https://doi.org/10.29309/TPMJ/2026.33.07.10276 www.theprofesional.com

ORIGINAL ARTICLE

Comparative role of serratus anterior plane block and thoracic erector spinae plane block in post-operative analgesia for breast surgery.

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ABSTRACT… Objective: To compare the analgesic efficacy of the serratus anterior plane block and thoracic erector spinae plane block in terms of duration of analgesia, pain score at 12 hours, and total opioid consumption in women undergoing breast surgery. **Study Design:** Randomized Controlled Trial. **Setting:** Department of Anesthesiology, Fauji Foundation Hospital, Islamabad. **Period:** Sep-2025 to Dec- 2025. **Methods:** Sixty female patients planned for unilateral breast surgery were included and equally randomized to receive either erector spinae plane block (Group ES) or serratus anterior plane block (Group SA). Severity of pain in the postoperative period was assessed using the Numerical Rating Scale. Primary outcome was the duration of analgesia (time to need for first rescue analgesia), while secondary outcomes included pain score at 12 hours and total opioid consumption in first 24 hours. **Results:** The duration of analgesia was significantly longer in Group ES compared to Group SA (394.3 ± 34.1 min vs. 324.3 ± 29.9 min, $p < 0.0001$). A lower but statistically non-significant pain score was observed at 12 hours in Group ES (4.43 ± 1.14 vs. 4.96 ± 1.03, $p = 0.06$). Similarly, total 24-hour opioid consumption was also lower in Group ES compared to Group SA, however it did not reach statistical significance (60.13 ± 11.86 mg vs. 64.23 ± 9.51 mg, $p = 0.16$). **Conclusion:** Erector spinae plane block provided a significantly longer duration of analgesia as compared to serratus anterior plane block in women undergoing breast surgery.

Key words: Erector Spinae Plane Block, Mastectomy, Regional Anesthesia, Serratus Anterior Plane Block.

Article Citation: Mumtaz K, Fatima N, Sarwar A, Khan MA, Haq M, Abbasi B. Comparative role of serratus anterior plane block and thoracic erector spinae plane block in post-operative analgesia for breast surgery. Professional Med J 2026; 33(07):1211-1216.
https://doi.org/10.29309/TPMJ/2026.33.07.10276

INTRODUCTION

Breast surgery is among routinely performed surgical procedures worldwide including both oncological procedures and reconstructive interventions. The most common reason for this procedure is related to oncology where primary techniques include mastectomy for complete breast tissue removal, lumpectomy for breast-conserving tumor excision, and axillary lymph node dissection (ALND) performed for staging and regional disease control. Among these modified radical mastectomy (MRM) remains the most frequently performed and cornerstone treatment for breast cancers.[1]

Postoperative pain (POP) management represents a major challenge following these procedures and remains important factor in overall success of the surgery as, POP can hinder early mobilization, prolong hospitalization, can progress to chronic pain syndrome, and thereby affect the patient's satisfaction. Moreover, inadequately controlled pain may also activate the physiological stress response, which can have deleterious effects on cardiac, pulmonary, and immune function of the patient.[2,3]

The management of POP after breast surgery has traditionally relied on systemic opioids; however, their use is linked to significant risks, including nausea, respiratory depression, sedation, constipation, and carries the risk of dependence.[4] These challenges have shifted the POP care to multimodal analgesia approach emphasizing on regional anesthesia techniques capable of providing superior and targeted analgesia. These techniques offer reduced reliance on opioid as well lower doses of other analgesic agents.[5]

In order to minimize these challenges, regional anesthesia techniques, which offer effective pain relief while reducing opioid use, have gained attention.

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Article received on:
29/12/2026
Accepted for publication:
24/03/2026

Fascial plane blocks are important for this purpose due to their ease of administration, favorable safety profile and prolonged analgesic effects. The Serratus Anterior Plane (SAP) and Erector Spinae Plane (ESP) blocks are the two interfascial techniques that are now commonly employed for POP in breast surgery. These techniques are performed under ultrasonographic (USG) guidance, and provide effective analgesia in a relatively simpler and safer approach compared to neuraxial techniques by targeting the thoracic intercostal nerves.[6,7]

The SAPB is done by depositing local anesthetic superficial or deep to the serratus anterior (SA) muscle at the fifth rib. The technique is able to anesthetize the lateral cutaneous branches of the thoracic intercostal nerves (T2-T9), thereby providing somatic analgesia to the hemithorax, helpful for procedures like breast surgery. The superficial nature keeps the block at a distance from critical structures. Its technical simplicity contributes to a favorable safety profile, which makes it an attractive option for reducing POP and requirement of opioid doses.[8]

The ESPB is accomplished by administrating local anesthetic deep to the erector spinae (ES) muscle at the T5 transverse process. This mechanism relies on the cranio-caudal spread of the solution, which is diffused anteriorly and acts on the dorsal and ventral rami of spinal nerves and the sympathetic chain. This type of coverage provides broad multi-dermatomal analgesia for the anterior, lateral, and posterior hemithorax. The posterior location of this block offers extensive dermatomal coverage while keeping a safe distance from pleura and other critical structures.[9,10]

A key distinction between the two approaches lies in their coverage because SAPB provides targeted analgesia for the anterolateral thorax, whereas ESPB, which is more proximal injection, may offer broader, more profound dermatomal coverage. Both SAPB and ESPB reduce POP and thereby opioid use; however, direct comparison of their efficacy regarding better pain relief, longer-lasting analgesia, lower opioid use, and higher patient satisfaction is limited.

This study was therefore aimed to compare the analgesic efficacy of the two techniques in shape of duration of analgesia, pain score at 12 hours post-operatively and total opioid consumption during 24 hours. The results of this study will provide evidence for improving POP management, support optimal clinical practice and overall outcomes in breast surgery patients.

METHODS

This randomized controlled trial was conducted at the department of anesthesiology Fauji Foundation Hospital Islamabad from Sep-2025 to Dec-2025, after getting approval from ethical committee of the hospital (1031/RC/FFH/RWP/28-07/25).

The sample size was estimated using OpenEpi calculator. Expected time to need first rescue analgesia in ESPB group was taken as 412.5±42.4 minutes while time to need first rescue analgesia in SAPB group was taken as 313.0±42.4 minutes.[11] Taking Alpha = 5% (two-sided), power 80% the calculated sample size was 4 patients per group. However, to ensure adequate statistical power, we used a larger sample size and 60 patients were enrolled, 30 patients in each group.

A total of 60 female patients (aged 18–65 years), belonging to ASA physical status I or II, and undergoing elective unilateral breast surgery, including MRM, lumpectomy, and ALND were included in this study. The patients were randomized into 2 equal groups of 30 patients each using computer generated randomization, and labeled either as Group ES or Group SA. Written informed consent was taken from each patient prior to their inclusion.

Exclusion criteria were set as patients with known allergy to local anesthetics, infection at the site of needle insertion, coagulation disorders with INR >1.5, pregnancy or lactation. Patients having chronic opioid use, psychiatric or communication impairment were also excluded.

All the demographics and clinical details were taken and recorded on a predesigned proforma. Standard monitoring was arranged for each patient upon their arrival in the operation room. Patients were then premedicated intravenously with midazolam (0.03 mg/kg) and fentanyl (2 μg/kg). Propofol (2–2.5 mg/kg) was used for induction of general anesthesia and endotracheal intubation was performed. Anesthesia was then maintained with oxygen, air, and isoflurane (MAC 1.0). Intraoperative analgesia was facilitated with additional fentanyl boluses (0.5–1 μg/kg) and paracetamol (I/V 1 g).

Patients in Group ES were positioned in the sitting or lateral decubitus posture and the USG probe was placed 3 cm lateral to the T5 transverse process. Needle was advanced in-plane into the fascial plane after identifying the ES muscle under the USG guidance and bupivacaine (20–25 mL of 0.25%) was injected after hydro-dissection with 1–2 mL of saline.

In Group SA, patients were positioned supine with the ipsilateral arm abducted. The probe was then positioned over the mid-axillary line at the level of the 4th–5th rib. Needle was advanced in-plane after identification of the latissimus dorsi, teres major, and SA muscles under USG guidance. After the confirmation of needle placement, bupivacaine (20–25 mL of 0.25%) was deposited, as per standard technique, either superficial or deep to the SA muscle.

Routine post-op analgesia was administered to each patient consisting of IV paracetamol (1 g every 6 hours) and IV ketorolac (30 mg every 8 hours). Tramadol (1 mg/kg IV, maximum 400 mg/24h) was used as rescue analgesia when needed (if NRS ≥ 4). POP was assessed using numerical rating scale (NRS) where patients rated their pain from 0 = No pain to 10 = Worst pain imaginable.

Duration of analgesia was assessed from the time the block was administered until the patient required a rescue analgesic (at NRS ≥ 4). The pain score was documented at 1, 2, 4, 8, 12, 18, and 24 hours in post-op period. Total rescue opioid consumed as analgesic during the first 24 hours post-operatively was recorded for each patient. The primary objective was set as duration of analgesia, while secondary outcomes were pain score at 12 hours and the total rescue analgesia consumed during 24 hours after admission to the recovery room.

Data were analyzed using SPSS 26. Descriptive statistics were used to present the study variables where quantitative variables were expressed as mean ± SD while categorical variables were shared in shape of frequency and percentages. Primary and secondary outcomes between the two groups were compared by applying independent t-test and chi-square test (which ever appropriate). A p-value <0.05 was taken as statistically significant for all these comparisons.

RESULTS

The mean age in this study was 54.5 ±6.96 years (ranged from 45-68 years). Group wise demographics and clinical features are shared in Table-I.

The results of the study showed that duration of analgesia was significantly prolonged in Group ESPB as assessed by time to need first rescue analgesia (< 0.0001). Results of secondary outcomes showed that pain score at 12 hours and total opioid consumption was higher in Group SAPB; however, it did not reach statistically significance level (p-values 0.06 and 0.16, respectively) compared to Group SAPB as shown in Table-II.

Comparison of the incidence of adverse events showed no statistically significant difference between the two groups as shown in Table-III.

DISCUSSION

Our study showed significantly longer duration of analgesia in Group ES compared to Group SA (394.3± 34.1 min vs. 324.3± 29.9 min, $p < 0.0001$). Although lower in ES group, no statistically significant difference was recorded between the two groups for pain scores at 12 hours post-operatively (4.43± 1.14 vs. 4.96± 1.03, $p = 0.06$). These results suggest that while ESPB provides a longer duration of initial analgesia, both techniques then achieve comparable overall pain control when combined with multimodal analgesia. Similarly, total 24-hour opioid consumption was lower in Group ES compared to Group SA, however it did not reach statistical significance (60.13 ± 11.86 mg vs. 64.23 ± 9.51 mg, $p = 0.16$).

TABLE-I

Demographics and clinical features n= 60

Demographics and Clinical Features		Group ESPB (n=30)	Group SAPB (n=30)
Age (Mean± SD) years		54.5±6.79	55.4±7.24
BMI (Mean± SD) Kg/m^2		25.73±2.12	24.57±4.16
ASA status	I n (%)	12 (40)	14 (46.67)
	II n (%)	18 (60)	16 (53.33)
Type of surgery	MRM n (%)	20 (66.66)	19 (63.33)
	Lumpectomy n (%)	7 (23.33)	8 (26.67)
	ALND n (%)	3 (10)	3 (10)

TABLE-II

Study outcomes n= 60

Study Variables	Group ESPB (n=30)	Group SAPB (n=30)	P-Value*
Primary outcomes			
Time to first rescue analgesia (Mean± SD) min.	394.3±34.13	324.33±29.94	< 0.0001
Secondary outcomes			
Pain score at 12 hours at NRS (Mean± SD)	4.43±1.14	4.96±1.03	0.06
Total opioid consumption during 24 hours (Mean± SD) mg	60.13±11.86	64.23±9.51	0.16

Independent t-test*

TABLE-III

Incidence of adverse events n = 60

Adverse Events	Group ESPB (n=30)	Group SAPB (n=30)	P-Value
Nausea/ Vomiting n (%)	5 (16.67)	6 (20)	0.74*
Injection site pain n (%)	3 (10)	2 (6.67)	1**
Pneumothorax n (%)	0 (0)	0 (0)	N/A

Chi-square test*,Fisher's exact test**

Comparison of the incidence of adverse events showed no statistically significant difference between the two groups including the incidences of nausea/vomiting, injection site pain and pneumothorax. The analgesic profiles of ESPB and SAPB have been studied in previous international and national studies to offer insights to the anesthetists regarding selection of drug in these important surgical procedures.

Loha S et al. compared the duration of analgesia between ESPB and SAPB and found that the ESPB had a significantly longer analgesic duration, with a mean time to first rescue analgesia of 412.50 minutes compared to 313.00 minutes in the SAPB group ($p<0.001$). The study thereby concluded that ESPB provides a substantially longer pain-free period than SAPB.[11] Similarly, Bedewy AAE et al. compared the ESPB, SAPB, and intravenous morphine for post-mastectomy pain. Both the blocks outperformed morphine alone for pain control. The study concluded that ESPB is more effective than SAPB in providing superior analgesia with significantly lower post-op morphine consumption and 1-hour serum cortisol levels ($p=0.021$) than SAPB.[12]

Further support to this trend was given by Hassan ME and Wadod MA. who compared SAPB, ESPB and the controls for post-op analgesia in thoracic cancer surgery. The use of morphine was significantly lower in the ESPB and the SAPB versus controls (8.52 ± 4.29 mg, 19.57 ± 7.63 mg and 36.37 ± 8.27 mg respectively). ESPB also maintained lower dynamic pain scores at 24 h and provided an improved quality of analgesia in comparison to other groups.[13] Comparable results were also shared by Muhammad QUA et al. in their review analysis across nine RCTs on the comparison of these blocks in thoracic surgeries. Data showed that ESPB offers lower pain scores and reduced opioid use. Overall, both blocks offered similar safety and statistically comparable efficacy.[14] These studies reinforce the superior analgesic profile of plane blocks particularly ESPB over conventional methods and highlighted the growing utility of these techniques across different surgical processes including breast surgeries.

In addition, Zhao P et al. included 9 research articles in a meta-analysis to compare ESPB versus SAPB in breast and thoracic surgery on the basis of currently available evidence. The results demonstrated that ESPB significantly reduced the intra and post-op opioid use (2.32 mg, $p < 0.01$ and 4.86 mg, $p < 0.01$, respectively). The incidence of nausea, vomiting and other adverse events were same. The authors concluded that ESPB may offer a superior analgesia, however, need for further studies were emphasized to confirm this finding.[15]

This longer duration of analgesia with ESPB observed in our study and the studies discussed above can be attributed to its deeper, more confined fascial plane between the ES muscle and transverse processes, facilitating sustained drug retention and providing prolonged neural contact. The posterior location of this block allows local anesthetic to spread at both dorsal and ventral rami of the spinal nerves across multiple dermatomal levels. On the other hand, SAPB involves a more superficial injection at the mid-axillary line, and thereby targets lateral cutaneous branches. This results in faster vascular absorption and systemic clearance of the anesthetic. In conclusion, the tighter fascial space in ESPB, helps the drug stay longer, whereas in SAPB, the looser planes result faster spread but results in earlier block wear-off.[16]

Despite this overall trend discussed above favoring ESPB in terms of analgesic duration, there are studies showing comparable outcomes. For instance, Ahuja D et al. compared SAPB and ESPB for analgesia in 80 women undergoing MRM and found similar time to rescue analgesia ($p= .056$), however, pain scores at 0 minutes favored SAPB ($p= 0.03$). Opioid and NSAID requirements were also comparable and the both blocks overall demonstrated equivalent post-op analgesic efficacy.[17]

Similarly, Gamal BW et al. compared SAPB (posterior approach) and ESPB in 56 women planned for MRM. Time to analgesic request ($p = 0.916$), pain scores at rest (p-value= 0.28), pain scores at movement (p-value= 0.11), morphine consumption ($p = 0.408$), were similar. Although ESPB produced greater segmental sensory loss ($p < 0.031$), however both blocks were safe and offered comparable analgesic efficacy.[18] These studies suggest that surgical site, block technique, and drug dynamics may also influence the efficacy results.

In summary, the available evidence suggests that ESPB offers advantage in prolonging the duration of analgesia; however both ESPB and SAPB remain effective in terms of other parameters and provide safe options for POP control in breast surgery. The choice between the two blocks therefore may be individualized based on patient factors, operator personal experience expertise, and institutional practices.

The general applicability of these results may be limited by a relatively small sample size and single center design. Moreover, block performance by a single operator may also have influenced the consistency of technique limiting the generalizability of the results.

CONCLUSION

This finding demonstrates that the ESPB provides a longer duration of post-op analgesia in women undergoing breast surgery. The other important outcomes like pain control and opioid requirements are same. In short, both techniques remain effective components of multimodal analgesia approach, with ESPB offering a modest advantage regarding early pain relief.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Komal Mumtaz:** Study design, manuscript drafting.
2	**Noor Fatima:** Data collection, data analysis.
3	**Asma Sarwar:** Data interpretation.
4	**Manahil Asghar Khan:** Substantial contribution to data collection.
5	**Momina Haq:** Data entry.
6	**Bushra Abbasi:** Critical revisions.