Section: Anaesthesiology

Original Research Article

A COMPARATIVE STUDY BETWEEN ULTRASOUND GUIDED ERECTOR SPINAE PLANE BLOCK AND MODIFIED PECS BLOCK IN MODIFIED RADICAL MASTECTOMY SURGERIES FOR POSTOPERATIVE PAIN RELIEF

Divya Nancy. J[1], Jesudoss Dhinakaran. S.J[2], Vidhya. A[3]

[1]Senior Resident, Department of Anaesthesiology, Government Theni medical college and Hospital, Tamilnadu, India.
[2]Assistant Professor, Department of Anaesthesiology, Government Theni medical college and Hospital, Tamilnadu, India.
[3]Assistant Professor, Department of Anaesthesiology, Government Theni medical college and Hospital, Tamilnadu, India.

Received : 05/06/2025
Received in revised form : 25/07/2025
Accepted : 14/08/2025

Keywords:
Erector Spinae Plane Block, PECS Block, Mastectomy, Postoperative Pain, Regional Anaesthesia, Analgesia.

Corresponding Author:
Dr. Divya Nancy.J,
Email: ketodoc91@gmail.com

DOI: 10.47009/jamp.2025.7.4.237

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

Int J Acad Med Pharm
2025; 7 (4); 1253-1257

ABSTRACT

Background: Modified radical mastectomy is associated with significant postoperative pain. Ultrasound-guided regional blocks, such as the erector spinae plane (ESP) and modified pectoral nerve (PECS) blocks, have been used to reduce opioid consumption and improve pain control. Objectives: To compare the postoperative pain relief and safety of ultrasound-guided ESP and modified PECS blocks in women undergoing modified radical mastectomy. **Materials and Methods:** This prospective, randomised study included 60 female patients who underwent modified radical mastectomy. Group E received an ultrasound-guided ESP block, and Group P received a modified PECS II block before general anaesthesia. Pain scores, time to first rescue analgesia, total analgesic dose, and side effects were recorded for 24 h. **Result:** The mean immediate postoperative VAS score was 1.46 ± 0.50 in Group P and 1.4 ± 0.49 in Group E (p = 0.61). At 24 hours, the mean VAS score was 3.93 ± 0.52 in Group P and 3.83 ± 0.69 in Group E (p = 0.532). The time to first rescue analgesia was 9.86 ± 1.84 hours in Group P and 10.72 ± 1.57 hours in Group E (p = 0.057). The mean total analgesic doses were 1.63 ± 0.61 in Group P and 1.57 ± 0.62 in Group E (p = 0.679). No significant differences in side effects or complications were observed between the groups. **Conclusion:** Both ultrasound-guided ESP and modified PECS blocks provided effective and safe postoperative pain relief after modified radical mastectomy, with no significant differences in pain scores, analgesic use, or side effects.

INTRODUCTION

Breast cancer is a serious health issue and the most common cancer among women worldwide, including in India.[1] A common surgical procedure for treating breast cancer, particularly in advanced cases, is modified radical mastectomy. Following this procedure, patients frequently experience moderate to severe pain, which, if poorly treated, can postpone recovery and possibly result in chronic pain.[2] Improved comfort, accelerated mobility, decreased opioid use, and a decreased risk of chronic pain are all benefits of effective pain management following surgery.[3] Although opioids have long been used to treat post-breast surgery pain, they can have negative side effects such as nausea, vomiting, drowsiness, breathing issues, and an increased risk of addiction.[4] These issues have led to the use of alternative techniques, such as regional anaesthesia, to more safely and successfully manage pain. Regional nerve blocks are now safer and easier to administer thanks to ultrasound.[5]

In recent years, two nerve block techniques have gained recognition: the erector spinae plane (ESP) block and modified pectoral nerve block (PECS block). These blocks have proven effective in reducing post-breast surgery pain and can be administered with the aid of ultrasound.[6] Nerves that supply the front of the chest and the area under the arms, including the lateral and medial pectoral nerves, the intercostobrachial nerve, and the long thoracic nerve, are blocked by the modified PECS block.[7] Local anaesthetics can reach the spinal nerves to relieve pain throughout a large portion of the chest, and the ESP block is administered at the level of the erector spinae muscle. Both of these blocks have been shown to decrease pain after

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

surgery and help decrease the amount of opioids needed.[8]

Only a small number of studies, particularly in India, have directly compared the ESP block and the modified PECS block in patients undergoing modified radical mastectomy.[9] It is still unclear how these two blocks differ in terms of side effects, pain duration, pain scores, and the need for additional pain medication.[10]

Therefore, the purpose of this study was to compare the pain relief that patients undergoing modified radical mastectomy experienced from USG (Ultrasound) ESP and modified PECS block.

MATERIALS AND METHODS

This randomised prospective comparative study of 60 patients, was conducted in the general surgery operation theatre of Government Rajaji Hospital, Madurai, from June 2022 to October 2022. Institutional ethical committee approval and written informed consent were obtained.

Inclusion and exclusion criteria

Patients aged 25–65 years with American Society of Anaesthesiologists physical status I, II, or III, scheduled for elective modified radical mastectomy procedures, were included.

Patients who had a known allergy to local anaesthetics, were receiving anticoagulant therapy, had any bleeding disorder, or showed evidence of a local infection were excluded.

Methods

Sixty patients were divided into two groups of 30 each using computer-generated numbers. With the patient in a supine position and the arm abducted at 90°, Group P received an ultrasound-guided modified PECS II block. Fifteen ml of 0.25% bupivacaine was deposited between the pectoralis major and minor (PECS I) and another 15 ml between the pectoralis minor and serratus anterior (PECS II). Group E received a USG-guided erector spinae plane (ESP) block preoperatively in the sitting position without flexion of the spine; 30 ml of 0.25% bupivacaine was administered between the erector spinae muscle and the transverse process at the T4 level.

Demographic data were collected during the preoperative assessment, and the Visual Analogue Scale (VAS) was recorded. An 18G cannula was secured on the non-operative side. Premedication provided intravenous midazolam (0.02 mg/kg) and fentanyl (1 µg/kg). General anaesthesia was induced with fentanyl, propofol, and succinylcholine and maintained with sevoflurane in a 50% oxygen/nitrous oxide mixture.

Block failure was defined as a rise in HR (heart rate) or MAP (mean arterial pressure) of >20% from baseline and was healed with paracetamol or fentanyl. Postoperative assessments included time to first rescue analgesia, total analgesic requirements, nausea, vomiting, and 24-hour pain scores recorded by a blinded observer.

Sample size calculation

The sample size was calculated with an alpha error of 0.05, power of 0.95, effect size of 0.87, and 58°of freedom, resulting in 60 patients (30 per group). A t-test confirmed an actual power of 0.954 with a critical t-value of 1.672, indicating that the sample size was sufficient for group comparison. The formula used was, $n = (Z\alpha/2+Z\beta)2\times2\times\sigma2)/d2$

Statistical Analysis

The mean, standard deviation, and p-values were calculated using the chi-square test for categorical variables and the t-test for continuous variables, $p<0.05$ was considered significant, and SPSS version 16 was used for data analysis.

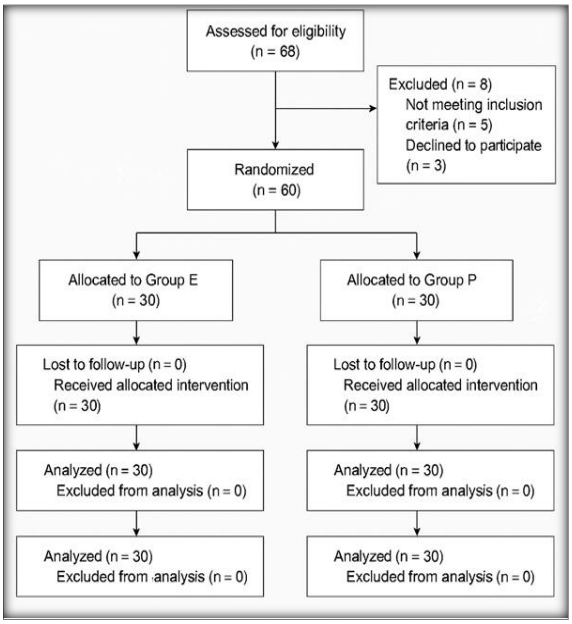

Figure 1: CONSORT flow diagram

RESULTS

The distribution of age showed that the majority of participants in both groups were within the 41–60 years category (63.3% in Group P, 60% in Group E), not comparable between the groups ($p = 0.175$). BMI was comparable between the two groups and the difference was not statistically significant ($p= 0.469$). Preoperative vital parameters such as mean systolic blood pressure (126.87 ± 18.59 mmHg in Group P vs. 124.20 ± 17.44 mmHg in Group E, $p = 0.569$), diastolic blood pressure (83.87 ± 8.14 mmHg vs. 83.60 ± 7.32 mmHg, $p = 0.894$), pulse rate (87.90 ± 15.02 beats/min vs. 85.33 ± 10.98 beats/min, $p = 0.453$) and peripheral oxygen saturation (98.37 ± 1.27% vs. 98.13 ± 0.63%, $p = 0.372$) with no significance (Table 1).

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

Table 1: Demographic and preoperative clinical characteristics

Parameter		Group P (n=30)	Group E (n=30)	P -value
Age (years)	<40	8	5	0.175
	41–60	19	18	
	>60	3	7	
BMI (kg/m²)	<24	17	18	0.469
	>24	13	12	
Preoperative Vitals	Systolic BP (mmHg)	126.867 ± 18.589	124.2 ± 17.438	0.569
	Diastolic BP (mmHg)	83.867 ± 8.136	83.6 ± 7.323	0.894
	Pulse rate (beats/min)	87.9 ± 15.016	85.333 ± 10.978	0.453
	SpO2 (%)	98.367 ± 1.273	98.133 ± 0.629	0.372

The duration of surgery averaged 190 ± 26.13 min in the PECS group and 182.17 ± 25.21 min in the ESP group (p = 0.242). Mean intraoperative SBP was 135.2 ± 18.43 mmHg in the PECS group versus 132.43 ± 17.7 mmHg in the ESP group, with DBP of 92.26 ± 7.99 mmHg and 92 ± 7.39 mmHg, respectively. Intraoperative PR were 95.4 ± 13.34 beats/min in the PECS group and 92.56 ± 11.6 beats/min in the ESP group.

MAP was similar (106.57 ± 9.16 mmHg vs. 105.47 ± 8.6 mmHg, p = 0.634), and oxygen saturation was comparable (98.9 ± 1.02% vs. 99.03 ± 0.61%). There was no significant difference in intraoperative vitals (p > 0.05).

The immediate postoperative VAS score averaged 1.46 ± 0.50 in the PECS group and 1.4 ± 0.49 in the ESP group (p = 0.61). At 24 hours, mean VAS was 3.93 ± 0.52 in the PECS group and 3.83 ± 0.69 in the ESP group (p = 0.532) (Table 2).

Table 2: Comparison of duration of surgery, intraoperative vitals and postoperative VAS scores between groups

Parameter		Group P	Group E	P-value
Duration of surgery (minutes)	Longest duration	240	210	-
	Shortest duration	150	120	-
Intraoperative vitals (Mean ± SD)	Systolic BP	135.2 ± 18.43	132.43 ± 17.7	0.556
	Diastolic BP	92.26 ± 7.99	92 ± 7.39	0.894
	Pulse rate	95.4± 13.34	92.56 ± 11.6	0.385
	SPO2	98.9 ± 1.02	99.03 ± 0.61	0.545
	MAP	106.57 ± 9.16	105.47 ± 8.6	0.634
VAS score (immediate postoperative)	VAS 1	16	18	-
	VAS 2	14	12	-
VAS score at 24 hours (Mean ± SD)		3.93 ± 0.52	3.83 ± 0.69	0.532

The time to first rescue analgesia in Group PECS and Group ESP for (7.5 to 13 hours), averaged (9.86 ± 1.84 hours vs 10.72 ± 1.57 hours), the difference was not significant (p = 0.057).

The total analgesic needed on the first day, following operation, in the groups was (13 vs 15 patients) received a single dose, while (15 vs 13 patients) needed two doses, and two patients in both groups needed three doses, required an average of 1.633 ± 0.615 vs 1.567 ± 0.626 doses of analgesics, respectively, with no significant difference (p = 0.679) (Table 3).

Table 3: Comparison of rescue analgesia timing and total analgesic doses

		Group P	Group E
Time of demand 1st rescue analgesia (in hours)	Maximum duration	13	13
	Minimum duration	7.5	7.5
Total dose of analgesic in 24 hrs after surgery	1 dose	13	15
	2 doses	15	13
	3 doses	2	2

In Group P, two patients experienced nausea or vomiting, whereas 28 did not. In Group E, four patients had nausea or vomiting, and 26 did not have these symptoms; the difference was not significant (p = 0.671).

Regarding satisfaction with block performance, 26 patients in Group P were satisfied with the block, whereas four were not satisfied. All 30 patients in Group E showed satisfaction with the block, and there was no significant difference (p = 0.112) (Table 4).

Table 4: Comparison of the incidence of nausea/vomiting and block performance satisfaction between groups

		Group P	Group E	P value
Occurrence of nausea/vomiting	Yes	2	4	0.671
	No	28	26	
Block performance	Satisfied	26	30	0.112
	Non satisfied	4	0	

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

DISCUSSION

The effectiveness, safety, and patient satisfaction with ESP and modified PECS blocks, as well as key outcomes, including pain scores, analgesia needs, and side effects, were discussed. In our study, there were no differences in the average age or BMI between groups, in the length of surgery. Similarly, Bakeer et al. showed that there was a comparable average age between groups, which were 51 ± 6.1 and 50 ± 5.9 years, respectively (p = 0.520). The ESP and PECS groups had mean BMIs of 27.4 ± 1.7 vs 27.6 ± 1.9 kg/m², respectively (p = 0.671). The surgery duration was also similar, with 99 ± 6 mins vs 100 ± 6 mins in the groups (p = 0.287).[11]

Shanmugam et al. reported that the mean age of the PECS group with 50.23 ± 7.46 years, while that of the ESP group was 48.53 ± 6.42 years (p = 0.278). The ESP group's mean weight was 56.1 ± 7.46 kg, while the PECS group's was 57.1 ± 6.23 kg (p = 0.49). The ESP group's mean surgery time was 89.1 ± 7.59 minutes, while the PECS group's was 90.2 ± 9.45 minutes (p = 0.109).[12]

In our study, intraoperative vitals were stable and comparable between the groups, with low immediate postoperative pain scores and similar pain scores at 24 h. Similarly, Rashad et al. found no significant differences in mean arterial pressure, heart rate, or BIS levels (p>0.05), and Gad et al. reported no similarity in intraoperative HR or MAP.[13,14] Similarly, Bashandy et al. observed low pain scores at 0 and 2 hours postoperatively without significant differences.[15] Bakeer et al. reported more intense pain at 1, 2, and 6 hours in the ESP group.[11] Similarly, Mohamed et al. reported pain was low at 6, 12, and 24 hours in both groups, and Eskandr et al. showed comparable 24-hour VAS scores between ESP and PECS groups (p>0.05).[16,17] Hong et al. found PECS II block had lower pain scores compared to systemic analgesia, while the ESP block did not.18

In our study, the ESP group experienced a longer time to first rescue analgesia, but this difference was not significant. In contrast, Majumdar et al. found the ESP group experienced a significantly longer time to first rescue analgesia (871.30 ± 589.51 min) than the PECS group (460 ± 507.40 min, p=0.032).[19] Bhattacharya et al. found that the time to rescue analgesia was significantly longer in the groups (11.21 ± 3.14 hours vs 6.15 ± 3.52 hours, p < 0.05).[20] Sinha et al. found analgesia lasted 5.87 ± 1.47 hours in group I and 7.26 ± 0.69 hours in group II (p=0.001).[21]

In our study, the total number of analgesic doses required in 24 h was similar in both groups.

Nausea and vomiting were observed in a few patients in both groups, but without a significant difference. In contrast, Cesur et al. found that patients in the ESPB group experienced lower opioid use and lower pain scores at 6, 12, and 24 hours, whereas the PECS group consumed more morphine throughout 24 hours.[22] Similarly, Bakeer et al. found that, one PECS patient and two ESP patients experienced postoperative nausea and vomiting. In our study, nausea and vomiting rates were similar across groups, as were the time to primary rescue analgesia and the total analgesic doses over 24 hours.[11]

In our study, most patients were satisfied with the block in both groups, although a few in the PECS group were dissatisfied because of pain during block placement. Similarly, Gawęda et al. found higher satisfaction with pain control in both groups, and Sinha et al. observed T2 blockade in 10 group I patients and 26 in group II (p=0.00).[21,23] Gad et al. found higher analgesic requests in the E group (p=0.016).[14]

In our study, both modified PECS and ESP blocks provided good postoperative pain relief after mastectomy, with no significant difference in pain scores, rescue analgesic use, or side effects. In contrast, Altıparmak et al. found that the PECS group experienced significantly lower pain scores at various points after surgery (p = 0.018), the 12th hour (p = 0.021), and the 24th hour (p = 0.011). The PECS group consumed 132.78 ± 22.44 mg of tramadol after surgery, while the ESP group consumed 196 ± 27.03 mg (p = 0.001).[24] Khorasanizadeh et al. found that the incidence of nausea and vomiting did not differ significantly between the two groups (p > 0.55).[25] Our study highlights the value of ultrasound-guided PECS and ESP blocks in breast surgery and suggests exploring them further through larger studies.

Limitations

The study had a small sample size and was conducted at a single centre, limiting its generalisability. It included only ASA I–III patients without exploring higher-risk groups, and blinding could not be maintained. A short follow-up of only 24 h may not detect late complications, and no long-term pain outcomes were evaluated in this study.

CONCLUSION

After a modified radical mastectomy, pain was effectively reduced by both modified PECS blocks and ultrasound-guided erector spinae plane. In contrast to the PECS and the ESP block group, they experienced similar pain scores at 24 hours and a longer time for first rescue analgesia. Rescue pain reliever use and side effects were similar in both groups. Overall, both blocks were safe and reliable, with no major complications. This shows that both methods can be taken into account for pain relief following breast cancer surgery, with the ESP block showing a small benefit in terms of analgesia duration. To validate these findings and evaluate long-term pain outcomes, more extensive research with longer follow-up times is required.

REFERENCES

1. Mehrotra R, Yadav K. Breast cancer in India: Present scenario and the challenges ahead. World J Clin Oncol 2022; 13:209–18. https://doi.org/10.5306/wjco.v13.i3.209.

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

2. Goethals A, Menon G, Rose J. Mastectomy. StatPearls, Treasure Island (FL): StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK538212/.
3. Gan TJ. Poorly controlled postoperative pain: prevalence, consequences, and prevention. J Pain Res 2017; 10:2287–98. https://doi.org/10.2147/JPR.S144066.
4. Bohringer C, Astorga C, Liu H. The benefits of opioid free anaesthesia and the precautions necessary when employing it. Transl Perioper Pain Med 2020; 7:152–7. https://doi.org/10.31480/2330-4871/104.
5. Wiederhold BD, Garmon EH, Peterson E, Stevens JB, O'Rourke MC. Nerve block anaesthesia. StatPearls, Treasure Island (FL): StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK431109/.
6. Abraham AS, Mehta P, Girotra G, Yadav N. A randomised trial comparing ultrasound-guided modified pectoral block versus erector spinae block for post-mastectomy pain management: A comparative analysis. Clin Breast Cancer 2025. https://doi.org/10.1016/j.clbc.2025.03.023.
7. Maldonado KA, Tadi P. Anatomy, thorax, medial pectoral nerves. StatPearls, Treasure Island (FL): StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK556059/.
8. Siddiqui N, Krishnan S, Dua A, Cascella M. Erector spinae plane block. StatPearls, Treasure Island (FL): StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK545305/.
9. Bhavani V, Dhanger S, Gupta N, Raajesh IJ, Pandian S. Comparison of the efficacy of ultrasound-guided pectoral versus Erector Spinae Plane blocks for postoperative analgesia in patients undergoing modified radical mastectomy: A randomised controlled trial. J Clin Diagn Res 2022. https://doi.org/10.7860/jcdr/2022/55835.16686.
10. Cai Q, Liu G-Q, Huang L-S, Yang Z-X, Gao M-L, Jing R, et al. Effects of erector spinae plane block on postoperative pain and side-effects in adult patients undergoing surgery: A systematic review and meta-analysis of randomised controlled trials. Int J Surg 2020; 80:107–16. https://doi.org/10.1016/j.ijsu.2020.05.038
11. Bakeer A, Abdallah NM. Erector spinae plane block versus PECS block type II for breast surgery: A randomised controlled trial. Anesth Pain Med 2022;12. https://doi.org/10.5812/aapm-122917.
12. Shanmugam P, Dunna H, Paleti S, A. Venkateswara Rao. Comparative study between ultrasound-guided modified pectoral nerve block versus erector spinae block in breast surgeries-prospective randomised comparative study. Int J Basic Clin Pharmacol 2023; 12:458–63. https://doi.org/10.18203/2319-2003.ijbcp20231128.
13. Rashad MM, Abdelhay AA. Ultrasound-guided modified pectoral plane (PECS II) block versus erector spinae plane (ESP) block for perioperative analgesia of surgical treatment of gynecomastia. Ain-Shams J Anaesthesiol 2022;14. https://doi.org/10.1186/s42077-022-00295-2.
14. Gad M, Abdelwahab K, Abdallah A, Abdelkhalek M, Abdelaziz M. Ultrasound-guided erector spinae plane block compared to modified pectoral plane block for modified radical mastectomy operations. Anesth Essays Res 2019; 13:334–9. https://doi.org/10.4103/aer.AER_77_19.
15. Bashandy GMN, Abbas DN. Pectoral nerves I and II blocks in multimodal analgesia for breast cancer surgery: A randomised clinical trial. Reg Anesth Pain Med 2015; 40:68–74. https://doi.org/10.1097/aap.0000000000000163.
16. Mohamed RM, Ahmed WG, Azzam RE, Farhat AEA. Comparison of the efficacy of ultrasound-guided erector spinae plane block, pectoral nerve block, and thoracic epidural for postoperative analgesia after mastectomy surgery: a randomised comparative prospective clinical study. Al-Azhar Med J 2022;21. https://doi.org/10.53555/hkv21s45.
17. Eskandr A, Mahmoud K, Kasemy Z, Mohamed K, Elhennawy T. A comparative study between ultrasound-guided thoracic paravertebral block, pectoral nerves block, and erector spinae block for pain management in cancer breast surgeries. A randomised controlled study. Rev Esp Anestesiol Reanim (Engl Ed) 2022; 69:617–24. https://doi.org/10.1016/j.redare.2022.02.004.
18. 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; 35:723–33. https://doi.org/10.1007/s00540-021-02923-x.
19. Majumdar U, Deka A, Basing J, Paul R. Ultrasound-guided erector Spinae plane block versus modified pectoral plane block in modified radical mastectomy: a prospective, randomised, single-blinded study. Int J Res Med Sci 2021; 9:2988. https://doi.org/10.18203/2320-6012.ijrms20213920.
20. Bhattacharya S, Mahajan S, Sood A. Comparison of postoperative analgesic effect of ultrasound-guided pectoral vs. Erector spinae block in patients undergoing modified radical mastectomy: A randomised controlled study. J Anesth Clin Res 2023; 14:1–8. https://doi.org/10.35248/2155-6148.23.14.1114.
21. Sinha C, Kumar A, Kumar A, Prasad C, Singh PK, Priya D. Pectoral nerve versus erector spinae block for breast surgeries: A randomised controlled trial. Indian J Anaesth 2019; 63:617–22. https://doi.org/10.4103/ija.IJA_163_19.
22. Cesur S, Aksu C, Güler SA, Kuş A. Modified pectoral nerve block versus bi-level erector spinae plane block for postoperative analgesia after radical mastectomy surgery: a prospective, randomised, controlled trial. Korean J Anesthesiol 2023; 76:317–25. https://doi.org/10.4097/kja.22188.
23. Gawęda B, Borys M, Belina B, Bąk J, Czuczwar M, Wołoszczuk-Gębicka B, et al. Postoperative pain treatment with erector spinae plane block and pectoralis nerve blocks in patients undergoing mitral/tricuspid valve repair - a randomised controlled trial. BMC Anesthesiol 2020; 20:51. https://doi.org/10.1186/s12871-020-00961-8.
24. Altıparmak B, Korkmaz Toker M, Uysal Aİ, Turan M, Gümüş Demirbilek S. Comparison of the effects of modified pectoral nerve block and erector spinae plane block on postoperative opioid consumption and pain scores of patients after radical mastectomy surgery: A prospective, randomised, controlled trial. J Clin Anesth 2019; 54:61–5. https://doi.org/10.1016/j.jclinane.2018.10.040.
25. Khorasanizadeh S, Arabzadeh B, Teymourian H, Mohseni GR. Pectoral nerve block and erector spinae plane block, and post-breast surgery complications. Int J Cancer Manag 2020;13. https://doi.org/10.5812/ijcm.100893.

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