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.MSPREC.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 ± 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 (SonoSitelnc, Bothell, USA) and a 10 to 15 MHz linear transducer (SonoSitelnc, Bothell, USA) as previously described (9). A 22-gauge, 80 mm-long Stimuplex needle ultra 360 (B-Braun, 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 ± 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).

| Variables                      | Control (Mean ± SD) | PECS (Mean ± SD) | P value |
|--------------------------------|---------------------|------------------|---------|
| Age                            | 46.36 (18.02)       | 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 (14.35)       | 75.67 (17.21)    | 0.280   |
| SBP before induction           | 133.09 (16.47)      | 126.66 (27.50)   | 0.508   |
| SBP post induction I           | 122.09 (15.82)      | 118.75 (21.51)   | 0.678   |
| DBP before induction           | 80.54 (6.81)        | 75.33 (14.77)    | 0.287   |
| DBP post induction I           | 76.72 (8.48)        | 74.66 (13.36)    | 0.667   |
| 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).
The PECS block in combination with general anesthesia 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.

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 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.

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

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