Original Article

Pectoral nerve versus erector spinae block for breast surgeries: A randomised controlled trial

Address for correspondence:
Dr. Ajeet Kumar,
Department of Anaesthesia,
AIIMS, Patna, Bihar, India.
E-mail: ajeetanaes@gmail.com

Chandni Sinha, Amarjeet Kumar, Ajeet Kumar, Chandrakant Prasad[1], Prashant Kumar Singh[2], Diti Priya[3]

Departments of Anaesthesia, [2]General Surgery and [3]CFM, AIIMS, Patna, Bihar, [1]Department of Neuroanesthesia, C.N Centre, AIIMS, New Delhi, India

Access this article online

Website: www.ijaweb.org

DOI: 10.4103/ija.IJA_163_19

Quick response code

ABSTRACT

Background and Aims: Patients undergoing breast cancer surgeries face significant post-operative pain. We aimed to compare pectoral nerve (PECS) block with erector spinae (ESP) block in these patients in terms of analgesic efficacy and adverse effects. **Methods:** Sixty four American Society of Anesthesiologists' status I and II female patients between age 18 to 60 years scheduled for unilateral modified radical mastectomy (MRM) under general anaesthesia, were enrolled in this prospective randomised study. Patients in group I received ultrasound guided (USG) ESP block (20 cc 0.2% ropivacaine) while group II received USG guided PECS II block (25 cc 0.2% ropivacaine). General anaesthesia was administered in a standardised manner to both the groups. The various parameters observed included sensory blockade, duration of analgesia and any adverse effects. The primary outcome was the total morphine consumption in 24 hours. **Results:** The total morphine consumption in 24 hours was less in group II (4.40 ± 0.94 mg), compared to group I (6.59 ± 1.35 mg; *P* = 0.000). The mean duration of analgesia in patients of group II was 7.26 ± 0.69 hours while that in the group I was 5.87 ± 1. 47 hours (*P* value = 0.001). 26 patients in group II (PECS) had blockade of T2 as compared to only 10 patients in group I. (*P* value = 0.00). There was no incidence of adverse effects in either group. **Conclusion:** PECS II block is a more effective block when compared to ESP block in patients of MRM in terms of postoperative analgesia and opioid consumption.

Key words: Analgesia, erector spinae block, modified radical mastectomy, pectoral block

INTRODUCTION

Achieving adequate perioperative analgesia can be challenging in patients undergoing breast surgeries. These patients experience significant postoperative pain. Regional anaesthetic techniques like thoracic epidural and paravertebral blocks were considered gold standard analgesic techniques till date. These techniques may be associated with problems like pneumothorax, vascular puncture, nerve damage etc.[1] As an alternative to these blocks some newer techniques have been designed with better safety profile and comparable pain relief. Pectoral (PECs) block is one of them in which the drug is deposited into the inter-fascial plane between pectoralis major and minor/pectoralis minor and serratus anterior muscles.[2]

Recently, in 2016, Forero *et al*. described erector spinae block (ESP) in which local anaesthetic drug is injected deep to erector spinae muscle.[3] This block has been used in various surgeries including radical mastectomy.[3] There has been only a single study comparing both of these blocks in these surgeries,[4] but none in the Indian subpopulation. We hypotthesised that ESP block can be as effective as PECS block for MRM patients in terms of perioperative analgesia. The primary objective was to compare morphine consumption in 24 hours postoperatively. The secondary objective included duration of analgesia,

How to cite this article: Sinha C, Kumar A, Kumar A, Prasad C, Singh PK, Priya D. Pectoral nerve versus erector spinae block for breast surgeries: A randomised controlled trial. Indian J Anaesth 2019;63:617-22.

sensory blockade, postoperative pain scores and adverse effects.

METHODS

Approval from the Institutional Ethics Committee was taken for this randomised study and CTRI registration (CTRI/2017/11/010569) done. This prospective, single blinded study was done over a period of 15 months, from November 2017 to January 2019.

Sixty four American Society of Anesthesiologists' status I and II female patients between the age group 18 to 60 years scheduled for unilateral modified radical mastectomy under general anaesthesia were enrolled in this study [Figure 1]. Patients scheduled for bilateral surgery, suffering from psychiatric disorder, chronic neurological disease, not willing to give consent, having BMI >40 were excluded from the study. All the patients were explained about the procedure and written informed consent taken. The study followed the guidelines laid down in Declaration of Helsinki (2013).

On the day before surgery, they were acquainted with numerical rating scale (NRS). The statistician using computer-generated random numbers randomly allocated them into two groups of 32 each. The group allocation numbers were concealed in sealed opaque envelopes that were opened only after shifting the patient to preoperative holding area.

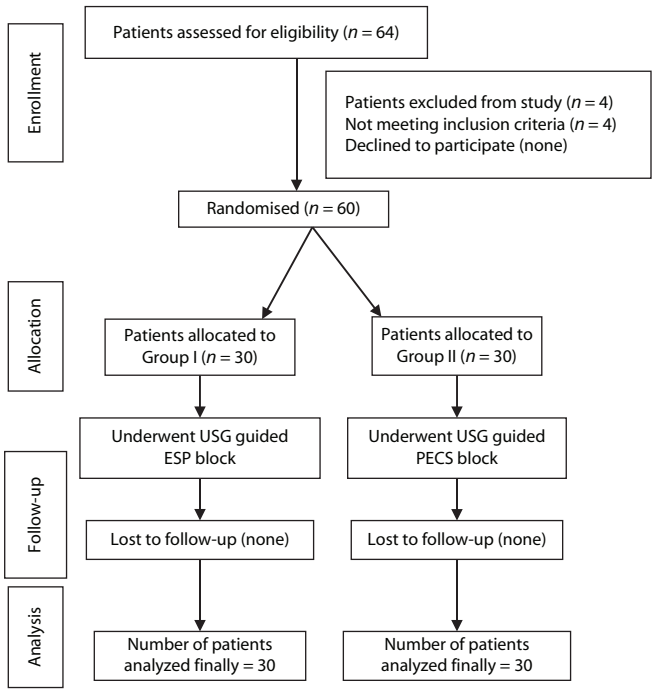

Figure 1: Consort flow chart

The monitors attached included non-invasive blood pressure (NIBP), electrocardiography (ECG), and peripheral oxygen saturation (SPO_2). An 18 G I.V cannula was secured in the opposite hand and fluid started. Patients in group I received ESP block while Group II received PECS block. The blocks were performed under aseptic precautions 30 minutes before surgery with a 22 gauge echogenic needle (Pajunk, sonoplex stim™ cannula, Geisingen, Germany; 80 mm) using the same ultrasound machine (Sonosite™, Inc., Bothell, WA, USA) and linear array probe (38 mm, 7-12 MHz frequency). First or the second author performed all the blocks in the patients and were present only till the procedure. The third or fourth authors who were blinded to the blocks made all the perioperative assessments. The patients were not blinded to the block technique.

Erector spinae block was given with the patient in the sitting position. A high frequency linear probe was placed in a transverse orientation to visualize right lateral tip of T4 transverse process. After identifying the three muscles trapezius, rhomboid major, and erector spinae superficial to the hyperechoic transverse process, the probe was turned 90 longitudinally. After infiltrating 2 ml of 2% lignocaine, the block needle was inserted in a cephalo caudad direction to contact the transverse process. Twenty ml of 0.2% ropivacaine was injected. The correct placement was indicated by linear fluid spread that lifted the erector spinae muscle off the underlying transverse processes and intercostal muscles.

Pectoral nerve block was performed on the side of surgery with the patient in the supine position and the arm abducted. Infraclavicular region was scanned to locate the axillary artery and vein. The probe was thereafter moved laterally until pectoralis minor and serratus anterior muscles were identified at the level of third rib. Two ml of 2% lignocaine was used for skin infiltration. The needle was advanced in an oblique manner until its tip was visualised between the pectoralis minor and serratus anterior muscle. Fifteen ml of 0.2% ropivacaine was deposited in between the muscles. The needle was withdrawn till the tip was between the pectoralis major and minor and 10 ml of 0.2% ropivacaine injected.

The patients were observed for 30 minutes after performing the block. The anaesthesiologist who was blinded to the technique of block assessed the sensory level of block with pin-prick sensation in each side

from T1 to T8. The total number of dermatomes that had less pain to pin prick compared with opposite side were noted. If the pin-prick sensation did not decrease in any segment up to 30 minutes, it was considered as a block failure and patients were excluded from the analysis.

The patient's ECG and SpO_2 were monitored continuously, and heart rate (HR) and NIBP were recorded at baseline, after performing the block, and every 5 minutes for 30 minutes. Any block-related complications, such as hypotension, vascular puncture, pneumothorax were looked for.

General anaesthesia was administered in a standardised manner with intravenous (IV) propofol 2 $mg.kg^{-1}$, fentanyl 2 µg. kg^{-1} and vecuronium 0.1 mg. kg^{-1}, and a laryngeal mask airway (LMA) was inserted. Intraoperatively, HR and NIBP were recorded at baseline, after induction, after LMA insertion, at skin incision, and then every 15 minutes until the end of surgery. The patients received a continuous infusion of normal saline at a rate of 5-8 ml/kg/hour during surgery. If the HR or mean arterial pressure (MAP) exceeded 20% of baseline, fentanyl 1.0 µg kg^{-1} was given. All the patients received ondansetron 0.1 mg kg^{-1} I.V. before completion of surgery. At the end of surgery, the neuromuscular block was reversed with I .V. neostigmine 0.05mg kg^{-1} and atropine 0.02mg kg^{-1}. The LMA was taken out once the patient was fully awake.

Postoperatively patient-controlled analgesia pump was connected to the patients. Postoperative pain was assessed using a numerical rating scale (NRS, 0–10; 0 = no pain and 10 = worst imaginable pain). No basal infusion was given and only bolus doses of 1- 2 mg morphine with a 10 minute lock out interval was allowed. The total analgesic consumption in 24 hours was taken as the primary outcome measure. The secondary outcome measures included duration of analgesia (time to first rescue analgesia after administration of block), the level of sensory blockade as assessed preoperatively and the postoperative pain scores. Adverse effects such as hypotension, respiratory depression were looked for and treatment planned (fluid bolus 10 $ml.kg^{-1}$ and oxygen supplementation with simple face mask at 5L/min).

Sample size calculated on the basis of preliminary pilot study with ten patients in each group (ESP block and PECS II block). There was a clinically significant difference of morphine consumption (mean 0.58 mg, SD ± 0.79, P = 0.045) in 24 hours between two groups. Based on this finding, we estimated the minimum sample size with 95% level of confidence and 80% power of the study and type I error of 0.05 to be 60 patients, 30 in each study group. Statistical analysis was performed using SPSS16 software. The quantitative variables were compared using the unpaired student *t*-test. The qualitative variables were compared using the Chi-square test. $P < 0.05$ was considered statistically significant.

RESULTS

Both the groups were comparable in terms of demographic profile: age, height and weight [Table 1].

The mean duration of analgesia in patients of PECS block group was 7.26 ± 0. 69 hours while that in the ESP group was 5.87 ± 1. 47 hours (P value = 0.001). The mean requirement of morphine was also less in PECS group: 4.40 ± 0.94 mg in 24 hours postoperatively, while that in ESP group was 6.59 ± 1.35 mg (P value <0.05) [Table 2]. This difference was statistically significant.

The NRS scores were significantly lower in PECS group at all time intervals except at 8 and 12 hours [Table 3]. The scores were lower at these time points also but this difference was not statistically significant.

The dermatomal spread showed that the spread to T2 level was statistically more in the patients with PECS block (26 vs 10, P value = 0.000) The spread to other dermatomes was similar in both the groups.

Table 1: Demographic details between the two groups

Variable	Mean (SD)		*P*
	Group I: ESP	Group II: PECS	
Age (years)	53.63±8.80	53.80±9.37	0.761
Height (cm)	158.97±5.02	160.90±5.73	0.19
Weight (kg)	57.93±8.63	57.83±8.37	0.876
ASA status (I/II)	22:8	20:10	

Unpaired *t*-test

Table 2: Duration of analgesia & requirement of morphine analgesia in 24 h

Variables	Grp I: ESP (*n*=30)	Grp II: PECS (*n*=30)	*P*
Duration of analgesia (h, mean±SD)	5.87±1.47	7.26±0.69	0.001
Morphine requirement (mg, mean±SD)	6.50±1.35	4.40±0.94	0.000

*Independent sample *t*-test

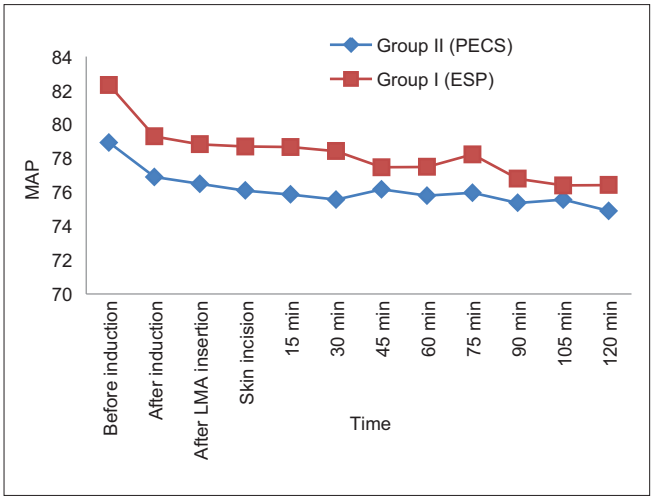

Figure 2: Intraoperative tend of MAP

Table 3: NRS scores postoperatively

Time (h)	Grp I: ESP (mean±SD)	Grp II: PECS (mean±SD)	*P*
0.5	1.56±0.61	1.10±0.47	0.0018
1	2.06±0.57	1.43±0.49	0.0001
2	2.03±0.60	1.60±0.48	0.004
4	3.10±0.90	2.46±0.84	0.006
6	3.30±0.82	2.73±0.78	0.007
8	3.16±0.93	3.10±0.65	0.77
12	3.30±0.69	3.1±0.7	0.2697
16	2.90±0.70	2.26±0.697	0.006
24	2.60±0.48	2.23±0.632	0.0123

Unpaired *t*-test

The vitals of the patients in both the groups were similar intraoperatively [Figures 2 and 3], with none of them requiring additional fentanyl doses. None of the patients reported any adverse effect in any of the groups.

DISCUSSION

This prospective study shows that PECS block performed in patients scheduled for MRM results in better pain control and less postoperative morphine consumption in the first 24 hours. Hence it is a superior block than ESP in patients scheduled for MRM surgeries.

The PECS block is a relatively new block that relies upon the deposition the local anaesthetic at the inter-fascial planes among the pectoralis major, minor, and serratus anterior muscles: it blocks the pectoral, the intercostobrachial, the intercostals III and VI, and the long thoracic nerves. Blanco and colleagues used this block in 50 patients undergoing MRM. All these patients reported good analgesia upto 8 hours. These

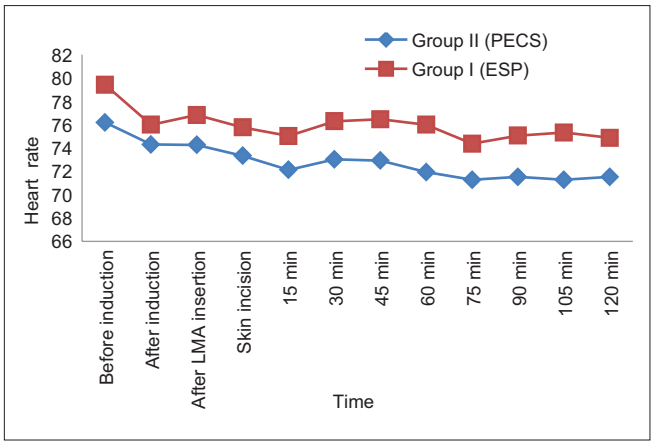

Figure 3: Intraoperative trend of HR

results are similar to our study wherein the pain relief was up to 7. 26 ± 0. 69 hours. Recent studies done by Bashadyet and Khemka *et al*., have established the role of PECS in patients undergoing MRM under general anaesthesia.[4,5]

Recently, Altiparmik *et al*. published a study where they compared PECS block with ESP in 40 patients undergoing MRM surgery.[6] They concluded PECs block is better than ESP block with lower tramadol intake and lower pain scores in the postoperative period. They speculated that the better analgesic profile was due to the blockade of medial, lateral pectoral and long thoracic and thoracodorsal nerves. These results were similar to our studies. Unlike their study, we administered the block when the patients were awake, assessing the extent of sensory blockade in the thoracic wall. Sensory blockade was better in patients who were administered PECS block, matching our analgesic intake.

Median and lateral pectoral nerves have been implicated in post mastectomy surgical pain. They are supposed to carry nociceptive and proprioceptive fibres. Also, all the motor nerves supplying the chest wall carry postganglionic fibers from the cervical and thoracic ganglion. Long thoracic and thoracodorsal nerves also contribute to post surgical pain in these patients.[7,8]

In a study done by Wahba *et al*. 60 patients undergoing MRM were studied in terms of morphine requirement and duration of postoperative analgesia. The patients receiving PECS block had better pain relief and less requirement of opioids when compared to PVB. These results are similar to those found in our study.[9]

Bakshi *et al*. have reported difficulty during surgery due to fluid filled spaces after PECS block.[10] We did not encounter this problem in any of our patients. This could be explained due to the time gap between the block and the surgery (>30 minutes) which could have led to the absorption of local anaesthetic.

Kulhari *et al*. have compared modified PECS block with thoracic paravertebral block (TPVB) in similar patients. They also concluded that PECS block is better in terms of analgesia in such patients.[11]

A modification of PVB block is ESP block which was introduced by Forero *et al*.[3] He used this simple interfascial plane block in cases of severe neuropathic pain post trauma/malignancy/thoracotomy. The local anaesthetic deposited between the two muscles (rhomboidus major and erector spinae) is speculated to penetrate anteriorly through costotransverse foramina and enter the thoracic paravertebral space. The ventral and dorsal rami and rami communicants get subsequently blocked.

Gurkan *et al*. performed ESP block in patients undergoing unilateral breast surgery. They used a volume similar to our study: 20 ml and compared it with no intervention group. Patients in the ESP group required lesser morphine postoperatively when compared to the other group.[12] Singh *et al*., in their study, reported less pain scores and less morphine usage in patients receiving ESP preoperatively in MRM surgeries.[13]

Though the role of PECS has been studied in chronic pain after MRM surgeries, we have not studied the effect of PECS/ESP on follow up of the patient or patients presenting with chronic post-surgical pain. This could be considered as one of the limitations of our study.[14]

Another limitation was that the patients were not blinded. Block was given before general anaesthesia to assess the level of sensory block in awake patient. Also, no sham block was given as it was considered to be ethically unnecessary.

CONCLUSION

In conclusion, PECSs is a potential analgesic technique alternative to ESB after breast surgery. It provides better pain scores with lesser opioid requirement in comparison with ESP.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Acknowledgements

Dr. Umesh Kumar Bhadani, HOD, Anaesthesia, for his general support in carrying out the project.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Schnabel A, Reichl SU, Kranke P, Pogatzki-Zahn EM, Zahn PK. Efficacy and safety of paravertebral blocks in breast surgery: A meta-analysis of randomized controlled trials. Br J Anaesth 2010;105:842-52.
2. 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;59:470-5.
3. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The erector spinae plane block: A novel analgesic technique in thoracic neuropathic pain. Reg Anesth Pain Med 2016;41:621-7.
4. 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.
5. Khemka R, Chakrborty 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;63:530-6
6. Altiparmak B, Korkmaz Toker M, Uysal Aİ, Turan M, Gümüş Demirbilek S. Comparison of the effects of modified pectoral nerve block and erector spinae block on postoperative opioid consumption and pian scores of patients after radical mastectomy surgery: A prospective, randomized, controlled trial. J Clin Anesth 2019;54:61-5.
7. Kwekkeboom K. Postmastectomy pain syndromes. Cancer Nurs 1996;19:37-43.
8. Vecht CJ, van de Brand HJ, Wajer OJ. Post-axillary dissection pain in breast cancer due to a lesion of the intercostobrachial nerve. Pain 1989;38:171-6.
9. Wahba SS, Kamal SM. Thoracic paravertebral block versus pectoral nerve block for analgesia after breast surgery. Egypt J Anaesth 2014;30:129-35.
10. Bakshi SG, Karan N, Parmar V. Pectoralis block for breast surgery: A surgical concern? Indian J Anaesth 2017;61:851-2.
11. Kulhari S, Bharti N, Bala I, Arora S, Singh G. Efficacy of pectoral nerve block versus thoracic paravertebral block for postoperative analgesia after radical mastectomy: A randomized controlled trial. Br J Anaesth 2016;117:382-6.

12. Gürkan Y, Aksu C, Kuş A, Yörükoğlu UH, Kılıç CT. Ultrasound guided erector spinae plane block reduces postoperative opioid consumption following breast surgery: A randomized controlled study. J Clin Anesth 2018;50:65-8.
13. Singh S, Kumar G, Akhileshwar. Ultrasound-guided erector spinae plane block for postoperative analgesia in modified radical mastectomy: A randomised control study. Indian J Anaesth 2019;63:200-20.
14. Wijayasinghe N, Andersen KG, Kehlet H. Analgesic and sensory effects of the pecs local anesthetic block in patients with persistent pain after breast cancer surgery: A pilot study. Pain Pract 2017;17:185-91.