Efficacy of Pectoralis Nerve Block in Postoperative Pain Control in Breast Surgeries: Literature Review

Eficácia do bloqueio de nervo peitoral no controle da dor pós-operatória em cirurgias mamárias: Revisão bibliográfica

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Abstract

Introduction Proper postoperative pain management in breast surgeries reduces complications, improves patient comfort, and decreases opioid use. Pectoralis nerve (PECS) blocks I and II are effective peripheral analgesic techniques in this context, promoting hemodynamic stability and faster recovery. The present article reviews the literature on PECS block efficacy in breast surgery analgesia and its relationship with reduced opioid use.

Materials and Methods We performed a systematic search in the PubMed database using the keywords *breast surgery*, *pectoral nerve block*, and *opioid use*. We included clinical trials published from January 2016 to April 2023 in Portuguese, English, and Spanish on the effects of PECS blocks I and II in breast surgeries, with a focus on pain control, opioid use, antiemetic requirements, length of hospital stay, and associated complications. We selected 14 articles after applying the eligibility criteria.

Results The PECS blocks demonstrated superior postoperative analgesia and reduced opioid use compared to general anesthesia or other interfascial blocks. They also resulted in lower rescue analgesia requirements and fewer complications.

Conclusion The PECS blocks are an effective strategy for postoperative pain management in breast surgeries, reducing opioid use and its adverse effects, while promoting better patient recovery.

Keywords
- analgesia
- breast
- opioid analgesics
- pain
- postoperative pain

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Resumo

Introdução O controle adequado da dor pós-operatória em cirurgias de mamárias reduz complicações, melhora o conforto do paciente e diminui o consumo de opioides. Os bloqueios do nervo peitoral (*pectoralis nerve*, PECS, em inglês) I e II são técnicas analgésicas periféricas eficazes nesse contexto, pois promovem estabilidade hemodinâmica e recuperação mais rápida. Este artigo revisa a literatura sobre a eficácia do bloqueio PECS na analgesia para cirurgia de mama e sua relação com a redução do uso de opioides.

Materiais e Métodos A base de dados PubMed foi sistematicamente pesquisada utilizando os descritores *cirurgia mamária*, *bloqueio de nervo peitoral* e *consumo de opioide*. Foram incluídos ensaios clínicos publicados entre janeiro de 2016 e abril de 2023, em português, inglês e espanhol, que avaliaram o efeito dos bloqueios PECS I e II em cirurgias mamárias, considerando controle da dor, uso de opioides, necessidade de antieméticos, tempo de internação e complicações. Após aplicação dos critérios de elegibilidade, 14 estudos foram selecionados.

Resultados O bloqueio PECS demonstrou superioridade na analgesia pós-operatória e redução do consumo de opioides quando comparado a anestesia geral e a outros bloqueios interfasciais, além de menor necessidade de analgesia de resgate e menores taxas de complicações.

Conclusão O bloqueio PECS é uma estratégia eficaz no controle da dor pós-operatória em cirurgias mamárias, pois reduz a necessidade de opioides e seus efeitos adversos, o que favorece a recuperação do paciente.

Palavras-chave

- analgesia
- dor
- dor pós-operatória
- mama
- analgésicos opioides

Introduction

Pain results from a set of sensory, cognitive, emotional, autonomic, and behavioral organic responses. It is an essential part of the postoperative evolution. Poorly-controlled pain can trigger cardiovascular, metabolic, respiratory, gastrointestinal, urinary, and immunological abnormalities.[1]

In thoracic surgeries, pain, as well as other organofunctional disorders, hinders deep breathing, increases extracellular fluid, decreases lung compliance, and causes hypoventilation and hypoxemia, which can lead to atelectasis and respiratory infections. Therefore, postoperative pain control is a critical factor in patient recovery, postoperative morbidity and mortality, and quality of life.[2]

Pain control after breast surgery often uses opioids. These drugs frequently cause adverse events, including nausea, vomiting, sedation, pruritus, paralytic ileus, and urinary retention. These adverse events are uncomfortable for the patient and can increase the length of hospital stay. For better analgesic outcomes after breast surgery, combined with the benefit of reduced opioid use, peripheral analgesic blocks have been performed on the nerves responsible for innervating the pectoral muscles, such as the pectoralis nerve (PECS) block.[3,4]

The name of the technique depends on the block site. A block with local anesthesia injected only between the pectoralis major and minor muscles consists of a PECS I block (►**Fig. 1**). With the addition of an anesthetic injection between the pectoralis minor and the serratus anterior muscles, the technique receives the name of PECS II block (►**Fig. 2**).[5,6]

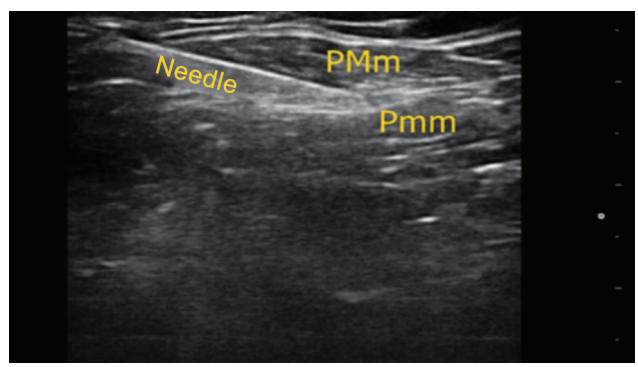

Fig. 1 Ultrasound anatomy of type-I pectoralis nerve (PECS) block.[5] **Abbreviations:** PMm, pectoralis major muscle; Pmm, pectoralis minor muscle.

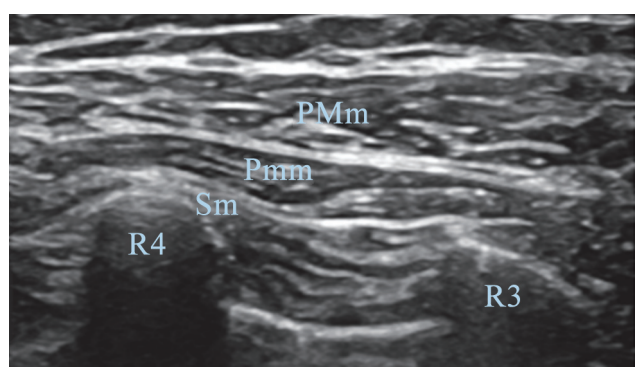

Fig. 2 Ultrasound anatomy of the pectoralis nerve (PECS) block II.[6] **Abbreviations:** PMm, pectoralis major muscle; Pmm, pectoralis minor muscle; Sm, serratus anterior muscle; R3, third rib; R4, fourth rib.

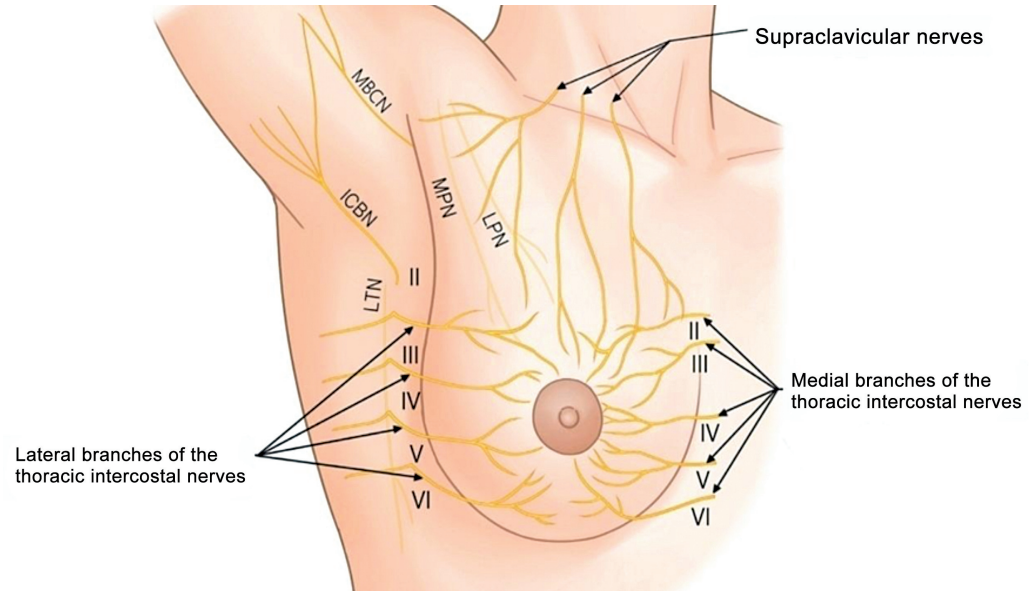

Fig. 3 Schematic representation of the nerves from the female breast and armpit.[6] **Abbreviations:** ICBN, intercostobrachial nerve; LPN, lateral pectoral nerve; LTN, long thoracic nerve; MBCN, medial brachial cutaneous nerve; MPN, medial pectoral nerve.

For the PECS I block, each site receives a bilateral injection of a 10-mL solution of local anesthetic (levobupivacaine, ropivacaine, or bupivacaine) diluted to a 0.25% concentration. For the PECS II block, also known as *modified PECS block*, in addition to the aforementioned administration, a volume of 20 mL of the same solution is injected between the pectoralis minor and serratus muscles. These two procedures block the medial and lateral pectoral nerves and the lateral cutaneous branches of the thoracic intercostal nerves.[2,7]

For better postoperative pain control, blocks of the peripheral nerves responsible for breast innervation are under study. These procedures block the supraclavicular nerves, lateral branches of the thoracic intercostal nerves, and medial branches of the thoracic intercostal nerves (►**Fig. 3**). These studies aim to provide greater postoperative comfort with better pain control, contributing to reduced opioid use and, as a result, decrease the complication rate from opioids and the length of hospital stay.[6,8,9]

It is worth noting that, as the breast tissue has several nerves, it is unfeasible to block all of them. Moreover, the painful stimulus depends on the surgical technique. Therefore, there may be significant variation in postoperative pain control depending on the type and performance of breast surgery.[8,9]

Therefore, the present article aims to review the literature on PECS I and II blocks for postoperative pain control in patients undergoing breast surgery and to evaluate the need for rescue opioids for pain control.

Materials and Methods

We performed a literature review in the PubMed database using the following Health Sciences Descriptors (Descritores em Ciências da Saúde, DeCS, in Portuguese) and Medical Subject Headings (MeSH): *breast surgery*, *pectoral nerve block*, and *opioid use*. We used the Boolean operators AND and OR for search refinement per the query strategy.

We included clinical trials published from January 2016 to April 2023, in Portuguese, English, and Spanish that evaluated the effects of PECS I and II blocks in breast surgeries. The outcomes analyzed included postoperative pain control, opioid use, antiemetic requirement, length of hospital stay, and block-associated complications.

The initial search identified 29 articles. After applying the eligibility criteria, we selected 14 clinical trials for the final analysis. The exclusion criteria were studies that did not specifically address the PECS block or that associated it with other regional blocks ($n = 10$), articles not about breast surgical procedures ($n = 2$), and studies that did not evaluate the PECS block for postoperative pain control ($n = 3$).

Two independent reviewers performed the study selection and solved disagreements by consensus. We used the Jadad scale to assess the methodological quality of the clinical trials, considering randomization, blinding, and description of losses to follow-up.

Results

Kim et al.[6] (2018) reported that the PECS II resulted in higher opioid use in the control group than in the block group (mean: 77.0 ± 41.9 µg versus 43.8 ± 28.5 µg respectively; $p < 0.001$), which indirectly resulted in lower blood pressure and heart rate variability (►**Fig. 4**).[6]

Karaca et al.[3] (2019) observed similar results, reporting lower opioid use during 24 hours in patients who underwent PECS compared to the control group (mean: 115.7 ± 98.1 µg versus 378.7 ± 54.0 µg respectively; $p < 0.001$), and a shorter hospital stay (24.4 ± 1.2 hours versus 27.0 ± 3.1 hours respectively; $p < 0.001$) (►**Fig. 4**).

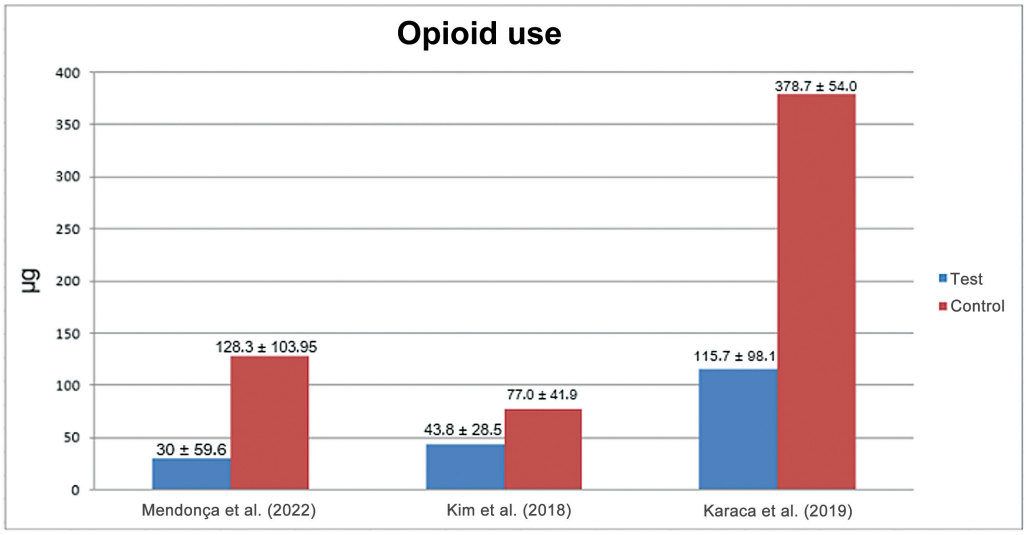

Fig. 4 Comparison of clinical outcomes between patients undergoing PECS I and II blocks versus the control group in different studies, presenting the average amount of opioid use in micrograms (µg).

Consistently, Najeeb et al.[10] (2019) compared the pain control provided by the PECS with a control group not undergoing a peripheral nerve block. Immediately after the end of surgery (hour 0), the mean pain score was of 1.05 ± 1.63 in patients undergoing the PECS, and of 2.42 ± 2.17 in the control group ($p < 0.001$). These findings were reinforced by the significantly lower pain scores in the test group during the first 24 hours postoperatively (0.32 ± 0.87 versus 1.52 ± 1.85; $p<0.001$), with a similar pattern observed in the other evaluations performed throughout the period.

In addition to the excellent postoperative pain control, Mendonça et al.[2] (2022) observed that only 23.3% of patients undergoing PECS block required intraoperative fentanyl, compared with 83.3% in the control group (relative risk [RR]=0.28; 95% CI: 0.14 -0.54; p=0.0002). The mean fentanyl administered was also significantly lower in the test group (30±59.6 µg) compared to the control group (128.3±103.95 µg; $p<0.001$), representing an approximately four-fold reduction.

Regarding block performance before or after surgery, Ciftci et al.[5] (2021) divided patients into 3 groups: the first underwent a preoperative PECS I block, before surgical incision; the second underwent a PECS I block after the end of surgery; and the third received no block (control group). The authors monitored the patients from the first to the 24th hours postoperatively using the visual analog scale (VAS) for pain. The findings[5] showed better pain control in the first group throughout the studied period than in the control group ($p < 0.001$). The second group did not present better pain control in the first hour after surgery compared to the controls, but presented reduced pain at the 24-hour assessment ($p < 0.001$).[5]

Discussion

Since the description of the PECS block technique in 2011, several studies, such as those herein cited, have demonstrated its broad benefits. The outcomes show reduced opioid use in the postoperative period, which indirectly reflects better pain control, leading to greater patient comfort not only in terms of pain, but also in reduced blood pressure and heart rate variability. In addition, there was a significant decrease in the number of opioid side effects.[2,11]

The question about the best time to perform the block (before, during, or after surgery) is answered by Ciftci et al.[5] (2021), who showed better pain control throughout the period evaluated when the block was performed before the surgical incision. Despite this, it is worth emphasizing that the block also showed benefits when performed after surgery compared with patients who did not receive it, once again clarifying the benefit of the technique.[5,12]

Najeeb et al.[10] (2019) reaffirmed this finding when analyzing the numerical pain scale (NPS), showing the important postoperative pain control provided by PECS blocks immediately, 30 minutes, 6 hours, 12 hours, and 24 hours after the end of surgery. Patients undergoing PECS presented mean NPS scores at 0, 0.5, 6, 12, and 24 hours of 1.05 ± 1.63, 1.35 ± 1.23, 0.8 ± 1.23, 0.48 ± 0.72, and 0.32 ± 0.87 respectively ($p < 0.001$), while patients not undergoing the PECS block presented, in the same period, mean scores of 2.42 ± 2.17, 1.90 ± 1.38, 2.25 ± 1.90, 1.70 ± 2.02, and 1.52 ± 1.85 respectively ($p < 0.001$). An analogous study by Altıparmak et al.[13] (2019) found similar results. In addition to better pain control and, consequently, a reduction in opioid use, Mendonça et al.[2] (2022) showed a decrease in the mean length of hospital stay, of 41.2 ± 13.4 hours in the group undergoing PECS compared with 45.1 ± 15.4 hours in the placebo group.

During breast surgery preparation, it is possible to perform several other blocks rather than the PECS block, including the paravertebral thoracic block and the erector spinae muscle block. Martsiniv et al.[14] (2020) evaluated and compared these

blocks to determine the best alternative for breast surgeries. In a study by Eskandr et al.[8] (2022), the PECS block showed better benefits in postoperative pain control, reduced opioid use during and after surgery, and reduced nausea and vomiting. In addition to the benefits regarding postoperative pain control, compared to other regional block techniques, PECS presented a lower risk of complications such as pneumothorax, abscesses, neuritis, local anesthetic toxicity, vascular puncture, and hematomas, which are undesirable complications, especially in surgeries performed in a day hospital setting.[8,14]

As PECS II blocks provide analgesia in part of the breast and armpit region, Kim et al.[6] (2018) reinforced that they can result in excellent postoperative pain control in the first 24 hours in breast surgeries, consistent with Karaca et al.[3] (2019) and other studies reporting that the PECS II block, in addition to the excellent effect on postoperative pain control, significantly reduced opioid use and hospital stays.

Given the evidence from these studies, it is critical to encourage the dissemination and implementation of PECS I and II blocks in breast surgeries, since several clinical trials have proven their benefits and superiority in postoperative pain control and, consequently, reduced opioid use, lower risks inherent to the procedure, and greater patient comfort, results that lead to shorter hospital stays.[6,7]

Conclusion

The current review demonstrated that PECS I and II blocks provide effective postoperative pain control in breast surgeries, significantly reducing opioid use and its adverse effects and improving hemodynamic stability and patient comfort. The review also showed that preoperative blocks result in better pain control in the first 24 hours after surgery, although the technique also yields benefits when performed after surgery. In addition to pain relief, reduced opioid use is associated with a lower incidence of nausea, vomiting, and other side effects, favoring patient recovery and reducing hospital stay.

Despite the assumption that PECS II blocks would present a better analgesic effect than PECS I blocks because they cover a larger area, the literature analyzed did not prove it. Other variables studied to improve the technique include anesthetic dose, type, and concentration for injection into the block sites, which can increase the duration of pain control. Considering the benefits, we concluded that the implementation of PECS blocks in the clinical practice should be encouraged as part of the multimodal pain management in breast surgeries. Future studies with larger samples and cost-benefit analyses may contribute to consolidate this technique as a standard in perioperative analgesia.

Clinical Trials
None.

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Conflict of Interests
The authors have no conflict of interests to declare.

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