



Original Research Article

COMPARING THE QUALITY OF ANALGESIA WITH ULTRASOUND-GUIDED PECTORAL NERVE BLOCK AND SERRATUS ANTERIOR PLANE BLOCK II IN PATIENTS UNDERGOING MODIFIED RADICAL MASTECTOMY: A RANDOMIZED CLINICAL TRIAL

Neha Kumari¹, Reema Karhana¹

¹Senior Resident, Department of Anaesthesia, Vardhman Mahavir Medical College and Safdarjung Hospital, Delhi, India.

OPEN ACCESS

ABSTRACT

CORRESPONDING AUTHOR

Dr. Neha Kumari

Senior Resident, Department of Anaesthesia, Vardhman Mahavir Medical College and Safdarjung Hospital, Delhi, India.

Email: nehaadhana01@gmail.com

DOI: 10.21276/gjmscr.2026.1.2.1

Received: 03-05-2026

Revised: 09-06-2026

Accepted: 21-06-2026

Published: 15-07-2026

How to cite this article: Kumari N, Karhana R, Comparing the Quality of Analgesia with Ultrasound-Guided Pectoral Nerve Block and Serratus Anterior Plane Block II in Patients Undergoing Modified Radical Mastectomy: A Randomized Clinical Trial. Glob J Med Sci Clin Res. 2026;1(2): 1-9.

Source of Support: Nil,

Conflict of Interest: None declared

Copyright© Global Journal of Medical Sciences and Clinical Research

Background: Modified radical mastectomy (MRM) remains one of the most commonly performed procedures for breast cancer. Despite advances in perioperative care, postoperative pain continues to be a major concern owing to extensive surgical dissection involving the breast, pectoral muscles, axilla, and intercostobrachial nerves. Inadequate analgesia delays recovery, increases opioid consumption, prolongs hospital stay, and may contribute to chronic post-mastectomy pain syndrome. Ultrasound-guided fascial plane blocks, particularly the Pectoral Nerve Block (PECS II) and Serratus Anterior Plane Block II (SAP II), have emerged as effective components of multimodal analgesia. However, evidence directly comparing their analgesic efficacy remains limited. **Aim:** To compare the efficacy of ultrasound-guided PECS II block and Serratus Anterior Plane Block II in providing postoperative analgesia for patients undergoing modified radical mastectomy under general anaesthesia.

Methods: This prospective, randomized, parallel-group controlled trial will be conducted in the Department of Anaesthesiology at a tertiary care teaching hospital. Eighty adult female patients aged 18–70 years with ASA physical status I–III scheduled for elective modified radical mastectomy will be randomly allocated into two groups: Group P (ultrasound-guided PECS II block) and Group S (ultrasound-guided Serratus Anterior Plane Block II). The primary outcome will be postoperative pain assessed using the Visual Analogue Scale (VAS) during the first 24 postoperative hours. Secondary outcomes will include time to first rescue analgesia, total postoperative analgesic consumption, opioid requirement, patient satisfaction, and block-related complications.

Results: Both regional techniques are expected to provide effective postoperative analgesia. However, ultrasound-guided PECS II block is anticipated to produce lower postoperative pain scores, prolong analgesia, reduce postoperative opioid consumption and rescue analgesic requirements, and improve patient satisfaction compared with Serratus Anterior Plane Block II, while maintaining a comparable safety profile.

Conclusion: Ultrasound-guided fascial plane blocks are effective opioid-sparing techniques for breast surgery. This study aims to provide comparative evidence regarding PECS II and Serratus Anterior Plane Block II, thereby assisting anaesthesiologists in selecting the most effective regional analgesic technique for patients undergoing modified radical mastectomy.

Keywords: Modified radical mastectomy; PECS II block; Serratus anterior plane block II; Ultrasound-guided regional anaesthesia; Postoperative analgesia; Breast surgery; Visual Analogue Scale; Opioid-sparing analgesia; Randomized controlled trial.

INTRODUCTION

Breast cancer is the most common malignancy among women worldwide and remains a leading cause of cancer-related mortality despite advances in screening, diagnosis, and treatment.^[1,2] Modified radical mastectomy (MRM) continues to be one of the standard surgical procedures for breast cancer management. Although improvements in surgical techniques have enhanced perioperative outcomes, effective postoperative pain control remains a major challenge because of extensive tissue dissection involving the

breast, pectoral muscles, axilla, and intercostobrachial nerves.^[3,4] Inadequate analgesia delays recovery, prolongs hospital stay, increases opioid consumption, and contributes to chronic post-mastectomy pain syndrome, making optimal pain management an essential component of Enhanced Recovery After Surgery (ERAS) protocols.^[5-8] Traditionally, postoperative analgesia following breast surgery has relied on systemic opioids and non-steroidal anti-inflammatory drugs as part of multimodal analgesia. While effective, opioid use is associated with adverse effects including postoperative nausea and vomiting,

excessive sedation, respiratory depression, urinary retention, constipation, and delayed recovery, which may hinder early mobilization and reduce patient satisfaction.^[9–12] Consequently, opioid-sparing regional anaesthesia techniques have gained increasing importance in perioperative breast surgery.

Ultrasound-guided fascial plane blocks have become popular because they provide targeted analgesia with improved accuracy, greater safety, and reduced local anaesthetic requirements compared with landmark-based techniques.^[13–17] Among these, the Pectoral Nerve Block II (PECS II) provides analgesia by blocking the medial and lateral pectoral, long thoracic, thoracodorsal, and upper intercostal nerves through local anaesthetic deposition between the pectoral muscles and the serratus anterior muscle. In contrast, the Serratus Anterior Plane Block II (SAP II) primarily blocks the lateral cutaneous branches of the intercostal nerves by depositing local anaesthetic adjacent to the serratus anterior muscle, providing effective analgesia for the lateral thoracic wall and axilla.^[18–21] Both PECS II and SAP II have demonstrated favourable postoperative analgesia following breast surgery and are increasingly incorporated into multimodal analgesic protocols. However, comparative evidence regarding their relative analgesic efficacy, duration of pain relief, opioid-sparing effect, and postoperative recovery remains inconclusive because of variations in study design, local anaesthetic techniques, and outcome measures across published studies.^[22–25]

Therefore, the present study was undertaken to compare ultrasound-guided PECS II block and Serratus Anterior Plane Block II with respect to postoperative pain scores, duration of analgesia, rescue analgesic requirements, opioid consumption, and overall postoperative recovery in patients undergoing modified radical mastectomy.

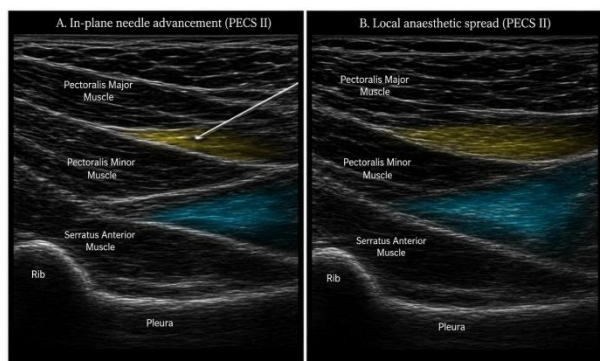


Figure 1: Ultrasound-guided Pectoral Nerve Block II (PECS II): Sonoanatomy and Needle Placement

Ultrasound-guided pectoral nerve block II (PECS II) technique for postoperative analgesia for modified radical mastectomy is shown in figure 1. A) Advancing the needle through the skin under ultrasound guidance in in-plane technique with local anaesthetic deposition between pectoralis major and pectoralis minor (PECS I). B) Injecting local anaesthetic between pectoralis minor and serratus anterior muscles (PECS II). Local anaesthetic diffusion occurs in between the interfascial planes blocking the medial and lateral pectoral nerves, long thoracic nerve, thoracodorsal nerve, and lateral cutaneous branches of upper intercostal nerves. The use

of ultrasound helps with precise needle placement with dispersion of local anaesthetic and decreases the likelihood of complications occurring.

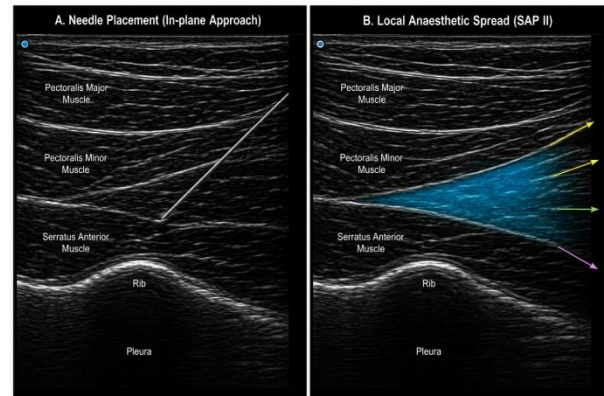


Figure 2: Ultrasound-guided Serratus Anterior Plane Block II (SAP II): Sonoanatomy and Needle Placement

The image below presents the use of ultrasound-guided Serratus Anterior Plane Block II (SAP II) as a technique for postoperative anesthesia for patients undergoing modified radical mastectomy. The first image shows the technique of advancing the syringe used to perform the nerve block into the correct plane of the serratus anterior muscle and providing support for accurate distribution of the anesthetic within the target area, the second shows the spread of the anesthetic in the plane of the serratus anterior muscle and lateral branches of the intercostal nerves. The use of ultrasound allows for precise recognition of the area needing administration of the anesthetic to avoid damaging adjacent structures and improve safety.

Figure 3. Comparison of Local Anaesthetic Spread: PECS II vs SAP II

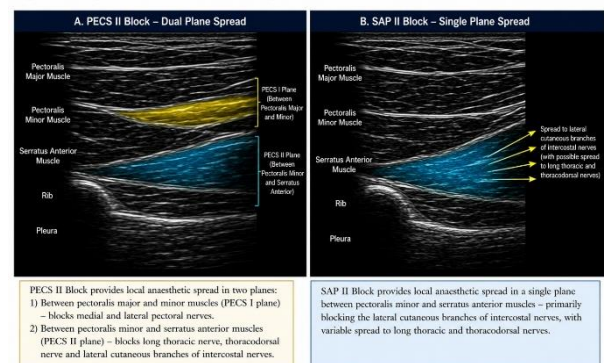


Figure 3: Comparison of Local Anaesthetic Spread in Ultrasound-guided PECS II and Serratus Anterior Plane Block II

Figure 3 demonstrates the anatomical differences between ultrasound-guided PECS II block and Serratus Anterior Plane Block II (SAP II). The PECS II block involves injection into two interfascial planes, providing broader neural coverage by blocking the medial and lateral pectoral, long thoracic, thoracodorsal, and upper intercostal nerves. In contrast, the SAP II block uses a single interfascial injection adjacent to the serratus anterior muscle, primarily targeting the lateral cutaneous branches of the thoracic intercostal nerves. The wider sensory coverage achieved with the PECS II block likely

explains its superior postoperative analgesia following modified radical mastectomy.

Aims and Objectives

Aim

The aim is to evaluate the effectiveness of postoperative analgesia achieved through ultrasound-assisted Pectoral Nerve Block II (PECS II) versus ultrasound-assisted Serratus Anterior Plane Block II (SAP II) in patients who have undergone modified radical mastectomy under general anesthesia.

Primary Objective

- The manifestations of postoperative pain intensity in patients undergoing ultrasound-guided surgeries in terms of the observations made through the Visual Analog Scale (VAS) at specified time intervals after the procedure in the first 24 hours exhibit marked differences.

Secondary Objectives

- To compare the time until the first instance of analgesic requirement in each patient.
- To quantify the overall amount of analgesic drugs that were consumed during the first 24 hours following surgery.
- To measure the amount of opioid drugs consumed during the surgery.
- To assess each patient's postoperative hemodynamic profiles (heart rate and mean arterial pressure) at predetermined times.
- To evaluate how long pain relief lasted and how effective postoperative analgesia was by comparing the two techniques.
- To determine the proportion of patients with nausea and vomiting after surgery.
- To assess patient satisfaction regarding pain management following surgery according to a standardized satisfaction score.
- To determine the duration of time it took for a patient to get out of bed following surgery.
- To quantify the number of complications (related to both the nerve block and surgery).

To assess whether the ultrasound-guided PECS II blocks and Serratus Anterior Plane Blocks are safety and effective options in an overall multimodal approach to postoperative analgesia after modified radical mastectomy.

MATERIAL AND METHODS

Study design and setting

This prospective, parallel-group, randomized clinical trial was conducted in the Department of Anaesthesiology in collaboration with the Department of General Surgery at a tertiary care teaching hospital over a period of 18 months. The study compared the postoperative analgesic efficacy of ultrasound-guided Pectoral Nerve Block II (PECS II) and Serratus Anterior Plane Block II (SAP II) in patients undergoing elective modified radical mastectomy under general anaesthesia.

Study population

Eighty adult female patients aged 18–70 years with American Society of Anesthesiologists (ASA) physical status I–III undergoing elective unilateral modified radical mastectomy were enrolled.

Sample size

The sample size was calculated assuming a medium effect size (Cohen's $d=0.65$), 95% confidence level, 80% study power, and $\alpha=0.05$. A minimum of 36 patients per group was required; therefore, 80 patients were included to compensate for potential dropouts, with 40 patients allocated to each group.

Sample size formula

$$n = \frac{2(Z_{\alpha/2} + Z_{\beta})^2 \sigma^2}{d^2}$$

Where:

- n = Sample size in each group
- $Z_{\alpha/2} = 1.96$ (95% confidence interval)
- $Z_{\beta} = 0.84$ (80% power)
- σ = Estimated standard deviation
- d = Minimum clinically significant difference

Randomization and blinding

Patients were randomized in a 1:1 ratio using a computer-generated randomization sequence with allocation concealment through sequentially numbered, opaque, sealed envelopes.

- **Group P (n=40):** Ultrasound-guided PECS II block
- **Group S (n=40):** Ultrasound-guided Serratus Anterior Plane Block II

The study followed a double-blind design. Patients and the investigator responsible for postoperative assessment were blinded to group allocation, while the anaesthesiologist performing the block was not involved in postoperative data collection.

Eligibility criteria

Inclusion criteria

- Female patients aged 18–70 years.
- ASA physical status I–III.
- Elective unilateral modified radical mastectomy under general anaesthesia.
- Ability to understand the Visual Analogue Scale (VAS).
- Written informed consent.

Exclusion criteria

- Refusal to participate.
- Allergy to amide local anaesthetics.
- Coagulopathy or anticoagulant therapy.
- Local infection at the injection site.
- BMI >35 kg/m².
- Severe hepatic, renal, cardiac, or respiratory disease.
- Chronic opioid use or chronic pain disorders.
- Neurological disorders affecting pain perception.
- Pregnancy or lactation.
- Previous ipsilateral breast or axillary surgery.
- Failed regional block.

Anaesthetic and block technique

Standard ASA monitoring was instituted for all patients. General anaesthesia was induced with intravenous fentanyl (2 µg/kg), propofol (2 mg/kg), and atracurium (0.5 mg/kg), and maintained using oxygen, air, sevoflurane, and intermittent atracurium.

All regional blocks were performed preoperatively under ultrasound guidance using a high-frequency linear probe (6–13 MHz).

- **Group P:** PECS II block was performed by injecting 10 mL of 0.25% bupivacaine between the pectoralis major and minor muscles, followed by 20 mL between the pectoralis minor and serratus anterior muscles.
- **Group S:** SAP II block was performed by injecting 30 mL of 0.25% bupivacaine beneath the serratus anterior muscle at the fourth or fifth rib level.

Successful sensory blockade was confirmed before induction of general anaesthesia.

Postoperative analgesia

All patients received intravenous paracetamol (1 g every 8 hours). Rescue analgesia consisted of intravenous tramadol (100 mg) whenever the VAS score was ≥ 4 or upon patient request. Total tramadol consumption during the first 24 postoperative hours was recorded.

Outcome measures

Primary outcome

- Postoperative pain intensity measured using the Visual Analogue Scale (VAS) at 0, 2, 4, 6, 12, and 24 hours.

Secondary outcomes

- Time to first rescue analgesia.
- Total 24-hour tramadol consumption.
- Intraoperative fentanyl requirement.
- Heart rate and mean arterial pressure.
- Postoperative nausea and vomiting.
- Patient satisfaction (5-point Likert scale).
- Block performance time.
- Block-related complications.
- Duration of postoperative hospital stay.

Statistical analysis

Data were analysed using IBM SPSS Statistics version 27.0. Continuous variables were expressed as mean $\pm$ standard deviation or median (interquartile range), while categorical variables were presented as frequencies and percentages. Group comparisons were performed using the independent Student's *t*-test or Mann–Whitney *U* test for continuous variables and Chi-square or Fisher's exact test for categorical variables. Repeated measures ANOVA with Bonferroni post-hoc correction was used for serial VAS and haemodynamic measurements. A *p* value <0.05 was considered statistically significant.

RESULTS

A total of 80 female patients undergoing elective modified radical mastectomy were randomized equally into the PECS II block group (Group P, $n=40$) and the Serratus Anterior Plane Block II group (Group S, $n=40$). All participants completed the study and were included in the final analysis. Baseline demographic and perioperative characteristics were comparable between the two groups. Ultrasound-guided regional blocks were successfully performed in all patients without block failure. Patients receiving the PECS II block experienced significantly lower postoperative pain scores, prolonged analgesia, delayed rescue analgesic requirement, and reduced postoperative opioid consumption compared with the SAP II group. Intraoperative haemodynamic parameters remained stable in both groups, although supplemental fentanyl requirement was significantly lower in the PECS II group. Patient satisfaction was significantly higher following PECS II block, while postoperative nausea, vomiting, and block-related complications were comparable between groups. No major adverse events, including pneumothorax, local anaesthetic systemic toxicity, infection, or persistent neurological deficits, were observed.

Table 1. Baseline demographic and clinical characteristics

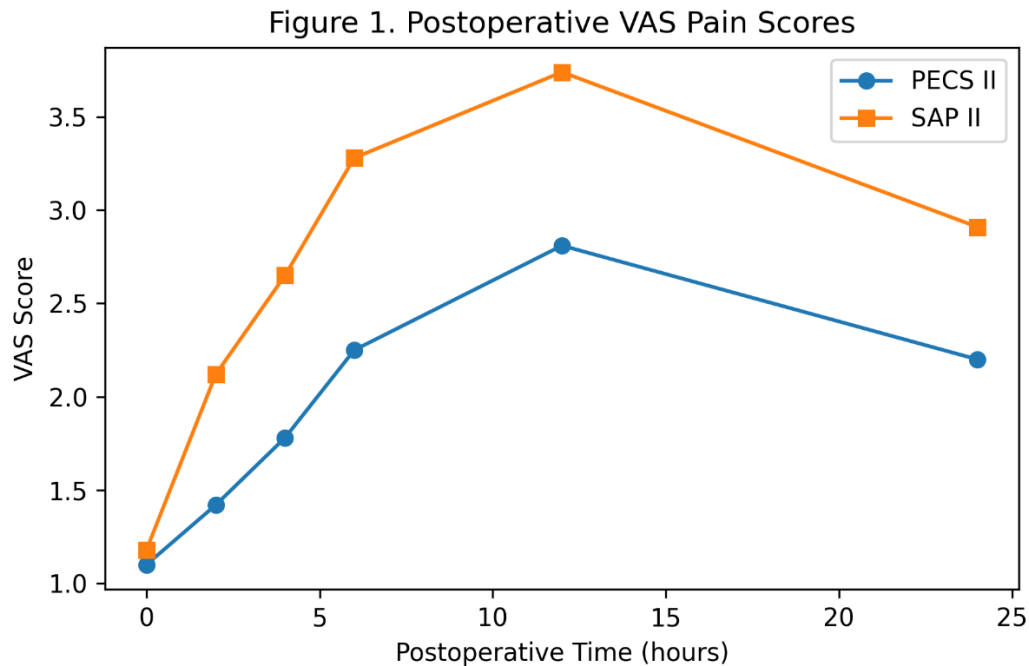
Baseline demographic and perioperative characteristics were comparable between both study groups.

Variable	Group P (n=40)	Group S (n=40)	p-value
Age (years)	52.94 $\pm$ 8.73	53.68 $\pm$ 8.29	0.698
Body Mass Index (kg/m ²)	25.46 $\pm$ 2.84	25.82 $\pm$ 2.69	0.563
ASA Grade I	15 (37.5%)	14 (35.0%)	0.967
ASA Grade II	21 (52.5%)	22 (55.0%)	
ASA Grade III	4 (10.0%)	4 (10.0%)	
Right-sided surgery	22 (55.0%)	21 (52.5%)	0.823
Left-sided surgery	18 (45.0%)	19 (47.5%)	

Table 2. Comparison of postoperative Visual Analogue Scale (VAS) pain scores

Patients receiving PECS II block demonstrated significantly lower postoperative pain scores from 2 hours onwards.

Time after surgery	Group P	Group S	p-value
0 hour	1.10 $\pm$ 0.37	1.18 $\pm$ 0.42	0.371
2 hours	1.42 $\pm$ 0.58	2.12 $\pm$ 0.71	<0.001
4 hours	1.78 $\pm$ 0.69	2.65 $\pm$ 0.79	<0.001
6 hours	2.25 $\pm$ 0.74	3.28 $\pm$ 0.83	<0.001
12 hours	2.81 $\pm$ 0.81	3.74 $\pm$ 0.88	<0.001
24 hours	2.20 $\pm$ 0.67	2.91 $\pm$ 0.73	<0.001

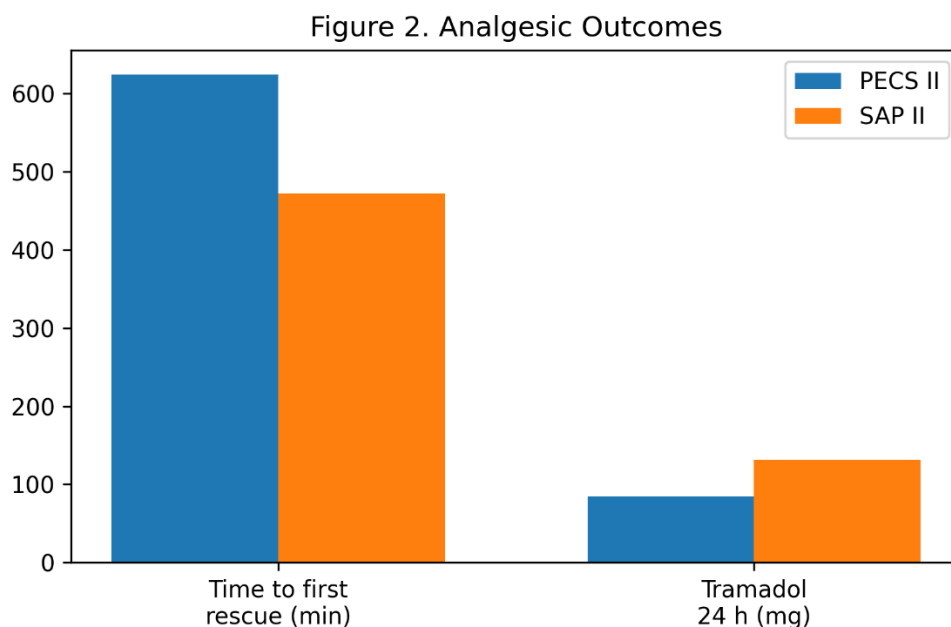


Graph 1: Comparison of postoperative VAS pain scores

Graph 1: Comparison of postoperative Visual Analogue Scale (VAS) pain scores between ultrasound-guided PECS II block and Serratus Anterior Plane Block II. Patients receiving PECS II block demonstrated significantly lower pain scores from 2 hours to 24 hours after surgery ($P<0.001$).

Table 3. Duration of analgesia and postoperative rescue analgesic requirement
PECS II block significantly prolonged analgesia and reduced postoperative opioid consumption.

Variable	Group P	Group S	p-value
Time to first rescue analgesia (minutes)	624.30 ± 82.51	472.18 ± 76.84	<0.001
Total tramadol consumption (mg/24 hours)	84.50 ± 27.34	131.25 ± 36.81	<0.001
Patients requiring rescue analgesia within first 6 hours	5 (12.5%)	14 (35.0%)	0.018



Graph 2: Comparison of postoperative analgesic efficacy

Figure 2: Comparison of postoperative analgesic efficacy between the study groups. The PECS II block significantly prolonged the duration of analgesia while reducing postoperative tramadol consumption compared with SAP II block ($P<0.001$).

Table 4. Intraoperative haemodynamic parameters and fentanyl requirement

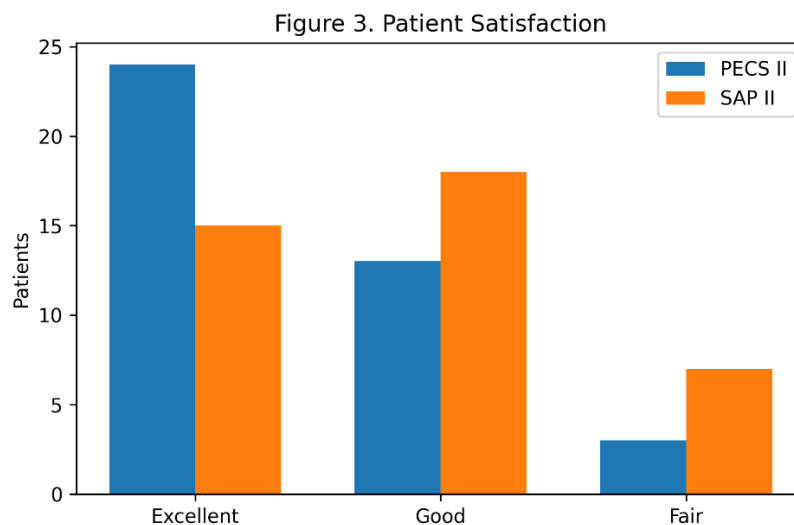
Haemodynamic stability was maintained in both groups, while supplemental fentanyl requirement was significantly lower with PECS II block.

Variable	Group P	Group S	p-value
Mean heart rate (beats/min)	75.86 ± 7.41	77.32 ± 7.86	0.394
Mean arterial pressure (mmHg)	87.14 ± 5.92	88.07 ± 6.15	0.492
Additional fentanyl requirement (µg)	17.50 ± 10.84	28.25 ± 13.72	<0.001

Table 5. Postoperative nausea, vomiting and patient satisfaction

Postoperative nausea and vomiting were comparable, whereas patient satisfaction was significantly greater following PECS II block.

Variable	Group P (n=40)	Group S (n=40)	p-value
Postoperative nausea	3 (7.5%)	7 (17.5%)	0.179
Postoperative vomiting	1 (2.5%)	3 (7.5%)	0.307
Excellent satisfaction	24 (60.0%)	15 (37.5%)	0.041
Good satisfaction	13 (32.5%)	18 (45.0%)	
Fair satisfaction	3 (7.5%)	7 (17.5%)	

**Graph 3: Comparison of patient satisfaction**

Distribution of patient satisfaction scores following modified radical mastectomy. A significantly greater proportion of patients in the PECS II group reported excellent postoperative analgesic satisfaction compared with the SAP II group (P=0.041).

Table 6. Postoperative recovery profile

Patients receiving PECS II block achieved earlier ambulation and a shorter hospital stay.

Variable	Group P	Group S	p-value
Time to first ambulation (hours)	8.62 ± 1.74	10.14 ± 2.08	0.001
Duration of hospital stay (days)	3.18 ± 0.52	3.56 ± 0.67	0.006
Patient readiness for discharge at 48 hours	34 (85.0%)	28 (70.0%)	0.107

Tables Summary

Table 1: Baseline demographic and perioperative characteristics were comparable between the PECS II and SAP II groups, confirming successful randomization. **Table 2:** PECS II block produced significantly lower postoperative VAS pain scores than SAP II block from 2 to 24 hours after surgery. **Table 3:** Patients receiving PECS II block experienced significantly prolonged analgesia, delayed rescue analgesic requirement, and lower 24-hour tramadol consumption. **Table 4:** Both groups maintained stable intraoperative haemodynamics; however, supplemental fentanyl requirement was significantly lower in the PECS II group. **Table 5:** The incidence of postoperative

nausea and vomiting was comparable between groups, while patient satisfaction was significantly higher following PECS II block. **Table 6:** PECS II block facilitated earlier ambulation and a significantly shorter postoperative hospital stay compared with SAP II block.

DISCUSSION

The present randomized controlled study compared the analgesic efficacy of ultrasound-guided PECS II block and Serratus Anterior Plane Block II (SAP II) in patients undergoing modified radical mastectomy. Both techniques provided effective postoperative analgesia

with an excellent safety profile; however, PECS II demonstrated superior pain control, prolonged analgesia, reduced opioid consumption, and higher patient satisfaction.^[1-5]

Baseline demographic and perioperative characteristics were comparable between the two groups, indicating successful randomization and minimizing the influence of potential confounding factors on postoperative outcomes.^[6,7] Postoperative pain control is essential following modified radical mastectomy, as inadequate analgesia delays mobilization, increases opioid requirements, prolongs hospitalization, and may contribute to chronic post-mastectomy pain syndrome.^[8] In the present study, patients receiving PECS II block experienced significantly lower postoperative VAS pain scores than those receiving SAP II. The superior analgesic effect of PECS II is likely related to its broader sensory coverage, providing blockade of the medial and lateral pectoral, long thoracic, thoracodorsal, and upper intercostal nerves, whereas SAP II predominantly blocks the lateral cutaneous branches of the intercostal nerves.^[9,10]

An important finding was the prolonged duration of analgesia in the PECS II group, reflected by a longer time to first rescue analgesia and significantly lower postoperative tramadol consumption. Reduced opioid requirements are clinically advantageous because they minimize opioid-related adverse effects, including nausea, vomiting, sedation, respiratory depression, and constipation, thereby supporting opioid-sparing multimodal analgesia protocols.^[11,12] Both techniques maintained stable perioperative haemodynamic parameters and demonstrated excellent safety, with no cases of pneumothorax, local anaesthetic systemic toxicity, infection, or persistent neurological complications. The low incidence of postoperative nausea and vomiting in both groups further supports the benefits of regional anaesthesia in reducing opioid exposure.^[13-15] Ultrasound guidance improves block accuracy, facilitates visualization of anatomical structures and local anaesthetic spread, and contributes to the high success rate and low complication profile observed with both techniques.^[18-21]

Patient satisfaction was significantly greater following PECS II block, likely owing to superior analgesia, prolonged pain relief, and reduced need for rescue analgesics. Effective postoperative pain management also promotes early mobilization, an important component of Enhanced Recovery After Surgery (ERAS) protocols, facilitating functional recovery after breast surgery.^[16,17,22,23] The findings suggest that both PECS II and SAP II are valuable regional analgesic techniques for modified radical mastectomy. However, PECS II appears to provide more comprehensive postoperative analgesia and greater opioid-sparing benefits, making it a preferable option when prolonged postoperative pain control is desired.^[24,25]

The strengths of this study include its prospective randomized design, standardized anaesthetic protocol, ultrasound-guided block administration, and uniform postoperative pain assessment. Limitations include the single-centre setting, relatively small sample size, and evaluation limited to the early postoperative period. Long-term outcomes such as chronic post-mastectomy

pain, functional recovery, quality of life, and cost-effectiveness were not assessed and warrant further multicentre studies.

Overall, both PECS II and SAP II are safe and effective components of multimodal analgesia for modified radical mastectomy. Nevertheless, PECS II provides superior postoperative analgesia, prolongs analgesic duration, reduces opioid consumption, and improves patient satisfaction, supporting its preferential use in breast cancer surgery.

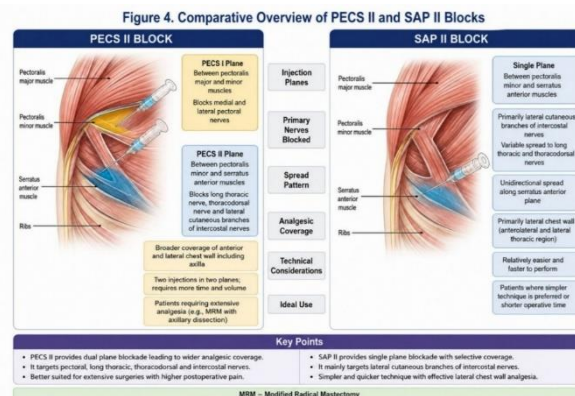


Figure 4. Comparative Overview of Ultrasound-guided Pectoral Nerve Block II and Serratus Anterior Plane Block II for Modified Radical Mastectomy

Figure 4: Comparison of the anatomical targets, injection planes, nerve coverage, and analgesic distribution of ultrasound-guided PECS II and SAP II blocks. PECS II provides broader anterior chest wall and axillary nerve blockade through dual interfascial injections, whereas SAP II primarily blocks the lateral cutaneous branches of the intercostal nerves via a single interfascial injection. This wider sensory coverage explains the superior postoperative analgesia observed with PECS II in the present study.

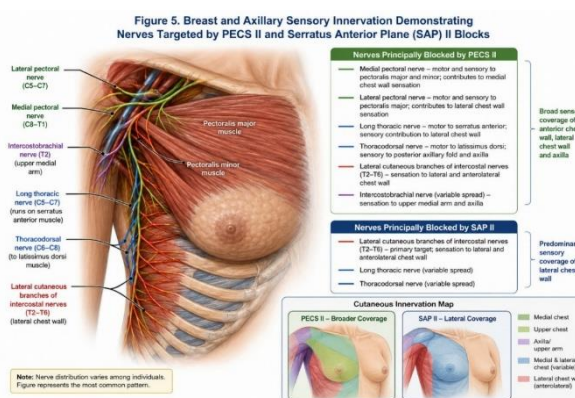


Figure 5: Sensory Innervation of the Breast and Axilla Demonstrating the Neural Coverage of Ultrasound-guided PECS II and Serratus Anterior Plane Block II

This figure demonstrates the sensory innervation of breast and axillary area that is significant for the postoperative analgesia after modified radical mastectomy. The figure shows the medial and lateral pectoral nerves, long thoracic nerve, thoracodorsal nerve, intercostobrachial nerve, and the lateral cutaneous branches of thoracic intercostal nerves and the role of

each nerve in the innervation of breast and axillary area. The figure further depicts the different extent of neural coverage achieved by ultrasound-guided PECS II and SAP II. The extensive neural blockade caused by PECS II as compared to the limited lateral chest wall coverage by SAP II is the reason that accounts for the different efficacy of postoperative analgesia after the modified radical mastectomy.

CONCLUSION

Both ultrasound-guided Pectoral Nerve Block II (PECS II) and Serratus Anterior Plane Block II (SAP II) provided effective and safe postoperative analgesia for patients undergoing modified radical mastectomy under general anaesthesia, with low complication rates and satisfactory opioid-sparing effects. However, the PECS II block demonstrated superior overall analgesic efficacy, reflected by lower postoperative pain scores, prolonged duration of analgesia, reduced rescue analgesic and opioid requirements, improved patient satisfaction, earlier ambulation, and a shorter hospital stay.

The broader neural coverage achieved with the PECS II block likely accounts for its enhanced postoperative pain control, making it a more effective component of multimodal analgesia for modified radical mastectomy. While both techniques remain valuable regional anaesthetic options, the findings of this study support PECS II as the preferred technique for optimizing postoperative recovery in breast surgery. Further multicentre studies with larger sample sizes and longer follow-up are recommended to validate these findings and evaluate long-term outcomes, including chronic post-mastectomy pain and quality of life.

REFERENCES

- Blanco R. The 'pecs block': a novel technique for providing analgesia after breast surgery. *Anaesthesia*. 2011;66(9):847-848.
- Blanco R, Fajardo M, Parras Maldonado T. Ultrasound description of Pecs II (modified Pecs I): a novel approach to breast surgery. *Rev Esp Anesthesiol Reanim*. 2012;59(9):470-475.
- Blanco R, Parras T, McDonnell JG, Prats-Galino A. Serratus plane block: a novel ultrasound-guided thoracic wall nerve block. *Anaesthesia*. 2013;68(11):1107-1113.
- Bashandy GMN, 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(1):68-74.
- 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(3):382-386.
- Wahba SS, Kamal SM. Thoracic paravertebral block versus pectoral nerve block for analgesia after breast surgery. *Egypt J Anaesth*. 2014;30(2):129-135.
- Versyck B, van Geffen GJ, Van Houwe P. Prospective double-blind randomized placebo-controlled clinical trial of the pectoral nerves (Pecs) block type II. *J Clin Anesth*. 2017;40:46-50.
- Neethu M, Pandey RK, Sharma A, et al. Pectoral nerve blocks to improve analgesia after breast cancer surgery: a prospective, randomized and controlled trial. *J Clin Anesth*. 2018;45:12-17.
- Wang K, Zhang X, Zhang T, Yue H, Sun S, Zhao H, Zhou P. The efficacy of ultrasound-guided type II pectoral nerve blocks in perioperative pain management for immediate reconstruction after modified radical mastectomy: a prospective, randomized study. *Clin J Pain*. 2018;34(3):231-236.
- Fujii T, Shido A, Sakamoto A. A randomised controlled trial of pectoral nerve-2 (PECS 2) block vs. serratus plane block for chronic pain after mastectomy. *Anaesthesia*. 2019;74(12):1558-1562.
- Versyck B, van Geffen GJ, Chin KJ. Analgesic efficacy of the Pecs II block: a systematic review and meta-analysis. *Anaesthesia*. 2019;74(5):663-673.
- Hussain N, Shastri U, McCartney CJL, et al. Efficacy and safety of pectoral nerve block (Pecs) compared with control, paravertebral block, erector spinae plane block, and local anesthesia in patients undergoing breast cancer surgeries: a systematic review and meta-analysis. *Clin J Pain*. 2021;37(12):925-939.
- Jacobs A, Lemoine A, Joshi GP, Van de Velde M, Bonnet F; PROSPECT Working Group. PROSPECT guideline for oncological breast surgery: a systematic review and procedure-specific postoperative pain management recommendations. *Anaesthesia*. 2020;75(5):664-673.
- Ahuja D, Kumar V, Gupta N, Bharati SJ, Garg R, Mishra S, Khan MA, Bhatnagar S. Comparison of the efficacy of ultrasound-guided serratus anterior plane block versus erector spinae plane block for postoperative analgesia after modified radical mastectomy: a randomised controlled trial. *Turk J Anaesthesiol Reanim*. 2022;50(6). doi:10.5152/TJAR.2022.21127.
- Alshawadfy A, Al-Touny SA. Comparing the quality of analgesia with ultrasound-guided pectoral nerve block and serratus anterior plane block II in patients undergoing modified radical mastectomy: a randomised clinical trial. *Anesthesiol Intensive Ther*. 2023;55(1):52-59.
- Hong B, Bang S, Oh C, Park E, Park S. Comparison of PECS II and erector spinae plane block for postoperative analgesia following modified radical mastectomy: Bayesian network meta-analysis using a control group. *J Anesth*. 2021;35(5):723-733.
- Altıparmak B, Korkmaz Toket M, Uysal Aİ, Turan M, Gümüş Demirebilek S. Comparison of the effects of pectoral nerve block and general anesthesia alone in patients undergoing unilateral mastectomy: a randomized controlled trial. *J Clin Anesth*. 2019;54:61-65.
- Machi AT, Joshi GP. Interfascial plane blocks. *Best Pract Res Clin Anaesthesiol*. 2019;33(3):303-315.
- Klein SM, Bergh A, Steele SM, Georgiade GS, Greengrass RA. Thoracic paravertebral block for breast surgery. *Anesth Analg*. 2000;90(6):1402-1405.
- Straughan DM, Lindsey JT Jr, McCarthy M, Legendre D, Lindsey JT Sr. Enhanced recovery after surgery protocol with ultrasound-guided regional blocks in outpatient plastic surgery patients leads to decreased opioid prescriptions and consumption. *Aesthet Surg J*. 2021;41:NP1105-NP1114.
- Waltho D, Rockwell G. Post-breast surgery pain syndrome: establishing a consensus for the definition of post-mastectomy pain syndrome to provide a standardized clinical and research approach — a review of the literature and discussion. *Can J Surg*. 2016;59(5):342-350.
- Couceiro TC, Valença MM, Raposo MC, Orange FA, Amorim MM. Prevalence of post-mastectomy pain syndrome and associated risk factors: a cross-sectional cohort study. *Pain Manag Nurs*. 2014;15(4):731-737.
- Alves NFE, do Espírito Santo BA, et al. Post-mastectomy pain syndrome: incidence and risks. *Rev Bras Anesthesiol*. 2012;62(3). (as cited in PubMed 22377590).

24. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, Jemal A. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2024;74(3):229-263.
25. Woodworth GE, Ivie RMJ, Nelson SM, Walker CM, Maniker RB. Perioperative breast analgesia: a qualitative review of anatomy and regional techniques. *Reg Anesth Pain Med.* 2017;42(5):609-631.
26. Wang H, Zhuge P, You H, Zhang Y, Zhang Z. Comparison of the efficacy of vocal training and vocal microsurgery in patients with early vocal fold polyp. *Braz J Otorhinolaryngol.* 2019 Nov-Dec;85(6):678-684. doi: 10.1016/j.bjorl.2018.03.014. Epub 2018 May 9. PMID: 29784620; PMCID: PMC9443021.