



# The emerging role of pectoral nerve block (PECS block) in breast surgery: A case-matched analysis

Alessandro Fancellu MD, PhD, FACS | Teresa Perra MD | Chiara Ninniri MD |  
Pietrina Cottu MD | Giulia Deiana MD | Claudio F. Feo MD, FACS | Alberto Porcu MD

Department of Medical, Surgical and Experimental Sciences, Unit of General Surgery 2, University of Sassari, Sassari, Italy

## Correspondence

Alessandro Fancellu, MD, PhD, FACS, Department of Medical, Surgical and Experimental Sciences, Unit of General Surgery 2, University of Sassari, V.le San Pietro 43, 07100 Sassari, Italy.  
Email: afancel@uniss.it

## Abstract

To evaluate the benefits of pectoral nerve block (PECS block) in breast cancer surgery, we compared outcomes of 100 patients receiving PECS vs 107 without PECS. Intraoperative use of fentanyl ( $P < .001$ ) acetaminophen ( $P = .02$ ), morphine ( $P < .01$ ), and nonsteroidal anti-inflammatory drugs (NSAIDs) ( $P < .01$ ) was lower in the PECS group. Occurrence of postoperative nausea and vomiting (PONV) was lower in the PECS group ( $P = .04$ ). On postoperative day 1, the use of acetaminophen ( $P = .23$ ), morphine ( $P = .83$ ), and NSAIDs ( $P = .4$ ) did not differ. Twenty-one patients received surgery with PECS block plus sedation alone. PECS block can reduce intraoperative use of opioids and analgesic drugs, and is associated with reduced occurrence of PONV. Selected patients can receive breast-conserving surgery with PECS plus sedation, avoiding general anesthesia.

## KEYWORDS

breast conserving surgery, mastectomy, PECS block

## 1 | INTRODUCTION

The advance in the knowledge of sensitive innervation of the breast and the widespread use of ultrasound have led to the development of new types of interfascial plane blocks, such as the pectoral nerve blocks (PECS blocks), that can be added to general anesthesia to improve perioperative pain management and control in breast cancer surgery. PECS blocks' combination acts by blocking the long thoracic and thoracodorsal nerves in addition to the lateral branches of the intercostal nerves. The latter innervate the mammary gland and the skin from the 2nd to 6th thoracic dermatomes; as a consequence, PECS blocks prove to be useful in both breast-conserving surgery (BCS) and mastectomy with or without axillary lymphadenectomy.<sup>1-3</sup>

Potential benefits of adding regional blocks to general anesthesia include reduced perioperative use of opioids, thus limiting adverse effects such as respiratory complications, postoperative nausea and vomiting (PONV), and other symptoms related to abuse for pain control.<sup>1,4,5</sup> In addition, some studies have underscored that the use of

opioids may negatively impact on survival outcomes in patients undergoing multimodality treatment for cancer.<sup>2,3,6,7</sup>

We performed a case-matched study to assess the potential advantages of adding PECS to general anesthesia in patients with early breast cancer. A secondary aim was to identify a selected subgroup of patients that might receive PECS blocks plus conscious sedation, avoiding general anesthesia.

## 2 | MATERIAL AND METHODS

Data were collected of patients operated for breast cancer between January 2017 and August 2019. We identified two cohorts of patients: one in which the PECS block was performed (PECS group), and the other one in which it was not (no-PECS group). Each patient who underwent PECS block was matched by preoperative characteristics including age, body mass index (BMI), tumor histology, and type of surgery, to a patient who did not undergo PECS block. All patients, except those receiving BCS for DCIS, underwent sentinel

node biopsy. For induction of anesthesia, 1-2 µg/Kg fentanyl and 2-3 mg/Kg propofol were injected intravenously. After tracheal intubation, anesthesia was maintained with fentanyl 1-2 µg/kg and 1.0-1.5 MAC sevoflurane. Fentanyl and cisatracurium were used to maintain the heart rate and blood pressure at about 20% of the preoperative baseline value. PECS blocks were carried out under ultrasound guidance, using a high-frequency linear array transducer and a 21-gauge 50-mm needle. For PECS 1, ropivacaine 0.375% were injected between the pectoralis major and pectoralis minor muscles. For PECS 2, the ropivacaine was injected over the 3rd and 4th ribs between the pectoralis minor and serratus anterior muscles.

Patients undergoing BCS for cancers located in the medial aspect of the breast also received a parasternal block. In patients also receiving paravertebral block (PVB), it was performed under ultrasound guidance with the patient in lateral position before anesthesia induction. Patients with low-BMI candidate to BCS and sentinel node biopsy were offered to receive PECS block and conscious sedation alone, without general anesthesia. Patients' demographic, tumor characteristics, intraoperative, and postoperative variables were summarized using descriptive statistics. Continuous variables were compared using the *t* test. Differences in proportions between the groups were evaluated using the chi-square test. All *p* values lower than 0.05 were considered statistically significant.

### 3 | RESULTS

One-hundred patients underwent PECS block for breast surgery. These were matched to 107 patients who did not undergo neither PECS nor other regional blocks. There were no significant differences between the two groups in regard to mean age (*P* = .87), ASA

physical status (*P* = .84), tumor histotype (*P* = .31), and surgical procedure (*P* = .52; Table 1).

In the PECS group, 15 patients received PECS 1 block, 33 PECS 2, and 52 a combination of PECS 1 and 2. In 11 patients receiving mastectomy and immediate reconstruction, a PVB was also associated, while in 6 patients receiving BCS for tumors located in the inner quadrants, a parasternal block was associated.

Mean duration of surgery was similar in the two groups (*P* = .17). Percentage of patients who were given intraoperative acetaminophen (71% vs 88.8%, *P* = .02), morphine (3.0% vs 16.8%, *P* < .01), and NSAIDS (36% vs 77.6%, *P* < .01) was statistically lower in the PECS group. Also, fentanyl consumption was lower in the PECS group (*P* < .001; Table 2).

Occurrence of PONV was significantly lower in the PECS group (*P* = .04). Total number of patients requiring postoperative analgesic drugs was similar in the two groups (*P* = .69). On postoperative day 1, percentage of patients who were given acetaminophen (5% vs 9.3%, *P* = .23), morphine (1.0% vs 0.9%, *P* = .96), and NSAIDS (8% vs 1.9%, *P* = .4) did not differ in the two groups. Mean hospital stay was similar (*P* = .43).

Twenty-one patients underwent surgery without general anesthesia. Mean age was 68.3 years and mean BMI was 27.3. The use of PECS 1, PECS 2, and PECS 1 + 2 was 19.0%, 42.8, and 38.2%, respectively. In 13 cases, an additional block was performed (PVB in 11 patients and parasternal block in 2). Mean duration of surgery was 61.7 minutes. As for the using of intraoperative drugs, none of the patients received morphine; acetaminophen was given to 8 (38.1%), and NSAIDS in 3 (10.7%) of them. Mean duration of hospital stay was 1 day. On postoperative day 1, no patient needed morphine or NSAIDS, while 3 were given acetaminophen (Table 3).

**TABLE 1** Demographic and clinico-pathological characteristics of the study population

Characteristics	Total (n = 207)	PECS (n = 100)	No-PECS (n = 107)	<i>P</i> value
Age (mean, SD, range)	63.0 ± 13.1 (29-90)	62.9 ± 12.7 (36-88)	62.5 ± 13.6 (29-90)	.87
BMI (mean, SD, range)	26.0 ± 4.4 (16.2-29.9)	26.1 ± 5.6 (19.3-39.9)	26.2 ± 4.25 (16.9-39.9)	.96
ASA				.84
I	34 (16.4%)	15 (15.0%)	19 (9.2%)	
II	160 (77.3%)	79 (79.0%)	81 (75.7%)	
III	13 (6.3%)	6 (6.0%)	7 (3.4%)	
Surgical procedure				.52
BCS	128 (61.8%)	63 (63.0%)	65 (60.8%)	
Mastectomy	44 (21.3%)	23 (23.0%)	21 (19.6%)	
Mastectomy + IR	35 (16.9%)	14 (14.0%)	21 (19.6%)	
Histology				.31
DCIS	29 (14.0%)	11 (11.0%)	18 (16.8%)	
IDC	156 (75.4%)	80 (80.0%)	76 (71.0%)	
ILC	22 (10.6%)	9 (9.0%)	13 (12.2%)	

Abbreviations: ASA, American Society of Anesthesiologists; BCS, breast-conserving surgery; BMI, body mass index; DCIS, ductal carcinoma in situ; IDC, invasive ductal carcinoma; ILC, invasive lobular carcinoma; IR, immediate reconstruction.

**TABLE 2** Intraoperative data

Characteristics	Total (n = 207)	PECS (n = 100)	No-PECS (n = 107)	P value
Duration of surgery (min; mean ± SD)	97.14 ± 62.07	91.15 ± 57.9	102.8 ± 65.5	.17
Acetaminophen	166 (80.2%)	71 (71%)	95 (88.8%)	.02
Morphine consume	21 (10.1%)	3 (3.0%)	18 (16.8%)	<.01
NSAIDS consume	119 (57.5%)	36 (36.0%)	83 (77.6%)	<.01
Fentanyl consume (µg/Kg/h; mean ± SD)	2.12 ± 1.55	1.62 ± 1.26	2.63 ± 1.64	<.001

Abbreviation: NSAIDS, nonsteroidal anti-inflammatory drugs.

## 4 | DISCUSSION

The main results of the present study are that PECS block was associated with both reduced consumption of opioids as a component of balanced anesthesia and lower intraoperative requirement of intraoperative analgesics, such as acetaminophen and NSAIDS. The use of both fentanyl and morphine during surgery was significantly

**TABLE 3** Characteristics of patients receiving PECS + conscious sedation only

Characteristics	N (%)
Age (mean)	68
BMI (mean)	27.3
ASA	
1	2 (9.5%)
2	18 (85.7%)
3	1 (4.8%)
Tumor histology	
Invasive carcinoma	16 (76.2%)
In situ carcinoma	5 (23.8%)
Type of surgery	
BCS	21 (100%)
Type of PECS block	
PECS I	4 (19.0%)
PECS II	9 (42.8%)
PECS I + II	8 (38.2%)
Additional locoregional blocks	
PECS + PVB	11 (52.4%)
PECS + PS	2 (9.5%)
Duration of surgery (min) mean	61.7
Intraoperative drug use	
Morphine	0 (0%)
Acetaminophen	8 (38.1%)
NSAIDS	3 (14.3%)
Postoperative drug use (24 h)	
Morphine	0 (0%)
Acetaminophen	3 (14.3%)
NSAIDS	0 (0%)
PONV	0(0%)

lower in the PECS group. This is consistent with the results of randomized studies comparing PECS block plus general anesthesia versus general anesthesia alone.<sup>8,9</sup>

Several studies highlighted the advantages of PECS block over PVB that was the most used regional block until the advent of interfascial blocks, as it rarely causes major complications such as pneumothorax and bleeding, and avoids the risk of spinal cord injury and epidural hematoma.<sup>1,4,5,10</sup>

Nonetheless, it should be recognized that different regional nerve blocks are often associated to better cover the surgical area, especially during mastectomy. In our study, PVB was performed along with PECS in 11% of patients.

PONV is a opioid-related side effect commonly observed in patients undergoing breast surgery. These postoperative symptoms may lead not only to increased patients suffering, but also contribute to a prolonged hospital stay and related costs.<sup>11</sup> In our series, the incidence of PONV was lower in the PECS group, as a possible consequence of reduced intraoperative use of opioids.

As for the use of analgesics drugs in postoperative day 1, although none of the patients in the PECS group received morphine, we did not observe reduced requirement of postoperative analgesics related to the use of PECS block. Similar results were reported by Kim et al.<sup>12</sup> A possible explanation for those results can be found in the bias related to the retrospective nature of our study. However, essentially few patients in both groups required analgesics in postoperative day 1 (22% vs 24.3%,  $P = .69$ ), and only two of them, belonging to the no-PECS group, necessitated morphine for pain relief.

Looking at the present literature, most cases of PECS block are performed under general anesthesia. To note, 21 patients in the present study underwent surgery with PECS block and conscious sedation, without general anesthesia. In our opinion, this represents the most interesting aspect of PECS block, since this allows to perform breast surgery avoiding the possible risks and inconveniences of general anesthesia and oro-tracheal intubation.<sup>13</sup> In that subgroup, we did not observe patients complaining of PONV, nor requiring morphine use during the intraoperative or postoperative period. All the 21 patients received BCS that is the most common form of surgical treatment in patients with both in situ and invasive breast cancer.<sup>14</sup>

In line with similar reports, we noticed that in more than half of the patients (61.9%), PECS block was associated with additional regional blocks, such as PVB and parasternal block. Scholars highlighted that none of the regional block effectively covers the whole of breast and

axilla; therefore, a combination of blocks is often needed, depending on the site of incision and extent of surgical resection.<sup>5,11</sup> However, the current trend at our institution is toward a more exclusive use of PECS block, with possible additional parasternal block when an incision in the medial breast quadrants is needed. It is likely that the demand for awake breast surgery will increase in the near future.

There has been growing interest in the benefits of reducing or avoiding use of opioids in breast cancer surgery. In fact, opioids were linked to inhibition of cellular and humoral immune response that may lead to an increased risk of local recurrence and distant metastases.<sup>5,7,8</sup>

On the other hand, analgesics such as NSAIDs may influence immunity by preventing or attenuating the surgical stress response that is responsible to some extent for the perioperative depression of antitumoral cellular immunity.<sup>7</sup> PECS and other regional anesthesia blocks reduce afferent neural transmission, thus preventing noxious afferent inputs from reaching the central nervous system, and mitigating the stress response to surgery. It is plausible that this may attenuate the action of perioperative factors that promote tumor growth and spread. Albeit further evidence is required, it is likely that regional nerve blocks may act in maintaining the balance of the immune function by reducing general anesthesia requirements and by sparing perioperative use of opioids.<sup>6,7</sup>

## 5 | CONCLUSIONS

PECS blocks in patients undergoing surgery for breast cancer represent a safe and relatively simple procedure that permits to reduce the intraoperative use of opioids and analgesic drugs; furthermore, they are associated with reduced PONV. Selected patients can receive PECS blocks without general anesthesia for their surgery.

### ORCID

Alessandro Fancellu  <https://orcid.org/0000-0002-3997-8183>

### REFERENCES

- Choi JJ, Jo YY, Kim SH, et al. Remifentanyl-sparing effect of pectoral nerve block type II in breast surgery under surgical pleth index-guided analgesia during total intravenous Anesthesia. *J Clin Med*. 2019;8:pii:E1181.
- Blanco R. The 'pecs block': a novel technique for providing analgesia after breast surgery. *Anaesthesia*. 2011;66:847-848.
- Blanco R, Fajardo M, Parras MT. Ultrasound description of PECS II (modified PECS I): a novel approach to breast surgery. *Rev Esp Anestesiol Reanim*. 2012;59:470-475.
- Singh PM, Borle A, Kaur M, Trikha A, Sinha A. Opioid-sparing effects of the thoracic interfascial plane blocks: A meta-analysis of randomized controlled trials. *Saudi J Anaesth*. 2018;12:103-111.
- Garg R, Bhan S, Vig S. Newer regional analgesia interventions (fascial plane blocks) for breast surgeries: Review of literature. *Indian J Anaesth*. 2018;62:254-262.
- Exadaktylos AK, Buggy DJ, Moriarty DC, Mascha E, Sessler DI. Can anesthetic technique for primary breast cancer surgery affect recurrence or metastasis? *Anesthesiology*. 2006;105:660-664.
- Forget P, Vandenhende J, Berliere M, et al. Do intraoperative analgesics influence breast cancer recurrence after mastectomy? A retrospective analysis. *Anesth Analg*. 2010;110:1630-1635.
- Khemka R, Chakraborty A, Agrawal S, Ahmed R. Is COMBIPECS the answer to perioperative analgesia for breast surgery? A double blinded randomized controlled trial. *Indian J Anaesth*. 2019;63:530-536.
- Bashandy GM, Abbas DN. Pectoral nerves I and II blocks in multimodal analgesia for breast cancer surgery: A randomized clinical trial. *Reg Anesth Pain Med*. 2015;40:68-74.
- Kelly ME, Mc Nicholas D, Killen J, Coyne J, Sweeney KJ, McDonnell J. Thoracic paravertebral blockade in breast surgery: Is pneumothorax an appreciable concern? A review of over 1000 cases. *Breast J*. 2018;24:23-27.
- Cali Cassi L, Biffoli F, Francesconi D, Petrella G, Buonomo O. Anesthesia and analgesia in breast surgery: the benefits of peripheral nerve block. *Eur Rev Med Pharmacol Sci*. 2017;21:1341-1345.
- Kim DH, Kim S, Kim CS, et al. Efficacy of pectoral nerve block Type II for breast-conserving surgery and sentinel lymph node biopsy: a prospective randomized controlled study. *Pain Res Manag*. 2018;2018:4315931.
- Simpson J, Ariyathenam A, Dunn J, Ford P. Breast surgery using thoracic paravertebral blockade and sedation alone. *Anesthesiol Res Pract*. 2014;2014:127467.
- Fancellu A, Sanna V, Sedda ML, et al. Benefits of Organized Mammographic Screening Programs in Women Aged 50 to 69 years: A Surgical Perspective. *Clin Breast Cancer*. 2019;19:637-642.

**How to cite this article:** Fancellu A, Perra T, Ninniri C, et al. The emerging role of pectoral nerve block (PECS block) in breast surgery: A case-matched analysis. *Breast J*. 2020;00:1-4. <https://doi.org/10.1111/tbj.13939>