Int J Cancer Manag. 2020 May; 13(5):e98879. doi: 10.5812/ijcm.98879.

Published online 2020 April 19. **Research Article**

The Effect of Pectoral Nerves Blocks on Narcotic Consumption and Pain Intensity in the Patients Undergoing Breast Cancer Surgery

Alireza Mirkheshti [1], Elham Memary [1], Shahram Sayyadi [1], Majid Samsami [2,*] and Seyed Hassan Motevalli [1]

[1]Department of Anesthesiology, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2]Cancer Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

[*]*Corresponding author*: Cancer Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Email: samsamimd@gmail.com

Received 2019 October 14; **Revised** 2020 January 19; **Accepted** 2020 February 02.

Abstract

Background: To decrease postoperative pain (PP) control, opioid requirement, and outcome improvement, regional anesthesia or preoperative analgesia is routinely performed as an alternative to general anesthesia. Thoracic wall nerve blocks, such as the pectoral nerves (PECS) block have recently become popular for preoperative pain control in patients undergoing breast cancer (BC) surgery.
Objectives: The current study was designed to evaluate the effect of PECS anesthesia on the fentanyl and propofol consumption, as well as time to the first request to analgesia in the patients with BC surgery.
Methods: A total of 22 women aged 20 to 75 years old with biopsy-proven BC were randomized to receive either propofol general anesthesia with PECS or total intravenous anesthesia without PECS in a randomized clinical trial. Total propofol and fentanyl dose and time to the first request for postoperative analgesia were assessed and compared in both groups.
Results: The obtained data showed no significant difference in the total dose of fentanyl and propofol between the two groups. However, the PECS group showed a significant increase in time to the first request for postoperative analgesia.
Conclusions: The PECS block in combination with general anesthesia for BC surgery significantly increased time to the first request to analgesia and was effective for reducing PP in the recovery room. PECS block combined with general anesthesia did not reduce the intraoperative use of fentanyl and propofol compared with the control group injected with normal saline.

Keywords: Fentanyl, Propofol, PECS Block, Breast Cancer

1. Background

Despite the advance in surgical technique with less invasive procedures, breast cancer (BC) surgery is still associated with moderate to severe postoperative pain (PP) that can impede recovery on postoperation (1). To decrease PP control, opioid requirement, outcome improvement, and side effect decrease, regional anesthesia or preoperative analgesia is routinely performed as an alternative to general anesthesia (2, 3). Minimizing analgesic-related adverse effects, as well as maximizing PP relief, is vital to postoperative patients' recovery (4). Preoperative analgesia for BC surgery consumes significant quantities of opioids compared to cosmetic breast surgeries. Thoracic wall nerve blocks, such as pectoral nerves (PECS) block, have recently become popular for preoperative pain control in patients undergoing BC surgery (5). Ultrasound-guided (US) modified PECS initially described for cosmetic BC surgeries provides excellent analgesia (1). It has been shown that thoracic paravertebral block in combination with general anesthesia improves the quality of recovery (6, 7). Several clinical trials have shown the positive results of analgesic drugs in the PECS block in BC surgery. However, it has been recently shown that the PECS block does not effectively block the sensory nerves nor does it exert additional analgesic effects.

2. Objectives

Therefore, the current study was designed to elucidate the effect of PECS anesthesia on the fentanyl and propofol consumption, as well as time to the first request to analgesia in the patients with BC surgery (1, 8).

3. Methods

3.1. Ethical Statement

The Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (SBMU.MSP.REC.1397.110) ap-

proved the study protocol. All patients were included after signing the written informed consent form.

A total of 22 female BC patients with ASA status I and II aged 20 to 75 years old with the same pathologic grade of BC without any history of surgery, coagulation disorders, sensitivity to local anesthetic, and opioid or drug users were included in this study and divided into two groups receiving either propofol general anesthesia with PECS or standard propofol general anesthesia in a randomized clinical trial. The exclusion criteria were hemorrhage more than 20% of the total blood volume and any hemodynamic change resulted from arrhythmia. Routinely, all patients were monitored for vital signs such as peripheral oxygen saturation (Spo2), mean arterial blood pressure (ABP), bispectral (BIS) index, baseline measurements of heart rate (HR), electrocardiogram, and depth of anesthesia in the operating room.

A standardized anesthetic regimen consistent with premedication with intravenous administration of fentanyl 2 μg/kg and midazolam 0.02 mg/kg was applied to creating a desirable BIS index (60 - 80). Infusion of 5 cc/kg normal saline was done before anesthesia induction for all patients. The anesthesia was induced by IV administration of atracurium 0.5 mg/kg and propofol 1 to 2 mg/kg with the goal of the BIS index between 40 and 60.

Propofol infusion of 100 to 200 μg/kg/min continued to maintain the anesthesia. The depth of anesthesia was maintained in a range of 50 $\pm$ 10 associated with BIS monitoring. BC patients received bolus fentanyl 1 μg/kg based on the requirement. If any patient was involved with systolic hypertension more than 20% of its baseline with the maintenance of BIS and without muscular response, this dose of fentanyl would be repeated in both groups.

After the establishment of general anesthesia, PECS-II and PECS-I were performed, using 10 and 20 mL of 0.25% Ropivacaine Molteni (5 mg/mL), respectively, by S-Nerve ultrasound apparatus (SonoSiteInc, Bothell, USA) and a 10 to 15 MHz linear transducer (SonoSiteInc, Bothell, USA) as previously described (9). A 22-gauge, 80 mm-long Stimuplex needle ultra 360 (B-Braun^{TM}, Germany) was used to perform the block. For the PECS II injection, the area between the pectoralis minor and serratus anterior muscles above the fourth ribs was selected to conduct the needle. Pectoral I was blocked by the injection of Ropivacaine between pectoralis minor and major.

All patients underwent axillary surgery such as sentinel lymph node (s) biopsy or dissection. Fentanyl consumption during surgery and the first request for postoperative analgesia was recorded and compared for each group. The control group received normal saline instead of Ropivacaine in the same manner.

All patients were familiarized with the numerical rating scale (NRS) of pain before surgery, which is a scale for self-reporting of pain. The postoperative NRS > 3 was considered as the first time of request for analgesia; so, the infusion of morphine through a patient-controlled analgesia pump was started. A person, who assessed the pain, was blind in this study.

3.2. Statistical Analysis

The data were analyzed, using SPSS 20 (SPSS Inc., Chicago, Ill., USA). All data are expressed as mean $\pm$ standard deviation (SD). The effect of PECS-II and PECS-I on Fentanyl consumption and the first request for analgesia were compared between two groups, using independent *t* test. A value of $P < 0.05$ was considered statistically significant.

4. Results

The demographic data of 22 enrolled patients were presented in Table 1. There were no significant differences between the two groups in terms of demographic data ($P > 0.05$).

Table 1. Demographic Results in Both Groups

Variables	Groups		P Value
	Control (Mean $\pm$ SD)	PECS (Mean $\pm$ SD)	
Age	46.36 (11.02)	48.67 (12.63)	0.377
Time of surgery (min)	123.18 (31.72)	117.92 (27.58)	0.675
HR before induction	87.18 (14.51)	75.92 (16.90)	0.103
HR post induction	83.00 (14.15)	75.67 (17.21)	0.280
P value	0.121	0.883	
SBP before induction	133.09 (16.47)	126.66 (27.50)	0.501
SBP post induction I	122.09 (15.82)	118.75 (21.51)	0.678
P value	0.038	0.148	
DBP before induction	80.54 (6.81)	75.33 (14.77)	0.287
DBP post induction	76.72 (8.48)	74.66 (13.36)	0.667
P value	0.246	0.844	
Time of surgery (min)	123.18 (31.72)	117.92 (27.58)	0.364

Abbreviations: HR, heart rate; PECS, pectoral nerves

The assessment of the total administrated dose of fentanyl and propofol, as well as the first request to analgesia drug in both control and PECS groups, is also shown in Table 2. Although there was no significant difference between the PECS group compared to the control group in terms of fentanyl and propofol consumption, the first request to analgesia was significantly increased in the PECS group compared to the control group (Table 2).

Table 2. Total Dose Fentanyl and Propofol Consumption in Both Groups

Variables	Groups		P Value
	Control (Mean ± SD)	PECS (Mean ± SD)	
Total fentanyl dose (μg)	230.45 (60.22)	211.36 (25.89)	0.351
Total propofol dose (mg)	1130.91 (343.05)	1094.55 (187.20)	0.761
The first request to analgesia (min)	26.54 (8.00)	71.66 (30.77)	< 0.001

5. Discussions

The aim of this study was to evaluate the effect of PECS anesthesia on opioid consumption and time to the first request to analgesia in patients with BC surgery. An increase in the usage of peripheral nerve blocks (PNB), as a part of comprehensive anesthesia care regimens, has been currently developed (10). Thoracic interfascial plane PECS have recently gained popularity for analgesic potential during breast surgery such as BC mastectomy (11). The advent of US regional anesthesia has further improved anesthesiologist's skills in such peripheral block (9). We have found that Pectoral I and II blocked by the injection of Ropivacaine significantly increased time to the first request for analgesia on recovery in the patients undergoing BC surgery. These findings show that PECS block combined with general anesthesia can reduce PP in the patients, who underwent BC surgery compared to general anesthesia alone in the recovery room. Some of the researchers have shown that the local anesthetic agents can enter the systemic circulation and suppress the functioning of the sodium channel in the central nervous system (CNS) leading to sedation (12-14). The analgesic effect of the PECS block has been clearly demonstrated during the intraoperative period (15). Even single-shot regional techniques have been shown to give excellent early analgesia (16).

The PECS block used in this study is a simple technique that was first described by Blanco (17) and innovative yet safer than much other regional anesthesia, in which a local anesthetic is injected into the interfascial muscle planes within the anterior thoracic wall. The first injection of 20 mL of Ropivacaine below pectoralis minor resulted in the spread of injectate local analgesia into the axilla at the level of the third rib addressed the sensory supply of the breast. In addition, the second injection of 10 mL between the pectoralis minor and major blocked both the pectoral nerves supplying the fascia over the pectoralis major adding to pain relief (5). Blocking the sensory supply to breast, axilla, and over the pectoral muscles has been shown to create adequate analgesia in the postoperative period (5). Over the last few years, the analgesic efficacy of PECS block in various thoracic surgeries such as BC surgery has been evaluated (18-20). Kamiya et al. (1) have found that the PECS block not only could reduce PP for up to 6 hours after surgery but also improves the quality of recovery. They have also reported that the PECS block does not affect the intraoperative requirement for remifentanil despite decreasing PP and the intraoperative requirement for propofol. In the present study, there was no significant difference between the two groups in terms of the requirement for propofol and fentanyl. These results may be due to the small sample size of the patients compared to other studies, in which they reported that PECS block can reduce propofol consumption (1, 11). However, the propofol dose-sparing might have been affected by the systemic effects of local anesthetics (1).

5.1. Conclusion

The PECS block in combination with general anesthesia for BC surgery showed the significantly increased time to the first request to analgesia and was effective for reducing PP. PECS block combined with general anesthesia did not reduce the intraoperative use of fentanyl and propofol compared with the control group. Further studies are required to investigate the various drugs effect, as well as using the catheter for pain control.

Footnotes

Authors' Contribution: AM and MS designed the study. EM, SHM and MRH collected the data. All the authors read and approved the study.

Conflict of Interests: The authors have no conflict of interest.

Ethical Approval: The Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (SBMU.MSP.REC.1397.110) approved the study protocol.

Funding/Support: None.

Informed Consent: All patients were included after signing the written informed consent form.

References

1. Kamiya Y, Hasegawa M, Yoshida T, Takamatsu M, Koyama Y. Impact of pectoral nerve block on postoperative pain and quality of recovery in patients undergoing breast cancer surgery: A randomised controlled trial. *Eur J Anaesthesiol.* 2018;**35**(3):215–23. doi: 10.1097/EJA.0000000000000762. [PubMed: 29227351].
2. Memary E, Mirkheshti A, Dabbagh A, Taheri M, Khadempour A, Shirian S. The Effect of Perineural Administration of Dexmedetomidine on Narcotic Consumption and Pain Intensity in Patients Undergoing Femoral Shaft Fracture Surgery; A Randomized Single-Blind Clinical Trial. *Chonnam Med J.* 2017;**53**(2):127–32. doi: 10.4068/cmj.2017.53.2.127. [PubMed: 28584791]. [PubMed Central: PMC5457947].
3. Divatia JV, Ambulkar R. Anesthesia and cancer recurrence: What is the evidence? *J Anaesthesiol Clin Pharmacol.* 2014;**30**(2):147–50. doi: 10.4103/0970-9185.129990. [PubMed: 24803747]. [PubMed Central: PMC4009629].

4. Joshi GP. Multimodal analgesia techniques and postoperative rehabilitation. *Anesthesiol Clin North Am*. 2005;**23**(1):185–202. doi: 10.1016/j.atc.2004.11.010. [PubMed: 15763418].
5. Thomas M, Philip FA, Mathew AP, Krishna KJ. Intraoperative pectoral nerve block (Pec) for breast cancer surgery: A randomized controlled trial. *Journal of anaesthesiology, clinical pharmacology*. 2018;**34**(3):318.
6. Lee WK, Kim MS, Kang SW, Kim S, Lee JR. Type of anaesthesia and patient quality of recovery: a randomized trial comparing propofol-remifentanil total i.v. anaesthesia with desflurane anaesthesia. *Br J Anaesth*. 2015;**114**(4):663–8. doi: 10.1093/bja/aeu405. [PubMed: 25500679].
7. Abdallah FW, Morgan PJ, Cil T, McNaught A, Escallon JM, Semple JL, et al. Ultrasound-guided multilevel paravertebral blocks and total intravenous anesthesia improve the quality of recovery after ambulatory breast tumor resection. *Anesthesiology*. 2014;**120**(3):703–13. doi: 10.1097/ALN.0000436117.52143.bc. [PubMed: 24071616].
8. Desroches J, Belliveau M, Bilodeau C, Landry M, Roy M, Beaulieu P. Pectoral nerves I block is associated with a significant motor blockade with no dermatomal sensory changes: a prospective volunteer randomized-controlled double-blind study. *Can J Anaesth*. 2018;**65**(7):806–12. doi: 10.1007/s12630-018-1122-2. [PubMed: 29600482].
9. Blanco R, Fajardo M, Parras Maldonado T. Ultrasound description of Pecs II (modified Pecs I): a novel approach to breast surgery. *Rev Esp Anestesiol Reanim*. 2012;**59**(9):470–5. doi: 10.1016/j.redar.2012.07.003. [PubMed: 22939099].
10. Syal K, Chandel A. Comparison of the post-operative analgesic effect of paravertebral block, pectoral nerve block and local infiltration in patients undergoing modified radical mastectomy: A randomised double-blind trial. *Indian J Anaesth*. 2017;**61**(8):643–8. doi: 10.4103/ija.IJA_81_17. [PubMed: 28890559]. [PubMed Central: PMC5579854].
11. 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**(1):103–11. doi: 10.4103/sja.SJA_382_17. [PubMed: 29416465]. [PubMed Central: PMC5789467].
12. Goyal R, Shukla RN. Local anesthetic systemic toxicity (LAST) - Should we not be concerned? *Med J Armed Forces India*. 2012;**68**(4):371–5. doi: 10.1016/j.mjafi.2012.02.011. [PubMed: 24532907]. [PubMed Central: PMC3862663].
13. Stewart J, Kellett N, Castro D. The central nervous system and cardiovascular effects of levobupivacaine and ropivacaine in healthy volunteers. *Anesth Analg*. 2003;**97**(2):412–6. table of contents. doi: 10.1213/01.ane.0000069506.68137.f2. [PubMed: 12873927].
14. Knudsen K, Beckman Suurkula M, Blomberg S, Sjovall J, Edvardsson N. Central nervous and cardiovascular effects of i.v. infusions of ropivacaine, bupivacaine and placebo in volunteers. *Br J Anaesth*. 1997;**78**(5):507–14. doi: 10.1093/bja/78.5.507. [PubMed: 9175963].
15. Isil CT, Cinar AS, Oba S, Isil RG. Comparison of Spinal Anaesthesia and Paravertebral Block in Unilateral Inguinal Hernia Repair. *Turk J Anaesthesiol Reanim*. 2014;**42**(5):257–63. doi: 10.5152/TJAR.2014.75508. [PubMed: 27366432]. [PubMed Central: PMC4894171].
16. O'Scanaill P, Keane S, Wall V, Flood G, Buggy DJ. Single-shot pectoral plane (PECs I and PECs II) blocks versus continuous local anaesthetic infusion analgesia or both after non-ambulatory breast-cancer surgery: a prospective, randomised, double-blind trial. *Br J Anaesth*. 2018;**120**(4):846–53. doi: 10.1016/j.bja.2017.11.112. [PubMed: 29576125].
17. Blanco R. The 'pecs block': a novel technique for providing analgesia after breast surgery. *Anaesthesia*. 2011;**66**(9):847–8. doi: 10.1111/j.1365-2044.2011.06838.x. [PubMed: 21831090].
18. Torre PA, Jones JJ, Alvarez SL, Garcia PD, Miguel FJG, Rubio EMM, et al. [Axillary local anesthetic spread after the thoracic interfacial ultrasound block - a cadaveric and radiological evaluation]. *Rev Bras Anestesiol*. 2017;**67**(6):555–64. Portuguese. doi: 10.1016/j.bjan.2016.10.009. [PubMed: 28867151].
19. Okmen K, Okmen BM, Uysal S. Serratus Anterior Plane (SAP) Block Used for Thoracotomy Analgesia: A Case Report. *Korean J Pain*. 2016;**29**(3):189–92. doi: 10.3344/kjp.2016.29.3.189. [PubMed: 27413485]. [PubMed Central: PMC4942648].
20. Fujiwara A, Komasawa N, Minami T. Pectoral nerves (PECS) and intercostal nerve block for cardiac resynchronization therapy device implantation. *Springerplus*. 2014;**3**:409. doi: 10.1186/2193-1801-3-409. [PubMed: 25120950]. [PubMed Central: PMC4128952].