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ORIGINAL RESEARCH REGIONAL ANESTHESIA

Effectiveness of the medial approach to PECS block in modified radical mastectomy: a retrospective study

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ABSTRACT

Background & objective: Perioperative management of female patients undergoing breast surgery includes a big anesthetic task to adequately manage persistent postoperative pain and postoperative nausea and vomiting (PONV). Pectoral nerve blocks (PECS I and PECS II), while effective in managing postoperative pain, carry a risk of throacoacromial artery puncture with the lateral approach. We evaluated analgesic efficacy of medial approach to PECS I and PECS II blocks in female patients undergoing breast surgery under general anesthesia (GA).

Methodology*:* This is a retrospective study of 116 female patients undergoing modified radical mastectomy that were divided into two groups. Group 1 patients received PECS block with general anesthesia and Group 2 patients received general anesthesia alone. Mean time to extubate, postoperative morphine consumption and PONV were evaluated up to 24 h.

Results: Patients who received the PECS block required significantly less postoperative morphine immediately after and 12 h after surgery ($P = 0.043$ and $P = 0.006$, respectively). There was no significant difference in PONV between both groups in the first 24 h ($P > 0.05$). Time to extubation (TTE) was significantly less in Group 1 patients ($P < 0.001$).

Conclusion: The medial approach of PECS I and II nerve block is effective and safe demonstrating reduced postoperative morphine requirement.

Abbreviations: PECS: Pectoral Nerve Blocks; PONV: Postoperative Nausea and Vomiting; TPVB: thoracic paravertebral block; TTE: Time to Extubation;

Keywords: Nausea; PECS I block; PECS II block; Postoperative morphine; Pain, Postoperative; Regional anesthesia; Ultrasound; Vomiting, Postoperative

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1. INTRODUCTION

Acute postsurgical pain is common after breast surgery, affecting more than half of breast surgery patients.[1] The severity of acute postoperative pain is a consistent predictor of chronic postsurgical pain.[2] Other various contributing factors for chronic postsurgical pain have been identified, including factors such as female gender, hormonal characteristics, younger age and breast surgery itself, which appears to be associated with a higher incidence and greater severity of nerve injuries compared to other surgical procedures.[3]

Multimodal analgesia, defined as the use of a variety of analgesic medications and techniques, that work synergistically or additively, has been recommended for the management of postoperative pain.[4] Postoperative opioid use, a component of the Apfel score, is one of the predictors of postoperative nausea and vomiting (PONV) risk.[5] Despite administering prophylactic antiemetic treatment to mitigate the occurrence of PONV in high risk female patients, breast surgery constitutes additional risks factors for PONV, with an incidence that reaches 30–68% in the first 24 postoperative hours.[6] Multimodal pain management is believed to reduce the incidence of PONV.[7]

The main contributors to breast innervation include the anterior branches of the 4th to 6th intercostal nerves, supplemented by the intercostobrachial nerve and medial and lateral pectoral nerves. Regional anesthesia, when combined with general anesthesia during breast surgery, has been shown to provide excellent postoperative analgesia, with a significant reduction in PONV.[8] Ultrasound-guided thoracic paravertebral block (TPVB) is considered the gold standard for pain management after breast surgery. A systematic review suggested that PECS block and TPVB offer comparable postoperative analgesic efficacy for mastectomy.[9] The choice of technique depends on the anesthesiologist's expertise. The PECS I block should ideally be performed near the thoracoacromial artery since both pectoral nerves run lateral to the pectoral branch of this artery.[10] While the PECS block carries a lower risk of intravascular injection, it does have the possibility of injection into the pectoral branch.[11] Evaluation of the spread of injection showed that the needle positioning medial to the pectoral branch of the thoracoacromial artery reaches the medial and lateral pectoral nerves.[12] In an attempt to reduce the risk of vascular puncture, a medial approach was suggested instead of the conventional lateral approach. However, the safety and efficacy of this approach have not yet been established.

We evaluated the safety and efficacy of the medial approach of PECS I and PECS II in terms of postoperative opioid consumption and PONV in patients undergoing modified radical mastectomy under GA.

2. METHODOLOGY

After obtaining approval from the Institutional Review Board (IRB) at Geitaoui University Medical Center (UMC) Lebanese Hospital, code 2020-IRB-034, dated 16 October 2020, a single center, retrospective, cross-sectional chart review was performed for all patients who underwent modified radical mastectomy between January 01, 2018, and September 30, 2020 to evaluate the safety and efficacy of the medial approach in PECS block. Written patient consents were not needed for this study.

2.1. Patient Selection

Patient records of 116 female patients, ≥ 18 y of age, who underwent elective modified radical mastectomy under GA were included. Patients were excluded if they had Alzheimer's disease, mental retardation, or recorded failure of PECS block. All patients who met the inclusion criteria were allocated to one of the two groups: Group 1 included patients who received PECS block with general anesthesia and Group 2 included patients who received general anesthesia alone.

Demographic parameters including age, weight and procedure time, sufentanil dose, time to extubate, postoperative morphine and antiemetic use during the first 24 h were calculated.

2.2. Study Protocol

All patients were admitted to operating room and monitored after undergoing a pre-operative checklist. Induction of anesthesia was started after pre-oxygenation. All patients received intravenous (IV) sufentanil at a dose of 0.1-0.2 µg/kg followed by xylocaine 1 mg/kg, propofol 2 mg/kg and rocuronium 1 mg/kg. After three minutes of ventilation, the trachea was intubated and mechanical ventilation was initiated after proper endotracheal tube placement was confirmed. Targeted controlled infusion (TCI) of propofol was used for anesthesia maintenance. TCI propofol (Schneider

plasma) was initiated at 3 µg/ml and titrated throughout the procedure as needed.

PECS I and II blocks were administered post-induction, prior to incision. In the supine position with arms abducted, a 10-12 MHz linear transducer was applied between the third and fourth rib from the sternal side. The probe was adjusted until the pectoralis major; pectoralis minor muscle and serratus anterior muscle planes were properly identified. A 20-gauge 5 cm hyper-echogenic needle was inserted from medial-to-lateral and in-plane position, with the needle and throacoacromial artery visualized on both sides of the ultrasound probe. The needle was advanced to the fourth rib and 10 mL of local anesthetic was injected between the serratus anterior and pectoralis minor. The needle was then withdrawn and another 10 mL of local anesthetic was injected between the pectoralis major and minor muscles. A 0.35% ropivacaine local anesthetic was used in all patients. All patients received IV sufentanil intraoperatively as needed, when a 20% increase in baseline blood pressure or heart rate was observed. Inj ondansetron 4 mg was administered to all patients near the end of surgery.

At the end of surgery, propofol infusion was stopped at skin closure and the muscle relaxant antagonist was administered after the skin dressing was completed. The time to extubate was counted as the beginning of the dressing time until extubation.

Postoperative data was collected from the nurse sheet for 24 h and both groups were infused inj. paracetamol lg IV and inj. morphine 0.l mg/kg IM on the demand of the patients. In the postoperative period, inj. morphine was administered only to patients with visual analogue scale (VAS) score equal to or more than 4/10.

2.3. Statistical Analysis

Data was analyzed using the Statistical

Package for Social Sciences (SPSS, IBM-Version 25). Nominal variables are represented by frequencies and proportions and continuous variables are represented by mean, median, standard deviation, minimum, and maximum as feasible. Bivariate analysis was enrolled to test the statistical difference between two study groups according to morphine use, PONV, anti-emetic needs, and time to extubate (TTE). Tests used were Chi square test, Fisher Exact test and Mann-Whitney U test. A probability value (P-value) less than 0.05 was used as the cut-off value for statistical significance.

Table 1: Patients demographic data (mean ± SD)

Parameter	Group 1 (With Block) (N = 56)	Group 2 (Without Block) (N = 60)	P-value
Age (y)	54.39 ± 14.3	52.4 ± 13.21	0.437
Weight (Kg)	71.75 ± 13.17	76.7 ± 20.64	0.129

Data presented as mean ± SD; P < 0.05 is significant

3. RESULTS

3.1. Patient Characteristics

The results indicate that there was no significant difference in the mean ages between the two groups (P = 0.437) (Table 1). On average, patients without block had a mean age of 54.39 y, while patients with block had a mean age of 52.40 y. The standard deviation for age in both groups was relatively similar, indicating consistent age distribution within each group. There was no statistical significance in weight between the two groups (P = 0.129) (Table 1).

3.2. Extubation time

Patients who received the PECS block required shorter extubation time than patients who did not receive the group (P < 0.001) (Table 2).

Table 2: Comparative extubation times in the groups

Variable	Group 1 (With Block) (N = 56)	Group 2 (Without Block) (N = 60)	P-value
Extubation Time (min)	6.61 ± 4.06	9.23 ± 4.16	< 0.001*

**Statistically significant P < 0.05; Data presented as mean ± SD*

Table 3: Comparative postoperative morphine consumption (mg)

Postoperative Time (h)	Group 1 (With Block) (N = 56)	Group 2 (Without Block) (N = 60)	P-value
0	8.04 ± 20.3	17.5 ± 27.7	0.040*
6	1.79 ± 9.4	6.67 ± 20.5	0.159
12	0 ± 0	7.5 ± 19.7	0.005*
18	0 ± 0	0 ± 0	---
24	0 ± 0	4.17 ± 16.1	0.05

**P < 0.05 considered as statistically significant; Data presented as mean ± SD*

Table 4: Number of patients requiring postoperative morphine

Postoperative Time (h)	Group 1 (With Block) (N = 56)	Group 2 (Without Block) (N = 60)	P-value
0	8 (14.3%)	18 (30%)	0.043*
6	2 (3.6%)	6 (10%)	0.274
12	0 (0%)	8 (13.3%)	0.006*
18	0 (0%)	0 (0%)	---
24	0 (0%)	4 (6.7%)	0.119

P < 0.05 considered as statistically significant; Data presented as number (%)

3.3. Postoperative morphine consumption

Patients in Group 1 required less morphine in the first 24 h after breast surgery at all times with a significant difference at T0 (P = 0.04) and 12 h after surgery (P = 0.005) (Table 3).

In the Group 2, 30% of the patients received morphine at T0 while in the Group 1, 14.3% of patients required morphine with a statistically significant difference (P = 0.043) (Table 4). 13.3% of Group 2 patients received morphine at T12 while none of Group 1 patients required morphine with a statistically significant difference (P = 0.006) (Table 4). There was no significant difference in morphine consumption at 6 h, 18 h and 24 h postop (Table 3).

3.4. PONV

There was no significant difference in PONV between both groups at 6 h, 12 h, 18 h and 24 h after surgery, although a smaller number of patients in Group 1 experienced PONV than Group 2 patients (P > 0.05 at all-time intervals) (Table 5).

4. DISCUSSION

The PECS I block, initially described by Blanco in 2011, involves the injection of local anesthetic into the interfascial space between the pectoralis major and minor muscles to block the lateral pectoral nerve.[13] The modified PECS block, also known as PECS II block, was introduced in 2012, and it targets the interfacial plane between the pectoralis minor muscle and serratus anterior muscle to additionally block intercostobrachial, intercostals and the long thoracic nerve.[14] Although complications are rare when using ultrasound guidance, the most common complications associated with the block include pneumothorax and vascular puncture.[15]

This study aimed to use the medial approach to the PECS block, instead of the conventional lateral approach, as part of a multimodal analgesia plan in modified radical mastectomy, with a focus on assessing its efficacy in reducing postoperative opioid consumption and PONV.

Patients who received the PECS block required less morphine 12 h after modified radical mastectomy. A clinical trial comparing analgesic efficacy of general anesthesia with PECS block to general anesthesia alone in patients undergoing radical mastectomy, demonstrated a significant reduction in postoperative morphine consumption in the PECS group during the first 12 h.[16] Similar results were published in a meta-analysis by Zhao et al., where patients undergoing radical mastectomy who received the PECS block in addition to general anesthesia required significantly fewer postoperative opioids than patients who received general anesthesia alone.[17]

Although there was no significant difference in the occurrence of PONV between both groups, fewer patients in the PECS block group experienced PONV during the first 12 h compared to those who didn't receive the block. PONV can be extremely distressing for patients and are considered one of the major contributors to patients' dissatisfaction and discomfort after anesthesia.[18] In a prospective study by Khemka et al. patients who received PECS block had lower PONV scores at all times with statistically significant difference in the first 8 h postop.[19] However, a meta-analysis by Sun et al. yielded results similar to this study regarding PONV.[20]

Table 5: Postoperative nausea and vomiting in the groups

Postoperative Time (h)	Group 1 (With Block) (N = 56)	Group 2 (Without Block) (N = 60)	P-value
6	4 (7.1%)	10 (16.7%)	0.156
12	4 (7.1%)	8 (13.3%)	0.365
18	2 (3.6%)	2 (3.3%)	1.000
24	2 (3.6%)	2 (3.3%)	1.000

P < 0.05 considered as statistically significant; Data presented as number (%)

5. LIMITATIONS

This study has several limitations. Firstly, our study population was limited to

patients undergoing modified radical mastectomy at a single tertiary hospital center, which restricts the generalizability of our study findings. Secondly, as this is a retrospective study dependent on historical data that influences patient inclusion, the potential presence of selection bias should be acknowledged. Accordingly, caution is warranted when generalizing the results beyond the study population. Another limitation is the small number of patients included. Additionally, bias control related to subjective assessment of pain represented an additional limitation. Finally, other factors that were not within the scope of our analysis, including patients' comorbidities, chronic pain history, and concomitant medication use, including preoperative opioid use, may have influenced our findings.

5. CONCLUSION

Our study shows that the medial approach to the PECS block is associated with reduced postoperative morphine consumption, with no significant difference in PONV when compared to general anesthesia alone, results similar to those documented with the conventional PECS block approach. Nevertheless, prospective randomized trials comparing the lateral PECS approach to the medial approach are needed to comprehensively assess the efficacy and safety of this modified approach.

6. Data availability

Numerical data generated in the course of this trial is available with the authors on a reasonable request.

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8. Conflict of Interest

The authors of this study declare no conflict of interest.

9. Authors' contribution

GA: conceptualization, data curation, formal analysis, methodology, project administration, supervision, validation, writing-original draft, writing-review and editing.

LG, RAN, HB: data interpretation, writing-original draft, writing-review and editing.

SN. JD, YG, WM: data curation, project administration, writing-review and editing.

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