Section: Anaesthesia

Original Research Article

COMPARISON OF POSTOPERATIVE ANALGESIC EFFICACY OF USG GUIDED PECS BLOCK VERSUS ERECTOR SPINAE PLANE BLOCK USING LEVOBUPIVACAINE IN PATIENTS UNDERGOING SURGERY FOR BREAST CANCER

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Received : 05/01/2025
Received in revised form : 15/02/2025
Accepted : 02/03/2025

Keywords:
Breast cancer surgery, postoperative analgesia, PECS block, ESP block, regional anaesthesia, levobupivacaine.

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DOI: 10.47009/jamp.2025.7.2.107

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (2); 523-528

Abstract

Background: Effective postoperative pain management is crucial in breast cancer surgery, particularly modified radical mastectomy (MRM), to reduce distress and improve recovery. Ultrasound-guided pectoral nerve (PECS) and erector spinae plane (ESP) blocks offer regional analgesia during mastectomy. This study compared the analgesic efficacy of these blocks using levobupivacaine in patients who underwent breast cancer surgery. **Materials and Methods:** A prospective, randomised controlled trial was conducted on 60 patients undergoing MRM, who were divided into PECS (n=30) and ESP (n=30) block groups. Under ultrasound guidance, Group I received 30 ml of 0.25% levobupivacaine via the PECS block, whereas Group II received the same volume via the ESP block. Haemodynamic parameters and postoperative pain scores were recorded at multiple intervals, with opioid consumption and rescue analgesia requirements assessed for 24 h postoperatively. **Result:** The PECS block provided significantly longer analgesia (7.01±0.89 h) than the ESP block (5.87±1.36 h) ($p<0.001$). The VAS scores were significantly lower in the PECS group at 1, 2, 4, 18, and 24 h ($p<0.05$), whereas no difference was observed at 0, 6, and 12 h. Rescue analgesia was required less frequently in the PECS group (76.7% vs. 43.3% in the ESP group, $p=0.027$). Two doses were required in the ESP group (46.7% vs. 16.7%, $p=0.027$). No significant intergroup differences were observed in intraoperative haemodynamic parameters, SpO2 levels, or adverse effects. **Conclusion:** The PECS block significantly reduced postoperative pain and opioid use and provided longer pain relief than the ESP block. Given its efficacy and safety, it is preferable for pain management after breast cancer surgery.

INTRODUCTION

Pain management after surgery is essential for surgical patient care. Pain management can be difficult after breast cancer surgery, such as modified radical mastectomy (MRM). Breast cancer is one of the most prevalent cancers affecting women globally, with surgery as the main treatment.[1] The primary source of pain with MRM is the extensive tissue resection and axillary lymph node dissection, often causing severe acute postoperative pain.[2] Effective pain management is crucial for reducing patient distress and minimizing the surgical stress response that can impair immune function and recovery.[3] Effective postoperative analgesia improves outcomes, decreases recovery time, and potentially aids survival at distant sites by reducing stress-related complications.[4]

Several regional anaesthetic methods are employed to control postoperative pain following MRM. These include thoracic epidural anaesthesia, paravertebral block (PVB), and intercostal blocks.[5,6] Their limitations are technical complexity, risk of pneumothorax, and, in some cases, incomplete analgesia, particularly in the axilla area. More recently developed regional blocks include the pectoral nerve block (PECS) and erector spinae plane block (ESP).[7] Both procedures employ the use of ultrasound guidance for precision and minimisation of complications. The success of these blocks is higher with ultrasound guidance than with traditional approaches.[8] A head-to-head comparison is still necessary to determine which block provides greater

ISSN (O): 2687-5365; ISSN (P): 2753-6556

pain relief and superior postoperative outcomes in MRM patients.

The rationale for comparing the PECS and ESP blocks was based on their mechanism of action and anatomical targets. The PECS block targets the pectoral, intercostobrachial, and thoracic intercostal nerves, providing analgesia to the chest wall and axilla. The ESP block targets the erector spinae muscles and indirectly blocks the dorsal and ventral rami of the spinal nerves, theoretically providing better coverage of the thoracic and abdominal segments.[9] Evidence suggests that both blocks reduce postoperative opioid use and pain scores; however, few head-to-head comparisons exist, and debate continues on optimal pain management for patients undergoing major soft tissue resection.[10] Here, a direct comparison is proposed between the two blocks regarding postoperative analgesic efficacy.

This study addresses clinically relevant gaps in the current knowledge. Evidence supports the use of PECS and ESP blocks in breast surgery; however, few controlled studies have compared their efficacy. While an ESP block may deliver analgesia to the axillary region, its mechanism remains speculative.[11] The two blocks were compared in terms of pain control and stress response to provide evidence-based conclusions on their efficacy and safety, guiding clinicians in postoperative pain management following breast cancer surgery.

Aim

This study aimed to compare the postoperative analgesic efficacy of the USG-guided PECS and ESP blocks in patients undergoing breast surgery using levobupivacaine.

MATERIALS AND METHODS

This prospective randomised controlled trial (RCT) was conducted on 60 patients at the Department of Anaesthesiology, Government Medical College, Omandurar Government Estate, Chennai, for 12 months from January 2023 to December 2023. The Institutional Ethics Committee approved this study (IEC NO. 32/IEC/GOMC/2022). The informed consent was obtained from all patients.

Inclusion Criteria

Patients aged between 18 and 65 years who were admitted for elective breast surgeries under anaesthesia, with an American Society of Anesthesiologists (ASA) physical status of I or II, and patients willing to participate and able to provide valid informed consent were included.

Exclusion Criteria

Pregnant women, patients with neurological disorders of any cause and duration, those with cardiovascular, hepatic, renal, and respiratory diseases and coagulopathy, a history of allergy or anaphylaxis to drugs used in the study, bleeding disorders, or infection at the puncture site were excluded from the study.

Methods: Patients were selected using consecutive sampling and randomised into two equal groups using SNOSE. Group I (n=30) received a PECS block, while Group II (n=30) received an erector spinae plane (ESP) block before induction. Preoperatively, patients were evaluated, informed about the study, and administered intravenous ranitidine (50 mg) to reduce gastric secretions. On the day of surgery, patients were monitored for ECG, noninvasive blood pressure (NIBP), oxygen saturation (SpO2), heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and respiratory rate (RR). Intravenous access was established, and fluid therapy was initiated.

In Group I, the PECS block was performed in the supine position using a high-frequency linear probe to identify the pectoralis minor and serratus anterior muscles at the third rib level. A needle was inserted, and 20 ml of 0.25% levobupivacaine was injected between the pectoralis minor and serratus anterior muscles. An additional 10 ml was injected between the pectoralis major and minor muscles. In Group II, the ESP block was performed in the sitting position, targeting the right lateral tip of the T4 transverse process. A needle was inserted cephalocaudally until it contacted the transverse process, and 20 ml of 0.25% levobupivacaine was injected.

Intraoperative haemodynamic monitoring was performed at baseline and every 10 min for 70 min, recording HR, SBP, DBP, and SpO2. Postoperatively, haemodynamic parameters and pain scores were assessed at 0, 2, 4, 6, 12, and 24 h using the visual analogue scale (VAS). Patients with VAS scores > 4 received rescue analgesia (intravenous paracetamol 15 mg/kg). In the postanesthetic care unit (PACU), haemodynamic parameters were recorded every 15 min for the first hour. In the ward, assessments were continued at designated times to evaluate postoperative pain and analgesic consumption. The primary outcome was total postoperative opioid consumption in the first 24 h, while the secondary outcomes included VAS pain scores, need for rescue analgesia, and complication incidence.

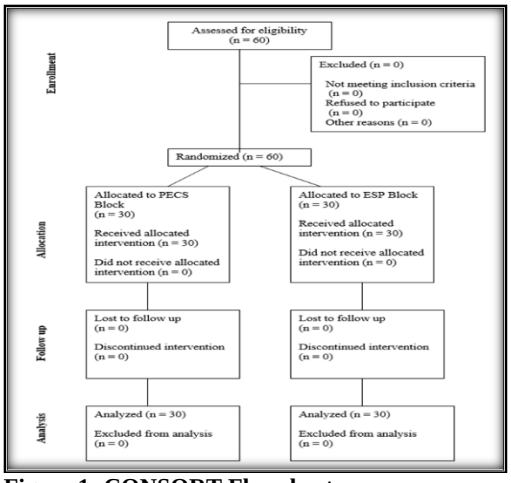

Figure 1: CONSORT Flowchart

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Statistical analysis: Data were presented as mean, standard deviation, frequency, and percentage. Continuous variables were compared using the independent sample t-test and repeated measures ANOVA. Categorical variables were compared using the Pearson chi-square test. Significance was defined as $p < 0.05$ using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0.

RESULTS

There was no significant difference in the mean HR between the groups throughout the intraoperative period. However, a significant variation in the mean HR was observed within each group during the intraoperative period [Figure 2].

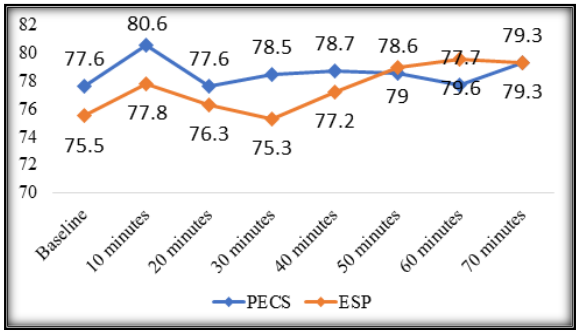

Figure 2: Comparison of Intraoperative variation in HR between the groups

There was no significant difference in the mean SBP between the groups or within each group throughout the intraoperative period, except at 50 min [Figure 3].

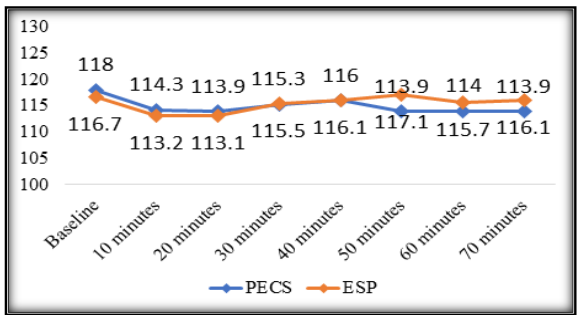

Figure 3: Comparison of Intraoperative variation in SBP between the groups

There was no significant difference in the mean DBP between the groups or within each group throughout the intraoperative period [Figure 4].

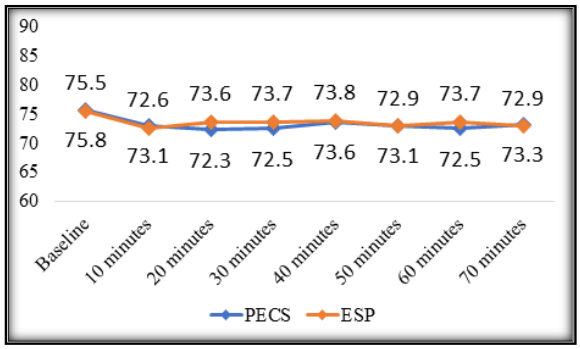

Figure 4: Comparison of Intraoperative variation in DBP between the groups

There was no significant difference between the groups in terms of age (p=0.782) and ASA grade (p=0.796) [Table 1].

Table 1: Comparison of age and ASA grade between groups.

		Group N (%)		P value
		PECS	ESP	
Age (years)	21-30	3(10%)	6(20%)	0.782
	31-40	7(23.3%)	7(23.3%)	
	41-50	10(33.3%)	7(23.3%)	
	51-60	6(20%)	7(23.3%)	
	>60	4(13.3%)	3(10%)	
ASA grade	I	15(50%)	16(53.3%)	0.796
	II	15(50%)	14(46.7%)	

Regarding the duration of postoperative analgesia, the PECS group experienced a longer duration (7.01±0.89 hours) than the ESP group (5.87±1.36 hours) (p<0.001). There were no significant differences between the groups in terms of mean age (p=0.577), weight (p=0.762), height (p=0.908), BMI (p=0.730), and duration of surgery (p=0.106) [Table 2].

Table 2: Comparison of demographics and postoperative analgesia between groups

	Group (Mean±SD)		P value
	PECS	ESP	
Age (years)	45.97±11.01	44.30±11.97	0.577
Weight (kg)	70.42±12.51	69.47±11.63	0.762
Height (cm)	163.29±9.43	163.55±7.90	0.908
BMI (kg/m2)	26.64±5.42	26.16±5.31	0.73
Duration of surgery (mins)	89.93±8.54	93.73±9.37	0.106
Duration of postoperative analgesia (hours)	7.01±0.89	5.87±1.36	<0.001

Regarding postoperative VAS scores, at 1 h, a higher proportion of patients in the PECS group had lower pain scores than those in the ESP group, showing a significant difference (p=0.002). At 2 h, the PECS group had significantly lower pain scores than the ESP group (p<0.001). Similarly, at 4 h, the PECS

ISSN (O): 2687-5365; ISSN (P): 2753-6556

group had lower pain scores than the ESP group, with a significant difference (p<0.001). At 18 h, the PECS group had lower pain scores than the ESP group, with a significant difference (p=0.036). By 24 h, pain levels remained lower in the PECS group than in the ESP group, showing a significant difference (p=0.008).

There was no significant difference in pain scores between the groups at 0 h (p=1.000), 6 h (p=0.152), and 12 h (p=0.519) [Table 3].

Table 3: Comparison of postoperative VAS scores between the groups

Hours	VAS Score	Group N (%)		P value
		PECS	ESP	
0 hours	Score 0	30(100%)	30(100%)	1
1 hour	Score 0	26(86.7%)	15(50%)	0.002
	Score 1	4(13.3%)	15(50%)	
2 hours	Score 0	18(60%)	3(10%)	<0.001
	Score 1	8(26.7%)	13(43.3%)	
	Score 2	4(13.3%)	12(40%)	
	Score 3	0	2(6.7%)	
4 hours	Score 0	5(16.7%)	0	<0.001
	Score 1	13(43.3%)	2(6.7%)	
	Score 2	7(23.3%)	14(46.7%)	
	Score 3	5(16.7%)	6(20%)	
	Score 4	0	5(16.7%)	
	Score 5	0	3(10%)	
6 hours	Grade 0	1(3.3%)	0	0.152
	Grade 2	9(30%)	7(23.3%)	
	Grade 3	7(23.3%)	8(26.7%)	
	Grade 4	13(43.3%)	10(33.3%)	
	Grade 5	0	5(16.7%)	
12 hours	Score 1	2(6.7%)	1(3.3%)	0.519
	Score 2	16(53.3%)	12(40%)	
	Score 3	10(33.3%)	15(50%)	
	Score 4	1(3.3%)	2(6.7%)	
	Score 5	1(3.3%)	0	
18 hours	Score 0	2(6.7%)	0	<0.036
	Score 1	7(23.3%)	2(6.7%)	
	Score 2	13(43.3%)	9(30%)	
	Score 3	5(16.7%)	14(46.7%)	
	Score 4	2(6.7%)	1(3.3%)	
	Score 5	1(3.3%)	4(13.3%)	
24 hours	Score 0	2(6.7%)	0	0.008
	Score 1	5(16.7%)	1(3.3%)	
	Score 2	12(40%)	4(13.3%)	
	Score 3	5(16.7%)	11(36.7%)	
	Score 4	1(3.3%)	7(23.3%)	
	Score 5	5(16.7%)	7(23.3%)	

Regarding rescue analgesia doses, a higher proportion of patients in the PECS group (76.7%) required only one dose than in the ESP group (43.3%). The need for two doses was higher in the ESP group (46.7%) than in the PECS group (16.7%). Three doses were required by 6.7% of patients in the PECS group and 10% in the ESP group, showing a significant difference (p=0.027) [Table 4].

Table 4: Comparison of required doses of rescue analgesia between the groups

Doses of rescue analgesia	Group N (%)		P value
	PECS	ESP	
One dose	23(76.7%)	13(43.3%)	0.027
Two doses	5(16.7%)	14(46.7%)	
Three doses	2(6.7%)	3(10%)	

There was no significant difference in median oxygen saturation (SpO2) levels within and between the groups throughout the intraoperative period.

Regarding the median postoperative VAS score, pain scores differed significantly at 1 h (p=0.002), 2 h (p<0.001), 4 h (p<0.001), 18 h (p=0.003), and 24 h (p=0.002).

There was no significant difference in pain scores between the groups at 0 h (p=1.000), 6 h (p=0.206), and 12 h (p=0.235) [Table 5].

Table 5: Comparison of median postoperative VAS score between groups

Post-operative Time	PECS Group		ESP Group		P value
	Median VAS	IQR	Median VAS	IQR	
0 hours	0	0	0	0	1.000
1 hour	0	0	1	0 to 1	0.002

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2 hours	0	0 to 1	1	1 to 2	<0.001
4 hours	1	1 to 2	2	2 to 4	<0.001
6 hours	3	2 to 4	4	3 to 4	0.206
12 hours	2	2 to 3	3	2 to 3	0.235
18 hours	2	1 to 3	3	2 to 3	0.003
24 hours	2	2 to 3	3	3 to 4	0.002

DISCUSSION

In our study, there were no significant differences between the PECS and ESP groups in terms of age, weight, height, BMI, ASA grade, or duration of surgery, ensuring baseline comparability. In a study by Sinha et al., the mean age was 47.5 ± 12.2 years for the PECS group and 46.3 ± 11.8 years for the ESP group, and the mean duration of surgery was 92.5 minutes which closely aligns with our findings.[12] Similarly, Bakeer et al. reported an age range of 18–65 years, ensuring consistency in baseline characteristics. The average surgical time was nearly 90 minutes.[13] Khorasanizadeh et al. also found comparable mean ages of 43.8 ± 11.1 years in the PECS group and 44.2 ± 12.5 years in the ESP group.[14]

In our study, no significant differences were observed between the groups in terms of intraoperative and postoperative heart rate, systolic blood pressure, diastolic blood pressure, or oxygen saturation. Gergis et al. reported no intergroup differences in blood pressure and heart rate, in agreement with our findings.[15] Khorasanizadeh et al. also found haemodynamic stability in both blocks, although the intraoperative systolic blood pressure was slightly reduced in the ESP group.[14] Sanad et al. also corroborated this, with a small reduction in mean arterial pressure in the ESP group, presumably because it is close to the sympathetic nerves. These observations support the safety and hemodynamic stability of both blocks in clinical practice.[16]

In our study, the PECS block presented a much longer analgesic duration than the ESP block. Sinha et al. reported a mean analgesia duration of 7.26 ± 0.69 hours for the PECS block and 5.87 ± 1.47 hours for the ESP block, which closely aligns with our results.[12] Similarly, Bakeer et al. found the PECS block provided 6.9 hours of analgesia compared to 5.6 hours in the ESP group, further reinforcing the similarity in outcomes and supporting the efficacy of the PECS block for prolonged postoperative pain relief.[13]

In our study, the PECS group showed significantly lower VAS scores at multiple time points, particularly at 1, 2, 4, 18, and 24 h postoperatively than the control group. No significant differences were observed at 0, 6, and 12 h. Fewer patients in the PECS group required multiple doses of rescue analgesia than those in the ESP group, demonstrating better pain control and an opioid-sparing effect. Sinha et al., Sanad et al., and Gergis et al. consistently reported lower postoperative VAS scores in the PECS group at multiple time intervals, reinforcing its effectiveness in pain management.[11,15,16]

Additionally, Sanad et al. highlighted a significant reduction in opioid consumption with the PECS block, a trend also observed in our study.[16] Gad et al. further confirmed better pain control in the PECS group at 12 hours postoperatively.[17] These findings support the PECS block's extended analgesic effect and opioid-sparing advantage, attributed to its distinct anatomical and physiological mechanisms.

In our study, no adverse events or complications were reported in either group, confirming the safety of both the PECS and ESP blocks under ultrasound guidance. Studies by Gergis et al. and Sanad et al. confirmed the comparable safety profiles of both blocks when performed under ultrasound guidance.[15,16] The PECS block, being relatively superficial, minimises the risk of severe complications, such as pneumothorax or vascular injury. In contrast, the ESP block, performed at a deeper anatomical level, requires stringent ultrasound guidance to ensure precise anaesthetic placement and reduce risks.

Limitations

This single-centre study limits the generalisability to different patient demographics, healthcare infrastructure, and anaesthetic practices. The block nature prevented the complete blinding of patients and anaesthesiologists, potentially introducing bias. The small sample size further restricts the applicability of the results. The study focused on immediate postoperative outcomes without follow-up for chronic pain or long-term complications, necessitating research on the lasting effects of these regional blocks on recovery.

CONCLUSION

We conclude that comparing PECS and ESP blocks for elective breast surgeries showed that PECS significantly reduced postoperative pain, as reflected by lower VAS scores, reduced opioid requirements, and longer pain-free periods. Both blocks are safe under ultrasound guidance, with minimal side effects and excellent haemodynamic stability. Given its benefits, the PECS block may be recommended as the preferred regional anaesthesia technique for elective breast surgeries, aiding in postoperative pain management with an opioid-sparing effect.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556