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Ultrasound-Guided Pectoral Nerve Block Type II Reduces Postoperative Opioid Requirements and Promotes Postoperative Recovery in Patients Undergoing Modified Radical Mastectomy

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Abstract: *Objective:* This study examined whether ultrasound-guided Pecs II block reduces postoperative opioid consumption and improves recovery quality in patients undergoing modified radical mastectomy. *Methods:* One hundred female patients with breast cancer scheduled for elective modified radical mastectomy between June 2023 and December 2024 were enrolled. They were randomly allocated in a 1:1 ratio to either the Pecs II block group (experimental group, $n = 50$) or the control group ($n = 50$). After induction of general anesthesia, the experimental group received ultrasound-guided Pecs II block with 35 mL of 0.25% ropivacaine. The control group received an equal volume of normal saline. Cumulative opioid consumption (morphine equivalents) within 48 hours postoperatively, Numerical Rating Scale (NRS) pain scores at each time point, time to first rescue analgesia, Quality of Recovery-15 (QoR-15) scores, time to first ambulation, length of hospital stay, and incidence of adverse events were recorded. *Results:* Cumulative 48-hour opioid consumption was 9.6 ± 2.4 mg in the experimental group, significantly lower than 24.8 ± 4.2 mg in the control group ($P < 0.001$). NRS pain scores and rescue analgesia rates were reduced at all time points ($P < 0.001$). QoR-15 scores at 24 and 48 hours postoperatively, time to first ambulation, and length of hospital stay all favored the experimental group ($P < 0.001$). *Conclusion:* Thus, the findings indicate that this block could provide important benefits across the relevant postoperative recovery context. Evidence supports broader clinical use.

Keywords: Pecs II block; Ultrasound guidance; Modified radical mastectomy; Opioids; Postoperative recovery quality

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1. Introduction

Breast cancer is still common among females and modified radical mastectomy (MRM) can indicate very complicated surgical procedures. According to relevant research, wound infection and seroma formation may be important obstacles after surgery that need to handle carefully [1]. Besides, there may be evidence showing that MRM will involve several groups of chest muscles and removal of axillary lymph nodes, thus leading to many acute pains after operations. Because inadequate treatment of pain may suggest chronic pain after surgery in some patients, these results would cause great influence on rehabilitation and quality of life [2]. MRM causes severe pain. For a very long time, opioids have been considered fundamental drugs used after operations, whose good effects are widely recognized. And according to relevant study, we find that side-effects such as nausea, vomiting, respiratory depression, and addiction cannot be ignored during the perioperative period. Under the current situation when measures to reduce the use of opioids are implemented, these results may prove that some safe and practical alternatives become more urgent than before [3]. Non-opioid treatment is very promising now. According to important evidence, opioid-free anesthetic methods combined with esketamine and pectoral plane nerve block have achieved important results in breast surgery; regional anesthesia technology should play very important roles throughout surgery of breast cancer patients as well [4]. In addition, there might be reasons accounting for the significance of the results. That is probably because the criteria used to decide on breast-conserving surgery instead of MRM have been clarified further among different stages clinically speaking. Since proof has told us that MRM continues to be important today, one important point of evidence might be showing that some critical differences need to exist between medical conditions. On the other hand, major findings also suggest that some severe troubles tend to happen frequently after MRM, such as arm swelling caused by poor blood circulation, tissue death due to lack of blood flow, and pain. Still, MRM plays an indispensable role here. Furthermore, evidence shows that controlling pain really matters for faster recovery because comprehensive postoperative care makes a big difference [6,7]. Ultrasound increases security ability. So, according to one main proof presented here, the current research was designed as a randomized controlled trial to assess the influence brought by ultrasound guidance Pecs II block. In addition to this, the main purpose is to look into the amount of opioid needed after operation and whole condition of recovery process among MRM patients.

2. Methods

2.1. Study design

This study was designed as a prospective randomized controlled trial. The Institutional Ethics Committee provided approval (approval number: KYEC-2023-108), and registration with the Chinese Clinical Trial Registry (registration number: ChiCTR-2300076452) was completed. Furthermore, the evidence could suggest that all procedures were conducted in accordance with the Declaration of Helsinki and applicable ethical guidelines for clinical research. Given that the study involved surgical patients, the participants were female breast cancer patients scheduled for elective MRM at our institution between June 2023 and December 2024. Enrollment criteria show patients informed of objectives; each patient was fully informed of the study objectives, intervention procedures, and potential risks by the research team prior to enrollment. Additionally, written informed consent was obtained from all participants [8]. The eligible patients were randomly allocated in a 1:1 ratio to either the Pecs II block group (experimental group) or the control group. A computer-generated random number sequence was used for allocation. Sequentially numbered envelopes ensured allocation concealment. Nevertheless, sequentially numbered, sealed opaque envelopes were prepared and held by an independent statistician, ensuring concealment of the allocation sequence [9].

2.2. Participants

The study considered female patients aged 18 to 70 years with pathologically confirmed breast cancer and planned elective MRM at our institution, American Society of Anesthesiologists (ASA) physical status classification I or II, body mass index (BMI) between 18.5 and 30.0 kg/m^2, and intact preoperative cognitive function sufficient to complete study assessments. However, the exclusion criteria may suggest that known allergy to amide-type local anesthetics or opioids, severe cardiac, hepatic, or renal dysfunction, coagulation disorders, or skin infection at the injection site could disqualify otherwise eligible participants. Furthermore, the significant criteria indicate that chronic use of opioids, sedative-hypnotics, or antidepressants that could interfere with pain perception, prior diagnosis of chronic pain or psychiatric disorders, prior neoadjuvant chemotherapy judged likely to affect neurological function, and pregnancy or lactation [10] appear to represent critical exclusionary conditions. Patients were withdrawn from the study if the surgical procedure changed intraoperatively (e.g., conversion to total mastectomy or extended radical mastectomy), if serious intraoperative complications required emergency intervention, or if participants voluntarily withdrew. Withdrawals show reasons recorded. Additionally, the significant sample size estimation may suggest that PASS 15.0 software, based on key data from a preliminary experiment and published literature, could provide an important foundation for the calculation. Moreover, a two-sided significance level of $\alpha = 0.05$ and a power of $1-\beta = 0.80$ appear to establish the critical parameters applied. Notwithstanding these results, the calculation indicated that 45 evaluable cases per group were required, and that accounting for an estimated 10% dropout rate may suggest that 50 patients per group were enrolled, giving a total of 100 participants [11].

2.3. Interventions

In addition, IV access was provided for all patients upon reaching the operating room. Also, continuous checking of electrocardiogram (ECG), pulse oximetry (SpO_2), and non-invasive blood pressure (BP) might mean sufficient perioperative care. On the other hand, midazolam 0.03 mg/kg was given intravenously prior to anesthesia induction, according to these findings, it seems that this way shows that preoperative nervousness has been dealt with well. With respect to experiment plan, important results suggest that USG-Pecs II block took place after anesthesia induction but before cutting open. Patients were put on their backs with the affected side arm raised to ninety degrees. Still, main findings reveal that ordinary skin cleaning and draping before getting started appeared sufficient sterilized condition. Besides, a high-frequency linear array probe (10–15 megahertz) was located beneath clavicle. As seen from results, such putting looks like suitable imaging condition. So then these data also seem that pectoralis major muscle, minor one, and serratus anterior could be recognized stepwise via real-time US. Identification was followed by puncturing. However despite technology, some results show that with in-plane needle way, 0.25% ropivacaine 15 ml would firstly be injected into intermuscular space between pectoralis major and minor muscles. In addition, outcome shows needle then advanced into plane deep to pectoralis minor muscle and superficial to serratus anterior muscle here, where finding proves another 20 ml 0.25% ropivacaine deposited into. Moreover, main finding says distribution of medicine appeared among each layer of fascia during process of injection. Given data may say injection could begin only after failed aspiration showed no sign that it was located inside blood vessels, thus important result proves safety has been sustained. Evidence tells Total dose of medicine was safe. Yet major results says overall dose of local anesthetics didn't surpass 3 mg/kg [12], so findings says Control group went through same process. Considering important data, proof suggests Same doctor did same positioning and ultrasonic scan at the same time point. Also important results tell same amount of normal saline (15 ml + 20 ml) has been injected on the same two layers of fasciae as substitute substance because main conclusion implies such technique looks like would maintain blindness. Normal saline was also injected at same place. Both groups got standard total intravenous anesthesia treatment during surgery, so outcomes suggest sodium paracoxib 40 mg given intravenously 30 minutes before operation ends [13].

2.4. Outcome measures

The study's focus on pain relief means that classification according to primary and secondary outcomes possibly points out a systematic approach towards results measurement. Besides that, primary outcomes may show that total opiate intake during first two days after operation, which has been converted into morphine-equivalent dosage (mg) of oxycodone hydrochloride seems like an indication for comparison on analgesics demand among different groups [14]. In addition, secondary outcomes may mean that many important fields about post-surgery rehabilitation have been included in its major findings. Because these results set up a general evaluation system, pain intensity could mean that NRS (0 to 10) evaluations before surgery and when coughing at five time periods after surgery: 2, 6, 12, 24, and 48 hours respectively may be very important. Time to first rescue analgesia showed interval reflected blocked period. But recovery quality may mean the confirmed Chinese version of 15-item Quality of Recovery Index (QoR-15) might give out main findings at 24 and 48 hours after surgery. In addition, one major scale could prove that the five dimensions—pain, feelings, physical comfort, personal independent capability, and mental aid—would show that overall score varying from 0 to 150 apparently demonstrates more improved recovery according to higher marks. Due to these main findings, possibly some indications prove that some harmful effects from taking opioids—such as nausea, vomiting, vertigo, skin itching, and impaired breathing—seem to be registered comprehensively [15].

2.5. Statistical analysis

All data were analyzed using SPSS version 26.0. Continuous variables were first assessed for normality using the Shapiro-Wilk test. Normally distributed data are presented as mean ± standard deviation (SD) and were compared between groups using the independent samples *t*-test. Non-normally distributed variables are reported as median with interquartile range [M (P_{25}, P_{75})] and were compared using the Mann-Whitney U test. Categorical variables are expressed as frequencies and percentages; between-group comparisons were made using the chi-square test, or Fisher's exact test when expected cell frequencies fell below 5. Repeated measures analysis of variance was applied to NRS pain scores and QoR-15 scores across postoperative time points. Where the assumption of sphericity was violated, the Greenhouse-Geisser correction was used. Interaction effects between group and time are reported. Time to first rescue analgesia was analyzed using Kaplan-Meier survival curves, with between-group differences assessed by the log-rank test [16]. To address potential confounding, multivariable linear regression was performed to isolate the independent effect of Pecs II block on the primary outcome. All tests were two-sided, with $P < 0.05$ considered statistically significant. Figures were generated using GraphPad Prism 9.0.

3. Results

3.1. Comparison of baseline characteristics and intraoperative parameters

A total of 100 patients were enrolled, with 50 in the Pecs II block group (experimental group) and 50 in the control group. No statistically significant differences were found between the two groups in age, weight, height, BMI, ASA classification, clinical tumor stage, or operative duration (all $P > 0.05$), indicating satisfactory comparability at baseline. These data are summarized in **Table 1**. Mean age was 48.3 ± 8.7 years in the experimental group and 49.1 ± 9.2 years in the control group ($P = 0.632$). Mean BMI was 23.6 ± 2.8 kg/m² versus 24.1 ± 3.1 kg/m² ($P = 0.384$). ASA Class I was recorded in 24 patients (48%) in the experimental group and 22 (44%) in the control group; Class II accounted for the remainder in both groups. The difference was not significant ($P = 0.681$) [17]. Regarding clinical tumor stage, Stage II predominated in both groups. The experimental group included 32 Stage II patients (64%) and 18 Stage III patients (36%). The corresponding figures in the control group were 30 (60%) and 20 (40%), with no significant between-group difference ($P = 0.701$). Operative duration was 112.4 ± 18.6 min in the experimental group and 115.2 ± 20.3 min in the control group ($P = 0.455$). Intraoperative blood loss was 86.3 ± 22.4 mL versus 89.7 ± 25.1 mL ($P = 0.493$) [18]. Taken together, these findings confirm that the two groups were well balanced on all measured preoperative and intraoperative parameters. This balance reduces the likelihood of confounding and provides a solid foundation for subsequent between-group comparisons of outcome measures (**Figure 1**).

Table 1. Comparison of baseline characteristics and intraoperative parameters between the two groups

Variable	Pecs II group(n = 50)	Control group(n = 50)	Statistic	*P* value
Age (years, mean ± SD)	48.3 ± 8.7	49.1 ± 9.2	$t = 0.479$	0.632
Height (cm, mean ± SD)	161.2 ± 5.4	160.8 ± 5.9	$t = 0.363$	0.718
Weight (kg, mean ± SD)	61.4 ± 8.3	62.7 ± 9.1	$t = 0.757$	0.451
BMI (kg/m², mean ± SD)	23.6 ± 2.8	24.1 ± 3.1	$t = 0.874$	0.384
ASA Class I (n, %)	24 (48%)	22 (44%)	$\chi^2 = 0.162$	0.681
ASA Class II (n, %)	26 (52%)	28 (56%)	—	—
Clinical Stage II (n, %)	32 (64%)	30 (60%)	$\chi^2 = 0.148$	0.701
Clinical Stage III (n, %)	18 (36%)	20 (40%)	—	—
Operative duration (min, mean ± SD)	112.4 ± 18.6	115.2 ± 20.3	t = 0.748	0.455
Intraoperative blood loss (mL, mean ± SD)	86.3 ± 22.4	89.7 ± 25.1	t = 0.689	0.493
Intraoperative fluid intake (mL, mean ± SD)	842.6 ± 124.3	856.4 ± 138.7	t = 0.525	0.601

BMI, body mass index; ASA, American Society of Anesthesiologists; mean ± SD, mean ± standard deviation

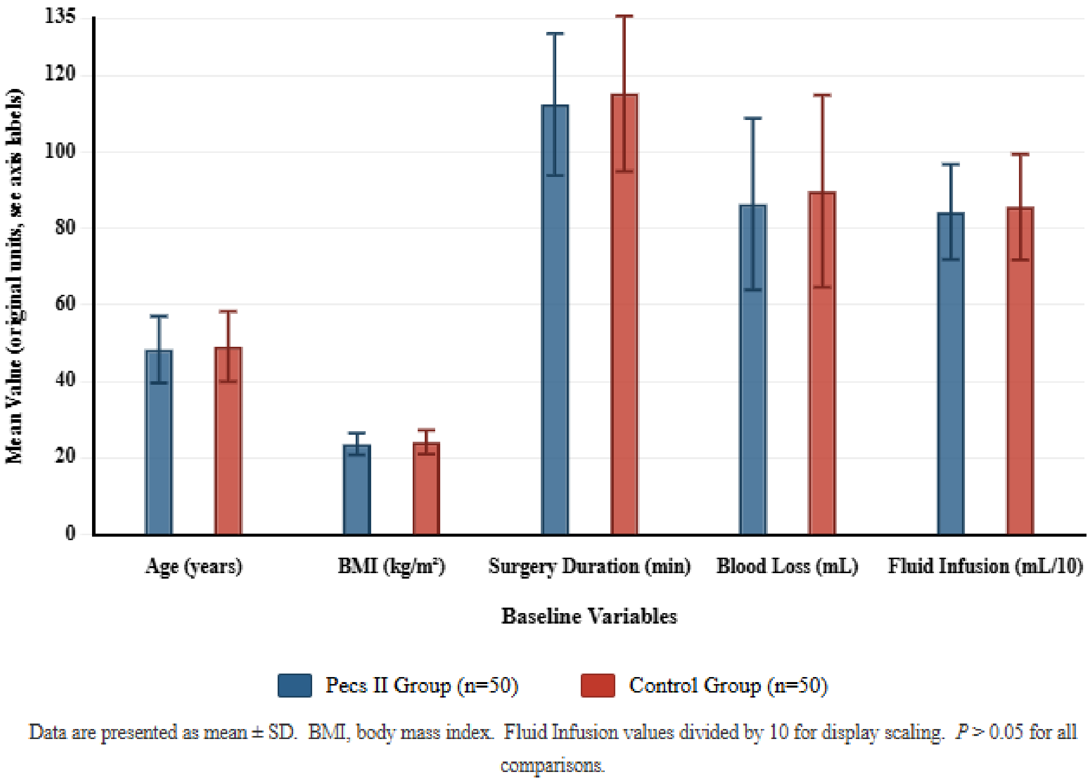

Figure 1. Comparison of baseline characteristics and intraoperative parameters between two groups

3.2. Effect of ultrasound-guided Pecs II block on postoperative opioid consumption

Cumulative opioid consumption, expressed in morphine equivalents, was significantly lower in the Pecs II block group at every postoperative time point. Full data are presented in **Table 2**. At 2 hours postoperatively, cumulative consumption was 1.8 ± 0.9 mg in the experimental group versus 4.6 ± 1.3 mg in the control group ($P < 0.001$). At 6 hours, the values were 3.4 ± 1.2 mg and 8.7 ± 2.1 mg, respectively ($P < 0.001$). By 12 hours, the experimental group had used 5.1 ± 1.6 mg compared with 13.2 ± 2.8 mg in controls ($P < 0.001$). At 24 hours, consumption was 7.3 ± 2.0 mg versus 18.5 ±3.4 mg ($P < 0.001$). At 48 hours, the experimental group had accumulated 9.6 ± 2.4 mg, while the control group reached 24.8 ± 4.2 mg. Overall, the block appears to improve the quality of perioperative pain management. See **Figure 2**.

Table 2. Comparison of cumulative postoperative opioid consumption and rescue analgesia between the two groups

Variable	Pecs II group(n = 50)	Control group(n = 50)	Statistic	*P* value
Cumulative consumption at 2 h (mg)	1.8 ± 0.9	4.6 ± 1.3	t = 12.84	< 0.001
Cumulative consumption at 6 h (mg)	3.4 ± 1.2	8.7 ± 2.1	t = 16.02	< 0.001
Cumulative consumption at 12 h (mg)	5.1 ± 1.6	13.2 ± 2.8	t = 18.37	< 0.001
Cumulative consumption at 24 h (mg)	7.3 ± 2.0	18.5 ± 3.4	t = 20.11	< 0.001
Cumulative consumption at 48 h (mg)	9.6 ± 2.4	24.8 ± 4.2	t = 22.56	< 0.001
Time to first rescue analgesia (min, median)	382	146	Z = 7.83	< 0.001
Patients requiring rescue analgesia (n, %)	18 (36%)	41 (82%)	χ^2 = 22.61	< 0.001
Number of rescue doses (median, range)	1 (0–2)	3 (2–5)	Z = 8.14	< 0.001

Data for normally distributed continuous variables are presented as mean ± standard deviation. Time to first rescue analgesia and number of rescue doses are presented as median (interquartile range)

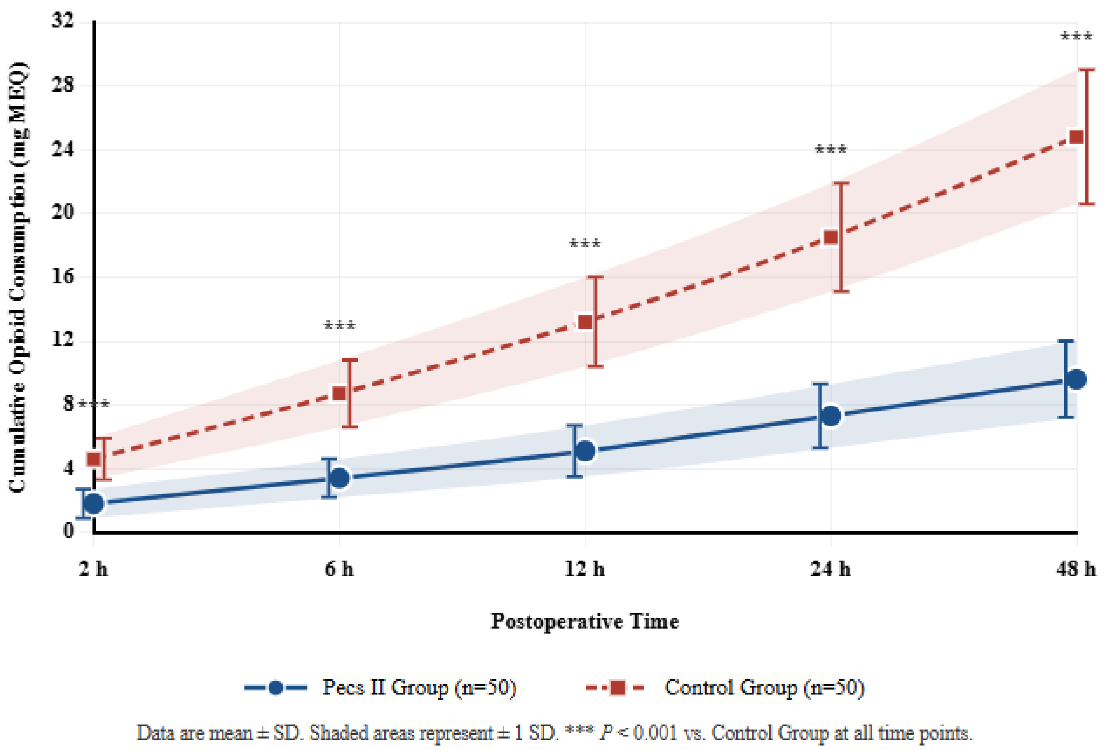

Figure 2. Cumulative postoperative opioid consumption (morphine equivalent, mg) at each time point between Pecs II group and control group

3.3. Effect of ultrasound-guided Pecs II block on postoperative recovery quality

Recovery outcomes were consistently superior in the Pecs II block group across all measured parameters. Full comparisons are shown in **Table 3**. QoR-15 total scores at 24 hours postoperatively were 118.4 ± 9.6 in the experimental group and 98.2 ± 11.3 in the control group (t = 9.87, P < 0.001). At 48 hours, scores were 132.6 ± 8.1 versus 112.8 ± 10.4, respectively (t = 10.52, P < 0.001). These results suggest that Pecs II block improves the postoperative recovery experience. Consistent with prior evidence, the addition of dexamethasone as an adjuvant to local anesthetics in fascial plane blocks has been shown to further reduce postoperative pain scores and extend analgesic duration in patients undergoing MRM [21]. Objective recovery milestones also favored the experimental group. Time to first ambulation was 14.3 ± 3.2 hours, compared with 22.6 ± 4.8 hours in the control group (t = 10.28, P < 0.001). Time to first oral intake was 8.6 ± 2.1 hours versus 13.4 ± 3.3 hours (t = 8.94, P < 0.001). Length of hospital stay was 5.2 ± 1.1 days in the experimental group and 7.1 ± 1.6 days in controls (t = 7.13, P < 0.001) [22]. The incidence of adverse events was lower in the experimental group. Postoperative nausea and vomiting occurred in 14% of patients (7/50), compared with 42% in the control group (21/50) (χ^2 = 9.76, P = 0.002). Dizziness was reported in 8% of the experimental group versus 26% of controls (P = 0.013) [23]. Taken together, ultrasound-guided Pecs II block improved QoR-15 scores at the subjective level and accelerated key recovery milestones at the objective level. It also reduced the incidence of opioid-related adverse events. These findings support its broader clinical application. See **Figure 3**.

Table 3. Comparison of postoperative recovery outcomes between the two groups

Variable	Pecs II group(n = 50)	Control group(n = 50)	Statistic	P value
QoR-15 score — postoperative 24 h	118.4 ± 9.6	98.2 ± 11.3	t = 9.87	< 0.001
QoR-15 score — postoperative 48 h	132.6 ± 8.1	112.8 ± 10.4	t = 10.52	< 0.001
Time to first ambulation (h)	14.3 ± 3.2	22.6 ± 4.8	t = 10.28	< 0.001
Time to first oral intake (h)	8.6 ± 2.1	13.4 ± 3.3	t = 8.94	< 0.001
Length of hospital stay (d)	5.2 ± 1.1	7.1 ± 1.6	t = 7.13	< 0.001
Postoperative nausea and vomiting (n, %)	7 (14%)	21 (42%)	χ^2 = 9.76	0.002
Dizziness (n, %)	4 (8%)	13 (26%)	χ^2 = 6.10	0.013
Pruritus (n, %)	2 (4%)	8 (16%)	χ^2 = 4.00	0.046

Data are presented as mean ± standard deviation unless otherwise stated. QoR-15, Quality of Recovery-15 scale (total score range 0–150; higher scores indicate better recovery)

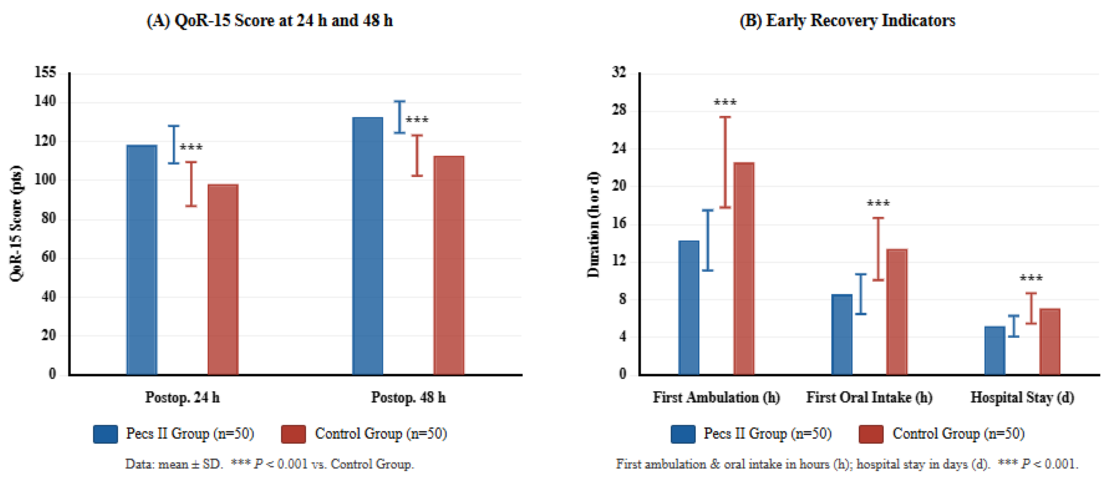

Figure 3. Postoperative recovery quality between Pecs II group and control group

4. Discussion

The results show that ultrasound-guided Pecs II block can greatly reduce painkiller use after operation in patients having modified radical mastectomy. And what has been found suggests also that performing such kind of block can extend period before having additional pain relief medicines and may have a good effect on quality-of-recovery score, time to first ambulation, and hospital stay length. But because those important outcomes imply that their finding mostly agree with previous studies about pain alleviating benefit provided by fascial plane blocks during breast operation [24], and considering the fact that anatomy shows this ground, Pecs II block suggests that putting local anesthetic agent into different spaces—at the area between pectoralis major and minor muscle and between back surface of pectoralis minor muscle and serratus anterior muscles at once—may stop painful sensation passing through medial pectoral nerve, lateral pectoral nerve, and intercostobrachial nerve pathway altogether. This blocks mainly the primary sensory nerve pathways of breast parenchyma, anterior thoracic wall skin and axillary region. In addition, extensive neuromuscular coverage suggests that this large coverage implies that the block has a strong anatomical basis for pain relief effect [25]. Besides, major results suggest that Pecs II blocks aim at a shallow level compared to thoracic paravertebral block. And there seems to be sufficient evidence showing that ultrasound landmarks appear obvious. Then these important results might mean that the chance of some serious complications such as pneumothorax and epidural diffusion is quite small. Therefore, Pecs II block will become more convenient for clinic use [26]. Furthermore, evidence indicates that less nausea, vomiting, and dizziness after surgery among participants appears because of the reduced amount of morphine. And morphine saving measures can improve patients' ease [27]. As indicated in major findings, the evidence suggests that the shorter hospitalization of experimental group reflects the real usefulness of Pecs II block helping improve the recovery process. So it seems that significant results have shown that this approach has possibilities to cut overall therapy costs considering health economy point of view. Yet the data also implies some critical weaknesses need to be recognized since this was only one center's research, which had a quite small number of participants. Despite such outcomes, main proofs show that the applicability of these conclusions needs verifying from several centers' examinations containing more samples. Experiment's follow-up only lasts up to 48 hours after operation. Because evidence points out existence of this restriction, significant results mean that the influence on chronic postoperative pain hasn't been examined yet in this case. Besides, what findings imply here is that there will be some significant chances offered by later investigations with longer observation times to see if Pecs II block will enhance patients' lives in breast cancer over a long-term period [28–30].

5. Conclusion

This planned randomized controlled trial could imply that ultrasound-guided Pecs II block shows a great anesthesia effect and important postop recovery results for patients receiving modified radical mastectomy operation. Furthermore, these remarkable results can also mean that this study has provided really useful evidence based evidence which will help clinicians apply this block clinically. At last, if compare ultrasound-guided preop Pecs II block with normal general anesthesia combined with rescue anesthetic when needed, this study suggests that preop ultrasound-guided Pecs II block could give great reduction amount of opioid consumed within 2 days postop. Since results show patients' first need for rescue analgesia time has been delayed as well as lowered ratio of patients receiving additional doses, these very interesting findings might show that patients receiving block can get reliable and long lasting postop pain relief. And also Pecs II block could reduce how much opioid patients take. In addition, there seems to be a clear advantage shown across the main endpoints recovery objective in experimental groups. So according to this result, QoR-15 scale score, time to first ambulation, time until first food intake, length of hospital stay may suggest all favor the Pecs II block group. Therefore, there will be much more evidence indicating that the treatment has benefits beyond just pain relief, seems to speed up general recovery of functional level. Despite all these findings, their findings are consistent with core principles of enhanced recovery after surgery.

Disclosure statement

The authors declare no conflict of interest.

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