

ORIGINAL ARTICLE

Effectiveness of Pectoral Nerve Blocks (PEC II) for Post Operative Pain Management in Breast Surgery

Golam Ferdous Alam¹, Kazi Farhana², Nahida Parveen Nimmi³,
Salah Uddin Al Azad⁴, Hasina Akhtar⁵, Shyama Prasad Mitra⁵, Lutful Aziz⁵

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Abstract

Background: Breast surgery is one of the most performed surgeries in Bangladesh. Though there is growing interest in using regional anaesthesia in other surgeries, the use of regional anaesthesia modalities for postoperative pain management in breast surgery is still lacking. Post operative pain in breast surgery is moderate to severe and there is increased incidence of postoperative persistent pain. In this study, the effectiveness of pectoral nerve blocks (PECs II) was assessed in comparison to no regional anaesthesia and overall impact was identified in breast surgery.

Methods: This randomized controlled study was conducted from January 2022 to December 2022. Total 60 female adult patients undergoing elective unilateral modified radical mastectomy under general anaesthesia were allocated in two groups. 30 patients received PEC II block with general anaesthesia and other 30 patients only received general anaesthesia. All patients received pre-emptive analgesia oral Paracetamol (1g) 1 hour before surgery and Inj. Diclofenac (75 mg) at induction. Postoperative analgesia with numerical pain rating score (NPRS), perioperative haemodynamic status with mean arterial pressure (MAP), perioperative blood loss, timing of first dose of supplemental analgesic requirement, total Morphine consumption, incidence of persistent postsurgical pain were assessed.

Results: In postoperative period mean NPRS was 2.0 (\pm 0.3) in PECs group compared to 4.6 (\pm 0.9) for control group for first 24 hours. Mean timing of first dose of Morphine requirement in PECs group was 8.2 (\pm 0.3) hours compared with 30.5 (\pm 2.8) minutes after arrival in PACU for control group. Morphine consumption in 24 hours was 7.3 (\pm 2.1) mg for PECs group and 18.5 (\pm 9.5) mg in control group. Average MAP was 66.3 (\pm 7.4) for PECs group and 81.4 (\pm 4.9) for no block group in first 24 hours after surgery. Mean intraoperative blood loss in PECs group was 91.67 (\pm 0.5) ml and in control 215 (\pm 2.7) ml. Surgeon satisfaction was 71% in PECs group regarding the perioperative blood loss. The incidence of persistent postsurgical pain was 13.33% in control group with no incidence in PECs group.

Conclusion: PEC II block provides an effective postoperative analgesia as part of multimodal analgesic techniques. It is also associated with positive effect on perioperative stable haemodynamic. To prevent chronic pain, PEC II block seems to be effective.

Keywords: Ultrasound guided regional blocks, pectoral block, PECs II block, Breast Surgery

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1 Specialty Doctor
Anaesthetics and ITU
Wexham Park Hospital, UK.

2 Specialist
Dept. of Anaesthesia and Pain
Medicine, Evercare Hospital,
Dhaka, Bangladesh.

3 Associate Consultant
Dept. of Anaesthesia and Pain
Medicine, Evercare Hospital,
Dhaka, Bangladesh.

4 Senior specialist
Dept. of Anaesthesia and Pain
Medicine, Evercare Hospital,
Dhaka, Bangladesh.

5 Senior consultant
Dept. of Anaesthesia and Pain
Medicine, Evercare Hospital,
Dhaka, Bangladesh.

Correspondence

Lutful Aziz
lutful.aziz@evercarebd.com

Introduction

Breast surgery is associated with significant postoperative pain¹. This necessitates the use of multimodal analgesic technique. In the absence of multimodal approach, often high dose of opioid is required in the postoperative period for pain management. Acute postoperative pain after breast surgery, is a risk factor for the development of chronic postmastectomy pain. A total of 60% women will have severe acute postoperative pain after breast cancer surgery, with severe pain persisting for 6-12 months in almost 10% of patients².

There is growing concern and acceptance that, in cancer surgery there is a relationship with opioid analgesia and cancer recurrence due to immune mechanism^{3,4}. This has fuelled an interest in regional anaesthesia for breast surgery.

Many techniques have been used such as thoracic paravertebral, thoracic epidural, interpleural, intercostal, interscalene block and wound infiltration^{5,6}. Thoracic paravertebral block (TPVB) has been shown to provide superior analgesia, and there is some evidence suggesting decreased persistent postsurgical pain and cancer recurrence rates with the use of TPVB⁷. The mechanism of decreased persistent postsurgical pain in paravertebral block causes decreased central sensitization (wind-up) and lower incidence of opioid-induced hyperalgesia⁸. But the technical complexity and the risk of serious complications hampered the popularity of these techniques.

The ultrasound-guided pectoral block is a fascial plane block that was first described in 2012⁹ has rapidly gained popularity in breast surgery due to its relative simplicity, safety and perceived efficacy¹⁰.

In this study we compared (Pectoral nerve blocks) PEC II in combination with general anesthesia and general anesthesia alone in modified radical mastectomy (MRM) surgery.

We hypothesized that the PEC II blocks would provide superior postoperative analgesia, less blood loss and decrease the incidences of persistent post-surgical pain for patients undergoing

mastectomy as compared with a control group.

Methods

This is a randomized control study which was conducted from January 2022 to December 2022 in Evercare hospital Dhaka after getting ethical clearance from the ethical committee of Evercare Hospital Dhaka. Total 60 female adult patients undergoing elective unilateral modified radical mastectomy under general anesthesia were included in the study.

Exclusion criteria were patient refusal, history of allergy to the medications used in the study, contraindications to regional anesthesia (including coagulopathy and local infection), and history of treatment for a chronic pain condition and/or psychiatric disorder.

All patients included in the study were randomly assigned by computer generated randomization techniques. The PECS group receiving PECS blocks and general anesthesia (n = 30) and a control group receiving general anesthesia alone (n = 30).

All the recruited patients were familiarized with NPRS pain scoring and patient-controlled analgesia (PCA).

All patients received 7.5 mg oral Midazolam on the night before surgery day. All patients received Oral Paracetamol (1g) 1 hour before surgery and Inj. Diclofenac (75 mg) at induction, as pre-emptive analgesia and as part of multimodal analgesic techniques.

PECs block was performed after induction of general anaesthesia. In all cases, incision was given 30 minutes after the induction of general anaesthesia. Haemodynamic data was collected from the induction of anaesthesia to 1 hour intraoperatively.

One anaesthesia consultant who was experienced in PEC II block, performed all the blocks for patients in the Pecs group. A (5–12 MHz) linear array probe of GE Venue 50 portable ultrasound system was used.

After proper antiseptic measures, the USG probe was

placed below the lateral third of the clavicle to identify the coracoid process. Then the transducer was rotated to identify the thoracoacromial artery. After identification of pectoralis major and minor, the first injection was given at the vicinity of the pectoral branch of the thoracoacromial artery with 10 mL of 0.25% bupivacaine.

The second injection was given at the anterior axillary line at the level of the fourth rib between the pectoralis minor and serratus anterior muscles with 20 mL of drug injection.

Anesthesia management and data collection were performed by personnel who was blinded to the study group.

In the PACU, patients were monitored for pain intensity using NPRS pain score. When the reported NPRS score was 4 or greater, a loading dose of 5 mg of morphine was administered through slow IV route. Then, a PCA Morphine was started. The PCA pump (3300 Pump; Smith Medical International, UK) was loaded with 1 mg/mL of morphine and set to deliver on demand bolus doses of 1 mL with a 10-minute lockout period. No background infusion was allowed. Ondansetron 8 mg IV was used to treat nausea and vomiting.

Patients with a score of 10 in the modified Aldrete scoring system were considered eligible for discharge to the surgical ward. Patients were discharged from the hospital based on the protocols of the surgical team, which included a pain score of less than 4 without morphine.

The following data were collected: postoperative NPRS pain scores (at 0, 2, 4, 6, 12, 18 and 24 postoperative hours); perioperative haemodynamic status of the patients; perioperative blood loss, time to PCA administration as well as total morphine requirements in postoperative period.

To evaluate persistent postsurgical pain, every patient was communicated 2 weeks after surgery. They were enquired about pain or ongoing pain medication.

Statistical analysis was done with student t test in Microsoft Excel 2022.

Results

Total 60 patients were divided into two groups. The demographic characteristics of the two groups showed no significant statistical difference (Table 1).

Table 1: Demographic data

	PECs group (n = 30) Mean (± SE)	Control group (n = 30) Mean (± SE)	P value
Age	49 (± 1.2)	52 (± 0.9)	< 0.05
Weight	73 (± 1.8)	71 (± 2.3)	< 0.05

In this study we have found that mean NPRS score for pain was 2.0 (± 0.3) in PECs group for first 24 hours and 4.6 (± 0.9) for control group with p value < 0.05. Figure 1 showed postoperative pain score in NPRS scale both in PECs block group (white) and control group (grey). Mean NPRS was 1.09 in PECs group at zero hour in postoperative room and 6.5 for control group.

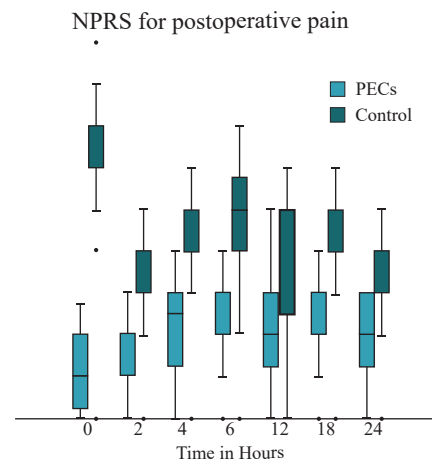


Figure 1: Postoperative pain score (NPRS)

Time for first Morphine dose in PECs group was 8.2 (± 0.3) hours and for control group was 30.5 (± 2.8) minutes after arrival in PACU.

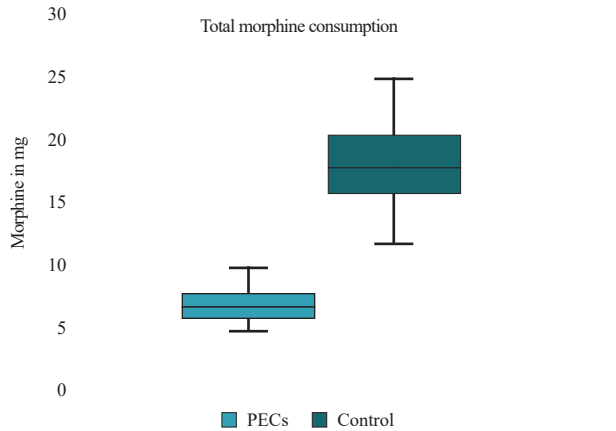


Figure 2: Postoperative Morphine consumption

Total morphine requirement in control group was high. Mean morphine consumption was 18.5 (\pm 9.5) mg in control group and 7.3 (\pm 2.1) mg for PECs group with mean p value < 0.05. Figure 2 showed postoperative morphine consumption in first 24 hours both in PECs block group (white) and control group (grey).

Mean intraoperative blood pressure was 62.4 (\pm 0.8) mmHg for PECs group and 75.2 (\pm 2.7) for control group, which was statistically significant. Figure 3 was showing mean value of intraoperative mean arterial blood pressure (MAP). After induction of anaesthesia there was no significant blood pressure change. Just after incision, at 30 minutes after induction, there was a significant variability of blood pressure.

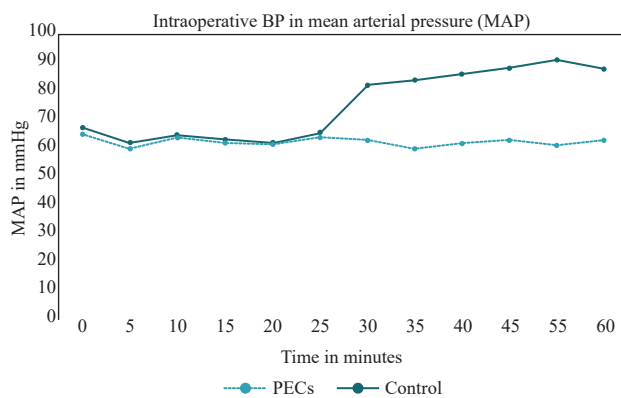


Figure 3: Mean intraoperative mean arterial pressure

Figure 4 showed mean value of postoperative mean arterial blood pressure (MAP). For postoperative haemodynamic status, mean MAP was 66.3 (\pm 7.4) for PECs group and 81.4 (\pm 4.9) for no block group in first 24 hours after surgery and mean p value < 0.05.

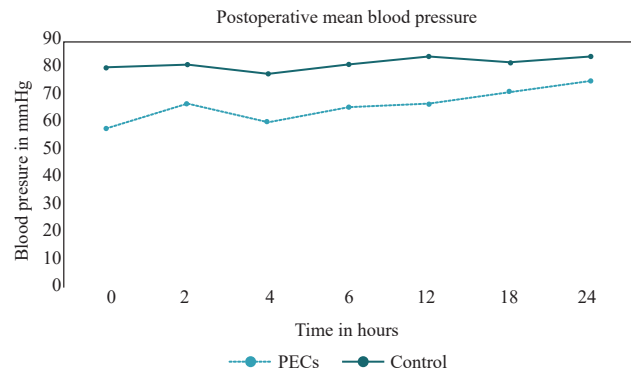


Figure 4: Mean postoperative mean arterial pressure (MAP).

Mean intraoperative blood loss for PECs group was 91.67 (\pm 0.5) ml and in control 215 (\pm 2.7) ml (Figure 5).

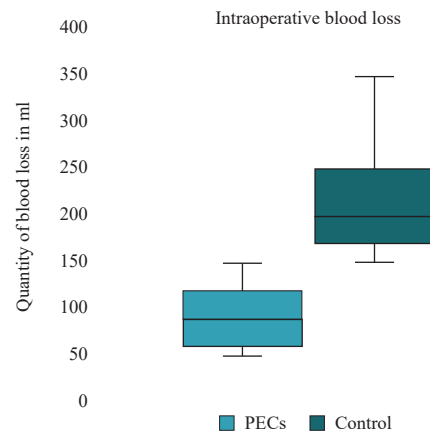


Figure 5: Mean intraoperative blood loss

Figure 6 showed surgeon satisfaction regarding intraoperative blood loss. 71% surgeons in PECs group was satisfied with intraoperative blood loss.

Surgeons opinion regarding controlled intraoperative blood loss

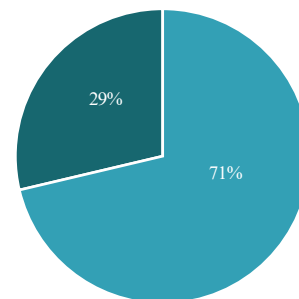


Figure 6: Percentage of surgeons satisfied with intraoperative blood loss

No patient from PECs group complained about persistent postsurgical pain or ongoing pain medication. From control group, 4 patients complained about pain that requiring analgesics.

Discussion

Though performing PEC II blocks are straight forward, there are wide variety in the course of pectoral nerves. They are described in most textbooks as purely motor nerves, but it was suggested that they also transport proprioceptive and nociceptive fibers as shown in other motor nerves. In modified radical mastectomy surgery, blocking only the pectoral nerves are not enough. The anterior divisions of the intercostal nerves from T2 to T6 and the long thoracic and the thoracodorsal nerves should be blocked also.

The intercostal nerves lie between the pleura and the posterior intercostal membrane and run in a plane between the intercostal muscles as far as the sternum. They give off lateral branches that pierce the external intercostal and the serratus anterior muscles at the midaxillary line to give off anterior and posterior terminal branches. The lateral cutaneous branch of the second intercostal nerve is called the intercostobrachial nerve. The intercostal nerves also give anterior branches that cross in front of the internal mammary artery and pierce the internal intercostals muscle, the intercostal membranes, and the pectoralis major muscle supply the medial aspect of the breast.

The long thoracic nerve arises from C5 to C7, entering the axilla behind the brachial plexus resting on the serratus anterior muscle.

The thoracodorsal nerve is a branch of the posterior cord made up of the 3 posterior divisions of the trunks of the brachial plexus. It follows the thoracodorsal artery and innervates the latissimus dorsi in the posterior wall of the axilla.

Blanco¹¹ first described PEC I block in 2011 as an interfascial block to place local anesthetic into the plane between pectoralis major and pectoralis minor muscles. One year later, Blanco et al⁹ described PEC block type II, another approach aiming to block intercostal nerves 3 to 6, intercostobrachial and the long thoracic nerves, all of which are necessary for

axillary node dissection.

A meta-analysis included 14 randomized trials, comparing PEC II block versus paravertebral blocks, found no differences in opioid utilization or pain scores between the groups in patients undergoing breast cancer surgery. Also, PEC II blocks were found to be non-inferior to paravertebral blocks when looking at 24-hour morphine utilization and pain intensity following surgery¹².

In our study, we performed PEC II blocks to the PECs group. The postoperative pain control was superior in the PECs group and total mean Morphine consumption in 24 hours was 7.3 (\pm 2.1) mg in PECs group in compared to 18.5 (\pm 9.5) mg in control group.

Though paravertebral block is regarded as the gold standard for regional anesthesia technique in breast surgery, but some complications are reported such as inadvertent vascular puncture (6.8%), hypotension (4%), epidural or intrathecal spread (1%), pleural puncture (0.8%), and pneumothorax (0.5%)¹². Paravertebral block is also unable to block medial and lateral pectoral nerves as well as long thoracic and thoracodorsal nerves¹³. Therefore, in performing breast surgeries involving axillary dissection, there is potential for lack of adequate analgesia.

PEC II block has some advantages, including no risk of sympathectomy, less restrictions on the use of anticoagulants, as compared to paravertebral or neuraxial blocks¹⁴.

In our study we did not find any inadvertent vascular puncture, pleural puncture or pneumothorax during our procedure.

In our study, we observed that PEC II block provided better intraoperative and postoperative haemodynamic control than the control group. We also observed that PEC II block was associated with lower intraoperative blood loss. Better haemodynamic control and lower intraoperative bleeding maybe associated with attenuated intraoperative sympathetic stimulation and use of local anaesthetic solution containing adrenaline.

We observed that 13.33% patients of control group

experienced persistent postsurgical pain. Risk factors of persistent postsurgical pain in breast surgery are pre-existing chronic pain, axillary surgery, and higher pain score value at 6h postoperatively¹⁵. The persistent post-surgical pain may be due to hormonal and neuroinflammatory responses; higher incidence and greater severity of nerve injuries; compression, ischemia, stretching, and retraction during breast cancer operation^{15,16}. Multimodal analgesic approach comprising NSAIDs, and regional anaesthesia is associated with less frequency of development of chronic pain syndrome¹⁸.

We have limitations in our study. Due to small sample size and short duration of study timeline, we could not predict the long-term effect of PECs block for the prevention of chronic pain syndrome and effect on cancer recurrence. Further long duration study is required for further enquires.

Conclusion

There is a clear superiority of regional anaesthesia practice over other pharmacological techniques in breast surgery. When the pathology is complicated with carcinoma, anaesthetist should consider further modification in pain management due to growing concern of cancer recurrence relating to anaesthesia. Moreover, persistent postsurgical pain is a major risk factor for the development of chronic pain, and this would increase the morbidity. PECs blocks are easy to perform and has great pain management capacity. Practice of PECs block as a modality of regional anaesthesia should be more frequently used in breast surgery.

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Declaration

Ethics approval

The study was approved by the ethical committee of Evercare Hospital Dhaka.

Author contributions

Conception and development of the idea *GFA, SPM, LA*

Data collection *GFA, SAA*

Data analysis *NPN, KF*

Writing - Original draft preparation *GFA, KF, NPN*

Review & editing *HA, SPM, SAA*

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Conflict of interests None

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