Original Article

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Combined Modified Pecs II Block and Pecto-Intercostal Fascia Block as an Alternative to Endotracheal General Anesthesia for Breast Cancer Surgery

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Objectives: This retrospective study aimed at assessing the feasibility of combined modified Pecs II block and pecto-intercostal fascia block (PIFB) with propofol sedation for elective breast cancer surgery.

Methods: The medical records of 82 patients who underwent breast cancer surgery under regional anesthesia (RA) (i.e., modified Pecs II block and PIFB) (PEC group, n = 30) or endotracheal general anesthesia (ETGA) (ETGA group, n = 52) were retrospectively reviewed. Data collected included the patients' demographic and anthropometric parameters, surgical procedures, perioperative variables, and postoperative recovery variables. The primary outcome was the surgical time based on the anesthetic technique performed. Secondary outcomes were the proportion of patients requiring postoperative analgesic rescue and their recovery profiles.

Results: A total of nine breast procedures were performed in 82 patients for benign or malignant breast lesions. Thirty patients (mean age of 48.8 ± 17.4) underwent successful surgical procedures under sedation and RA. Although surgical time (82.8 ± 51.1 vs. 93.5 ± 44.3, $p = 0.34$) were comparable between the two groups, the proportion of patients receiving ephedrine bolus for hypotension was lower in the PEC group than that in the ETGA group (3.3% vs. 32.7%, $p = 0.002$). Additionally, the proportion of patients requiring postoperative analgesic rescue and the recovery profiles were comparable between both groups. No nerve block-related complications were noted.

Conclusions: Our study demonstrated the feasibility of a combination of modified Pecs II block and pecto-intercostal fascia block for breast cancer surgery. The ability to maintain rintraoperative hemodynamic stability using this regional anesthetic technique warrants further investigation.

Key words: regional anesthesia, breast cancer, Pecs II block, pecto-intercostal fascia block, general anesthesia, analgesic rescue

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Introduction

For breast cancer, surgical excision of the tumor under general anesthesia (ETGA) according to the extent of the disease remains the mainstay of treatment. To enhance postoperative recovery, combining various regional analgesia techniques with ETGA has become a popular option in the recent decade.[1-3] The increasing use of ultrasonography to identify fascial layers has led to the development of several interfascial injection techniques for analgesia of the chest wall. For instance, pectoral nerve I (Pecs I) block,[4] which refers to the infusion of local anesthetics between the fascial planes of the pectoralis major and minor muscles, was designed to anesthetize the medial and lateral pectoral nerves. On the other hand, the conventional Pecs II block, in addition to the performance of Pecs I block, involves a second injection between the planes of pectoralis minor and serratus anterior muscles to block the upper intercostal nerves including the pectoral, the intercostobrachial, the intercostals III to VI, and the long thoracic nerves.[5] Recently, Pecs blocks (both I and II) have gained much popularity for postoperative analgesia in patients after breast surgeries.[6-8] A recent meta-analysis has shown that Pecs II block offers improved analgesic efficacy compared to that using systemic analgesia alone and the analgesic efficacy is comparable to that of thoracic paravertebral block (TPVB) after breast surgery.[9] In addition to being an effective approach to postoperative analgesia, a number of regional anesthesia (RA) techniques (e.g., TPVB) have been found to be feasible alternatives to ETGA.[10-12] Nevertheless, despite the efficacy of Pecs II block for postoperative analgesia, only sporadic case reports showed that this technique may replace ETGA for breast surgery.[13-15]

The demand for 'awake surgery' to reduce ETGA-associated peri-operative risk has been reported in patients undergoing breast surgery.[12] At our institute, RA incorporating modified Pecs II block and pecto-intercostal fascia block (mPecs II/PIFB) under sedation was routinely applied to patients who preferred RA to ETGA for breast procedures. By analyzing the data from patients undergoing this combined RA approach for breast surgeries at our institute, the current study primarily aimed at assessing the possible adverse impact of this anesthesia technique on surgery through comparing the surgical time in patients receiving mPecs II/PIFB with that in those undergoing ETGA. The secondary outcomes included the proportion of patients requiring postoperative analgesic rescue as well as the recovery profiles of patients including postoperative symptoms (e.g., nausea, vomiting) and the length of hospital stay.

Materials and Methods

Study population

The medical records of patients who underwent elective breast surgeries under RA or ETGA at a tertiary care medical center from October 1, 2017 to September 30, 2018 were retrospectively reviewed. To avoid the confounding factors from variations in individual surgical techniques in the interpretation of study outcomes, all elective breast procedures were performed by a single surgeon during the study period. The inclusion criteria were patients aged ≥ 20 with a body mass index (BMI) ≤ 40 kg/m^2 and those receiving breast surgeries under successful ETGA or RA. Patients with severe cardiovascular diseases (e.g., heart failure), an American Society of Anesthesiologists (ASA) Score ≥ 4, missing information on perioperative profiles, those undergoing more than one procedure, or those receiving both ETGA and RA for the same surgical procedure were excluded. Based on the institute's policy, patients were excluded from RA for anticipated prolonged surgical

intervention (e.g., large breast tumor), allergy to local anesthetics, pre-existing neurological deficits, infection at the blockage site, or an ASA score of 4 or more, bleeding disorders, sleep apnea as well as requirement of bilateral breast cancer surgery and/or reconstructive procedures. Patients recruited were divided into two groups: (1) those receiving ETGA (ETGA group); and (2) those receiving mPecs II/PIFB technique (PEC group) for their breast surgeries. The protocol of the whole study was reviewed and approved by the institutional research board of our institute (EMRP-107-034). Informed patient consent was waived due to the retrospective nature of this study.

Regional anesthetic technique

The decision to perform ETGA or RA was based on surgeon and patient preferences as well as the expertise of the anesthesiologists. There was a standard protocol for perioperative care in patients receiving RA for breast cancer surgery. After recording of their baseline hemodynamic profiles, all patients received analgesia with intravenous fentanyl 50 μg and sedation with intravenous propofol (1% Fresfol, Fresenius Kabi GmbH, Graz, Austria) using a target-controlled infusion pump based on Schneider's pharmacokinetics model (Injectomat TIVA Agilia; Fresenius Kabi GmbH). Propofol infusion was started with an initial effect-site concentration of 2 μg/mL, and increased by 0.5 μg/mL every 30 seconds until patients exhibited no response to verbal command but still with spontaneous breathing. Supplemental oxygen (6 L/min) was administered through a face-mask.

Under strict aseptic conditions, a modified Pecs II block[5] followed by PIFB[16] was carried out under the guidance of a portable ultrasound machine (GE Healthcare, Milwaukee, WI) with a 70 mm needle (Nipro, Osaka, Japan). In our patients, Pecs I block was not performed. Instead, a modified Pecs II block, which is the injection of a local anesthetic between the pectoralis minor and serratus anterior muscles, was performed on the side of surgery with the patients in a supine position. Briefly, an ultrasound probe, which was initially placed at the midclavicular level inferolaterally to locate the axillary artery and vein, was moved laterally until pectoralis minor and serratus anterior muscles were identified at the level of the third or fourth rib. After skin infiltration with lidocaine 2%, the needle was advanced on the plane of the probe until it lay in the potential space between pectoralis minor and serratus anterior muscles. A total of 20 mL local anesthetics (5 mL 1% ropivacaine + 5 mL 2% lidocaine with 1:200,000 adrenaline diluted with 10 mL normal saline) was deposited in this space. To perform PIFB, 20 mL of the same mixture was injected between the pectoralis major muscle and the external intercostal muscle as previously described.[16] After completion of modified Pecs II block and PIFB, adequacy of anesthesia was determined by sonographic confirmation of local anesthetic spread without formal dermatomal testing.

Before surgery, pain response of the patient was tested by a surgeon through skin pinching with forceps. For patients with inadequate surgical anesthesia (e.g., presence of mildly purposeful muscular movement), further doses of fentanyl 25 – 50 μg were provided intraoperatively and the target effect-site concentration was increased in steps of 0.5 μg/mL with an upper limit of 4.5 μg/mL. No other analgesics (e.g., paracetamol or non-steroidal anti-inflammatory drug) was administered intraoperatively. Bolus dose of ephedrine (8 mg) was administered intravenously if systolic blood pressure fell by > 20% of the baseline value or was < 90 mm Hg. RA was converted to ETGA when the former was considered a failure if the heart rate or blood pressure exceeded 20% of the pre-incision value in the presence of gross purposeful muscular movements after increasing anesthetic depth. After surgery, patients were sent to post-anesthesia

care unit (PACU) from which they were discharged to ward when they met the discharge criteria.

General anesthesia and airway management

Routine monitoring included ECG, non-invasive blood pressure, pulse oximetry, end-tidal CO_2 ($EtCO_2$), and body temperature measurements. After anesthetic induction with propofol or thiopental sodium, muscle relaxant was administered to facilitate insertion of a laryngeal mask airway or tracheal intubation with a Macintosh laryngoscope. After tracheal intubation, inhalation agents were used to maintain the anesthetic depth. Volume-controlled or pressure-controlled mechanical ventilation was initially set at a respiratory rate of 12 breaths/minute and a tidal volume of 8 – 10 mL/kg. At the end of surgery, neuromuscular blockade was reversed with reversing agents.

Postoperative analgesic rescue

In the PACU, the level of pain on a 0- to 10-point numerical rating scale (NRS) was routinely recorded. If moderate-to-severe pain (i.e., NRS ≥ 4) was noted, a bolus of morphine (e.g., 2 – 3 mg) was given according to our standard PACU protocol.

Definitions and outcomes

Because unsatisfactory anesthesia would prolong surgery, the primary outcome of the current study was the surgical time based on the anesthetic technique (i.e., mPecsII/PIFB vs. ETGA) with which the patients received for their breast cancer surgeries. Secondary outcomes were the proportion of patients requiring postoperative analgesic rescue and their recovery profiles, including the appearance of anesthesia-associated symptoms, namely, nausea, sore throat, vomiting, or shivering within the period of PACU stay, length of PACU stay, recovery time (defined as the length of time taken to meet recovery discharge criteria from PACU), and the length of hospital stay.

Data collection and statistical analysis

Data collected included the patients' de-

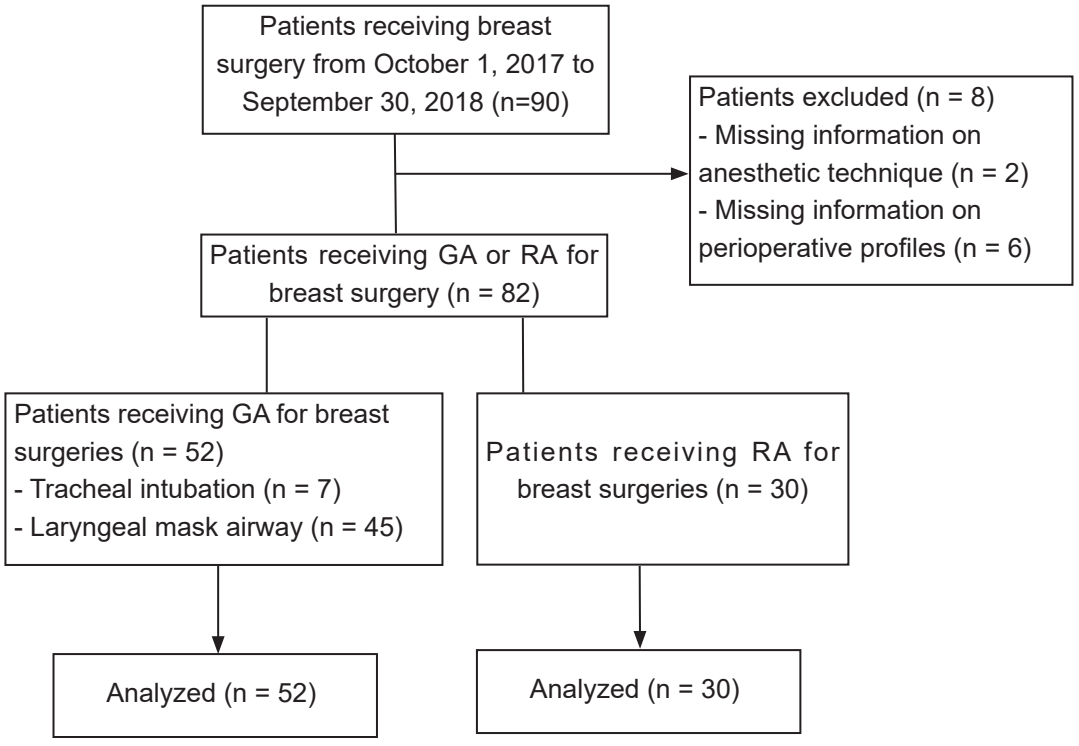

Fig. 1 Screening of patients receiving breast surgeries under either general anesthesia (GA) or regional anesthesia (RA) eligible for the present study

mographic and anthropometric parameters, surgical procedures, perioperative variables, and postoperative complications related to ETGA or RA. Because this was a retrospective study, a priori power analysis was not performed. Categorical variables, which are expressed as frequencies and percentages, were compared by Chi-square test. Continuous variables are reported as means and standard deviations. Continuous variables that were normally-distributed were compared using Student's t test, while non-normally distributed continuous variables were compared using the Mann-Whitney U test. $p < 0.05$ was considered statistically significant. All statistical analyses were performed using the Statistical Program for Social Sciences, version 22.0 (SPSS, Chicago, IL).

Results

A total of 90 patients receiving breast cancer surgery were reviewed. After excluding 8 cases (missing information, n = 8), 82 patients were included in the final data analyses (Fig. 1). No failure in ETGA or regional anesthesia was noted. Breast cancer surgery was performed under ETGA for 52 patients (ETGA group) and under RA for 30 patients (PEC group). The baseline patient characteristics in both groups are shown in Table 1. There were no significant differences in age (45.0 ± 13.8 vs. 48.8 ± 17.4, $p = 0.275$), height (157.4 ± 5.4 vs. 157.3 ± 5.2, $p = 0.923$), weight (57.8 ± 9.6 vs. 59.1 ± 11.3, $p = 0.579$), ASA physical status, baseline heart rate (73.0 ± 14.3 vs. 74.6 ± 18.1, $p = 0.663$), baseline diastolic blood pressure (74.5 ± 12.9 vs. 75.9 ± 13.9, $p = 0.643$) and comorbidities (i.e., hypertension, diabetes mellitus, and heart disease) between the two groups (Table 1). On the other hand, although hypertension appeared more common in the PEC group than that in the ETGA group without statistical significance (23.3% vs. 13.5%, $p = 0.252$), the baseline systolic blood pressure (SBP) was higher in the former than that in the latter (144.0 ± 31.3 vs. 128.2 ± 23.8, $p = 0.021$). The types of surgical procedures performed during the study period are summarized in Table 2. There was no difference in the prevalence of procedures between the two

Table 1. Demographic, anthropometric, and baseline clinical characteristics of testing subjects

Variables	ETGA group (n = 52)	PEC group (n = 30)	*p* value
Age (year)	45.0 ± 13.8	48.8 ± 17.4	0.275
Height (cm)	157.4 ± 5.4	157.3 ± 5.2	0.923
Weight (kg)	57.8 ± 9.6	59.1 ± 11.3	0.579
ASAI/II/III	15/37/0	12/17/1	0.217
Baseline HR (mmHg)	73.0 ± 14.3	74.6 ± 18.1	0.663
Baseline SBP (mmHg)	128.2 ± 23.8	144.0 ± 31.3	0.021
Baseline DBP (mmHg)	74.5 ± 12.9	75.9 ± 13.9	0.643
Comorbidities			
Hypertension	7 (13.5%)	7 (23.3%)	0.252
Diabetes mellitus	1 (1.9%)	2 (6.7%)	0.551
Heart disease	1 (1.9%)	3 (10%)	0.136

ETGA: endotracheal general anesthesia; PEC: pectoral block; ASA: American Society of Anesthesiologists; HR: heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure

Table 2. Breast procedures of the two groups of patients

Type of procedure	ETGA group (n = 52)	PEC group (n = 30)	*p value*
Partial mastectomy	6 (11.5%)	4 (13.3%)	1†
Partial mastectomy with SLNB	3 (5.8%)	1 (3.3%)	1†
Partial mastectomy with WGLB	10 (19.2%)	3 (10%)	0.356†
Partial mastectomy with ALND	5 (9.6%)	6 (20%)	0.198†
Mastectomy with ALND	0	1 (3.3%)	0.366†
Mastectomy with SLNB	2 (3.8%)	1 (3.3%)	1†
Excision	24 (46.2%)	13 (43.3%)	0.805‡
ALND	0	1 (3.3%)	0.366†
Others	2 (3.8%)	0	0.530†

ETGA: endotracheal general anesthesia; PEC: pectoral block; SLNB: sentinel lymph node biopsy; WGLB: wire-guided localization biopsy; ALND: axillary lymph node dissection; †Fisher exact test; ‡chi-square test

Table 3. Surgical and anesthetic parameters and medication requirements

Variables	ETGA group (n = 52)	PEC group (n = 30)	*p* value
Surgical time(mins)	82.8 ± 51.1	93.5 ± 44.3	0.34
Surgical time > 100 (mins)	14 (26.9%)	12 (40%)	0.22
Anesthetic time (mins)	112.1 ± 51.7	123.2 ± 44.3	0.33
Intraoperative fentanyl (mcg)	77.9 ± 27.0	67.7 ± 29.5	0.114
T1 HR (beats/min)	70.9 ± 13.0	75.7 ± 17.2	0.157
T1 SBP (mmHg)	103.3 ± 14.1	111.9 ± 17.1	0.015
T1 DBP (mmHg)	60.5 ± 10.6	54.3 ± 9.4	0.009
Ephedrine bolus (8mg)*	17 (32.7%)	1 (3.3%)	0.002
Blood loss 50-200 (mL)	47 (94%)	29 (96.7%)	0.728

ETGA: endotracheal general anesthesia; PEC: pectoral block; T1: 20 minutes after operation; HR: heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; * Number of patients requiring ephedrine bolus

groups.

Surgical time, perioperative hemodynamic profiles, and blood loss are shown in Table 3. SBP 20 minutes after operation was higher in the PEC group than that in the ETGA group (111.9 ± 17.1 vs. 103.3 ± 14.1, p = 0.015), whereas DBP was lower in the PEC group than that in the ETGA group (54.3 ± 9.4 vs. 60.5 ± 10.6, p = 0.009). The proportion of patients requiring intraoperative ephedrine for hypotension was higher in the ETGA group than that in the PEC group (32.7% vs. 3.3%, p = 0.002). The hemodynamic changes before and 20 minutes after operations are shown in Table 4. There was no significant difference in the change of heart rate in both groups (both $p > 0.05$). Postoperative complications (e.g., nausea, vomiting), the proportion of patients receiving analgesics for pain rescue, length of PACU stay, and length of hospital stay are presented in Table 5. There was no difference in the proportion of patients requiring postoperative analgesic rescue and postoperative recovery variation between the two groups. No block-related complications, such as pneumothorax, vascular puncture, and local anesthetic toxicity were observed.

Discussion

Although ETGA is a conventional anesthetic approach that has been widely accepted as the gold standard for breast surgery, technological advances in central and peripheral nerve block tend to overhaul the concept.[10, 17-20] Furthermore, for patients with severe cardiopulmonary diseases or a difficult airway, RA may be a more favorable alternative.[12] Pecs II block and PIFB, which are relatively new ultrasound-guided techniques, are considered safe and easy to perform. Despite previous sporadic reports on the feasibility of applying the combined mPecs II/PIFB approach in patients undergoing breast surgery,[13-15] the current study is the first to compare a series of patients receiving the combined regional block compared with those undergoing ETGA. Our study demonstrated that the mPecs II/PIFB technique may

Table 4. Hemodynamic change before and after operation in both groups

Variables	ETGA group (n = 52)		*p*	PEC group (n = 30)		*p*
	T0	T1		T0	T1	
Heart Rate (beats/min)	72.8 ± 14.4	70.9 ± 13.0	0.337	74.6 ± 18.1	75.7 ± 17.2	0.545
Systolic BP (mmHg)	128.2 ± 23.8	103.3 ± 14.1	< 0.001	144.0 ± 31.3	111.9 ± 17.1	< 0.001
Diastolic BP (mmHg)	74.5 ± 12.9	60.5 ± 10.6	< 0.001	75.9 ± 13.9	54.3 ± 9.4	< 0.001

ETGA: endotracheal general anesthesia; PEC: pectoral block; BP: blood pressure; T0: baseline; T1: 20 minutes after surgery

Table 5. Post-anesthetic complications and recovery parameters

Variables	ETGA group (n = 52)	PEC group (n = 30)	*p* value
Analgesics for pain rescue	11 (21.2%)	6 (20%)	0.901
PONV	2 (3.8%)	0	0.53
Sore throat	0	0	NA
Shivering	2 (3.8%)	0	0.53
Length of PACU stay (mins)	48.9 ± 6.9	47.7 ± 7.4	0.434
Recovery time† (mins)	36.3 ± 45.4	31.0 ± 8.4	0.528
Length of hospital stay (days)	2.2 ± 1.7	2.9 ± 1.7	0.067

ETGA: endotracheal general anesthesia; PACU: post-anesthesia care unit; PEC: pectoral block; PONV: postoperative nausea and vomiting; †The length of time taken to meet recovery criteria

attain a more stable hemodynamic profile than that achieved using ETGA during breast cancer surgery. Moreover, it could be performed with a high success rate without a negative impact on the conduction of surgery.

Although TPVB has been as an alternative analgesic/anesthetic technique for breast surgery in the past two decades,[12, 19-21] up to 6.1% of patients required conversion to ETGA in the course of surgery.[22] The safety of TPVB has also become a concern because of its potential complications, including inadvertent vascular puncture, hypotension, hematoma, signs of epidural or intrathecal spread, pleural puncture, and pneumothorax[22, 23] as well as the trend toward the conduction of breast surgeries in an outpatient setting.[1] Furthermore, some authors suggested that TPVB demands more advanced technical skills and a longer learning curve compared to interfascial block.[24] Additionally, a previous study reported that Pecs II block may provide better postoperative analgesia than that offered by TPVB in patients undergoing modified radical mastectomy.[25] In the current study, there were no block-related complications, such as pneumothorax, vascular puncture, and local anesthetic toxicity in our patients, supporting the use of the Pecs II block as a safe alternative to ETGA for breast surgeries. The finding was consistent with that of previous studies,[6,7] suggesting that the combined modified Pec II-PIFB approach may be superior to TPVB in this clinical setting.

A previous case-series report on the satisfaction with the combined TPVB-Pecs II method of anesthesia among 16 patients undergoing breast surgeries and their surgeons participating in those operations showed a high degree of acceptability in both parties.[12] Nevertheless, the surgeons reported increased difficulty in surgery conduction because of unsmooth anesthesia in 26.7% of patients (4/15).[12] Despite the lack of similar information in our study, the results showed comparable surgical time in both groups, indicating that the mPecs II/PIFB technique may not have significant negative impacts on the surgical process. The variety of surgical procedures in the current study also highlighted the feasibility of this RA approach in the breast surgery setting.

Another important finding of our study was the lower proportion of patients requiring ephedrine bolus for hypotension in the PEC group compared with that in the ETGA group, suggesting a more stable hemodynamic profile in the former. A previous large-scale study involving 27,381 patients undergoing 33,330 noncardiac surgeries demonstrated that even short durations of intraoperative hemodynamic instability (i.e., mean arterial pressure < 55 mmHg) are associated with an increased risk of acute kidney or myocardial injuries.[26] Because close to one-fourth of our patients (23.3%) undergoing RA had hypertension, the mPecs II/PIFB approach may be preferable to ETGA in optimizing intraoperative hemodynamics. However, it should be noted that several limitations exist regarding this finding. First, the high proportion of patients receiving ephedrine bolus for hypotension in the ETGA group may be due to an excessive inhalation of anesthetics because the depth of anesthesia was not moni-

tored. Second, the mean SBP (103.3 ± 14.1 mmHg) in the ETGA group remained clinically acceptable and may not be harmful to patients. Third, the high SBP in the PEC group may be associated with a high sympathetic tone caused by inadequate analgesia which may be harmful to patients, especially those with hypertensive cardiovascular diseases. Fourth, the wide range of blood loss (i.e., 50 – 200 mL) in our patients may make interpretation of the hemodynamic profile difficult. Therefore, the clinical findings regarding intraoperative hemodynamic stability from this regional anesthetic technique in the current study warrants further investigation.

Although previous studies reported superior postoperative analgesia of using interfascial plane block (i.e., Pecs I and II blocks) compared to systemic analgesia in patients undergoing breast surgery,[6-9] the proportions of patients requiring postoperative analgesic rescue in PACU in the two groups were comparable in the present study. Such apparently paradoxical findings may be explained by the complex innervation of the breast,[12] which may not be satisfactorily covered using the mPecs II/PIFB approach especially when Pec I nerve block was not performed in our patients. Another possible explanation could be the rich vascular supply on the pectoralis-serratus interfascial plane that leads to rapid clearance of local anesthetics, resulting in a shortened duration of analgesia.[24] A recent study on patients receiving combined TPVB/Pec II block demonstrated that one-fourth of them required postoperative analgesics.[12] In this way, the finding of our study was comparable to that of that study[12] as postoperative analgesia was required in 20% of our patients receiving the mPecs II/PIFB block.

Pecs I block, which involves the infusion of local anesthetic on the fascial plane between the pectoralis major and minor muscles, was designed to cover the medial and lateral pectoral nerves that innervate the pectoralis muscles,[4] whereas the conventional Pecs II block adds a second injection on the plane between the pectoralis minor and serratus anterior muscles to provide additional blockade of the upper intercostal nerves including the intercostobrachial, the intercostals III to VI, and the long thoracic nerves.[5] The advantages of Pecs II block include the avoidance of undesirable sympathetic suppression associated with paravertebral or epidural blockade, the reduction of opiate use in patients following ETGA, and the ease of achieving fast-acting nerve block.[25] Despite the reported advantages of the conventional Pecs II approach,[25] a previous study reported that the Pecs I block included in that technique produced mainly motor blockade without any overlying dermatomal sensory loss.[27] Therefore, we modified the conventional Pecs II technique by skipping the Pecs I block to avoid excessive local anesthetics and its potential complications.[28] In addition, taking into consideration that the mPecs II technique theoretically only blocks the lateral cutaneous branches of the intercostal nerves but not the anterior cutaneous branches,[5] PIFB was added for complete coverage of the whole anterior chest wall in the current study.

Several studies reported that intraoperative fentanyl may be needed when RA was used as the main anesthetic technique for breast surgery.[2,12] For example, when combined TPVB/Pecs II technique was used, 68.8% of patients (i.e., 11 out of 16) required low-dose intra-operative opioid to supplement surgical anesthesia during breast surgery.[12] Another study also reported the need for intraoperative opioid analgesics in 24.2% of patients during breast surgery after multi-level paraverbebral blocks with propofol sedation.[2] Our study demonstrated that the mean fentanyl dosage required for breast cancer surgery under mPecs II/PIFB blockade was 67.7 ± 29.5 mcg, indicating that low-dose fentanyl may be adequate for this approach.

There are several limitations to this study. First, the sample size was relatively small

because of the relatively short study period. It was impossible for us to perform propensity matching for the two treatment groups. In addition, because this was a retrospective study, the surgeon was not blinded to the anesthesia technique. Second, because the dermatomal spread after nerve block as well as the degree of satisfaction of patients and surgeons with the anesthesia technique were not routine items in our anesthesia records, relevant information was not available in this retrospective study. Third, Pecs I block was not performed in our patients; therefore, it remains unknown whether combination with Pecs I block could reduce the use of intraoperative opioid analgesics. Fourth, although our study included various breast procedures, most were of short durations (i.e., 93.5 ± 44.3 min in PEC group). Therefore, our results may not be extrapolated to other patient subpopulations with longer surgical time (e.g., breast reconstruction). Finally, intraoperative and chronic pain scores were not available in this retrospective study.

Conclusions

In conclusion, our study demonstrated the feasibility of a combination of modified Pecs II block and pecto-intercostal fascia block for breast cancer surgery. Advantages of this anesthetic approach included low complication rate and its potential application in a wide range of breast surgeries. Intraoperative hemodynamic stability associated with this regional anesthetic approach warrants further investigation.

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