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Comparison of Pectoral Nerve Block (II) And Erector Spinae Block for Postoperative Analgesia Following Breast Surgeries

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ABSTRACT

Introduction: Effective postoperative pain management is essential in breast cancer surgeries to enhance recovery and reduce opioid-related side effects. Regional anesthesia techniques, such as the Pectoral Nerve Block (PECS-II) and Erector Spinae Plane (ESP) Block, have been used as opioid-sparing strategies. However, comparative data on their efficacy remain limited. This study aimed to evaluate and compare the analgesic effectiveness of PECS-II and ESP blocks in postoperative pain control, opioid consumption, and time to first analgesic requirement in patients undergoing breast surgery. **Methodology:** This randomized controlled study included 60 patients undergoing elective breast cancer surgery, divided into two groups: PECS-II (n=30) and ESP (n=30). Patients were randomly assigned using a computer-generated randomization method. Both blocks were performed under ultrasound guidance 30 minutes before general anesthesia. Postoperative pain was assessed using the Numeric Rating Scale (NRS) at multiple time intervals (immediately, 1, 2, 6, 12, and 24 hours). Primary outcomes included nalbuphine consumption, time to first analgesic requirement, and pain scores. Data were analyzed using SPSS, with $p<0.05$ considered statistically significant. **Results:** The PECS-II group had lower nalbuphine consumption (1.72 ± 3.24 mg vs. 3.79 ± 4.22 mg, $p = 0.037$) and a longer time to first analgesic (9.01 ± 1.68 vs. 4.64 ± 0.98 hours, $p = 0.001$). Pain scores at all-time intervals were significantly lower in the PECS-II group ($p = 0.001$), indicating superior and prolonged analgesia with reduced opioid use. **Conclusion:** The PECS-II block provided superior postoperative analgesia with lower pain scores, reduced opioid consumption, and prolonged analgesic duration compared to the ESP block. These findings support its preference for effective pain management in breast surgeries.

INTRODUCTION

Breast surgeries are common due to high breast cancer rates. Managing pain in breast surgery is challenging due to the procedure's complexity and the breast's innervation. Patients often experience significant post-operative pain. Regional anaesthetic techniques like paravertebral and thoracic epidural blocks have been the preferred analgesic methods, despite potential complications like vascular punctures and nerve damage.[1-2] Novel techniques like PECS-II and ESP blocks offer improved safety and comparable pain relief as alternatives. PECS-II involves injecting drugs between certain muscles, while ESP injects them deep to another muscle.[3] Gurkan et al compared PECS-II and ESP in breast surgery patients, finding no significant difference from PVB group.[4]

In their meta-analysis, Hong et al compared PECS II and ESP blocks for post-mastectomy analgesia, finding PECS II block resulted in 10 mg opioid consumption, compared to 5.7 mg for ESP block. Additionally, PECS II block showed lower pain scores within the first 24 post-op hours compared to systemic analgesia, while ESP block did not.[5] De Cassai and team found that in comparison to general anesthesia, PECS-II was more effective in reducing chronic pain at 3 months (14.9% vs. 31.8%, p=0.039), requiring lower intraoperative opioids (fentanyl 1.61 µg/kg/hour vs. 3.3 µg/kg/hour, p<0.001) and resulting in less postoperative pain (3 vs. 4, p=0.017).[6]

In Sinha et al's study, morphine use in 24 hours was lower in the PECS-II group (4.40±0.94 mg) than in the ESP group (6.59±1.35 mg; p=0.000). PECS-II patients also had longer analgesia duration (7.26±0.69 hours) compared to ESP patients (5.87±1.47 hours; p=0.001).[7] Bakeer et al found similar results with more ESP participants needing rescue morphine than PECS-II (p=0.028). Pain intensity was higher in the ESP group at

1, 2, and 6 hours post-surgery.[8] The research aimed to compare postoperative pain scores and opioid consumption levels between cases using the Pectoral Nerve Block II (PECS-II) versus the Erector Spinae Plane (ESP) block technique, which are crucial in assessing patient discomfort and pain management efficacy following surgical procedures.

METHODOLOGY

The study was conducted at Operation Theatre of General Surgery Department, Services Hospital, Lahore from June 15, 2024 to December 14, 2024. The study commenced after obtaining approval from the Institutional Review Board (IRB) and ethical clearance from the local ethics committee. Using WHO calculator, sample size of 60 (30 in each group) was calculated taking 1% level of significance, 99% power of test, 1.08 population standard deviation, 1.1664 population variance, 7.26 as Test value of PECS-II group's population mean and 5.87 anticipated population mean of EPS group.[7]

All eligible patients who met the inclusion criteria were approached, and written informed consent was obtained before participation. The study included patients aged 20 to 55 years with an American Society of Anesthesiologists' (ASA) physical status of I–II who were scheduled for elective breast cancer surgery. Patients with a BMI greater than 35 kg/m², pre-existing breast or chronic pain, skin infections at the needle puncture site, known drug allergies, coagulopathy, or recent opioid use were excluded.

Patients were selected through consecutive sampling and randomized using a random number generator. Two groups were formed: Group A received the PECS II block, and Group B received the ESP block administered by an experienced anesthetist 30 minutes pre-anesthesia. The PECS II block was performed with the patient supine and arms abducted. Ultrasound guided placement of 0.25% bupivacaine was done with 20 ml deposited between specific muscles after skin infiltration.

The ESP block was done at T4 level with the patient lying prone. An in-plane approach was used with a convex ultrasound probe positioned 2–3 cm laterally to the spine sagittally. After identifying the erector spinae muscle and transverse processes, a needle was inserted deep cranially into the muscle. Correct needle position was confirmed with 0.5–1 ml of local anesthetic before injecting 20 ml of 0.25% bupivacaine. Local anesthetic spread was observed in both cranial and caudal directions. Patients were monitored post-block for 30 minutes, evaluating sensory block level every five minutes with a pin-prick test. Dermatomes with reduced sensation were noted. Any block complications like hypotension were recorded, while ECG, SpO_2, HR, and NIBP were monitored continuously for 30 minutes following baseline recording.

General anesthesia involved propofol induction for unconsciousness, atracurium administration for intubation assistance, maintenance with nitrous oxide, isoflurane, and ventilation for CO2 levels. Patients were monitored for vital signs. Neuromuscular blockade was reversed at the end. Postoperative pain was assessed using an NRS scale. Rescue analgesia was delayed until reported pain. Time to first analgesia and nalbuphine use were recorded. Pain scores were noted at intervals. Outcomes included nausea, vomiting, and total nalbuphine consumption within 24 hours.

Data analysis was done using SPSS v25 with the Kolmogorov-Smirnov test checking data normality. Continuous variables were shown as mean ± standard deviation; categorical variables as percentages. Student's t-test compared normally distributed continuous variables, while Mann-Whitney U test was for non-normally distributed ones. Fisher's exact/Chi-square test compared categorical variables, with significance at $p<0.05$.

RESULTS

The age distribution between Group A (PECS-II) and Group B (ESP) showed that 40% vs 36.7% were aged 20-40 years, while 60% vs 63.3% were 41-55 years. Mean age was comparable (Group A: 43.43 ± 7.95 years, Group B: 42.87 ± 6.67 years). In BMI categories, Group A had 36.7% normal and 46.7% overweight, while Group B had 46.7% normal and 43.3% overweight, with few obese (16.7% in A, 10% in B). Group B had slightly higher height (164.90 ± 8.68 cm) and weight (66.13 ± 7.64 kg) than Group A (161.40 ± 9.47 cm, 66.27 ± 6.84 kg). Mean BMI was similar (Group A: 37.42 ± 12.37 kg/m², Group B: 38.68 ± 12.58 kg/m²). ASA status was comparable, with 60% ASA-I in Group A, 56.7% in B, and 40% ASA-II in A, 43.3% in B **(Table 1)**.

The requirement for nalbuphine was higher in Group B (ESP) compared to Group A (PECS-II). In Group A, only 23.3% of patients required nalbuphine postoperatively, while in Group B, 46.7% of patients required nalbuphine. Conversely, 76.7% of patients in Group A did not require nalbuphine, whereas in Group B, only 53.3% of patients did not require it. The p-value for this comparison was 0.058, suggesting a trend toward statistical significance **(Table 2)**.

Group A (PECS-II) had better pain relief outcomes than Group B (ESP), showing significantly lower nalbuphine consumption (1.72 mg vs. 3.79 mg, p=0.037) and longer time to first analgesic requirement (9.01 hours vs. 4.64 hours, p=0.001). Pain scores favored Group A at all intervals: immediately post-surgery (3.00 vs. 6.07, p=0.001), 1 hour (1.87 vs. 4.83, p=0.001), 2 hours (1.63 vs 3.93, p=0.001), 6 hours (0.43 vs. 2.93, p=0.001), 12 hours (0.30 vs. 2.53, p=0.001), and 24 hours (0.15 vs 1.50, p=0.001). Results indicate PECS-II

provided superior pain control and reduced postoperative opioid needs **(Table 3)**.

Table 1
Comparison of distribution of different variables between groups

Variables		Groups	
		Group-A (PECS-II)	Group-B (ESP)
Age groups	20-40 years	12(40.0%)	11(36.7%)
	41-55 years	18(60.0%)	19(63.3%)
	Mean age (years)	43.43±7.95	42.87±6.67
Body mass index	Normal	11(36.7%)	14(46.7%)
	Overweight	14(46.7%)	13(43.3%)
	Obese	5(16.7%)	3(10.0%)
	Mean height (cm)	161.40±9.47	164.90±8.68
	Mean weight (kg)	66.27±6.84	66.13±7.64
	Mean BMI (kg/m^2)	37.42±12.37	38.68±12.58
ASA status	ASA-I	18(60.0%)	17(56.7%)
	ASA-II	12(40.0%)	13(43.3%)

Figure 1

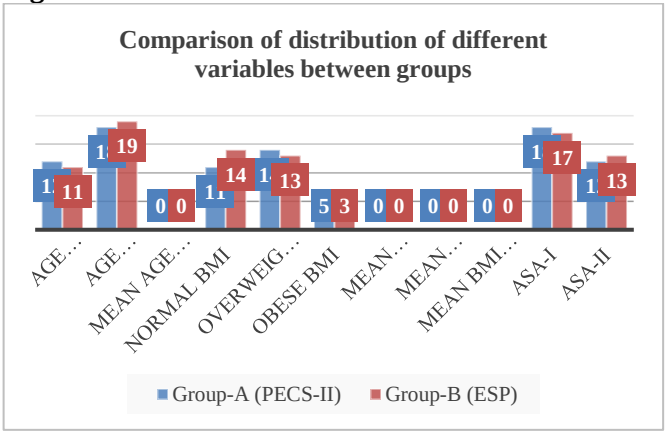


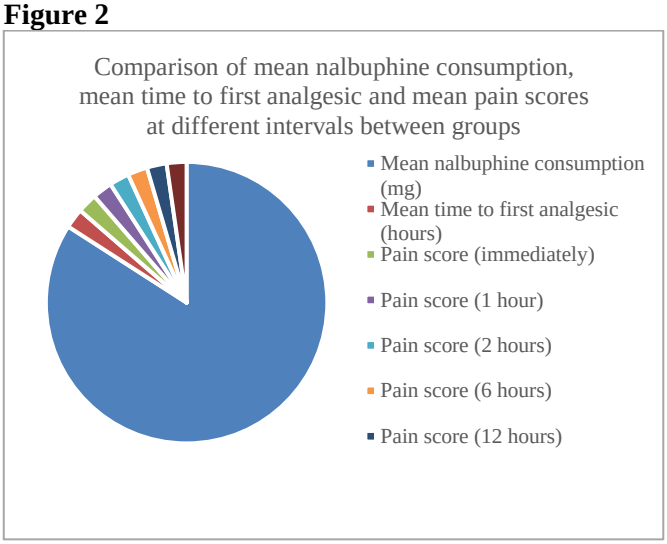
Table 2
Comparison of nalbuphine required between groups

Nalbuphine required	Groups		p-value
	Group-A (PECS-II)	Group-B (ESP)	
Yes	7(23.3%)	14(46.7%)	0.058
No	23(76.7%)	16(53.3%)	
Total	30(100.0%)	30(100.0%)	

Table 3
Comparison of mean nalbuphine consumption, mean time to first analgesic and mean pain scores at different intervals between groups

Outcome variables	Groups		p-value
	Group-A (PECS-II)	Group-B (ESP)	
Mean nalbuphine consumption (mg)	1.72±3.24	3.79±4.22	0.037
Mean time to first analgesic (hours)	9.01±1.68	4.64±0.98	0.001
Pain score (immediately)	3.00±0.788	6.07±0.785	0.001
Pain score (1 hour)	1.87±0.776	4.83±0.791	0.001
Pain score (2 hours)	1.63±0.490	3.93±0.828	0.001
Pain score (6 hours)	0.43±0.504	2.93±0.907	0.001
Pain score (12 hours)	0.30±0.466	2.53±0.507	0.001
Pain score (24 hours)	0.15±0.20	1.50±0.509	0.001

Figure 2



DISCUSSION

This study demonstrated that the PECS-II block provided superior postoperative analgesia compared to the ESP block in patients undergoing breast cancer surgery. The findings revealed that patients in the PECS-II group experienced significantly lower pain scores at all postoperative time intervals, had a prolonged time to first analgesic requirement, and required lower opioid consumption than those in the ESP group. These results highlight the efficacy of PECS-II in managing postoperative pain and reducing opioid use, which aligns with previous studies emphasizing the benefits of regional anesthesia techniques for breast surgeries.

The lower pain scores observed in the PECS-II group at all postoperative intervals suggest its greater efficacy in blocking nociceptive transmission in the anterior chest wall. Blanco et al. first described the PECS-II block as an effective alternative for breast surgery, targeting the lateral and medial pectoral nerves, intercostal nerves, and long thoracic nerve. This multi-level blockade likely contributed to the sustained analgesic effect observed in this study. In contrast, the ESP block primarily targets the dorsal rami of spinal nerves and may have limited coverage of the anterior chest wall, which explains the relatively higher pain scores in the ESP group.[9-10]

The mean time to first analgesic requirement was significantly longer in the PECS-II group (9.01 ± 1.68 hours) compared to the ESP group (4.64 ± 0.98 hours, p = 0.001), suggesting prolonged analgesic efficacy. These findings are consistent with previous research by

Bashandy and Abbas, who reported that PECS-II provided extended pain relief in patients undergoing breast cancer surgery compared to other regional techniques. The prolonged duration of analgesia observed in this study can be attributed to the deposition of local anesthetic between fascial planes, allowing for slower absorption and prolonged nerve blockade.[11-12]

Furthermore, opioid consumption was significantly lower in the PECS-II group, with only 23.3% of patients requiring nalbuphine postoperatively compared to 46.7% in the ESP group. The mean nalbuphine consumption was also significantly lower in the PECS-II group (1.72 ± 3.24 mg vs. 3.79 ± 4.22 mg, p = 0.037). These results align with the findings of Versyck et al., who demonstrated that PECS-II block reduced postoperative opioid consumption in patients undergoing mastectomy. Reduced opioid consumption is particularly important in minimizing opioid-related adverse effects such as nausea, vomiting, sedation, and respiratory depression.[13-14]

Despite the superior analgesic efficacy of the PECS-II block, both techniques were well tolerated, with no reported major complications. This supports the safety profile of both blocks, which is consistent with previous studies. However, the effectiveness of ESP block may be influenced by variability in the spread of local anesthetic, as suggested by Chin et al. Given its posterior approach, ESP block may not consistently provide adequate anterior chest wall analgesia, limiting its efficacy in breast surgeries.[15-16]

This study has a few limitations. First, the sample size was relatively small, which may limit the generalizability of the findings. A larger sample size could provide more robust conclusions. Second, this study focused only on short-term postoperative pain outcomes. Future studies should investigate the long-term effects of these blocks, particularly in reducing chronic post-mastectomy pain. Lastly, this study did not evaluate patient satisfaction scores, which could provide further insight into the clinical utility of these blocks.

CONCLUSION

The study concluded that the PECS-II block provided superior postoperative analgesia compared to the ESP block in breast cancer surgeries. Patients in the PECS-II group had lower pain scores, required less nalbuphine, and experienced a longer duration before needing rescue analgesia. These findings support the use of PECS-II as an effective regional anesthesia technique for improved pain management and reduced opioid consumption in breast surgeries. Further studies with larger populations and long-term follow-ups are recommended to validate these findings.

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