: This study aimed to compare the postoperative analgesic effects of ultrasound-guided posterior quadratus lumborum block with spinal morphine, after cesarean section, using the visual analogue scale pain score.
Methods: One-hundred-and-seventy-six pregnant women scheduled for elective cesarean section with spinal anesthesia were randomly allocated into four groups to receive spinal morphine 0.1 mg (group M^+); spinal saline (M^-); posterior quadratus lumborum block using either 0.3% ropivacaine (0.45 mL/kg each side, maximum 150 mg) group pQ^+); or saline (pQ^-). All patients received 11–13 mg hyperbaric bupivacaine 0.5% and 10 μg fentanyl. Intravenous droperidol, fentanyl and acetaminophen were administered during surgery. Bilateral posterior quadratus lumborum block was performed immediately after surgery. Postoperative pain was assessed at 0.5, 1, 2, 4, 6, 18 and 24 h after surgery, and the pain score 6 h after surgery was the primary endpoint.
Results: One-hundred-and-forty-six patients were included in the final analysis. Pain scores 6 h after surgery, both at rest and when moving, were significantly different when comparing the M^+pQ^+ group with the M^-pQ^+ or M^-pQ^- groups, and when comparing the M^+pQ^- group with the M^- pQ^+ or M^- pQ^- groups (all $P<0.05$). There was no significant difference between the M^+pQ^+ and M^+pQ^- groups, or between the M^-pQ^+ and M^-pQ^- groups.
Conclusion: Spinal morphine improved postoperative analgesia but the combination of posterior quadratus lumborum block with spinal morphine did not lead to further improvement.

Keywords: Cesarean section; Intrathecal morphine; Regional anesthesia; Posterior quadratus lumborum block; Postoperative pain

Introduction

Cesarean section (CS) is one of the most common surgical procedures and postoperative pain control is an important aspect of postoperative management.[1] Generally, spinal anesthesia is performed for the perioperative management of CS. Spinal anesthesia with opioids has gained popularity for postoperative pain relief because it results in improved analgesia, and ultrasound-guided nerve blocks have also been performed as part of multimodal analgesia after CS.[2]

Intrathecal opioids are frequently associated with adverse effects including nausea, pruritus and rarely with respiratory depression. Posterior quadratus lumborum block (pQLB) is thought to be suitable for pain management after lower abdominal surgery.[3] Some studies have reported that spinal anesthesia with pQLB is more effective than spinal anesthesia alone for postoperative analgesia,[2–4] possibly because pQLB has an analgesic effect on visceral pain.[2,3] However, the analgesic effect produced by pQLB for visceral pain is controversial.

This study aimed to compare the postoperative analgesic effects of ultrasound-guided pQLB, with or without spinal morphine, after CS. The primary outcome was postoperative pain six hours after surgery (identified as the most painful time point in our preliminary study), as assessed using a visual analogue scale (VAS) pain score. We hypothesized that spinal anesthesia (with or without intrathecal morphine) with pQLB would be more effective than spinal anesthesia alone after CS, and designed a prospective triple-blinded randomized controlled trial to test this hypothesis.

Materials and methods

This trial was approved by the institutional review board of the Japanese Red Cross Nagoya Daiichi

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Hospital, conformed to the tenets of the Declaration of Helsinki, and was registered prior to patient enrollment at the University Hospital Medical Information Network (registration number UMIN000018770). A total of 180 pregnant women aged 20–45 years who were scheduled for elective CS with spinal anesthesia, between August 2015 and October 2016, were assessed for eligibility. One-hundred-and-seventy-six were enrolled. Exclusion criteria were an American Society of Anesthesiologists (ASA) physical class III or more, use of analgesics before surgery, a bleeding disorder, allergy to ropivacaine and psychiatric illness.

After obtaining written informed consent and recording demographic data, we used a computer-generated randomization program to allocate the 176 patients to one of four treatment groups (n=44 per group). The treatments included spinal morphine 0.1 mg (M^+) or spinal saline 0.1 mL (M^-); pQLB using 0.3% ropivacaine (0.45 mL/kg each side, maximum 75 mg per side) (pQ^+); or saline (0.45 mL/kg each side) (pQ^-). The four groups were assigned to the following treatment combinations: M^+pQ^+ (spinal morphine and pQLB), M^+pQ^- (spinal morphine and saline infiltration), M^-pQ^+ (spinal saline and pQLB), and M^-pQ^- (spinal saline and saline infiltration). An age-stratified permuted block method was incorporated to achieve optimal balance (strata 20–32 years and 33–45 years). Patients and operators were blinded to the group allocation. Triple-blinding (anesthesiologist and surgeons responsible for the surgical intervention, anesthesiologists and nurses responsible for evaluation, and patients) was ensured as follows: the anesthesiologist responsible for each surgical intervention, the nerve block expert anesthesiologist responsible for pQLB and the chief anesthesiologist were never involved in the processing of drug syringes or in postoperative evaluation. The surgeons responsible for the surgical intervention, the operating room nurses, the ward nurses and the patients were never aware of group allocation. All recorded data were managed by unique identification numbers reported on the syringes. Drugs (spinal morphine or spinal saline) to be added to spinal anesthetics (bupivacaine and fentanyl) were in the same volume (0.3 mL), and the same applied to ropivacaine and normal saline for pQLB (0.45 mL/kg), such that group allocation could not be inferred from the syringes.

Before performing spinal anesthesia, intravenous access was secured and standard monitoring (electrocardiography, non-invasive blood pressure monitoring and pulse oximetry) applied. Prior to skin puncture with the spinal needle the skin was infiltrated with 4 mL 1% lidocaine. Aseptic technique was used throughout the block procedures. Spinal anesthesia was performed using a spinal needle (25-G × 7 mm, Hakko K.K., Nagano, Japan). A standard spinal anesthetic with 11–12.5 mg 0.5% hyperbaric bupivacaine and 10 μg fentanyl was administered to all patients and the analgesic effect was checked by assessing cold sensation up to T4. The CS was performed through a transverse skin incision over the lower abdomen and a median incision of the linea alba. Intravenous droperidol 1.25 mg, fentanyl 90 μg and acetaminophen 15 mg/kg were administered to all patients between delivery of the baby and completion of the surgery. Bilateral pQLB was carried out immediately after completion of the surgery, with the puncture area and the ultrasound probe kept clean and sterile.[5] The block procedures were performed with a dedicated needle (Stimuplex D Plus, 0.71 × 80 mm, 22-G × 3 1/8 in, B. Braun Aesculap Japan Co. Ltd., Tokyo, Japan) using an in-plane technique under guidance from an ultrasound system with a 50 mm, 13 MHz linear ultrasound transducer (Venous50, GE Healthcare Japan K.K., Tokyo, Japan).[5] An anesthesiologist administered 0.45 mL/kg 0.3% ropivacaine per side, up to a maximum of 75 mg, into the lumbar interfascial triangle.[3] When identification of the lumbar interfascial triangle was difficult, the needle was advanced from the lateral position of the lumbar interfascial triangle using a hydrodissection technique to place the needle in the correct position. The same procedure was repeated on the contralateral side. The maneuver and the image during nerve block were checked by the chief anesthesiologist and the anesthesiologist in charge of the surgical intervention. These two anesthesiologists had more than nine years' experience in surgical anesthesia and more than five years' experience with peri-operative nerve block. The ropivacaine concentrations for the pQ^+ patients were selected on the basis of a previous study[6] and the same concentrations are routinely used at our hospital. Standard monitoring was used for 24 h after leaving the operating room. Patient-controlled analgesia is restricted for CS with spinal anesthesia by our institution protocols, to maintain a strict management of opioids in order to ensure a safe postoperative respiratory management and to prevent abuse.

The primary study endpoint was postoperative pain at six hours after surgery. This had been identified as the most painful time point in our preliminary study, and assessed using a 0–10 VAS pain score. Pain assessments were performed at rest and during movement at 0.5, 1, 2, 4, 6, 18 and 24 h after leaving the operating room. All scores were assigned by each patient with the assistance of an anesthesiologist not responsible for the surgical intervention. Supplemental analgesia was administered as follows: no additional drug if the score was 0–2.9, but if the patient requested pain relief, oral diclofenac sodium 50 mg was administered. Intravenous pentazocine 15 mg, or acetaminophen 15 mg/kg and pentazocine 15 mg, were administered for patients with scores 3–5.9 or >6, respectively. All patients were allowed to drink water from 18 h after

surgery and an oral non-steroidal anti-inflammatory drug was administered on request. In addition, patient characteristics, dose of additional drugs required and incidence of complications were recorded. Postoperative nausea and vomiting (PONV) and pruritus were coded using four grades of none, mild, moderate, or severe.

To compensate for unforeseen dropouts and potentially higher than expected variability, we estimated that at least 146 patients would be required for the study to have 80% power to detect a significant between-group difference in pain scores at six hours postoperatively, with an effect size of 0.8 points at a significance level of 0.05.[7] The pain scores were analyzed using a linear mixed model including treatment group, time and interaction between these variables as covariates. Least-squares means and their 95% confidence intervals (CIs) were calculated for each time point and adjustments for multiple comparisons were performed using the Tukey-Kramer method. Qualitative variables and demographic data were compared using analysis of variance. All data were analyzed by a statistician using SAS version 9.4 software (SAS Institute Inc., Cary, NC, USA).

Results

Between August 2015 and October 2016, 176 patients were randomly allocated to one of the four treatment groups. After allocation, 30 patients withdrew from the study, leaving 146 in the final analysis (Fig. 1). Twelve of the 30 patients withdrew by not completing the VAS evaluation. In six cases the primary evaluation time was inappropriate due to the interruption of surgery for an emergency intervention. Five patients declined to participate after registration; four were converted to emergency CS; and three were removed due to human error in the blinding of the drug preparation process. Demographic data and surgical characteristics were comparable among groups (Table 1).

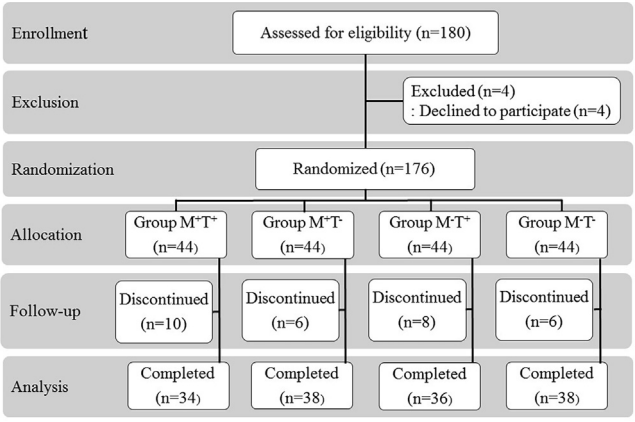

Fig. 1 Flow chart of the patient inclusion procedure. Of 180 patients initially screened for eligibility, four were excluded. The remaining 176 were randomly assigned to four groups to receive spinal morphine 0.1 mg (M^+) or spinal saline (M^-), combined with posterior quadratus lumborum block (pQLB) using 0.3% ropivacaine (0.45 mL/kg each side, pQ^+) or saline (pQ^-). Thirty patients discontinued the study after group allocation, leaving a final analysis of 146 patients

The scores at 0.5, 1, 2, 4, 6, 18 and 24 h after surgery are shown in Table 2 and Fig. 2. The pain scores at rest 1, 2, 4, and 6 h after surgery were significantly different between the M^+pQ^+ group (0.74 ± 0.63, 0.95 ± 0.82, 1.61 ± 0.82, and 2.32 ± 0.91, respectively) compared with the M^-pQ^+ group (2.03 ± 2.36, 3.33 ± 1.95, 4.33 ± 1.88, and 4.21 ± 2.33) and with the M^-pQ^- group (1.92 ± 1.32, 3.44 ± 2.14, 4.34 ± 2.38, and 4.39 ± 2.37). They were also significantly different in the M^+pQ^- group (0.67 ± 0.81, 1.17 ± 0.75, 1.42 ± 1.22, and 2.25 ± 1.28) compared with the M^-pQ^+ and M^-pQ^- groups (all $P < 0.05$). In addition, pain scores while moving at 1, 2, 4 and 6 h after surgery were significantly different in the M^+pQ^+ group (0.45 ± 0.74, 1.16 ± 1.49, 1.55 ± 1.61 and 2.11 ± 1.34, respectively) compared with the M^-pQ^+ group (2.06 ± 2.64, 3.61 ± 2.44, 4.78 ± 2.07 and 4.79 ± 2.39) and with the M^-pQ^- group (1.75 ± 1.71, 3.45 ± 2.18, 4.19 ± 1.99 and 4.50 ± 2.54): and in the M^+pQ^- group (0.89 ± 1.09, 1.50 ± 1.39, 1.72 ± 1.59 and 2.13 ± 1.81) compared with the M^-pQ^+ and M^-pQ^- groups (all $P < 0.05$) There were no significant differences between groups M^+pQ^+ and M^+pQ^- or between groups M^-pQ^+ and M^-pQ^- at any time point (Fig. 2). Significantly lower doses of diclofenac and pentazocine were administered until six hours postoperatively in groups M^+pQ^+ and M^+pQ^-, but there was no significant difference between groups M^-pQ^+ and M^-pQ^- (Table 1). After 18 h or later, patients were allowed to use orally administered loxoprofen on demand and there were no significant differences in loxoprofen use among the groups.

Regarding treatment-related adverse events, there were no significant differences between the four groups in the incidence of postoperative nausea and vomiting (mild to severe) or in the use of anti-emetic drugs. In contrast, there were significant differences in pruritus (mild to severe) between the M^+ and M^- groups (Table 1). No other adverse events associated with the surgical intervention, spinal anesthesia or pQLB procedure were recorded. Postoperative changes in blood pressure, heart rate and peripheral arterial oxygen saturation were similar in all groups, as were vital signs (data not shown).

Discussion

Blanco et al.[8] published the first study investigating the analgesic effect of QLB after CS. In this study 0.2 mL/kg 0.125% bupivacaine was injected at the posterolateral border of the quadratus lumborum muscle and clear benefits from both spinal morphine

Table 1 Demographics, surgical characteristics and postoperative outcomes

	Group M^+pQ^+ (n=34)	Group M^+pQ^- (n=38)	Group M^-pQ^+ (n=36)	Group M^-pQ^- (n=38)	*P*-value
Age (y)	35.2 ± 4.2	33.7 ± 5.8	33.2 ± 4.8	35.3 ± 4.8	0.23
Height (cm)	155.8 ± 5.4	157.7 ± 5.0	156.0 ± 4.8	157.5 ± 4.4	0.25
Body weight at cesarean section (kg)	61.2 ± 9.0	61.3 ± 7.8	62.7 ± 10.7	62.9 ± 8.4	0.80
Body weight before pregnancy (kg)	53.3 ± 9.3	52.5 ± 7.3	53.9 ± 10.5	56.0 ± 11.0	0.51
Pregnant days (days)	252.1 ± 28.8	258.8 ± 31.1	248.3 ± 27.3	251.9 ± 25.3	0.91
Surgery					
Duration of anesthesia (min)[*]	75.0 ± 15.8	74.3 ± 16.1	73.4 ± 18.8	76.3 ± 15.9	0.90
Operation time (min)	57.4 ± 12.8	57.5 ± 14.9	56.8 ± 18.7	57.2 ± 12.9	0.99
Infant information					
Apgar score at 1 min	7.4 ± 2.0	7.4 ± 1.8	6.9 ± 2.3	7.5 ± 1.9	0.61
Apgar score at 5 min	8.54 ± 1.3	8.5 ± 1.2	8.3 ± 1.7	8.8 ± 0.9	0.47
pH[†]	7.29 ± 0.07	7.28 ± 0.08	7.28 ± 0.07	7.29 ± 0.06	0.84
Base excess[§]	−2.8 ± 2.8	−3.2 ± 2.7	−2.8 ± 3.5	−2.4 ± 2.3	0.75
S. lactate (mmol/L)[§§]	2.3 ± 1.7	2.5 ± 1.5	2.8 ± 1.5	2.5 ± 1.2	0.48
Postoperative pruritus at 6 h					
None (n)	18	21	26	29	<0.05
Moderate to severe (n)	16	17	10	9	
Postoperative pruritus at 24 h					
None (n)	17	18	25	27	<0.05
Mild to severe (n)	17	20	11	11	
Supplemental analgesia until 6 h					
Diclofenac sodium (n)	4	5	19	18	<0.05
Acetaminophen (n)	1	1	10	9	<0.05
Pentazocine (n)	1	4	18	17	<0.05
Supplemental analgesia from 18-24 h					
Non-steroidal anti-inflammatory drug (n)	17	16	21	19	0.59

Group M^+pQ^+: spinal morphine 0.1 mg combined with pQLB using 0.3% ropivacaine. Group M^+pQ^-: spinal morphine 0.1 mg combined with pQLB using saline. Group M^-pQ^+: spinal saline 0.1 mL combined with pQLB using 0.3% ropivacaine. Group M^-pQ^-: spinal saline 0.1 mL combined with pQLB using saline. pQLB: posterior quadratus lumborum block. Data are mean ± SD (total n=146). There were significant differences between group M^+ (groups M^+pQ^+ and M^+pQ^- together$^-$) and group M^- (groups M^-pQ^+ and M^-pQ^- together); and no significant differences between groups M^+pQ^+ and M^+pQ^-; or between groups M^-pQ^+ and M^-pQ^-. Statistical significance of the differences among the four groups was assessed by analysis of variance. When analysis of variance indicated a significance difference, paired between-group differences were analyzed.

[*]Time from the injection of bupivacaine to the end of the surgical intervention.

[†]pH in umbilical cord blood.

[§]Base excess in umbilical cord blood.

[§§]Lactate in umbilical cord blood.

and pQLB were demonstrated,[3] but no comparative data for spinal morphine and pQLB have been published. We found that the addition of pQLB to a multimodal analgesic regimen including intrathecal morphine was associated with similar severity of postoperative pain. Pruritus and postoperative nausea and vomiting were more common after intrathecal morphine, in agreement with previous reports. Thus, the study hypothesis was rejected.

The efficacy of pQLB for visceral pain has been discussed.[3,9] Because local anesthetics delivered by pQLB spread into the paravertebral space (PVS), pQLB was thought to be useful after surgery in both the lower and upper abdomen and to counteract visceral pain.[3,4,8] Some studies suggest that the main cause of postoperative pain after CS is visceral pain such that nerve block for somatic pain (such as a transversus abdominis plane (TAP) block) is not useful for postoperative pain control after CS.[10,11] Other studies indicate that a nerve block after CS may be of additional analgesic benefit because of efficacy against visceral pain.[3,8] However, our previous study indicated that local anesthetic administered by pQLB spreads into the PVS only in small volumes and only at the T10–T12 vertebral levels, so the sensory block area of pQLB includes only the lateral and lower abdominal regions.[5] Despite using the same pQLB method as Blanco et al.,[3] those results indicated that there was no sensory loss induced by pQLB around the body midline. As in previous studies of TAP blocks,[10,11] the sensory loss area was inadequate after

Table 2 Visual analog scale pain scores

	Group M^+pQ^+ (n=34)	Group M^+pQ^- (n=38)	Group M^-pQ^+ (n=36)	Group M^-pQ^- (n=38)	*P*-value
VAS scores at rest					
0.5 h	0.29 ± 0.45	0.42 ± 0.54	0.89 ± 1.20	0.61 ± 0.95	–
1 h	0.74 ± 0.63	0.67 ± 0.81	2.03 ± 2.36	1.92 ± 1.32	<0.05[#]
2 h	0.95 ± 0.82	1.17 ± 0.75	3.33 ± 1.95	3.44 ± 2.14	<0.05[#]
4 h	1.61 ± 0.82	1.42 ± 1.22	4.33 ± 1.88	4.34 ± 2.38	<0.05[#]
6 h	2.32 ± 0.91	2.25 ± 1.28	4.21 ± 2.33	4.39 ± 2.37	<0.05[#]
18 h	2.29 ± 1.13	2.03 ± 1.26	3.22 ± 1.84	3.42 ± 1.77	–
24 h	1.95 ± 0.99	1.97 ± 1.17	2.67 ± 1.60	2.42 ± 1.12	–
VAS scores while moving					
0.5 h	0.32 ± 0.72	0.64 ± 0.81	1.18 ± 2.25	1.17 ± 1.52	–
1 h	0.45 ± 0.74	0.89 ± 1.09	2.06 ± 2.64	1.75 ± 1.71	<0.05[#]
2 h	1.16 ± 1.49	1.50 ± 1.39	3.61 ± 2.44	3.45 ± 2.18	<0.05[#]
4 h	1.55 ± 1.61	1.72 ± 1.59	4.78 ± 2.07	4.19 ± 1.99	<0.05[#]
6 h	2.11 ± 1.34	2.13 ± 1.81	4.79 ± 2.39	4.50 ± 2.54	<0.05[#]
18 h	2.87 ± 1.79	2.81 ± 1.98	4.06 ± 1.92	3.89 ± 1.58	–
24 h	2.95 ± 1.78	3.25 ± 1.73	4.14 ± 1.35	3.81 ± 1.13	–

Group M^+pQ^+: spinal morphine 0.1 mg combined with pQLB using 0.3% ropivacaine. Group M^+pQ^-: spinal morphine 0.1 mg combined with pQLB using saline. Group M^-pQ^+: spinal saline 0.1 mL combined with pQLB using 0.3% ropivacaine. Group M^-pQ^-: spinal saline 0.1 mL combined with pQLB using saline. pQLB; posterior quadratus lumborum block; VAS: Visual Analog Scale. Data are mean ± SD (total n=146). [#]There were significant differences between group M^+ (groups M^+pQ^+ or M^+pQ^- together$^-$) and group M^- (groups M^-pQ^+ or M^-pQ^- together), and no significant differences between groups M^+pQ^+ and M^+pQ^-, or between groups M^-pQ^+ and M^-pQ^-. Statistical significance of the differences among the four groups was assessed by analysis of variance. When analysis of variance indicated a significance difference, paired between-group differences were analyzed.

CS. In addition, there is no clear evidence of a prolonged analgesic effect from a pQLB. In fact, the duration of the sensory loss in our previous study[5] did not exceed eight hours after the pQLB, even at the anterior axillary line (unpublished data).

Another likely explanation for the lack of significant differences in postoperative pain in this study, with or without pQLB, is that local anesthetic delivered by pQLB spreads minimally into the PVS.[5] A study of the spread of local anesthetic (0.7 mL/kg) mixed with contrast media into the PVS after pQLB, when assessed one hour after initial injection using magnetic resonance imaging, found minimal spread despite the volume of local anesthetic solution being greater than typical in daily clinical use. Spread into the PVS was not seen in all patients. Such limited spread of local anesthetic is unlikely to exert a strong analgesic effect on visceral pain after CS. Ueshima et al. also considered that the volume of solution reaching the PVS was too small after pQLB.[12] A comparative study found that pQLB did not provide superior postoperative analgesia to systemic lidocaine infusion after laparoscopic colorectal surgery.[13] The authors suggested that the analgesic effect in pQLB might be a systemic effect rather than a specific effect on visceral pain.

This study indicates that pQLB after CS does not provide adequate analgesia for both lower somatic and uterine visceral pain after CS. In addition to no reduction in pain score, supplementary analgesic consumption up to six hours after CS was not reduced by a pQLB. The drugs that have been used for pQLB have differed and the volume of local anesthetic has been suggested to be an important determinant of the spread of solution with pQLB. Dose-response studies of drug volume and concentration may be necessary. In addition, anesthesiologists should disseminate information about differences in clinical effects from the several types of QLB.[14]

This study has several limitations. First, to avoid loss of blinding and the introduction of bias, we did not check for dermatomal sensory loss. Ultrasonic-guided needle placement is an operator-dependent technique but pQLB was performed under ultrasound visualization so we are confident about the correct placement of the blocks. Second, despite attempts at blinding to reduce bias, the effects of the study medications may have allowed both investigators and patients to infer the group allocation. In addition, 30 patients dropped out of the study, however, since the total number of patients analyzed exceeded the target number established in the sample size estimation, we believe our results are valid. Third, all patients in the study received spinal fentanyl, which produces early analgesia, although this may have largely waned by six hours after surgery. Fourth, Japan is a very strict country for what regards the abuse of opioids, even in the medical field, and opioid consumption is very low compared with other developed countries.[15,16] Avoidance of patient-

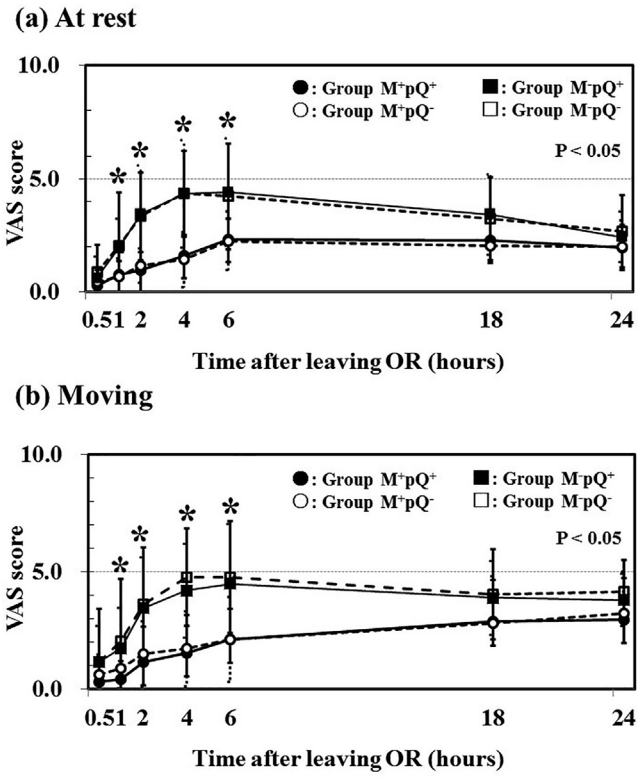

Fig. 2 Comparison of the analgesic effects of spinal anesthesia, with or without spinal morphine and with or without ultrasound-guided posterior quadratus lumborum block (pQLB), at cesarean section. OR: operating room. VAS: 0–10 visual analog scale. There were no statistically significant differences between group M^+pQ^+ and group M^-pQ^- or between group M^-pQ^+ and group M^-pQ^-; however, spinal morphine improved postoperative analgesia as assessed by the VAS scores shown at rest (a) and moving (b) for groups M^+ (●: n=34, and ○: n=38) and group M^- (■: n=36, and □: n=38). The differences at 1, 2, 4, 6, and 18 h after leaving the operating room were statistically significant

controlled analgesia was based on our routine clinical protocols and we considered that the study design could be safely implemented if additional analgesics were available on demand. However, the initial pain scores associated with non-morphine groups were significantly higher than those of the intrathecal morphine groups, indicating that the treatment placed an additional burden on those patients. Fifth, the quality of performance of pQLB might influence the results: pQLB was only performed by an experienced anesthesiologist and the ultrasound images were evaluated by other anesthesiologists. Finally, it may have been better to perform only an adequately powered study of pQLB in the absence of intrathecal morphine.

In conclusion, our results support that spinal morphine improves postoperative analgesia after CS, but suggest that the combination of pQLB with spinal morphine does not provide additional analgesia. Further studies are necessary to explore the analgesic effectiveness of pQLB in other post-CS settings.

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Declaration of interests

None of the authors has any conflict of interest to declare in relation to this work.

Availability of data and material

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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