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Original Research Article

USG Guided Erector Spinae vs Pectoralis Block as Perioperative Analgesia in Breast Cancer Surgeries: A Quasi Experimental Study at Tertiary Care Centre

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Abstract:

Introduction: Breast cancer surgery is frequently associated with significant postoperative pain, which may delay mobilization, increase opioid requirements, reduce patient satisfaction, and contribute to persistent post-mastectomy pain. Ultrasound-guided fascial plane blocks such as the Erector Spinae Plane (ESP) block and Pectoral Nerve (PECS) block are increasingly used as components of multimodal, opioid-sparing analgesia. This study compared the perioperative analgesic efficacy and safety of ESP and PECS blocks in patients undergoing breast cancer surgery.

Aim: To compare ultrasound-guided ESP block and PECS block with respect to perioperative opioid consumption, postoperative pain scores, duration of analgesia, rescue analgesic requirement, and adverse effects.

Methods: This quasi-experimental study was conducted in the Department of Anaesthesiology of a tertiary care teaching hospital over 18 months after Institutional Ethics Committee approval. Sixty female patients aged 18–60 years, ASA physical status I–II, scheduled for elective unilateral breast cancer surgery under general anaesthesia, were included using consecutive sampling. Patients were divided into two groups of 30 each: Group E received ultrasound-guided ESP block and Group P received ultrasound-guided PECS block. Perioperative analgesia was assessed by intraoperative fentanyl consumption, postoperative VAS scores, time to first rescue analgesia, 24-hour tramadol requirement, and adverse effects.

Results: Surgical and anaesthesia durations were comparable between groups. Mean intraoperative fentanyl consumption was significantly lower in the PECS group than the ESP group (82.5 ± 16.4 vs. 96.3 ± 18.7 µg; **p=0.003**). Postoperative tramadol requirement was also significantly lower with PECS block (86.0 ± 34.2 vs. 118.0 ± 41.5 mg; **p=0.002**). Time to first rescue analgesia was significantly longer in the PECS group (9.1 ± 2.6 vs. 6.2 ± 2.1 hours; **p<0.001**). Postoperative VAS scores were significantly lower in the PECS group at 0, 2, 4, and 6 hours. PONV was observed in 16.7% and 30.0% of PECS and ESP patients, respectively, without significant difference. No block-related complications or respiratory depression occurred. Conclusion: Both ESP and PECS blocks provided effective and safe perioperative analgesia. However, PECS block demonstrated superior analgesic efficacy, longer duration of analgesia, lower opioid consumption, and lower early postoperative pain scores. PECS block may therefore be preferred as part of a multimodal analgesic strategy for breast cancer surgery.

Keywords: Breast cancer surgery; Erector Spinae Plane block; Pectoral Nerve block; PECS block; postoperative analgesia; ultrasound-guided regional anesthesia; opioid-sparing analgesia; modified radical mastectomy.

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Introduction

Breast cancer is one of the most common malignancies affecting women worldwide and remains a major public health concern, especially in low- and middle-income countries such as India [1]. Surgery continues to be an important component of curative treatment and may include breast-conserving surgery, modified radical mastectomy, and axillary procedures depending on disease stage and patient factors.

Postoperative pain after breast cancer surgery is a frequent clinical problem. It may arise from surgical incision, tissue dissection, axillary clearance,

intercostal nerve injury, and inflammatory responses. Inadequately controlled acute postoperative pain can delay mobilization, impair respiratory effort, increase analgesic requirement, and reduce patient satisfaction. More importantly, severe acute pain is considered one of the risk factors for persistent post-surgical pain and post-mastectomy pain syndrome [2,3].

Systemic opioids have traditionally been used for perioperative analgesia in breast surgery. Although opioids are effective analgesics, their use is limited by adverse effects such as nausea, vomiting, sedation, respiratory depression, ileus, pruritus, delayed mobilization, and risk of opioid-related complications. Modern perioperative pain management therefore emphasizes multimodal and opioid-sparing analgesia, combining non-opioid analgesics with regional anesthesia techniques whenever appropriate [4,5].

Regional anesthesia techniques provide site-specific analgesia by blocking the neural pathways responsible for surgical pain. Thoracic paravertebral block has long been considered an effective technique for breast surgery analgesia, but its use may be limited by technical difficulty and potential complications such as pneumothorax, vascular puncture, hypotension, and neuraxial spread [6,7]. With the increasing availability of ultrasound guidance, newer fascial plane blocks have become popular because they are relatively easier to perform and have a favourable safety profile.

Among these techniques, the pectoral nerve block and erector spinae plane block have gained attention for perioperative analgesia in breast surgery. The pectoral nerve block targets the medial and lateral pectoral nerves, intercostobrachial nerve, long thoracic nerve, thoracodorsal nerve, and lateral branches of the intercostal nerves, thereby providing analgesia for the anterior chest wall and axillary region [8,9]. The erector spinae plane block is an interfascial plane block in which local anesthetic is deposited deep to the erector spinae muscle at the level of the transverse process. Its analgesic effect is believed to occur through cranio-caudal spread and diffusion toward the dorsal and ventral rami of spinal nerves [10,11].

Several studies have evaluated PECS block and ESP block for breast surgery analgesia, but the results have not been uniform. Some studies suggest better opioid-sparing effect and longer duration of analgesia with PECS block, whereas others report comparable analgesic efficacy between PECS and ESP block [12]. Differences in surgical procedure, block technique, local anesthetic volume, timing of block administration, and outcome measures may explain this variation.

Therefore, the present study was undertaken to compare ultrasound-guided erector spinae plane block and pectoral nerve block as components of perioperative analgesia in patients undergoing breast cancer surgery at a tertiary care centre. The comparison was made in terms of postoperative pain scores, intraoperative and postoperative analgesic requirement, duration of analgesia, patient satisfaction, and adverse effects.

Materials and Methods

The present quasi-experimental study was conducted to compare the efficacy of ultrasound-guided Erector Spinae Plane (ESP) block and Pectoral Nerve (PECS) block for perioperative analgesia in breast cancer surgeries in the Department of Anaesthesiology of a tertiary care teaching hospital over a period of 18 months, following approval from the Institutional Ethics Committee.

The study included female patients aged 18–60 years with American Society of Anesthesiologists (ASA) physical status I–II, scheduled for elective unilateral breast cancer surgery under general anaesthesia.

Sample Size was calculated by standard formula using a two-sample t-test for independent means, with a power of 80% and a significance level of 5%, the calculated sample size was 26 patients per group. After accounting for a 10% attrition rate, a total of 60 patients were included, with 30 patients in each group.

Patients were enrolled using a consecutive sampling method.

Inclusion Criteria

- Female patients aged 18–60 years
- ASA physical status I–II
- Patients scheduled for elective unilateral breast cancer surgery
- Patients willing to provide written informed consent

Exclusion Criteria

- Known allergy to local anaesthetics
- Coagulopathy or bleeding disorders
- Pre-existing neurological deficits involving the thoracic or cervical region
- History of chronic opioid use or substance abuse
- History of previous thoracic or breast surgery
- Psychiatric illness impairing comprehension or consent

Group Allocation - Eligible patients were allocated into two groups:

- **Group E (ESP group):** Patients received ultrasound-guided erector spinae plane block

- **Group P (PECS group):** Patients received ultrasound-guided pectoral nerve block

Materials Required for intervention

1) Inj. Bupivacaine 0.5% ampoule. (20 ml ampoule)
2) Multipara monitor (NIBP, ECG,)
3) Pulse oximeter
4) SONOSITE USG machine
5) Sterile USG probe over
6) A 22-gauge, 50-100 mm echogenic, short-bevel regional anesthesia needle

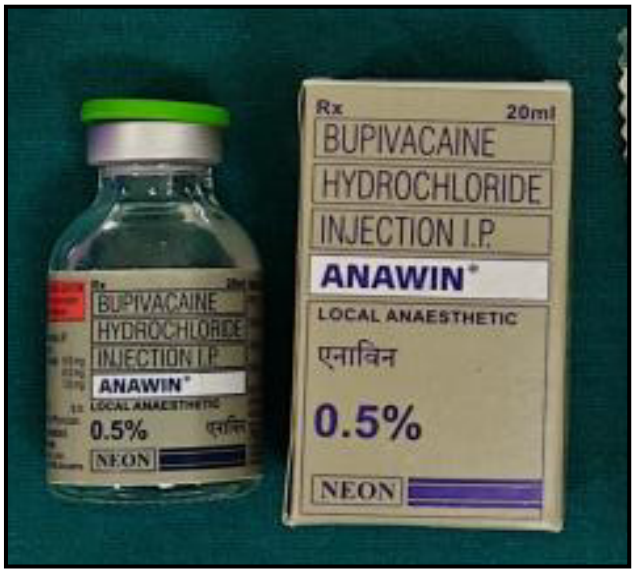

Image 1: Bupivacaine Injection

Anesthetic Technique: All patients were monitored intraoperatively with electrocardiography, non-invasive blood pressure, pulse oximetry, and capnography. After establishing intravenous access, general anaesthesia was induced using intravenous midazolam, propofol, fentanyl, and rocuronium. Endotracheal intubation was performed, and anaesthesia was maintained with sevoflurane in a mixture of oxygen and air. Ventilation parameters were adjusted to maintain end-tidal carbon dioxide within normal limits.

Methodology

A. The Erector Spinae Plane (ESP) block

The Erector Spinae Plane (ESP) block was an ultrasound-guided fascial plane block used for postoperative analgesia in patients undergoing modified radical mastectomy, breast-conserving surgery, thoracotomy, rib fracture management, video-assisted thoracoscopic surgery (VATS), upper abdominal surgery, and spine surgery.

Before performing the block, informed consent was obtained from all patients. Coagulation status and contraindications were assessed, allergies to local anesthetics were excluded, intravenous access was secured, and standard ASA monitoring was applied. Resuscitation equipment, oxygen, emergency drugs, and 20% lipid emulsion were kept readily available for the management of local anesthetic systemic toxicity (LAST).

Under strict aseptic precautions, including skin preparation with chlorhexidine-alcohol solution, use of a sterile ultrasound probe cover, sterile gel, and sterile draping, patients were positioned in the sitting, lateral decubitus, or prone position, with the sitting position being used most commonly.

For breast surgery, the block was usually performed at the T4–T5 vertebral level. A high-frequency linear ultrasound probe was placed in a parasagittal orientation approximately 2–3 cm lateral to the spinous process. The sonographic landmarks identified included the trapezius muscle, rhomboid major muscle (at upper thoracic levels), erector spinae muscle, transverse process, and pleura. Using an in-plane technique, the block needle was advanced under continuous ultrasound guidance until it contacted the transverse process. The needle tip was positioned deep to the erector spinae muscle and superficial to the transverse process.

After negative aspiration, 1–2 mL of normal saline was injected to confirm correct needle placement by demonstrating separation of the erector spinae muscle from the transverse process. Subsequently, 20–30 mL of 0.25% bupivacaine was administered incrementally, with 20–25 mL commonly used for unilateral breast surgery. The spread of local anesthetic beneath the erector spinae muscle was continuously observed under ultrasound guidance. Successful block placement was confirmed by hydrodissection, longitudinal spread of local anesthetic along the fascial plane, and elevation of the erector spinae muscle away from the transverse process. The block typically provided analgesia extending from the T2 to T8 dermatomes, covering

the anterior, lateral, and posterior thoracic walls as well as the axillary region.

Potential complications included vascular puncture, local anesthetic systemic toxicity, vasovagal reactions, pneumothorax, infection, hematoma formation, and block failure. These complications were minimized by maintaining strict aseptic precautions, ensuring continuous visualization of the needle tip, administering local anesthetic incrementally with repeated aspiration, adhering to maximum recommended doses of local anesthetic, and keeping resuscitation equipment and lipid emulsion immediately available throughout the procedure.

B. Pectoral Nerve Block (PEC1 AND PEC2)

The Pectoral Nerve (PECS) block was an ultrasound-guided fascial plane block used for postoperative analgesia in patients undergoing breast surgery, modified radical mastectomy, breast-conserving surgery, and other procedures involving the anterolateral chest wall.

After obtaining informed consent, confirming the patient's identity and surgical site, reviewing coagulation status, securing intravenous access, and applying standard ASA monitors, the patient was positioned supine with the ipsilateral arm abducted to approximately 90° and the head turned to the opposite side. Under strict aseptic precautions, including skin preparation with chlorhexidine-alcohol solution, use of a sterile ultrasound probe cover and sterile gel, and sterile draping, a high-frequency linear ultrasound probe (6–13 MHz) was used to identify the relevant anatomical structures.

For the PECS I block, the ultrasound probe was placed below the lateral third of the clavicle to identify the pectoralis major and pectoralis minor muscles. Using an in-plane approach, the needle was advanced from lateral to medial into the fascial plane between these two muscles. After negative aspiration and hydrodissection with 1–2 mL of normal saline, 10–15 mL of local anesthetic was injected into the plane.

For the PECS II block, the probe was moved laterally to visualize the pectoralis major, pectoralis minor, serratus anterior muscle, ribs, and pleura. Under continuous ultrasound guidance, the needle was advanced into the fascial plane between the pectoralis minor and serratus anterior muscles at the level of the third or fourth rib near the anterior axillary line. Following negative aspiration and hydro dissection, 20–25 mL of local anesthetic was administered. In most cases, 0.25% bupivacaine was used, with approximately 10 mL deposited in the PECS I plane and 20 mL in the PECS II plane.

The PECS I block provided anesthesia to the medial and lateral pectoral nerves, whereas the PECS II block additionally covered the intercostobrachial nerve, intercostal nerves (T2–T6), long thoracic nerve, and thoracodorsal nerve. This resulted in effective analgesia of the breast, axillary region, and anterolateral chest wall.

Potential complications included vascular puncture, hematoma formation, local anesthetic systemic toxicity (LAST), pneumothorax, infection, and block failure. These complications were minimized by maintaining strict aseptic precautions, ensuring continuous visualization of the needle tip, performing frequent aspiration, administering local anesthetic incrementally, and using meticulous ultrasound guidance throughout the procedure.

C. Drugs Used: The local anaesthetic solution used for both blocks consisted of 0.25% bupivacaine combined with dexamethasone as an adjuvant. Bupivacaine is a long-acting amide local anaesthetic widely used for fascial plane blocks due to its prolonged duration of action and favourable safety profile at appropriate concentrations. Dexamethasone was added as an adjuvant to extend the duration of block analgesia. For intraoperative analgesia supplementation, intravenous fentanyl (a synthetic opioid) was used; postoperative rescue analgesia was provided with intravenous tramadol.

D. Intraoperative Analgesia - Intraoperative opioid supplementation with intravenous fentanyl was administered if the mean arterial pressure increased by more than 20% from baseline. Total intraoperative opioid consumption was recorded.

E. Postoperative Assessment

Postoperative pain was assessed using the Visual Analogue Scale (VAS) at predefined time intervals. The time to first request for rescue analgesia**,** total analgesic consumption within 24 hours, and any adverse effects were recorded.

F. Outcome Measures

- Primary outcome: Efficacy of ESP block versus PECS block for perioperative analgesia
- Secondary outcomes: Duration of analgesia, postoperative pain scores, opioid consumption, and adverse effects

Results:

Table 1: Comparison of Duration of Surgery between two groups

Group	Duration (minutes) ± SD	p-value
ESP Group	128.4 ± 22.6	0.68
PECS Group	125.9 ± 24.1	

Table 1 compares the duration of surgery between the ESP and PECS groups. The mean duration of surgery was 128.4 ± 22.6 minutes in the ESP group and 125.9 ± 24.1 minutes in the PECS group. The difference was not statistically significant with a p-value of 0.68, indicating that surgical duration was comparable between the groups.

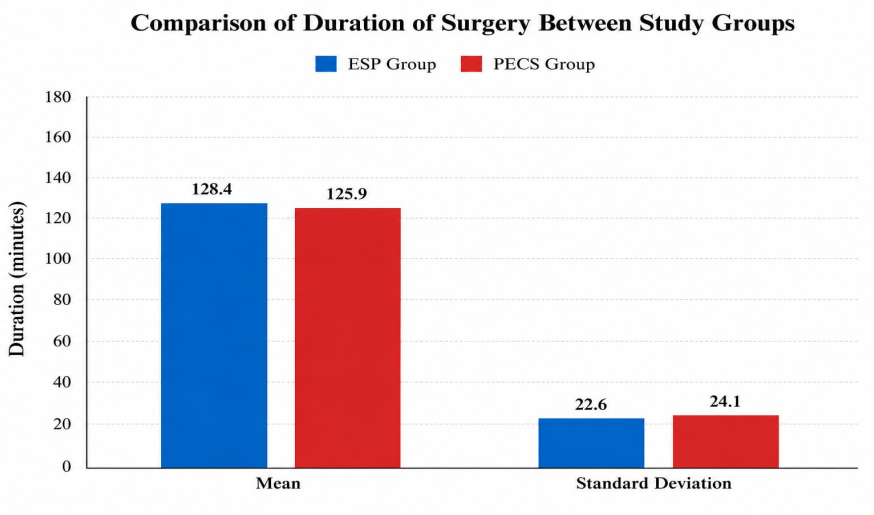

Figure 1: Comparison of Duration of Surgery between two groups

Table 2: Comparison of Duration of Anaesthesia between two groups

Group	Duration (minutes) ± SD	p-value
ESP Group	156.7 ± 24.5	0.70
PECS Group	154.2 ± 25.0	

Table 2 presents the comparison of anaesthesia duration between the two groups. The mean duration of anaesthesia was 156.7 ± 24.5 minutes in the ESP group and 154.2 ± 25.0 minutes in the PECS group. The difference was not statistically significant with a p-value of 0.70, showing that both groups were comparable with respect to anaesthetic exposure.

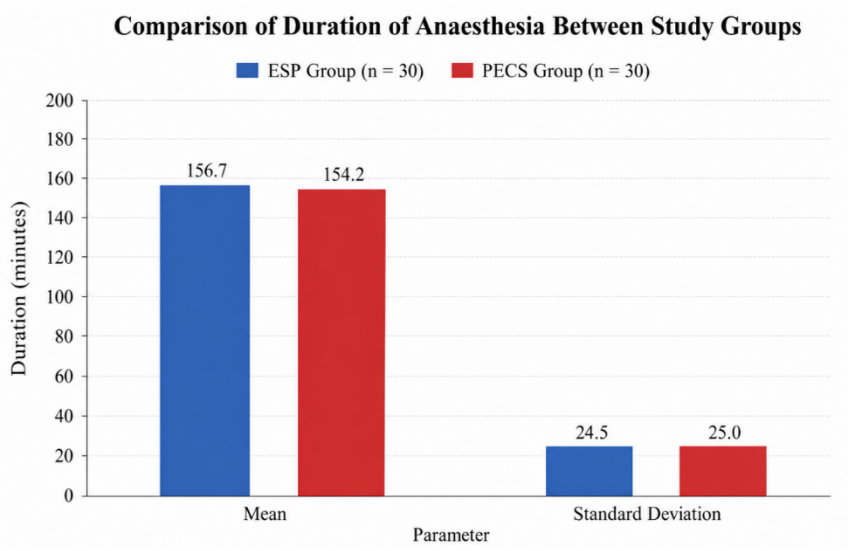

Figure 2: Comparison of Duration of Anaesthesia between two groups

Perioperative Analgesic Efficacy (Primary Objective)

Table 3: Comparison of Intraoperative Fentanyl Consumption

Group	Fentanyl Consumption (µg) ± SD	p-value
ESP Group	96.3 ± 18.7	0.003
PECS Group	82.5 ± 16.4	

Table 3 demonstrates the comparison of intraoperative fentanyl consumption between the ESP and PECS groups. The mean fentanyl consumption was higher in the ESP group at 96.3 ± 18.7 µg, compared to 82.5 ± 16.4 µg in the PECS group. This difference was statistically significant with a p-value of 0.003, indicating that patients receiving PECS block required significantly less intraoperative fentanyl than those receiving ESP block.

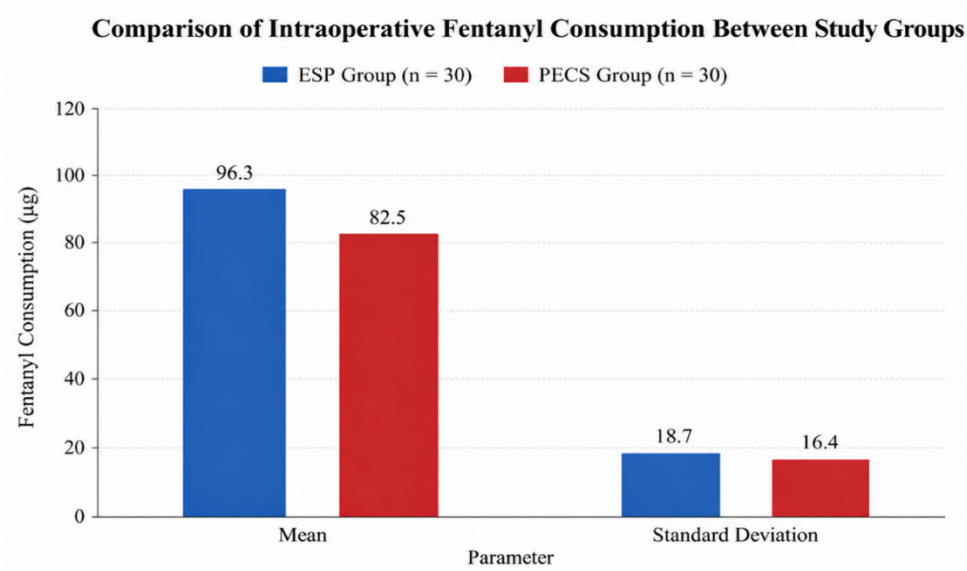

Figure 3: Comparison of Intraoperative Fentanyl Consumption

Table 4: Comparison of Postoperative Opioid Consumption in First 24 Hours

Group	Tramadol Requirement (mg) ± SD	p-value
ESP Group	118.0 ± 41.5	0.002
PECS Group	86.0 ± 34.2	

Table 4 shows the postoperative opioid requirement during the first 24 hours. The mean tramadol requirement was 118.0 ± 41.5 mg in the ESP group and 86.0 ± 34.2 mg in the PECS group. The difference was statistically significant with a p-value of 0.002, suggesting that the PECS block was associated with significantly lower postoperative opioid consumption compared to the ESP block.

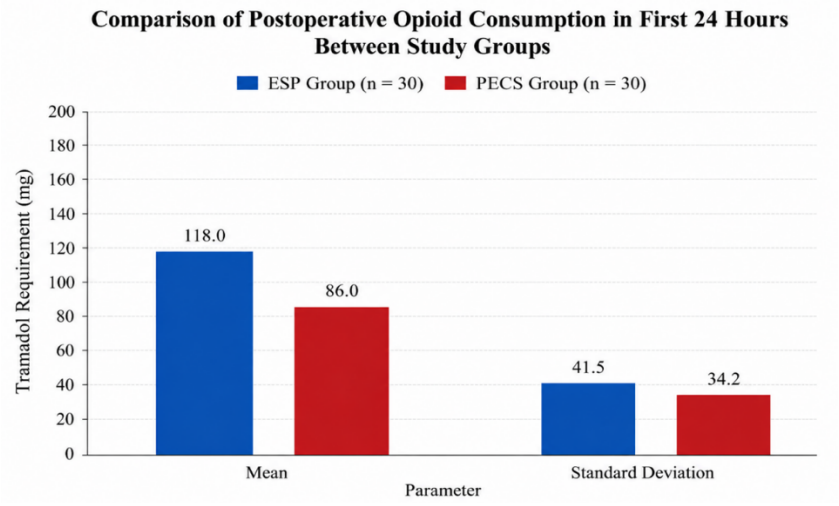

Figure 4: Comparison of Postoperative Opioid Consumption in First 24 Hours

Duration of Postoperative Analgesia

Table 5: Comparison of Time to First Rescue Analgesia

Group	Time (hours) ± SD	p-value
ESP Group	6.2 ± 2.1	<0.001
PECS Group	9.1 ± 2.6	

Table 5 compares the time to first request for rescue analgesia between the two groups. The mean time to first rescue analgesia was 6.2 ± 2.1 hours in the ESP group, whereas it was 9.1 ± 2.6 hours in the PECS group. The difference was highly statistically significant with a p-value of <0.001, indicating that PECS block provided a longer duration of postoperative analgesia than ESP block.

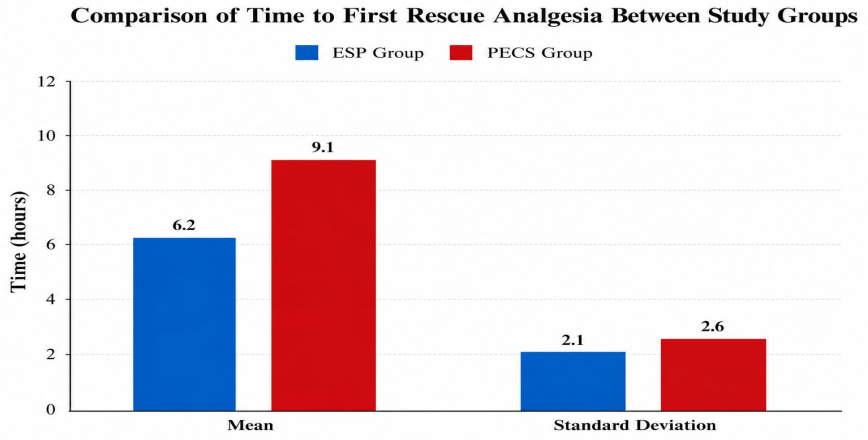

Figure 5: compares the time to first request for rescue analgesia between the two groups

Postoperative Pain Scores (VAS)

Table 6: Comparison of Early Postoperative VAS Scores

Time	ESP Group (Mean ± SD)	PECS Group (Mean ± SD)	p-value
0 hour	2.4 ± 0.9	1.9 ± 0.8	0.04
2 hours	3.3 ± 1.0	2.6 ± 0.9	0.01
4 hours	3.8 ± 1.1	3.0 ± 1.0	0.006
6 hours	4.1 ± 1.2	3.4 ± 1.1	0.03

Table 6 presents early postoperative VAS pain scores at 0, 2, 4, and 6 hours. At 0 hour, the mean VAS score was 2.4 ± 0.9 in the ESP group and 1.9 ± 0.8 in the PECS group, with a p-value of 0.04. At 2 hours, the score was 3.3 ± 1.0 in the ESP group and 2.6 ± 0.9 in the PECS group, with a p-value of 0.01. At 4 hours, the ESP group had a VAS score of 3.8 ± 1.1, while the PECS group had 3.0 ± 1.0, with a p-value of 0.006. At 6 hours, the VAS score was 4.1 ± 1.2 in the ESP group and 3.4 ± 1.1 in the PECS group, with a p-value of 0.03. These findings show that early postoperative pain scores were significantly lower in the PECS group at all measured time points.

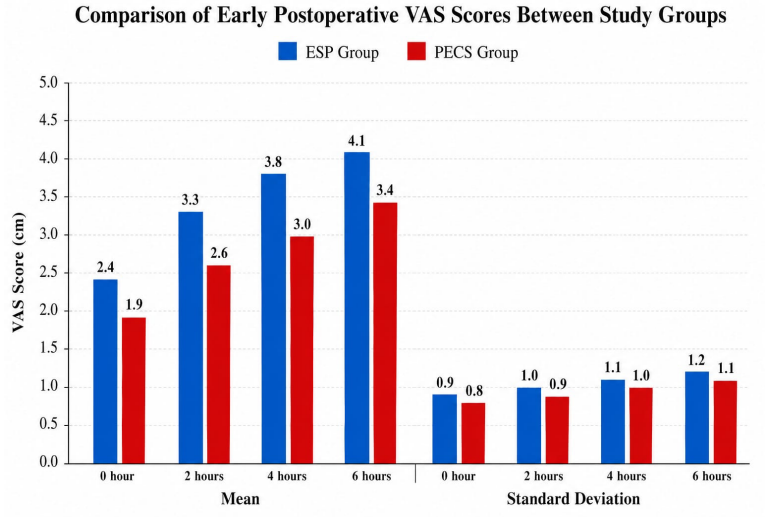

Figure 6: Comparison of Early Postoperative VAS Scores

Adverse Effects and Complications

Table 7: Other Adverse Effects in the Study Groups

Adverse Effect	ESP Group, n (%)	PECS Group, n (%)	p-value
Hypotension	2 (6.7)	1 (3.3)	0.55
Bradycardia	1 (3.3)	1 (3.3)	1.00
Respiratory depression	0 (0)	0 (0)	—
Block-related complications	0 (0)	0 (0)	—
	9 (30.0)	5 (16.7)	0.22

Table 13 presents other adverse effects observed in both groups. Hypotension occurred in 2 patients (6.7%) in the ESP group and 1 patient (3.3%) in the PECS group, with a p-value of 0.55. Bradycardia was observed in 1 patient (3.3%) in each group, with a p-value of 1.00. No cases of respiratory depression or block-related complications were reported in either group. These findings indicate that both blocks were relatively safe, with no significant difference in adverse effects between the two groups. PONV was observed in 9 patients (30.0%) in the ESP group and 5 patients (16.7%) in the PECS group. Although the incidence was numerically higher in the ESP group, the difference was not statistically significant with a p-value of 0.22.

Discussion

Breast cancer is the most commonly diagnosed cancer among women worldwide and remains a major public health concern. Modified radical mastectomy is frequently associated with significant postoperative pain caused by tissue injury, muscle dissection, nerve irritation, and axillary lymph node clearance. Inadequately treated acute pain may delay mobilization, prolong hospital stay, increase healthcare costs, and contribute to chronic post-mastectomy pain syndrome. Villa et al. [13] and Chang et al. [3] reported that persistent pain after breast surgery can adversely affect quality of life and functional recovery.

Multimodal analgesia has therefore become central to perioperative pain management. Schwenk and Mariano [4] emphasized that multimodal strategies improve analgesia while reducing opioid consumption and related adverse effects. Bugada et al. [5] similarly supported opioid-sparing techniques in cancer surgery. Ultrasound-guided fascial plane blocks are increasingly used because they are relatively simple, effective, and associated with a favorable safety profile. Barrington and Uda [7] highlighted the improved precision and safety provided by ultrasound guidance, while Woodworth et al. [6] described the expanding role of regional anesthesia in breast surgery.

The Erector Spinae Plane (ESP) block, described by Forero et al. [10], involves injection of local anesthetic deep to the erector spinae muscle adjacent to the transverse process. Spread along this plane may block multiple thoracic spinal nerves and provide extensive analgesia. Chin et al. [11] and Thiagarajan et al. [14] demonstrated its effectiveness in breast surgery. The Pectoral Nerve (PECS) block was developed specifically for breast and axillary procedures. It blocks the pectoral, intercostobrachial, thoracodorsal, long thoracic, and lateral intercostal nerves, thereby providing targeted coverage of the surgical field.

Although both techniques are effective, their comparative efficacy remains uncertain. Hong et al. [12], in a Bayesian network meta-analysis, reported that both PECS II and ESP blocks reduced postoperative pain and opioid consumption, with a possible advantage for PECS block. The present study therefore compared ultrasound-guided ESP and PECS blocks in patients undergoing modified radical mastectomy under general anesthesia.

Demographic Characteristics: The ESP and PECS groups were comparable in age, weight, BMI, and ASA physical status. Mean age was 49.2 ± 7.8 years in the ESP group and 48.6 ± 8.1 years in the PECS group, with no significant difference ($p = 0.78$). Similar demographic findings have been reported by Thiagarajan et al. [14], Hong et al. [12], Woodworth et al. [6], and Elewa et al. [15]. Comparable baseline characteristics reduce the likelihood that age, body habitus, or preoperative health status influenced postoperative analgesic outcomes.

Surgical Characteristics: The duration of surgery was similar in both groups, with no statistically significant difference. Thus, patients experienced comparable operative duration and tissue trauma, minimizing their potential influence on postoperative pain and analgesic consumption. Comparable surgical characteristics have also been reported by Thiagarajan et al. [14], Elewa et al. [15], and Hong et al. [12].

Intraoperative Hemodynamic Parameters: Heart rate and mean arterial pressure remained within acceptable physiological limits in both groups. Minor fluctuations occurred during surgery, but no clinically significant hemodynamic instability was observed.

Heart Rate: Baseline heart rate was comparable between groups and remained stable intraoperatively. No clinically important tachycardia or bradycardia occurred, suggesting that both blocks attenuated the sympathetic response to surgical

stimulation. Similar findings were reported by Forero et al. [10], Chin et al. [11], Thiagarajan et al. [14], and Hong et al. [12].

Mean Arterial Pressure: Baseline MAP and intraoperative trends were comparable. No significant hypertension or hypotension was recorded. These findings indicate that both techniques provided satisfactory control of nociceptive responses and maintained cardiovascular stability, consistent with previous reports by Forero et al. [10], Chin et al. [11], Thiagarajan et al. [14], and Woodworth et al. [6].

Intraoperative Opioid Requirement: Both blocks reduced the need for intraoperative fentanyl, indicating effective analgesic coverage. The PECS group required comparatively less opioid, possibly because PECS block directly targets nerves supplying the breast and axilla. The opioid-sparing effects of regional anesthesia have been described by Bugada et al. [5], Thiagarajan et al. [14], and Hong et al. [12].

Early Postoperative Pain: Both groups had low early postoperative VAS scores, confirming effective analgesia. However, scores were consistently lower in the PECS group during the first few hours, suggesting superior early pain control. This may be explained by direct blockade of nerves supplying the breast and axillary region. Hong et al. [12] reported effective analgesia with both PECS II and ESP blocks but noted a trend favoring PECS. Thiagarajan et al. [14] and Woodworth et al. [6] also confirmed the effectiveness of regional blocks in breast surgery.

Late Postoperative Pain: At 12 and 24 hours, pain remained acceptable in both groups. Nevertheless, the PECS group continued to demonstrate lower VAS scores, indicating a more sustained analgesic effect. Although the difference was less marked than during the early postoperative period, the overall trend favoured PECS block. ESP block has also been associated with prolonged analgesia, as reported by Forero et al. [10], Chin et al. [11], and Thiagarajan et al. [14] Duration of Analgesia

The mean time to first rescue analgesia was significantly longer in the PECS group than in the ESP group: 9.1 ± 2.6 versus 6.2 ± 2.1 hours, respectively ($p < 0.001$). This demonstrates that PECS block provided more prolonged analgesia after modified radical mastectomy.

PECS block provides comprehensive coverage of the pectoral, intercostobrachial, thoracodorsal, long thoracic, and lateral intercostal nerves. This is particularly advantageous in procedures involving axillary dissection. Woodworth et al. [6] described PECS block as an effective technique for breast surgery.

ESP block depends on the spread of local anesthetic deep to the erector spinae muscle and its diffusion to the dorsal and ventral rami. Chin et al.(11) noted that this spread may be variable, influencing the extent and duration of analgesia. Hong et al.(12) reported superior analgesia and lower analgesic requirements with PECS block, whereas Forero et al.(10), Chin et al.(11), and Thiagarajan et al.(14) reported effective but variable analgesia with ESP block. Thus, both techniques were effective, but PECS provided significantly longer analgesia in the present study.

Postoperative Analgesic Consumption: Patients in the PECS group required fewer rescue analgesics during the first 24 hours, including paracetamol, diclofenac, and tramadol. This indicates better pain control and prolonged analgesic efficacy. The comprehensive nerve blockade achieved with PECS may explain this finding, whereas variable local anesthetic spread may limit ESP block effectiveness.

Reduced tramadol use is clinically important because opioids may cause nausea, vomiting, sedation, respiratory depression, delayed mobilization, and prolonged hospitalization. Schwenk and Mariano (4) and Bugada et al.(5) emphasized the benefits of opioid-sparing analgesia. Hong et al.(12) similarly reported lower analgesic requirements with PECS block. These findings support PECS block as an important component of multimodal and enhanced recovery protocols.

Patient Satisfaction: Patient satisfaction was higher in the PECS group. This likely reflects lower pain scores, longer analgesia, and reduced rescue analgesic requirements. Schwenk and Mariano (4) emphasized that effective multimodal analgesia improves comfort and quality of recovery. Similar benefits have been reported by Hong et al.(12), Woodworth et al.(6), and Thiagarajan et al.(14).

Adverse Effects and Complications

Postoperative Nausea and Vomiting: PONV incidence was low in both groups, with no statistically significant difference. A slightly lower incidence in the PECS group may be related to reduced tramadol consumption. Opioid-sparing strategies are known to reduce PONV, as reported by Schwenk and Mariano (4), Bugada et al.(5), and Hong et al.(12).

Block-related Complications

No pneumothorax, local anesthetic toxicity, hematoma, or infection occurred. All blocks were performed under ultrasound guidance with aseptic precautions. Ultrasound permits visualization of anatomical structures and needle placement, improving safety, as described by Barrington and Uda (7). Woodworth et al.(6), Chin et al.(11), and Thiagarajan et al.(14) also reported favorable safety profiles for PECS and ESP blocks.

Clinical Implications: Both ESP and PECS blocks provided effective analgesia, but PECS block produced lower pain scores, longer analgesia, reduced rescue analgesic consumption, and greater patient satisfaction. Effective pain control facilitates early mobilization, physiotherapy, comfortable breathing, and recovery. Villa et al.(13) and Chang et al.(3) emphasized the importance of adequate perioperative analgesia in reducing persistent postoperative pain.

Both techniques are relatively simple and can be performed with standard ultrasound equipment. However, based on the present findings, PECS block may be preferable for modified radical mastectomy, particularly when axillary dissection is performed.

Limitations: This single-center study had a relatively limited sample size, which may restrict generalizability and reduce the ability to detect smaller differences. Follow-up was limited to 24 hours; therefore, long-term effects on chronic post-mastectomy pain could not be assessed.

Formal sensory mapping was not performed, and variability in local anesthetic spread may have influenced block effectiveness. Psychological factors, anxiety, individual pain perception, and patient expectations were also not evaluated. Future multicenter studies with larger samples, sensory mapping, and long-term follow-up are recommended.

Conclusion

The present prospective randomized comparative study evaluated the efficacy of ultrasound-guided Erector Spinae Plane (ESP) block and Pectoral Nerve (PECS) block for postoperative analgesia in patients undergoing modified radical mastectomy. Both ESP and PECS blocks provided effective postoperative analgesia as components of multimodal analgesia. However, patients receiving PECS block experienced significantly lower postoperative pain scores, particularly during the early postoperative period. The duration of analgesia was significantly longer in the PECS group, with a delayed requirement for first rescue analgesia (9.1 ± 2.6 vs. 6.2 ± 2.1 hours; $p < 0.001$). PECS block was also associated with lower postoperative consumption of paracetamol, diclofenac, and tramadol, demonstrating an opioid-sparing effect. Higher patient satisfaction scores further reflected improved postoperative comfort and recovery.

The incidence of postoperative nausea and vomiting was low and comparable between groups. No major block-related complications, including pneumothorax, local anesthetic systemic toxicity, hematoma, or infection, were observed, confirming the safety of both ultrasound-guided techniques. The superior analgesic efficacy of PECS block may be attributed to its comprehensive blockade of nerves supplying the breast and axillary region. Overall, both techniques are safe and effective; however, PECS block provides superior and longer-lasting postoperative analgesia, reduces perioperative opioid and rescue analgesic requirements, and may be preferred for modified radical mastectomy as part of a multimodal analgesic approach.

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