

Comparison of Ultrasound-guided Erector spinae plane block and Serratus anterior plane block with Levobupivacaine for intraoperative and post-operative analgesia in Modified radical mastectomy under General Anesthesia

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Abstract

Background: The incidence of Ca. Breast is very high (14% in India)¹. One of the most common surgeries is the Modified Radical Mastectomy (MRM). The complicated nerve supply of the breast makes analgesia difficult after MRM. Post-mastectomy pain syndrome is a type of postoperative pain that affects 10–20% of people. 2. Applying local anaesthetic in an interfascial plane that peripheral nerves pass through is the aim of USG-guided interfascial plane blocks, such as the erector spinae plane (ESP) block and the serratus anterior plane (SAP) block. For long-lasting analgesia, regional fascial plane blocks are appropriate. Nausea and vomiting are common side effects of using opioids alone to treat post-mastectomy pain. In 25% to 40% of patients, poor pain management may eventually result in chronic pain syndrome (paraesthesia, phantom breast pain, and intercostobrachial neuralgia). This study aimed to evaluate the analgesic efficacy of USG guided erector spinae plane block and serratus anterior plane block, the necessity of further analgesic dosages within 24 hours following surgery, and any possible adverse effects. **Material and Methods:** A single blind randomized clinical trial was conducted among 100 patients undergoing MRM surgery under general anaesthesia. Number of study subjects in ESP and SAP block = 50 each. Both groups received USG-guided blocks with levobupivacaine (0.25%) 30 ml. Then all patients were administered conventional method of GA. **Results:** The time to request of the first rescue analgesia was comparable in group E 24.81(2.96) and in Group S 7.86(1.62) ($P < 0.001$). Postoperative pain scores were significantly lower in erector spinae plane group as compared serratus anterior plane group ($P < 0.001$) at 6, 12, 24 hrs. The intraoperative haemodynamic stability was better, postoperative analgesic requirement in Group E 0.40(0.49) and Group S 1.38(1.38) $P < 0.001$ and side effects were less in Group E. **Conclusion:** ESP block was found to be better as it provides better haemodynamic stability intraoperatively, significantly decreases the post-operative analgesic requirement and has prolonged duration of analgesia as compared to SAP block.

Keywords: Serratus anterior plane block, regional anaesthesia, modified radical mastectomy, and erector spinae plane block.

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INTRODUCTION

The incidence of Breast cancer is very high (14% in India).^[1] One of the most common surgeries is the Modified Radical Mastectomy (MRM). The complicated nerve supply of the breast makes analgesia difficult after MRM. Post-mastectomy pain syndrome is a type of postoperative pain that affects 10–20% of people.^[2]

Applying local anaesthetic in an interfascial plane that peripheral nerves pass through is the aim of USG-guided interfascial plane blocks, such as the erector spinae plane (ESP) block and the serratus anterior plane (SAP) block.

These blocks are appropriate for providing long-lasting analgesia.

Nausea and vomiting are common side effects of using opioids alone to treat post-mastectomy pain. In 25% to 40% of cases, poor pain management may eventually lead to chronic pain syndrome (paraesthesia, phantom breast pain,

and intercostobrachial neuralgia). Some of the regional anaesthetic blocks used during thoracic surgery include Thoracic Epidural Block (TEB), Thoracic Paravertebral Block (PVB), PEC 1, PEC II, intercostal block, intra or extra-pleural block, Erector spinae plane block (ESPB), and serratus anterior plane (SAP). Every single one of these blocks has unique benefits and

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drawbacks.

We aimed to compare the intra and post-operative analgesic efficacy of ESPB and SAP Block in patients undergoing Modified Radical Mastectomy under general anesthesia.

MATERIALS AND METHODS

The institutional ethical committee gave its clearance for this investigation to be carried out. This was a single blinded randomized clinical trial conducted among 100 patients undergoing modified radical mastectomy surgery at VIMSAR, Burla, Sambalpur, Odisha. 100 female patients, ages 18 to 60, who were scheduled for modified radical mastectomy surgery under general anaesthesia and who fell into ASA grades I and II, were included in the study after giving their informed consent. Patient who refused to give consent, history of allergy to any medication, history of pre-existing chronic pain, history of previous heart disease, renal or hepatic insufficiency, bleeding disorders, psychiatric disorders, nerve block site infection were excluded from the study.

A computer-generated randomisation table was used to split the patients into two groups at random. Allocation was disguised using the consecutively numbered opaque-sealed envelope technique; it was opened in the preoperative holding room following recruiting. Group S patients underwent ultrasound-guided SAP block with 0.25% bupivacaine (30 ml) and general anaesthesia, while group ESP patients underwent ultrasound-guided ESP block with 0.25% bupivacaine (30 mL) and general anaesthesia.

Preoperative assessment of patients was done day before surgery; all patients were premedicated with Tab. Alprazolam 0.5mg and Ranitidine 150mg orally on the day before surgery and were kept nil per orally for a minimum duration of 8 hours. After shifting patients to operation theatre, 18-gauge cannula was secured, intravenous fluids were started, standard ASA monitors were applied, and baseline readings were noted. Prior to the induction of general anaesthesia, the anaesthesiologist who gave the block was not involved in any further case management. Heart rate (HR), oxygen saturation (SpO₂), mean arterial pressure (MAP), systolic blood pressure (SBP), diastolic blood pressure (DBP), and electrocardiogram (ECG) were continuously monitored.

Under all aseptic measures, the nerve blocks were performed under USG guidance.

Erector Spinae Plane Block (Group E): In sitting position sterile dressing of the injection site was done and spinous process of T5-vertebrae palpated. USG probe was placed in the para-sagittal orientation at T5 vertebrae level well off the midline over the ribs and then slid towards midline. 2 ml of 0.2% lignocaine were injected into the desired puncture location. After localization of transverse process, sonographic needle was advanced to contact the corner of Transverse process. Hydro-dissection of ESP fascia from Transverse process confirmed the correct position of needle. Then levobupivacaine 0.25% in a volume of 30 ml injected deep to erector spinae muscle.

Serratus Anterior Plane Block (Group S): Patient was

positioned in supine position with arm abducted. Sterile dressing done. USG probe was placed horizontally over 5th rib in mid axillary line. 2ml of 0.2% lignocaine were injected into the desired puncture location. Block needle was inserted (in plane approach) deep to serratus anterior muscle. Hydro-dissection of fascial planes confirmed the correct position of needle, levobupivacaine 0.25% in a volume of 30 ml injected deep to serratus anterior muscle.

Assessment of block: T2-T6 dermatome was used to check for cold sensation.

Success: The T2-T6 dermatome on the block's side was unable to detect a cold sensation.

Failed: Capable of feeling cold at the block's T2-T6 dermatome Midazolam (0.05 mg/kg IV), nalbuphine (0.2 mg/kg IV), and glycopyrrolate (0.005 mg/kg IV) were administered as premedication injections five minutes before induction. Propofol 2 mg/kg intravenously was administered to patients after they had been preoxygenated with 100% oxygen until they lost the ability to respond to spoken orders. After administering intubating dosages of injectable vecuronium according to the patient's weight, an endotracheal tube of the proper size is used for intubation.

In order to attain a MAC of 1-1.2, anaesthesia was maintained using a 2:1 ratio of nitrous oxide to oxygen mixture in addition to isoflurane. Vecuronium was administered at a quarter of the intubating dose to maintain muscular relaxation. Before the procedure was finished, all patients received IV ondansetron 0.1 mg/kg to avoid post-operative nausea and vomiting.

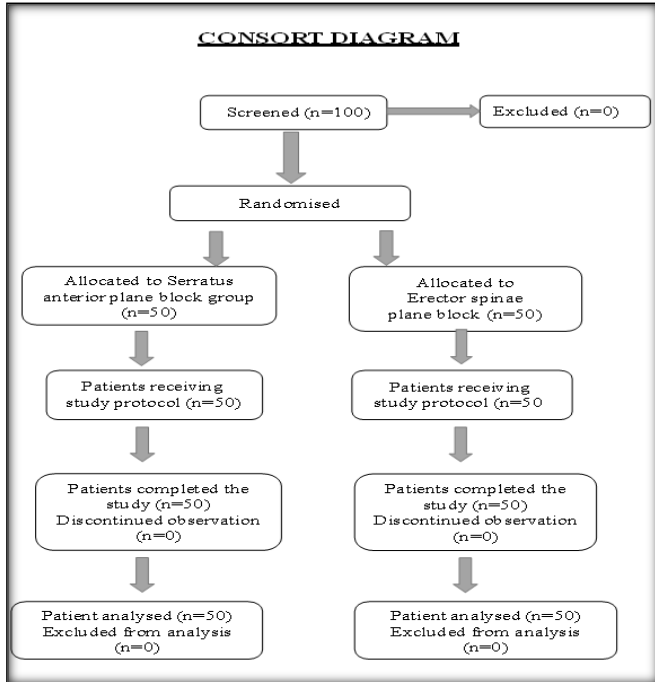
Ringer's lactate solution or, if necessary, an intravenous bolus of 3-6 mg of mephentermine were used to treat hypotensive episodes, which are defined as a drop in systolic blood pressure (SBP) of more than 20%. Atropine 0.6 mg intravenously was used to treat bradycardia, which is defined as a heart rate of less than 45 bpm.

Hypertension episodes (SBP and/or DBP >20% of baseline) managed by using inj. Nitroglycerine as a continuous intravenous infusion (0.5-5 mcg/kg/min) & tachycardia (HR > 150) managed by using inj. Esmolol (0.5-1 mg/kg) if required.

Neostigmine 0.05 mg/kg IV and Inj Glycopyrrolate 0.01 mg/kg IV were used to correct any remaining neuromuscular blockade following surgery. Once spontaneous breathing had returned with sufficient tidal exchange, tracheal extubation was carried out in accordance with established extubation criteria.

In the post-operative period all the patients kept under observation for the next 6 hour in the post-anaesthesia recovery room and HR, SPO₂, SBP, DBP and MAP recorded. Every patient's level of post-operative pain was measured using the VAS pain score scale at several predetermined intervals, such as 2, 4, 6, 12, and 24 hours. Considering the extubation as "Time 0," the "Time to first request of analgesia" was recorded. When VAS ≥ 3, rescue analgesia was given. Each patient's total analgesic usage during a 24-hour period was calculated. Additional adverse effects, such as bradycardia, nausea, vomiting, hypotension or hypertension, and respiratory depression, were noted and treated appropriately.

Outcome Measures: The time it took to request the first rescue analgesic was the main result. The evaluation of problems and side effects in the 24 hours following surgery, as well as the total amount of analgesics consumed, were secondary outcomes.



Statistical Analysis: From previous study by Ahuja D et al,^[3] minimum sample size calculated to be 45 (in each group) with 95% CI and Power of study 80%. Considering 10% drop out, total no. of study subjects in ESP and SAP block was taken to be 50 in each group.

Data was recorded in a predesigned format and entered in Microsoft Excel format. Every patient was monitored for 24 hours, and the Visual Analogue Score (a measure of post-operative pain) was recorded at 2, 4, 6, 12, and 24 hours. It was documented how long it took before the first dose of rescue analgesia was needed. Data was expressed as mean with standard deviation and analyzed with t –test with equality of means. P value of < 0.05 was considered statistically significant. VAS Score ≥ 3 was taken for analgesic dose administration. Tramadol 100 mg iv was given as Rescue analgesic. Subsequent analgesic requirement was supplemented with NSAIDS, acetaminophen.

RESULTS

When the two groups were compared, it was discovered that the demographic information, ASA physical state, length of anaesthesia, and length of surgery were not statistically significant.

Table 1: Comparison of general characteristics of the study participants between two groups

Characteristics	Group-E (N=50)	Group-S (N=50)	P value
Weight			0.11
Mean (SD)	63.82 (2.17)	64.66 (2.96)	
Height			0.78
Mean (SD)	144.30 (9.22)	143.81 (8.53)	
BMI			0.47
Mean (SD)	31.01 (4.03)	31.60 (4.21)	
ASA Grading			0.42
I	27 (27.0%)	31 (31.0%)	
II	23 (23.0%)	19 (19.0%)	

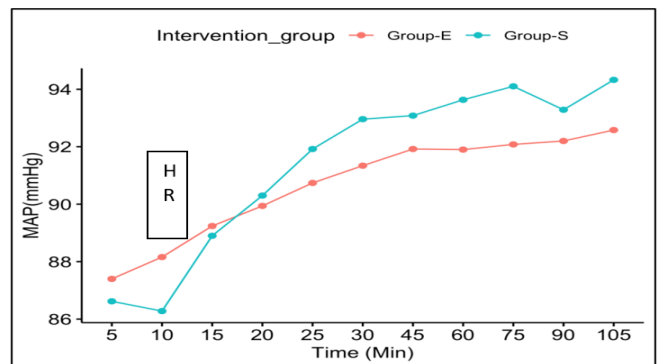
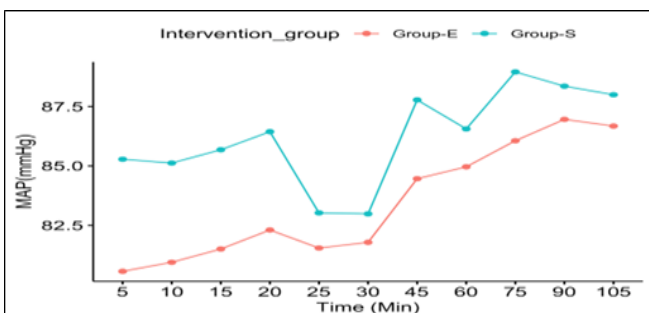
Table 2: Comparison of pre-intervention hemodynamic profile of the patients between two groups

Duration of Anesthesia(min)	Group-E (N=50)	Group-S (N=50)	P value
Mean (SD)	137.60 (16.00)	137.98 (9.29)	0.88
Duration of Surgery(min)	Group-E (N=50)	Group-S (N=50)	P value
Mean (SD)	124.02 (8.94)	123.98 (9.29)	0.98

This difference of heart rate (p=0.66), SBP and DBP (p=0.06 and p=0.07 respectively) and SpO2 (p=0.11). of the patients of both groups was statistically insignificant

Comparison of MAP of the patients between two groups at various time intervals: At several periods, the study participants' mean arterial pressure was evaluated between the two groups. There was no discernible difference (p>0.05).

Comparison of MAP of the patients between two groups at various time intervals: The mean heart rate of the study participants between two groups were measured at various time interval. At different time intervals, there was no discernible difference between the two intervention groups (p>0.05).

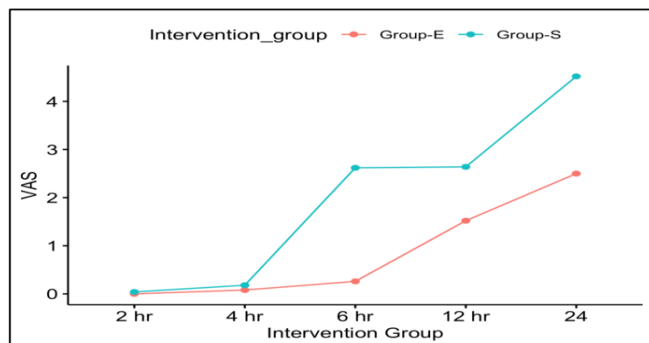


Comparison of heart rate of the patients between two groups at various time interval
 Comparison of post-operative VAS score at various time intervals between two groups
 Both the groups were compared on the basis of VAS score,

total time to request of rescue analgesia (Inj tramadol), additional analgesic requirement within 24 hrs, post operative incidence of nausea and vomiting, incidence of pneumothorax, LAST and bradycardia. The findings were described as below.

Table 3: Comparison of post-operative VAS score at various time intervals between two groups

VAS Score	Group-E (N=50)	Group-S (N=50)	P value
2hr	0.00 (0.00)	0.04 (0.28)	0.32
4hr	0.08 (0.27)	0.18 (0.66)	0.32
6hrs	0.26 (0.66)	2.62 (0.85)	<0.001
12hrs	1.52 (1.18)	2.64 (0.63)	<0.001
24hrs	2.50 (0.99)	4.52 (0.65)	<0.001



The post intervention VAS score was measure at 2hr, 4hr, 6hr, 12hr and 24hr post operatively. The mean VAS score in groups-E was 0.00 (0.00), 0.08 (0.27), 0.26 (0.66), 2.50 (0.99) respectively and in group-S, it was 0.04 (0.28), 0.18 (0.66), 2.62 (0.85), 2.64 (0.63) and 4.52 (0.65) respectively. The VAS scores of the patients of group-S were higher as compared to the patients of group-E at 6hr, 12hr and 24hrs of post operatively. This difference was also statistically significant (p<0.001) for the three-time period measured. Comparison of post-operative VAS score at various time intervals between two groups.

Table 4: Comparison of Time till the rescue analgesia between two groups

Total time till the requirement of rescue analgesia (hr)	Group-E (N=50)	Group-S (N=50)	P value
Mean (SD)	24.81 (2.96)	7.86 (1.62)	0<0.001

The request of rescue analgesia (Tramadol 100 mg) was 24.81 (2.96) hr in group-E and 7.86 (1.62) hr in group-S. The

time period was significantly (p<0.001) higher in group-E as compared to group-S.

Table 5: Comparison of total dose of additional analgesia between two groups

Total dose of additional analgesia within 24hrs post-surgery	Group-E (N=50)	Group-S (N=50)	P value
Mean (SD)	0.40 (0.49)	1.38 (1.38)	0<0.001

The mean total dose of analgesia within 24 hrs post-surgery was 0.40 (0.49) in group-E and 1.38 (1.38) in group-S. There was significant higher number of additional doses of analgesia required in group-S as compared to group-E. (p<0.001)

Comparison of post-operative nausea and vomiting between two groups: In group E, 4% of patients experienced post-operative nausea and vomiting, while in group S, the percentage was 5%. The incidence of post-operative complications was not significantly different. nausea (p=0.73) and vomiting. There was no incidence of pneumothorax, LAST or bradycardia among the patients of two intervention groups.

DISCUSSION

This study was carried out at the VIMSAR, Burla, Department of Anaesthesiology. This study covered 100 patients in total. This prospective randomised controlled trial demonstrated the comparable postoperative analgesic efficacy of ultrasound-guided SAP block and ESP block in patients undergoing MRM. Both groups had similar postoperative pain levels, intraoperative analgesic

requirements, postoperative analgesic requirements in 24 hours, and times to request the first rescue analgesic during the postoperative period. Group E had better haemodynamic stability intraoperatively, provided longer duration of analgesia, additional doses of analgesia required in 24 hrs was also considerably less. The medial and lateral pectoral nerves, the thoracodorsal and long thoracic nerves, the supraclavicular branches of the superficial cervical plexus, and the anterior and lateral cutaneous branches of the T1-T6 intercostal nerves all innervate the breast tissue. The technique of regional anaesthesia decreases the need for opioids, suppresses the surgical stress response, and offers sufficient analgesia.^[4] Tumour seeding with superficial SAP block is more likely when axillary tissue planes are disrupted, long thoracic and thoracodorsal nerves are blocked, nerves are difficult to identify and preserve after surgery, and needles are inserted across potential metastatic lymph nodes. The deep SAP block is safer and simpler to do technically because it uses the rib as the last point of postoperative analgesia and provides analgesia that is comparable to shallow SAP block. Thus, we made the decision to use a deep SAP block for our investigation.^[5] Blanco R et al,^[6] performed the serratus block at two different levels in the midaxillary line on four female volunteers. In

addition to performing fat-suppression magnetic resonance imaging and three-dimensional reconstructions of the local anesthetic's diffusion in the serratus plane, they documented the degree of paraesthesia attained. According to the study, injecting a local anaesthetic superficially or deeply under the serratus anterior produces a reliable and comparatively long-lasting regional anaesthesia that would be appropriate for chest wall surgery.

While SAP targets superficial nerves restricted to the anterior and lateral chest wall, ESP block restricts both the dorsal and ventral rami of the thoracic spinal neurones and causes some degree of sympathetic blocking, which may result in superior analgesia.^[7] Another study by Krishnan S. and Cascella M. used MRI to show the transforaminal and epidural diffusion of the local anaesthetic during ESP block, which may be beneficial for other thoracic interfascial plane blocks.^[8]

Our finding that ESP block provides a longer analgesic duration than SAP block is in line with the initial ESP block observation (Forero M et al),^[7] which stated a block length of roughly 24 hours. The duration of analgesia after various blocks varies depending on the drug deposition planes and the anaesthetised nerves involved.^[9,10] Even after standardised amount and concentration of local anaesthetic were given in a block, variations in the duration of analgesia are caused by differences in the structure and function of deep fascia as well as the interfascial transit of somatic and sympathetic nerves.^[11] In patients undergoing radical mastectomy, Altıparmak et al,^[12] found that tramadol intake was 196 ± 27.03 mg following ESP block with 20 mL of 0.25% bupivacaine and tramadol patient-controlled analgesia (PCA) during the postoperative period. They discovered that 50% of patients required rescue analgesia with morphine (intravenous morphine of 4 mg if NRS was ≥ 4 during coughing) after surgery, even though they received a high dose of tramadol. Non-steroidal anti-inflammatory medications (NSAIDs), such as acetaminophen and diclofenac sodium, were utilised in our trial to treat any further analgesia needs within 24 hours after tramadol was given for rescue analgesia. This reduced the need for opioids because of opioid sparing effects. As no major structures are involved Erector spinae plane block, it has the benefit of fewer complications during administration of block. The incidence of post-operative complications was also less in Erector spinae plane block. The post-operative side effects for the two intervention groups were compared in term of post-operative incidence of nausea and vomiting (PONV) and occurrence of pneumothorax and bradycardia. It was observed that the incidence of nausea and vomiting was present in 4% of the patients undergoing Erector spinae plane block and in 5% of the patients undergoing Serratus anterior plane block. The incidence of PONV was almost equal in both the groups which might be due female patients, use of inhalational anaesthetic agents, use of intraoperative opioids and might not be directly related to blocks administered. Similarly, the incidence of LAST, pneumothorax and bradycardia post operatively was not seen or nil in both the groups.

In order to properly quantify opioid requirements, the PCA

device was not used during the postoperative period. Another study limitation is the absence of a control group, which might have strengthened the findings. Due to the short patient follow-up period, the impact of the regional anaesthesia approach on cancer recurrence and chronic pain was not evaluated.

CONCLUSION

We conclude that Erector spinae plane block can be used as a potential supplemental approach for thoracic analgesia and is better than Serratus anterior plane block for managing pain during and after surgery in patients having modified radical mastectomy surgery.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. WHO: World Health Statistics 2019: Monitoring Health for the SDGs. Geneva, Switzerland, World Health Organization, 2018 Google Scholar
2. Madonna D, Jokevin P. Serratus anterior plane block in modified radical mastectomy surgery: a case series. *JA clin rep.* 2020 Dec; 6: 82.
3. Ahuja D, Kumar V, Gupta N, et al. 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):435-442.
4. Bajwa SJS, Anand S, Kaur G. Anesthesia and cancer recurrences: the current knowledge and evidence. *J Cancer Res Ther.* 2015;11(3):528-534
5. Exadaktylos AK, Buggy DJ, Moriarty DC, Mascha E, Sessler DI. Can anesthetic technique for primary breast cancer surgery affects recurrence or metastasis? *Anesthesiology.* 2006;105(4):660-664.
6. Blanco R, Parras T, McDonnell JG, Prats-Galino A. Serratus plane block: a novel ultrasound-guided thoracic wall nerve block. *Anaesthesia* 2013;68(11): 1107-13
7. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The Erector Spinae Plane Block: A Novel Analgesic Technique in Thoracic Neuropathic Pain. *Reg Anesth Pain Med.* 2016 Sep-Oct;41(5):621-7.
8. Krishnan S, Cascella M. Erector Spinae Plane Block. [Updated 2022 Apr 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022
9. 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
10. Elsharkawy H, Pawa A, Mariano ER. Interfascial plane blocks: back to basics. *Reg Anesth Pain Med.* 2018;43(4):341-34
11. Black ND, Stecco C, Chan VWS. Fascial plane blocks: more questions than answers? *Anesth Analg.* 2021;132(3):899-905. [
12. 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, randomized, controlled trial. *J Clin Anesth.* 2019;54:61-65.