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Effectiveness of Perioperative Ultrasound Guided Pectoralis Nerves Block for Pain Control and Reducing Analgesic Dose After Reduction Mammoplasty

Tuğba Gün KOPLAY[1], Mehmet Nurullah ARIKAN[2], Betül KOZANHAN[2*]

[1]Konya City Hospital, Department of Plastic Reconstructive and Aesthetic Surgery, Konya, Turkey
[2]Health Science University, Konya City Hospital, Department of Anesthesiology and Reanimation, Konya, Turkey

[*]**Corresponding author:** Tugba Gun Koplay,MD, Konya City Hospital, Konya, Turkey. Phone number: 0090 332 3105000-10039. +0905066348468; Fax Number: 0090 332 3105050; E-Mail address: koplaymustafa@hotmail.com; tugbagun@gmail.com**; ORCIDs:** TGK: 0000-0003-3095-6524; MNA: 0000-0001-6763-0662; BK: 0000-0002-5097-9291

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Abstract

Background: *Pain management is essential in reduction mammoplasty for easy recovery and satisfaction. However, due to the disadvantages of analgesics' adverse effects, studies focus on finding more effective and less harmful methods. Therefore, this study aims to evaluate the effects of perioperative ultrasound-guided Pectoralis Nerve (PECS) I and II blocks on pain control and used analgesic dose, type and time, and patient satisfaction.*

Materials and Methods: *Eighty-seven patients mean age of 38.3 ± 7.26 who underwent reduction mammoplasty in university hospitals between January 2018 – April 2022 were included in this study. In addition, the records of 44 patients who did not undergo PECS block (Group A) and 43 who underwent perioperative ultrasound-guided PECS I and II blocks under general Anesthesia (Group B) were reviewed retrospectively. Furthermore, VAS (Visual Analog Scale) scores, type and number of analgesics, postoperative length of stay (LOS), and EuroQol (EQ-5D) patient well-being questionnaire were evaluated by the researcher, who was blind about the technique.*

Results*: VAS scores were lower in Group B at the postoperative third, ninth, fifteenth, eighteenth, and twenty-first hours according to Group A ($p<0.05$ in each). Opioid consumptions were higher at the ninth, eighteenth, and twenty-first hours; paracetamol doses were higher at the third, sixth, and fifteenth hours, and nonsteroid anti-inflammatory doses were higher at the third and twelfth hours in Group A ($p<0.05$ in each). All the patients were discharged on the postoperative first day, and there had no statistical differences in EQ-5D at postoperative third month ($p>0.05$).*

Discussion*: Regional anesthesia is preferred as a part of comprehensive anesthesia related to the quality of pain control and reducing analgesic usage. Reducing the pain provides faster recovery and greater comfort. According to this study, while there were no differences in terms of satisfaction at postoperative third month, perioperative ultrasound-guided PEC I and II blocks were found as forceful alternatives in reduction mammoplasty to decrease pain and analgesic usage.*

Keywords: *Analgesia, Pain control, Pectoralis nerve block, Regional Anesthesia, Reduction mammoplasty.*

Introduction

Reduction mammoplasty is one of the most commonly applied aesthetic procedures in breast surgery. Pain management is essential in reduction mammoplasty for easy recovery and satisfaction. The pain after the reduction mammoplasty procedure can affect the healing process and lead to immobilization-related severe complications. Analgesics are used for physical and psychosocial well-being during the postoperative period [1]. Opioids, nonsteroidal anti-inflammatory drugs, and paracetamol are the most commonly used analgesics for this purpose. Due to the disadvantages of opioids' adverse effects such as nausea, vomiting, constipation, hypotension, sweating, disforia, and sedation, studies focus on finding more effective and less harmful methods [2].

Regional anesthesia is preferred as a part of comprehensive anesthesia and is performed in many areas for pain control and reducing analgesic usage. Intercostal, serratus, paravertebral, and pectoral I and II blocks are the most commonly chosen methods in breast surgery. The pectoral nerves (PECs) blocks were developed by Blanco, which include PEC I and PEC II blocks [3,4]. This technique blocks pectoral, intercostobrachial, third to sixth intercostals, and long thoracic nerves [5]. This study aims to evaluate the effects of intraoperative ultrasound-guided Pectoralis Nerves (PECs) I and II blocks on pain control and used analgesic dose, type and time, and patient satisfaction.

Material and Methods

Patient cohort

This study was conducted per the World Medical Association Declaration of Helsinki. Approval from the local ethics committee was obtained (2022/038). Eighty-seven patients mean age of 38.3 ± 7.26 (23-54), with the American Society of Anesthesiologists (ASA) I-II who underwent reduction mammoplasty under general anesthesia at the University of Health Science Hospital between January 2018 – April 2022, were included in this study. The exclusion criteria were BMI of more than 40, smoking, chronic pain, missing data, and previous breast surgery.

The study was designed retrospectively, and patients who underwent reduction mammoplasty by the same surgeon were divided into PECs block and control groups. PECs block was started in our series after March 2021; for this reason, cases between January 2018-March 2021 were considered the control group (Group A), and cases after March 2021 were the PECs block group (Group B). The records of 44 patients who did not undergo PECs block (Group A) and 43 patients who underwent perioperative ultrasound-guided PECs I and II blocks under general anesthesia (Group B) were reviewed retrospectively by the researcher, who was blind about the technique. The minimum follow-up period was six months. VAS (Visual Analog Scale) scores, type and number of analgesics, postoperative length of stay (LOS), and EQ-5D patient well-being questionnaire were evaluated.

Surgical Technique

All the operations were performed by the same board-certified plastic surgeon (T.G.K.) under general anesthesia. The wise pattern incision was used in all patients and the pedicle was not suspended on the muscle with any sutures. Electrocautery was used for dissection in all patients. Drains were placed in all patients and withdrawn when the drainage was less than 30 cc.

Anesthesia protocol

All patients received midazolam 1 mg before the induction of anesthesia and were monitored with three leads electrocardiography, pulse oximetry, non-invasive blood pressure, and capnography. General anesthesia was induced with fentanyl 1-1.5 µg/kg, propofol 1.5–2 mg/kg, and a tracheal tube was facilitated with rocuronium 0.6 mg/kg. Anesthesia was maintained with sevoflurane 2%, remifentanil infusion 0.1-1 µg/kg/min, and O2/air mixture with a fraction of 35%-%50 inspired O2. Fentanyl, 25 µg in bolus doses, was given intravenously if the mean blood pressure (MBP) or heart rate exceeded 20% of the preoperative baseline value. *Hypotension* was defined as a decrease of more than 20% of the baseline MBP and was treated with increments of 5 mg bolus doses of ephedrine iv and 250 ml of saline solution.

Administration of PECS I and II block

All the PECs blocks were performed by a skilled specialist in Ultrasound (USG) guided regional Anesthesia (author M.N.A.) to minimize the pain and discomfort in the postoperative period, at the end of the surgery, and before extubation (Figure 1). Blocks were performed in the operating room after the surgical side closure. We did not do preoperatively not to effect anatomy and to prolong aesthetic effect and achieve patient comfort.

At the end of the surgery, position was not changed and using a liner ultrasound probe (MyLabFive; Esaote Europe BV Philipsweg 1 6227 AJ, Maastricht, the Netherlands), PECS I block is achieved with a 10 mL of 0.25% bupivacaine injection of local anesthetic between the pectoralis major and minor muscles at the level of a third rib to block the medial and lateral pectoral nerves [3]. For PECs II block, 20 mL of 0.25% bupivacaine was injected between the pectoralis minor and serratus anterior muscles at the level of the fourth rib, aiming to block the intercostal nerves and the long thoracic nerve [4].

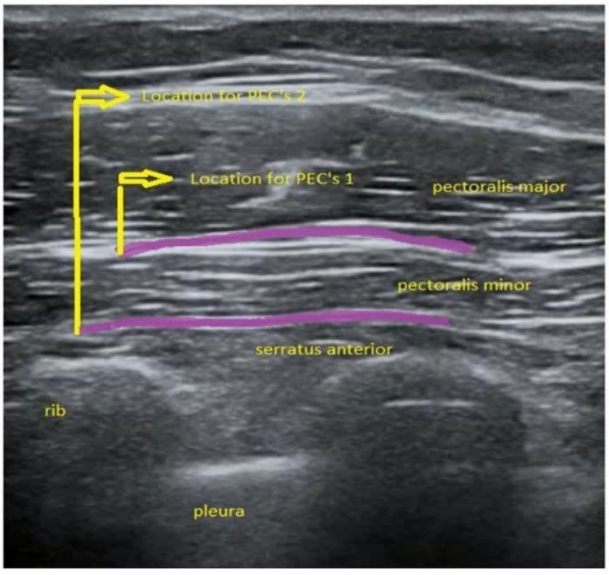

Figure 1: Anatomic landmarks and location of Pectoralis Nerve (PEC) I and II Block in ultrasonography.

Postoperative follow-up

Patients were hospitalized for at least one day. They were evaluated every three hours during the postoperative 21 hours by VAS score (0-10), and analgesic was applied if necessary. The pain scores ranged from 0:no pain to 10: worst pain. Postoperatively, Paracetamol was applied if the VAS score was 2-3, NSAID (Tenoksikam 20 mg) was applied if the VAS score was 4-5, and opioid (Tramol HCL 100mg/2cc) was applied intravenously if the VAS score was six or more in 100 cc saline. Paracetamol and opioid were administered to all the patients in the operating room before the surgical incision and at the end of the surgery, respectively. All the patients were mobilized at the sixth hour and discharged on the first day if the drainage was lower than 30cc. NSAID (per oral and once a day) was prescribed after discharge.

Two groups were compared according to the VAS score and analgesic need. EQ-5D satisfaction questionnaire was used to evaluate satisfaction at postoperative 3th month (6).

Statistical analysis

SPSS 26.0 (IBM Corporation, Armonk, New York, United States) program was used in the analysis of the variables. The conformity of univariate data to normal distribution was evaluated with the Shapiro-Wilk Francia test, while homogeneity of variance was evaluated with the Levene test. In the comparison of two independent groups according to quantitative variables, the Independent- Samples T-test was used together with the Bootstrap results, while the Mann-Whitney U test was used together with the Monte- Carlo results. While Friedman's Two-Way test was tested using Monte Carlo simulation results for comparing more than two repeated measurements of dependent quantitative variables, the Stepwise step-down comparisons test was used for Posthoc analysis.

Quantitative variables were expressed in the Tables as mean (standard deviation) (Minimum-Maximum) and Median (1st Quartile- 3rd Quartile), while categorical variables were shown as n (%). The variables were analyzed at a 95% confidence level and a p-value less than 0.05 was considered significant.

Results

Eighty-seven patients, aged 38,3±7,26 (23-54) whom we applied reduction mammoplasty were divided into two groups. The mean ages of the groups were comparable; it was 38.41 ± 7.36 and 38.19 ± 7.24, respectively (p>0.05) (Table 1). Also, groups were comparable according to the BMI (Table 1). The patients' mean BMI was 26.15 ± 3.14; it was 26.19 ± 3.19 and 26.11 ±3.12, respectively (p>0.05).

Table 1: Demographic values and postoperative evaluations of the patients about pain and satisfaction.

	Total (n=87)	Control (n=44)	PEC Block (n=43)	p
	mean (SD.) (Min-Max)	mean (SD.) (Min-Max)	mean (SD.) (Min-Max)	
Age	38.30 (7.26) (23-54)	38.41 (7.36) (24-53)	38.19 (7.24) (23-54)	0.884 [t]
BMI	26.15 (3.14) (21-34.2)	26.19 (3.19) (21-34.1)	26.11 (3.12) (21-34.2)	0.907 [t]
	Median (Q1-Q3)	Median (Q1-Q3)	Median (Q1-Q3)	
5Q5D	99 (98-100)	99 (98-100)	99 (98-100)	0.440 [u]
Vas				
0. hour	0.1 (0-0)	0 (0-0) 6 [9h 15h 18h]	0.1 (0-0)	0.120 [u]
3. hour	0.2 (0-0)	0 (0-0) [6h 9h 15h 18h]	0.4 (0-0)	0,03 [u]
6. hour	1 (0-2)	1.2 (0-2)	0.7 (0-2) [21h]	0.063 [u]
9. hour	1.4 (0-6)	4.4 (0-6) [12 h 21h]	0.5 (0-0)	<0.001 [u]
12. hour	0.6 (0-2)	0.8 (0-2) [18h]	0.5 (0-0)	0.321 [u]
15. hour	1 (0-2)	1.4 (0-2)	0.6 (0-2)	0.016 [u]
18. hour	1.2 (0-6)	4.2 (0-6)	0.4 (0-0)	<0.001 [u]
21. hour	0.4 (0-0)	0.8 (0-2)	0.2 (0-0)	0.003 [u]
p value for intra group		<0.001 [f]	0.032 [f]	
Changing				
(12-0) hour	0.6 (0-2)	0.8 (0-2)	0.4 (0-0)	0.149 [u]
(21-0) hour	0.3 (0-0)	0.8 (0-2)	0.1 (0-0)	<0.001 [u]

[t] Independent Samples T test (Boostrap),
[u] Mann Whitney U Test (Monte Carlo),
[f] Friedman Test (Monte Carlo); Posthoc Test: Stepwise step-down comparisons),
SD.:Standard Deviation, Q1: 1st Quartile, Q3: 3rd quaritle
[0h 3h 6h 9h 12h 15h 18h 21h] Express the significance according to the relevant houdemografrs

VAS scores were lower in Group B at the third, ninth, eleventh, fifteenth, eighteenth, and twenty-first hours and it was more stable according to Group A in postoperative twenty-one hour (p<0.05) (Figure 2).

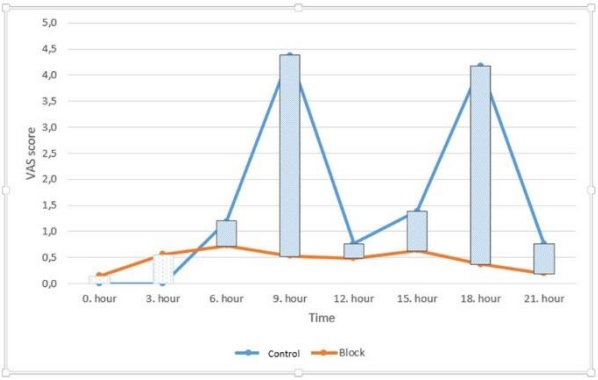

Figure 2: Graphical show of Visual Analog Scores of groups.

At the third hour, total analgesic usage, paracetamol, and NSAID doses were statistically higher in group A (p<0.05 each). At the sixth hour, total analgesic usage and paracetamol dose were higher in group A (p<0.05 each). At the twelfth hour, there were no differences between groups according to the total analgesic usage. However, the NSAID dose was higher in the Group A (p<0.05 each). At the fifteenth-hour total analgesic usage and paracetamol dose were higher in group A (p<0.05 in each). Finally, at the ninth, eighteenth, and twenty-first hours, total analgesic usage and opioid dose were higher in group A (p<0.05 in each) (Table 2).

Table 2: Postoperative analgesic doses.

	Total (n=87)	Control (n=44) Group A	Block (n=43) Group B	p
	n(%)	n(%)	n(%)	
Analgesia hour 3				0.001
None	77 (88.5)	34 (77.27)A	43 (100)	
NSAI	4 (4.6)	4 (9.3) [B]	0 (0.0)	
Paracetamol	6 (6.9)	6 (14.0) [B]	0 (0.0)	
Analgesia hour 6				0.026
None	49 (56.3)	20 (45.5)	29 (67.4) [A]	
NSAI	5 (5.7)	1 (2.3)	4 (9.3)	
Opioid	4 (4.6)	3 (6.8)	1 (2.3)	
Paracetamol	29 (33.3)	20 (45.5) [B]	9 (20.9)	
Analgesia hour 9				<0.001
None	47 (54.0)	14 (31.8)	33 (76.7) [A]	
NSAI	2 (2.3)	2 (4.5)	0 (0.0)	
Opioid	24 (27.6)	23 (52.3) [B]	1 (2.3)	
Paracetamol	13 (14.9)	4 (9.1)	9 (20.9)	
Paracetamol+NSAI	1 (1.1)	1 (2.3)	0 (0.0)	
Analgesia hour 12				0.010
None	65 (74.7)	31 (70.5)	34 (79.1)	
NSAI	7 (8.0)	7 (15.9) [B]	0 (0.0)	
Opioid	3 (3.4)	2 (4.5)	1 (2.3)	
Paracetamol	11 (12.6)	3 (6.8)	8 (18.6)	
Paracetamol+Opioid	1 (1.1)	1 (2.3)	0 (0.0)	
Analgesia hour 15				0.003
None	50 (57.5)	19 (43.2)	31 (72.1) [A]	
NSAI	5 (5.7)	1 (2.3)	4 (9.3)	
Opioid	11 (12.6)	7 (15.9)	4 (9.3)	
Paracetamol	21 (24.1)	17 (38.6) [B]	4 (9.3)	
Analgesia hour 18				<0.001
None	53 (60.9)	17 (38.6)	36 (83.7) [A]	None
NSAI	5 (5.7)	2 (4.5)	3 (7.0)	
Opioid	22 (25.3)	21 (47.7) [B]	1 (2.3)	
Paracetamol	6 (6.9)	3 (6.8)	3 (7.0)	
Paracetamol+Opioid	1 (1.1)	1 (2.3)	0 (0.0)	

Analgesia hour 21				0.010
None	72 (82.8)	31 (70.5)	41 (95.3) [A]	None
NSAI	4 (4.6)	3 (6.8)	1 (2.3)	
Opioid	6 (6.9)	6 (13.6) [B]	0 (0.0)	
Paracetamol	4 (4.6)	3 (6.8)	1 (2.3)	
Paracetamol+Opioid	1 (1.1)	1 (2.3)	0 (0.0)	
Fisher Freeman Halton test(Monte Carlo), [A] means lower incidence in group A , [B] means lower incidence in group B NSAI: Nonsteroidal anti-inflammatory				

All the patients were discharged postoperative first day. No complications related to PECs blocks were observed. The EQ-5D scores were high in all two groups and statistical differences were not detected ($p>0.05$).

Discussion

Pain is one of the prevalent and important complications after reduction mammoplasty, one of the most commonly performed procedures in breast surgery. Postoperative pain causes immobilization and discomfort. Reducing the pain provides faster recovery, fewer hospital stays, and greater comfort and satisfaction [1]. For these purposes, analgesics like paracetamol, NSAI drugs, and opioids are frequently used. Patient control anesthesia is another option [7], but it cannot be obtained in every center for each patient. While NSAID drugs cause gastric complaints, opioids cause vomiting, nausea, constipation, pruritis, respiratory depression, hypotension, and addiction [2]. Another significant complication is deaths due to opioid overdose. In 2018, 46,802 deaths were reported due to opioid overdose, 69.5% of all overdose deaths [8]. This study showed the benefits of PECs block in reducing analgesic doses and improving pain control.

Decreasing opioid dose is one of the goals of postoperative follow-up. Regional anesthesia is preferred as a part of comprehensive anesthesia related to the quality of pain control and reducing analgesic usage. Its effectivity was also shown in breast surgery [1]. The thoracic paravertebral block is one of the most commonly used technique, in breast surgery, which has been found beneficial in decreasing analgesic consumption [9,10]. The benefits of truncal regional anesthesia for postoperative pain were shown in the patients after mastectomy [11]. Interscalene block, intrapleural block, thoracic epidural block, thoracic paravertebral block, intercostal, serratus, pectoral I and II blocks, and wound infiltration are used mainly in breast cancer surgery for anesthesia and analgesia [5]. Most studies about regional anesthesia in breast surgery are on breast reconstruction [4, 12]. There are few reports on the reduction mammoplasty.

The PEC blocks were developed to provide postoperative analgesia, including PEC I and PEC II blocks by Blanco [3,4]. This technique blocks pectoral, intercostobrachial, third to sixth intercostals, and long thoracic nerves [5]. The PEC I block is achieved with a 10 mL of 0.25% bupivacaine injection of local anesthetic between the pectoralis major and minor muscles at the third rib level to block the medial and lateral pectoral nerves [3]. For the PEC II block, 20 mL of 0.25% bupivacaine is injected between the pectoralis minor and serratus anterior muscles at the level of the fourth rib block, the intercostal nerves, and the long thoracic nerve [4]. PEC II blockage has been reported as a beneficial method of pain relief for radical mastectomy compared to the control group [12]. However, PEC I block was not effective in breast augmentation [13]. In this study, VAS scores were lower in the block group at postoperative follow-up of reduction mammoplasty 9th, 15th, 18th, and 21st hours.

Daniel et al. reported their experiences with PEC block in reduction mammoplasty in adolescent patients. They reported this technique as an effective method for opioid use, nausea, vomiting, and pain scores [14]. Sercan et al. compared local infiltration and PEC II block in reduction mammoplasty and found PEC II block to reduce pain and analgesic use [15]. In the current literature, we could not find any study related to PEC I and its combination with PEC II block in reduction mammoplasty. In this study, the total analgesic dose was lower in group B at postoperative 3rd, 6th, 9th, 15th,18th, and 21st hours ($p<0.05$). The opioid dose was lower in group B at postoperative 9th, 18th, and 21st hours ($p<0.05$). Also, paracetamol was used in lower doses in group B at the postoperative 6th and 15th hours, and NSAID doses were higher in group A at the postoperative 12th hour ($p<0.05$). So, lower analgesic doses could be provided through PECs blocks.

Pneumothorax and local anesthetic toxicity are possible complications from a puncture but were not observed in this study due to the usage of ultrasound. It has also been published in the literature on reducing complications with ultrasound-assisted regional nerve block [16].

As it has been shown in many fields, regional anesthesia provides better recovery in the early period [17]. However, there were no differences between regional anesthesia and general anesthesia after the seventh day. In this study, there were no differences between groups regarding EQ-5D scores, which were used to evaluate postoperative recovery and satisfaction in the third month.

The limitations of this study are its retrospective design and short follow-up period.

Conclusion

In conclusion, studies are mostly focused on benefit from regional anesthesia in mastectomy and breast reconstruction, we did not observe any studies on PEC I and its combination with PECS II Block in reduction mammoplasty. However, decreasing the pain, analgesic dose, and morbidities are as crucial as other surgeries in reduction mammoplasty. For this purpose, the power of this study is demonstrating the benefits of perioperative ultrasound-guided PEC I and II blocks combination as a forceful alternative in reduction mammoplasty to decrease pain and analgesic dose.

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