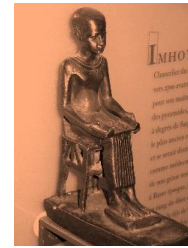




Available online at Journal Website
<https://ijma.journals.ekb.eg/>
 Main Subject [Anesthesia]



Original Article

A Comparative Study between Superficial Erector Spinae Muscle Block versus Deep Erector Spinae Muscle Block for Assessment of Pain Control during Radical Mastectomy Procedures

Elsayed Mohamed Abdelazeem *, Mohamed Fouad Elmeliogy, Islam Ali Shaboob, Zeinab Mohamed Abdelwahab

Department of Anesthesiology, Faculty of Medicine, Benha University, Qalyubiyya, Egypt

ABSTRACT

Article information

Received: 01-01-2024

Accepted: 17-02-2024

DOI: 10.21608/IJMA.2024.259772.1904.

*Corresponding author

Email: sayedzim12@yahoo.com

Citation: Abdelazeem EM, Elmeliogy MF, Shaboob IA, Abdelwahab ZM. A Comparative Study between Superficial Erector Spinae Muscle Block versus Deep Erector Spinae Muscle Block for Assessment of Pain Control during Radical Mastectomy Procedures. IJMA 2024 January; 6 [1]: 4091-4097. doi: 10.21608/IJMA.2024.259772.1904.

Background and Aim of the work: The superficial erector spinae muscle block or deep erector spinae muscle block is an effective approach for analgesia in thoracic surgical and chest trauma, providing excellent pain relief while reducing narcotic requirements. Our study compares superficial erector spinae muscle block versus deep erector spinae muscle block for assessment of pain during radical mastectomy procedures.

Patients and Methods: The patients were randomized into two groups of 30 each. Group I received 20 mL of 0.25% bupivacaine superficial to erector spinae muscle at the T4 level, while those in Group II received 20 mL of 0.25% bupivacaine deep to erector spinae muscle at the T4 level.

Results: As regards VAS, there was a significant decline [P = 0.001] in the middle VAS in group II when distinguished from group I at 12 h and a statistically significant decline [P = 0.035] at 8 h postoperatively. Also, as regards the moment of truth of first rescue analgesic, skilled was a considerably longer in group II when compared with group I [p value= 0.005], and the total measurement of morphine devouring was considerably lower in group II [6 ± 2 mg/24 h] when distinguished from group I [9 ± 2 mg/24 h].

Conclusion: Superficial erector spinae muscle block may be used as a method for controlling pain after radical mastectomy, but deep erector spinae muscle block is more effective than it.

Keywords: Erector Spinae Muscle; Ultrasound; Radical Mastectomy



This is an open-access article registered under the Creative Commons, ShareAlike 4.0 International license [CC BY-SA 4.0] [<https://creativecommons.org/licenses/by-sa/4.0/legalcode>].

INTRODUCTION

Erector Spinae Muscle [ESP] blocks are simple and dependable myofascial plane blocks^[1]. Ultrasound-guided ESP blocks have been around for a while and are used for operations like breast surgery^[2,3].

Block administration prior to surgery decreases opioid consumption and opioid-related adverse effects in reconstructed radical mastectomy [MRM]. The goal of installing an ESP block, like any fascial plane block, is to partially disperse the local anesthetic [LA]. Opioids are known to cause well-known side effects, such as nausea, vomiting, pruritus, difficulty passing urine, and ileus^[4,5]. These issues allow for the potential of a lengthy clinic stay. Once again, acute opioid fortitude and hyperalgesia may be caused by high doses of opioids^[6,7]. The drug's capacity, needle section, block approach, and pattern of dissemination within the myo-fascial plane determine the amount^[8].

The block was first shown by Forero and others; to reach the erector spinae muscle, he used two methods: superficial and deep. The substance seeping into the paravertebral space to obstruct the first and rear rami was the anticipated method^[9].

Patients undergoing thoracic surgery or suffering from chest injuries might benefit greatly from the ESP [superficial ESP or deep ESP] block as an analgesic method; it lessens the need for opioids while still providing adequate pain relief. In order to evaluate the level of pain experienced after radical mastectomy, our research contrasts the effects of a superficial and deep erector spinae muscle block^[10,11].

Our study compares superficial erector spinae muscle block versus deep erector spinae muscle block for assessment of pain during radical mastectomy.

PATIENTS AND METHODS

May 2022–May 2023 are the new start and end dates for the planned randomized, double-blind experiment. We moved forward with the Institutional Ethical Bureau once they found us appealing. The research ethics committee had met in Faculty of Medicine Benha University [study No, R. 5.5.2022].

Two nodes in the exclusive informal network, one for women aged 18 and the other for women aged 60, were used to recruit seventy-two female subjects who were members of the American Society of Anesthesiologists [ASA] I/II. Sixty instances were divided between the two groups.

During the preoperative appointment, all of the individuals were given an explanation of the procedure. After this, the assent of the conversant was recorded in each of these instances.

A body mass index [BMI] >30 kg/m² was one of the expulsion criteria, along with a strong aversion to the medications, coagulopathy, contamination at the puncture site, insanity, and communication disappointment.

Before heading to the operating room, a premedication of 1- 2 mg of midazolam was administered IV.

One basic examiner has completed the study's enrollment. Using calculating-produce random numbers per number cruncher, the patients were randomly divided into two groups of 30 each. Until a committee was formed, the random distribution series remained hidden in opaque, sealed containers.

Patients in Group I received 20 mL of 0.25 bupivacaine superficially to the erector spinae muscle, while patients in Group II received 20 mL of bupivacaine deeply to the same muscle.

Noninvasive blood pressure, electrocardiography [ECG], and pulse oximetry [SPO2] were added to the preoperative property extent and monitoring for the patients.

In all groups, GA was assumed to be administered with the anesthetics propofol and fentanyl at a dosage of 1 µg/kg. Vecuronium, at a dosage of 0.1 mg/kg, was administered to aid with tracheal intubation. It was said that anesthesia included the use of oxygen, inhaled anesthetics, and 1-2 percent isoflurane. Neostigmine 0.05 mg/kg was used to restore the neuromuscular block, followed by atropine 0.02 mg/kg and extubation.

After the operation was over, and before extubation, the patient was placed in a lateral posture with their operating side up so that the ultrasound-guided erector spinae muscle block could be performed in sterile settings.

The ultrasound transducer [10– 12 MHz] was used to confine the tip of the transverse process of the wanted vertebra. It was established in a cephalo-posterior management, 3 cm from the thorny process. After repairing the transducer on the wanted transverse process, we made acquaintance with a 22-gauge, 90-mm tease [Spinocan, B. Braun, Germany] in-plane to the US beam in a cephalo-posterior introduction to reach the transverse process. Then we aspirated to exclude accidental vascular puncture and introduced 1-2 ml of normal saline to confirm correct needle tip insertion.

A fluid line was visualized extending beneath the erector spinae muscle, dividing it from the transverse process. Patients group I received 20 mL of 0.25% bupivacaine superficial to erector spinae muscle at the T4 level, while patients group II received 20 mL of 0.25% bupivacaine deep to erector spinae muscle at the T4 level.

Results evaluations

The major result is the visual analogue scale detection at 2, 4, 8, 12, 16, 20 and 24 hours after surgery, which is the degree of clinical evaluation. A VAS score of 10 cm was used for the pain assessment [10 cm worst pain, 0 cm missing pain]. Prior to the commencement of the procedure, a pain assessment was conducted. When the VAS score exceeded 4, morphine was administered to the patients [5 mg IV].

Observed secondary outcomes

[a] morphine dosage [mg], [b] the requirement for rescue analgesia throughout the 24-hour examination, [c] mean arterial pressure following surgery for the initial six hours, [d] heart rate following surgery for the initial six hours, and [e] the occurrence of complications, including nausea and vomiting, during the 24-hour examination.

Sample size

With an expected difference of 4.6 and an initial error, this research calculates the difference in VAS ratings over 24 hours between the two groups. Thus, 30 participants per group was our goal [12].

Statistical data

The data analysis was carried out using SPSS. Mean and standard deviation were used to display quantitative data, which were analyzed using the highest quality-habit reasoning of different tests. Numbers and percentages were used to represent the qualitative data. The 2 and Fisher exact tests shed light on them, and a P-value of less than 0.05 was considered significant.

RESULTS

During the course of the research, 72 instances were included. Twelve patients failed to meet the inclusion requirements [fig 1].

There was a total of sixty participants in the research, with thirty splits evenly between the two groups. In terms of demographic information, the two groups did not differ statistically [Table 1].

In terms of MAP and HR in the PACU and for the first six hours after surgery, there was no statistically significant difference between the two groups [Figures 2 and 3].

When comparing groups I and II at 12 hours post-op, there was a statistically significant drop in middle VAS [$P = 0.001$], and at 8 hours post-op, there was a statistically significant drop [$P = 0.035$]. The two groups did not differ significantly with respect to VAS at 2, 4, 16, 20 and 24 hours after surgery [Table 2].

With a p-value of 0.005, group II participants waited significantly longer for the first rescue analgesic to take effect than those in group I. In comparison to group I [9 ± 2 mg/24 h], group II had a significantly reduced total measurement of morphine consumption [6 ± 2 mg/24 h], with a corresponding P-value of 0.02. [3rd table].

Concerning complications like nausea and vomiting, there is no statistically significant difference between the two groups [table 4].

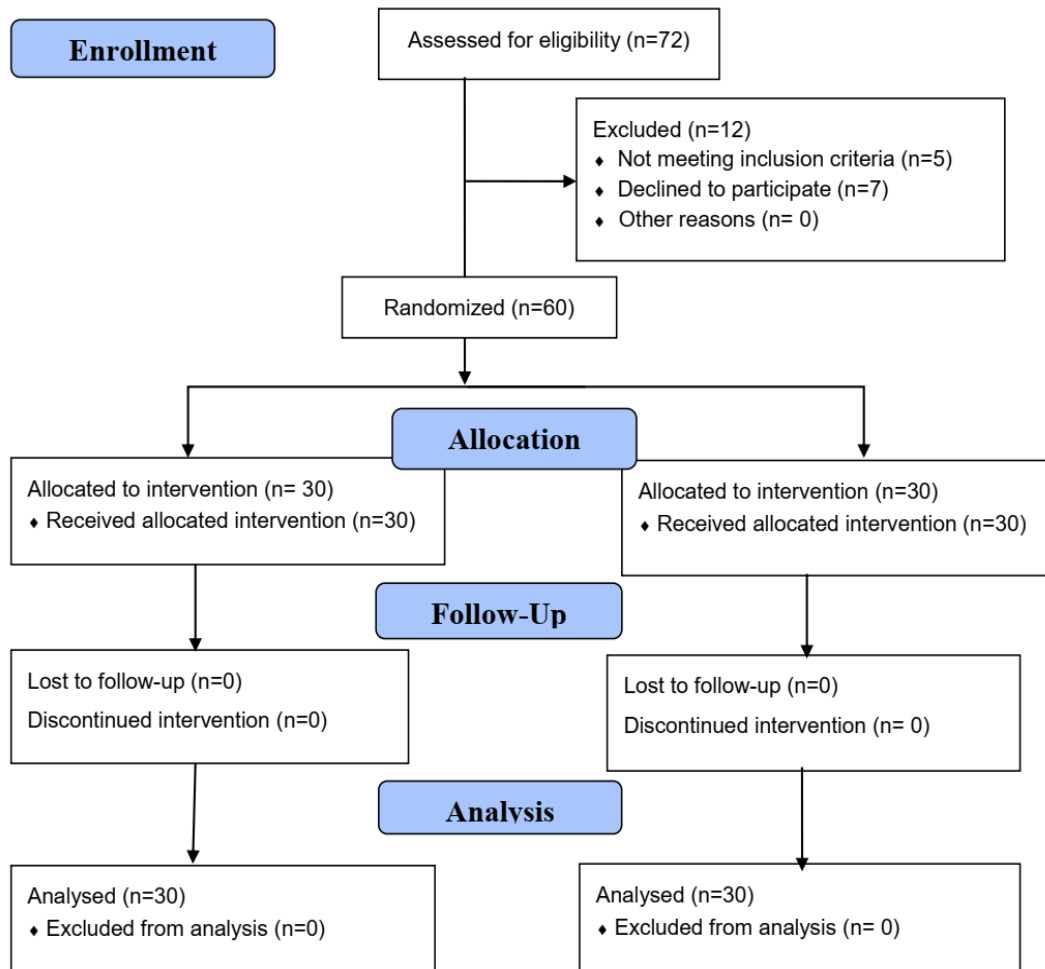


Figure [1]: Consort flow chart

Table [1]: Demographic data

| | | Group I [n=30] | Group II [n=30] | P value |
|---------------------------|----|----------------|-----------------|---------|
| Age [yrs.] | | 45.27 ± 4.83 | 47.52 ± 5.64 | 0.328 |
| Weight [kg] | | 75.32 ± 8.43 | 77.43 ± 7.83 | 0.321 |
| ASA | I | 18 | 16 | 0.33 |
| | II | 12 | 14 | |
| Height [cm] | | 167.21 ± 5.78 | 165.54 ± 6.45 | 0.329 |
| Duration of surgery [min] | | 96.33 ± 12.65 | 97.84 ± 14.54 | 0.657 |

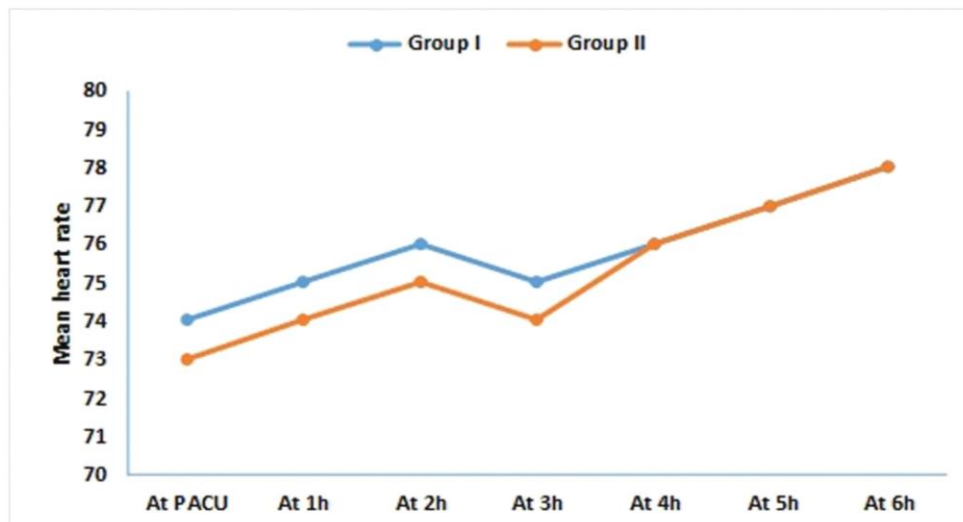


Figure [2]: Heart rate

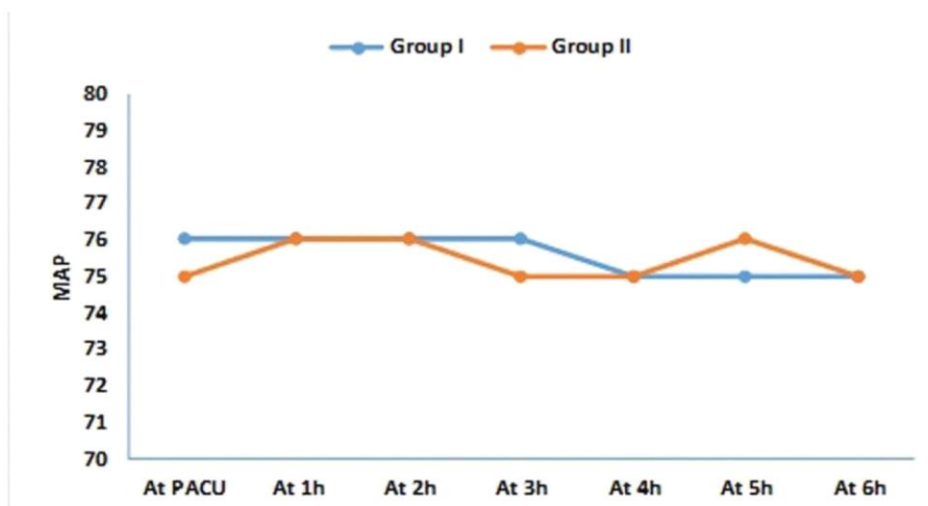


Figure [3]: Mean arterial pressure

Table [2]: Visual Analogue Score

| VAS | Group I [n=30] | Group II [n=30] | P value |
|---------|----------------|-----------------|---------------|
| At 2 h | 1 [0-4] | 1 [0-3] | 0.231 |
| At 4 h | 2 [0-4] | 2 [0-3] | 0.768 |
| At 8 h | 3 [0-5] | 2 [0-5] | 0.035* |
| At 12 h | 3 [0-5] | 2 [0-4] | 0.001* |
| At 16 h | 3 [0-6] | 4 [0-6] | 0.487 |
| At 20 h | 3 [0-6] | 4 [1-6] | 0.669 |
| At 24 h | 3 [1-6] | 4 [1-6] | 0.319 |

Table [3]: The entire dosage of morphine and the time of first rescue dose

| | Group I [n=30] | Group II [n=30] | P Value |
|-----------------------------------|----------------|-----------------|----------------|
| Time of first rescue dose [hours] | 7±3 | 12±4 | 0.005** |
| Total dose of morphine [mg] | 9±2 | 6±2 | 0.02* |

Table [4]: Postoperative complications

| | Group I [n=30] | Group II [n=30] | P Value |
|----------|----------------|-----------------|---------|
| Nausea | 5 | 4 | 0.548 |
| Vomiting | 3 | 2 | 1.000 |

DISCUSSION

Severe discomfort following surgery might impede recovery and lead to pulmonary complications. Additional deterioration of respiratory function, particularly in the post-operative phase, may result from opioid usage during the perioperative time [13, 14].

One easy-to-use interfascial block is the ESP block. The purpose of the ESP block was to reduce VAS scores and restore improvement traits. ESP block was effective in reducing opiate use and the risk of vomiting and nausea [15, 16].

Better conditioned pain management, reduced chronic pain, and ultimately a radical mastectomy are all outcomes of regional block approaches [MRM]. By lowering stress and the need for opioids, especially narcotics, which may inhibit

humoral and natural immune activities, better pain management improves immune function [17-19].

For the purpose of pain evaluation after radical mastectomy, our research contrasts deep erector spinae muscle block versus superficial erector spinae muscle block. Twenty milliliters of 0.25% bupivacaine were administered superficially to the erector spinae muscle at the T4 level to patients in Group I, and twenty milliliters of 0.25% bupivacaine was administered deep to the same muscle at the T4 level to patients in Group II. Table 1 shows that there was no statistically significant difference in the demographic data between the two groups. Figures 2 and 3 show that neither group differed statistically from the other in terms of heart rate or mean arterial pressure. In contrast, 12-hour postoperative VAS scores were significantly lower in group II compared to group I [P = 0.001], and

8-hour postoperative scores were statistically lower [P = 0.035]. However, there was no statistically significant difference between the groups with respect to VAS at 2, 4, 16, 20 and 24 hours postoperatively [Table 2]. The time it took for the first rescue analgesic to take effect was significantly longer in group II compared to group I [p = 0.005], and the total amount of morphine consumed was significantly lower in group II [6 ± 2 mg/24 h] compared to group I [9 ± 2 mg/24 h], with a corresponding P-value of 0.02 [table 3]. However, there is no statistically significant difference between the two groups with respect to the prevalence of complications, including nausea and vomiting [table 4].

Paracetamol, powerful medicine, physical therapy, acupuncture, and local anesthetic infiltration [thoracic epidural, PVBs, Pecs I, Pecs II, and ESP blocks] are some of the various options for pain management after radical mastectomy [9, 20]. Our findings are in agreement with those of a **Gürkan et al.** [21]'s approved research. They introduced a deep method [ESP] block for MRM, which significantly reduced opioid use. In comparison to the control group, the ESP group saw a decrease in anesthetic consumption, going from 16.6 ± 6.92 mg to 5.76 ± 3.8 mg. In group II [the deep group], the 24-hour narcotic consumption was 5.47 ± 1.14 mg, which is more in line with our data.

Concerning the comparison of superficial and deep erector spinae muscle blocks, our findings are in agreement with those of **De Cassai et al.** [22] and **Sinha et al.** [12]. The research by **Sinha et al.** found that group S had a morphine consumption of 7.66 ± 0.74 mg [P < 0.001], whereas group D had a lower consumption of 5.47 ± 1.1 mg.

Also, our study agrees with a systematic review and meta-analysis done by **Zhang et al.** [23] assessing the analgesic efficacy and safety of erector spinae plane block in breast cancer surgery. They found a reduction in opioid consumption, VAS, and incidence of nausea and vomiting in the group using ESP under ultrasound when compared to another group using GA alone.

Results from our research corroborated those from other writers' cadaveric investigations. Along with others, **Forero et al.** [9] completed a cadaveric investigation. The dye, which is situated deep inside the ESP muscle, has a dual action on the first rami. Dye only stains the first

rami when it's situated superficially. **Chin KJ** and colleagues state that the dye works on the spinal cord and the first rami of the thoracic nerves after diffusing into the paravertebral space. It has an effect on the sympathetic chain's rami communicans as well. This has also been shown in other research [24, 25].

Limitation of our study: One limitation of the research is a lack of studies that have compared deep and superficial erector spinae muscle blocks.

Conclusion: Though a deep erector spinae muscle block provides superior pain relief after a radical mastectomy, a superficial erector spinae muscle block may be dependable alternative.

Financial and non-financial relations and activities of interest: None

REFERENCES

1. Malawat A, Jethava D, Sachdev S, Jethava DD. Erector spinae plane block for breast oncological procedure as a surrogate to general anaesthesia: A retrospective study. *Indian J Anaesth.* 2020 Apr; 64[4]:328-333. doi: 10.4103/ija.IJA_858_19.
2. Macaire P, Ho N, Nguyen T, Nguyen B, Vu V, Quach C, Roques V, Capdevila X. Ultrasound-Guided Continuous Thoracic Erector Spinae Plane Block Within an Enhanced Recovery Program Is Associated with Decreased Opioid Consumption and Improved Patient Postoperative Rehabilitation After Open Cardiac Surgery-A Patient-Matched, Controlled Before-and-After Study. *J Cardiothorac Vasc Anesth.* 2019 Jun;33[6]:1659-1667. doi: 10.1053/j.jvca.2018.11.021.
3. Tsui BCH, Fonseca A, Munshey F, McFadyen G, Caruso TJ. The erector spinae plane [ESP] block: A pooled review of 242 cases. *J Clin Anesth.* 2019; 53:29-34. doi: 10.1016/j.jclinane.2018.09.036.
4. Nair AS, Seelam S, Naik V, Rayani BK. Opioid-free mastectomy in combination with ultrasound-guided erector spinae block: A series of five cases. *Indian J Anaesth.* 2018 Aug;62[8]:632-634. doi: 10.4103/ija.IJA_314_18.
5. Restrepo-Garces CE, Chin KJ, Suarez P, Diaz A. Bilateral Continuous Erector Spinae Plane Block Contributes to Effective Postoperative Analgesia After Major Open Abdominal Surgery: A Case Report. *A A Case Rep.* 2017 Dec 1;9[11]:319-321. doi: 10.1213/XAA.0000000000000605.
6. Lavand'homme P, Steyaert A. Opioid-free anesthesia opioid side effects: Tolerance and hyperalgesia. *Best Pract Res Clin Anaesthesiol.* 2017 Dec;31[4]: 487-498. doi: 10.1016/j.bpa.2017.05.003.

7. Bakan M, Umutoglu T, Topuz U, Uysal H, Bayram M, Kadioglu H, Salihoglu Z. Opioid-free total intravenous anesthesia with propofol, dexmedetomidine and lidocaine infusions for laparoscopic cholecystectomy: a prospective, randomized, double-blinded study. *Braz J Anesthesiol.* 2015; 65[3]:191-9. doi: 10.1016/j.bjane.2014.05.001.
8. Nagaraja PS, Ragavendran S, Singh NG, Asai O, Bhavya G, Manjunath N, Rajesh K. Comparison of continuous thoracic epidural analgesia with bilateral erector spinae plane block for perioperative pain management in cardiac surgery. *Ann Card Anaesth.* 2018;21[3]:323-327. doi: 10.4103/aca.ACA_16_18.
9. 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;41[5]:621-7. doi: 10.1097/AAP.0000000000000451.
10. Aksu C, Kuş A, Yörükoğlu HU, Tor Kılıç C, Gürkan Y. Analgesic effect of the bi-level injection erector spinae plane block after breast surgery: A randomized controlled trial. *Agri.* 2019 Jul;31[3]:132-137. doi: 10.14744/agri.2019.61687.
11. Ibrahim M, Elnabtity AM. Analgesic efficacy of erector spinae plane block in percutaneous nephrolithotomy : A randomized controlled trial. *Anaesthesist.* 2019 Nov;68[11]:755-761. doi: 10.1007/s00101-019-00673-w.
12. Sinha C, Kumar A, Kumar A, Kumari P, Singh JK, Jha CK. Deep versus superficial erector spinae block for modified radical mastectomy: A randomised controlled pilot study. *Indian J Anaesth.* 2021 Feb; 65[2]:97-101. doi: 10.4103/ija.IJA_513_20.
13. Adhikary SD, Liu WM, Fuller E, Cruz-Eng H, Chin KJ. The effect of erector spinae plane block on respiratory and analgesic outcomes in multiple rib fractures: a retrospective cohort study. *Anaesthesia.* 2019;74[5]:585-593. doi: 10.1111/anae.14579.
14. Bayman EO, Parekh KR, Keech J, Selte A, Brennan TJ. A Prospective Study of Chronic Pain after Thoracic Surgery. *Anesthesiology.* 2017;126 [5]:938-951. doi: 10.1097/ALN.0000000000001576.
15. Kelava M, Anthony D, Elsharkawy H. Continuous Erector Spinae Block for Postoperative Analgesia After Thoracotomy in a Lung Transplant Recipient. *J Cardiothorac Vasc Anesth.* 2018 Oct; 32[5]:e9-e11. doi: 10.1053/j.jvca.2018.04.041.
16. Chin KJ, Lirk P, Hollmann MW, Schwarz SKW. Mechanisms of action of fascial plane blocks: anarrative review. *Reg Anesth Pain Med.* 2021 Jul; 46[7]:618–28.
17. Marhofer D, Marhofer P, Triffterer L, Leonhardt M, Weber M, Zeitlinger M. Dislocation rates of perineural catheters: a volunteer study. *Br J Anaesth.* 2013;111[5]:800-6. doi: 10.1093/bja/aet198.
18. Gupta K, Kshirsagar S, Chang L, Schwartz R, Law PY, Yee D, Hebbel RP. Morphine stimulates angiogenesis by activating proangiogenic and survival-promoting signaling and promotes breast tumor growth. *Cancer Res.* 2002 Aug 1;62[15]: 4491-8. PMID: 12154060.
19. Cho TH, Kim SH, O J, Kwon HJ, Kim KW, Yang HM. Anatomy of the thoracic paravertebral space: 3D micro-CT findings and their clinical implications for nerve blockade. *Reg Anesth Pain Med.* 2021 Aug;46[8]:699-703. doi: 10.1136/rapm-2021-102588.
20. Vineetha P, Ramadas KT, Sajid B, Biji KP. A prospective observational study to assess the efficacy of thoracic epidural anaesthesia for mastectomy. *Ann Int Med Dent Res.* 2017;3[3]:9-13.
21. Gürkan Y, Aksu C, Kuş A, Yörükoğlu UH, Kılıç CT. Ultrasound guided erector spinae plane block reduces postoperative opioid consumption following breast surgery: A randomized controlled study. *J Clin Anesth.* 2018 Nov;50:65-68. doi: 10.1016/j.jclinane.2018.06.033.
22. De Cassai A, Bonvicini D, Correale C, Sandei L, Tulgar S, Tonetti T. Erector spinae plane block: a systematic qualitative review. *Minerva Anesthesiol.* 2019 Mar;85[3]:308-319. doi: 10.23736/S0375-9393.18.13341-4.
23. Zhang Y, Liu T, Zhou Y, Yu Y, Chen G. Analgesic efficacy and safety of erector spinae plane block in breast cancer surgery: a systematic review and meta-analysis. *BMC Anesthesiol.* 2021 Feb;21[1]:59. doi: 10.1186/s12871-021-01277-x.
24. Chin KJ, Malhas L, Perlas A. The Erector Spinae Plane Block Provides Visceral Abdominal Analgesia in Bariatric Surgery: A Report of 3 Cases. *Reg Anesth Pain Med.* 2017;42[3]:372-376. doi: 10.1097/AAP.0000000000000581.
25. Vidal E, Giménez H, Forero M, Fajardo M. Erector spinae plane block: A cadaver study to determine its mechanism of action. *Rev Esp Anesthesiol Reanim [Engl Ed].* 2018 Nov;65[9]: 514-519. doi: 10.1016/j.redar.2018.07.004.