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Bilateral Fascial Plan Block for Post Abdominoplasty Pain Control; Erector Spinae Plane Block Contrasted with Transversus Abdominis One

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ABSTRACT

Background: Abdominoplasty is a popular aesthetic procedure. Both patients and doctors are concerned about post-operative pain and discomfort. erector spinae plane block (ESP) with ultrasound guidance (UG) was an excellent analgesic technique in bariatric surgery.
Aim of the study: To evaluate the intensity and duration of analgesia (ESP) technique to that provided by the transversus abdominis plane (TAP) technique were done bilaterally with (UG) post abdominoplasty.
Patients and Methods: Our single-blinded, clinical, prospective, randomized study 51 patients received bilateral (UG) block: (ESP) group (n = 25), and (TAP) group (n = 26), Using the same dosage and volume of local anesthetics. Pain intensity using VAS score at first 30 minutes, and then at 2, 4, 6, 8, 12, 16, 20, and 24 hours postoperatively, IV boluses of pethidine (rescue analgesic) were administrated if VAS ≥ 4, The primary outcome considered as the duration of effective analgesia for each block. While the Secondary outcome measured the over-all pethidine usage, patient satisfaction and the incidence of harmful effects from the techniques.
Results: VAS score in the ESP group was significantly lower at 8hrs and 12hrs. There was significant prolonged time to the first analgesic dose in ESP group (9.16±1.07 hours) than TAP group (7.65±0.75 hours). Also, a significant reduction in to the overall pethidine intake in 24 hours (110.40±12.74mg.) in the ESP group.
Conclusion: Especially in comparison to the TAP block, the ESP block enables more reliable alleviation of pain, longer analgesic period, extends the time to initial analgesic requirements, reduces pethidine usage.

Keywords: *Abdominoplasty surgeries, Erector spinae plane block; Analgesia; Transversus abdominis plane block.*

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INTRODUCTION

Abdominoplasty is a widely performed cosmetic operation in the United States, with over 160,000 cases performed annually. [1]

Post-operative agony is an issue for both patients and physicians due to the immense incision and wounding of soft-tissue involved with this procedure. Historically, various nerve blocks have been used to enhance analgesia following abdominoplasty. [2]

Although the transversus abdominis plane (TAP) block, a regional nerve block, had first been discussed in 2001, it has not been frequently used in cosmetic surgery. [3] This might be linked to the technique's blind nature as originally defined or to cosmetic plastic surgeons' unwillingness for using ultrasound guidance. Despite this, the TAP block has been effectively used in colorectal, hernia, and a variety of gynecologic surgeries. [4]

Since opioid administration involves many unpleasant effects, including drowsiness, pruritus, vomiting, and nausea, regional opioid-free approaches are crucial to controlling post-operative pain in Abdominal surgeries.[5].

The ultrasonic-guided erector spinae plane (US-ESP) block is a unique method that targets the spinal nerves. Following injection, it was illustrated that the local Anaesthetic agent extends cranially and caudally throughout several dermatomal levels[6]. So many case reports and observational, randomized controlled trials have recorded that US-ESP block offered analgesia following various abdominal[7], thoracic[8], breast [9], and spinal surgeries[10]. ESP block offers favorable post-operative analgesia when administered in the T7 stage for abdominal procedures [7]. T 4-5 level for breast[9] and thoracic surgery[8], a cadaver-based study showed that when

introducing a 20 ml of a fluid at the T7 transverse phase, the fluid spreads cranially to the C7-T2 vertebra level and caudally to the L2-3 vertebra level10. Considering that LA spreads freely cranially and caudally throughout ESP, we presumed that ESP could be used adequately as an analgesic technique for abdominal surgeries, particularly those comprising various procedures and incisions in a single session.

Although the TAP block was described in 2001, It is not extensively used in cosmetic surgery. This may be connected to the blind kind of the treatment as mentioned or to the incapacity of cosmetic plastic surgeons to engage ultrasonography guidance. Yet, the TAP block in colorectal and gynecological surgeries has been effectively employed[12]

As mentioned in the classic literature, the TAP block is accomplished by injecting a single large dose of local anaesthesia into the plane located between the internal oblique and transversus abdominis, in a space spanning from the costal margin superiorly to end at the inguinal ligament and extend to the rectus abdominis. Based on the fact that the ventral rami of T7-L1 nerves pass through in this space from dorsal to anteriorly, the TAP technique has had the capability to block multiple cutaneous dermatomes with a single injection. The TAP space can indeed be accessed thru a variety of routes, such as the lumbar subcostal approach (petit triangle) outlined by *Hebbard*[13]. Fortunately, it is often performed through the use of the lumbar Petit triangle using a lateral approach, which consistently spreads up to the T10 dermatome, thus block the abdomen's lower quadrant effectively. This, however, is reportedly a tough approach to take for overweight patients[14]

The primary objectives were about to analyze post-operative pain severity as evaluated by the VAS score, the time needed for the first rescue analgesia (pethidine), the number of doses administered, and the overall amount of pethidine administered within first 24 hours after the procedure. Secondary objectives concerned patient satisfaction.

PATIENTS AND METHODS

This study was a clinical prospective randomized single-blinded trial approved by the Ethics and Scientific Committee at Al- Azhar University's Faculty of Medicine in Cairo for boys.

Between July 2020 and March 2021, patients who were admitted for abdominoplasty surgeries at Al-Azhar University Hospitals (Alhussein and Bab al sharia hospitals) in Cairo, Egypt, have been included in the study. This research surveyed 60 patients aged 21 to 40 years with a body mass index (BMI) of 25 to 35kg/m2, who fulfilled the American Society of Anesthesiologists (ASA) physical status I or II and had been planned for elective abdominoplasty under general anaesthesia.

The researchers have excluded patients with coagulation dysfunction or those on anticoagulants, altered mental state, a known case of allergy to the research medications (bupivacaine or pethidine), chronic pain, ASA ≥ III, or localized infection at the injection site from the study.

Participants were admitted after signing an affirmative consent application stating that they had been giving consent to participating in a clinical study and that their details would remain confidential. They would receive the same quality of healthcare as all operating theatre patients and it would not be declined medication for refusing to participate in the study. The patient was informed of the research process verbally and in writing. Since the patient receives no direct benefit and inflicts no extra costs as a result of participation in the trial, the results could be used to influence future local practice. Additionally, individuals had the option of withdrawing from the research at any time and would continue to receive prescribed therapy. However, four patients met the exclusion criterion, two patients experienced significant blood loss and hemodynamic instability intra - operative, and three patients refused to participate, leaving the trial with 51 patients, randomly divided into 25 patients in the (ES group) and 26 patients in the control group using a computer-generated algorithm (TAP group).

Given that the mean standard deviation in the ESP block is 4.7- 3.7 and 2.5 - 1 in the TAP block, so the overall sample size would have been 48 patients (24 of each group) using Open-Source Epidemiologic Statistics for Public Health version 3.01 software (OPENEPI) with a 95% standard error and an 80% power of examination. (No comparable experiments have yet been conducted). Finally, 51 patients were included in the sample, 25 of whom were randomly assigned to the ESP group and 26 of whom were randomly assigned to the control group (TAP group)

Techniques of Anesthesia and Blocking;

All patients would be told of the VAS score one day pre - operative. The VAS score is depicted by a 10-cm scale with the right border labeled "worst pain conceivable" and the left border labeled "no pain.". The patient would be asked to mark a point on the line to indicate the discomfort level they are now experiencing. Consequently, both patients were evaluated routinely prior to surgery. Both patients' baseline vital signs were collected in the preparatory room (blood pressure, oxygen saturation, respiratory rate, and heart rate).

In the operating room, both patients were followed up using a GE Healthcare model B40i monitor, that included end tidal CO_2, oxygen saturation, electrocardiography, and noninvasive blood pressure monitoring.

To administer IV fluids and drugs, an intravenous (IV) line was established. Both propofol 2 mg/kg and

Fentanyl 1 ug/kg had been used to induce anaesthesia, and 0.5-0.6 mg/kg IV atracurium was used to ease endotracheal tube placing. Anesthesia was achieved with 1 MAC isoflurane in 50% oxygen and 50% air, 0.1 mg/kg/h atracurium, and 0.5 ug/kg/h fentanyl.

After the surgical operation was performed and before the muscle relaxant was reversed, the ES group moved to lateral position and an ESP block was done at T9 level, following skin scraping with a disinfectant. The seventh cervical vertebrae's spine was used as a reference point for counting down to the ninth thoracic vertebrae's spine (T9). A sagittal 3 cm lateral to the T9 spinous phase, a high-frequency linear (6–13 MHz) ultrasound probe (Sonosite, Fujifilm, Edge II) was positioned. The transverse process (TP) and erector spinae were identified as hyperechoic shadows. A 22-gauge short bevel needle will be inserted cranial to caudal against the transverse process (TP) in the plane of the ultrasound transducer before the needle touches the TP and crosses all the muscles. On ultrasound imaging, the needle tip positioning could be confirmed by apparent normal saline solution between the ESM the TP. After the appropriate needle tip was obtained, 0.25% bupivacaine 20 mL was delivered. The process is repeated on the opposite side of the spine, pursuing this very same steps. The local anaesthetic distribution was confirmed sonographically by the distinguished spread of LA in the corresponding paravertebral spaces as an anechoic shadow between T7 and T12.

In the T group (UGTAPB), the same transducer (6–13 MHz) would be located in short-axis plane, mid-way between the iliac crest and the lower costal margin, in the mid-axillary line; the position is supine. The three abdominal wall muscles were visualized and identified from inside to outside as transversus abdominis, internal oblique and external oblique. The needle was indeed be inserted and progressed ventral to dorsal in-plane under simultaneous visualization until the needle tip is recognizable between the transversus abdominis and the internal oblique muscle. Following negative aspiration, 0.25 % bupivacaine 20 mL was injected. Distention of the plane with the LA as an elongated oval pocket is indicator of the injection's efficacy. On the other side, the operation was repeated in the same way. Isoflurane was then discontinued and Atracurium was reversed with neostigmine 0.05 mg/kg plus atropine 0.01 mg/kg. patients were extubated and shifted to the recovery room.

The primary and secondary results were determined in the recovery room and after complete recovery from general anesthesia by the outcomes inspector (An anesthesiologist not participating in the trial).

The primary outcomes assessed were the following:

(1) If the VAS score for pain severity was 4 at 30 minutes, then at 2, 4, 6, 8, 12, 16, 20, and 24 hours postoperatively, IV boosts of 40 mg pethidine (rescue analgesic) were administered. Patients were relocated to a post-operative pethidine analgesic scheme following rescue analgesic administration; 5 mg/kg IV as requested, with a median daily dosage of 200 mg.

(2) The cumulative amount of pethidine administered during the first 24 hours after surgery.

Secondary results quantified include the following:

(1) Total patient satisfaction 24 hours postoperatively: all patients would be asked to score their overall level of analgesia satisfaction on a three points verbal scale (1 indicates totally inadequate analgesia, 2 indicates adequate analgesia, and 3 indicating admirable analgesia).

(2) Some indication that the block strategies are having an adverse effect (, hematoma formation, bowel perforation, and pneumothorax). Both adverse events were recorded and treated promptly.

Statistical analysis:

The mathematical package for social sciences, version 20.0, was used to interpret the collected data (SPSS Inc., Chicago, Illinois, USA). The mean and standard deviation of quantitative results is calculated (SD). Frequency and percentages were used to express qualitative results.

We conducted the following tests:

For comparing two means, the independent-samples t-test of significance was used.

The Mann Whitney U test is used to compare two groups of non-parametric data.

To equate proportions between qualitative criteria, the Chi-square (x2) test of significance was used.

The confidence interval was set to 95%, and the appropriate margin of error was set to 5%. As a result, the following p-value was found significant:

Possibility (P-value);

–P-value of 0.05 was considered significant.
–P value of 0.001 was deemed highly significant.
–P-value of more than 0.05 was considered insignificant.

RESULTS

The study enrolled 51 patients, ranging in age from 21 to 40 years, BMI of 25 to 35 kg/m2 and ASA I or II, who were admitted for abdominoplastic surgeries under general anesthesia.

In terms of demographic evidence, no statistically difference exists between the ES and TAP groups. regards of age (years), gender, BMI [wt/(ht)2], and physical state (ASA), as seen in (Table 1).

There were statistically variations in VAS scores between the ES and TAP groups at 8 and 12 hours. Additionally, patients in both groups consistently exhibited a slightly lower VAS score, indicating progress in both groups, but more specifically in the ES community, as demonstrated by the p-value (p0.05) in (Table 2 and figure 1).

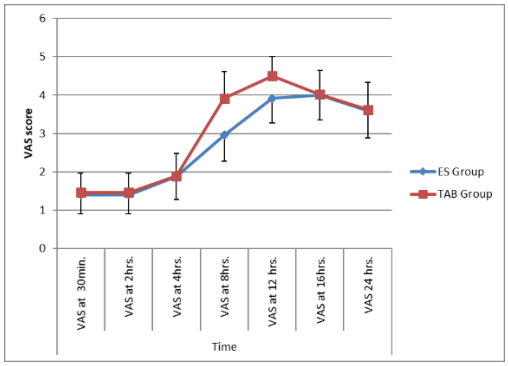

Fig 1: Comparison between ES Group and TAP Group according VAS score.

With regards to the first analgesic pethidine dosage postoperatively, there was a statistically significant delay in the ESP community compared to the TAP group, and with regards to the average volume of pethidine consumed in 24 hours, there was a highly significant drop in the ES group compared to the TAP group, as seen in (Table 3).

When comparing the amount of rescue pethidine doses administered within the first 24 hours between the ES and TAB groups, a statistically important increase in the number of rescue doses was observed in the TAP group relative to the ES group, as seen in (Table 4 and figure 2).

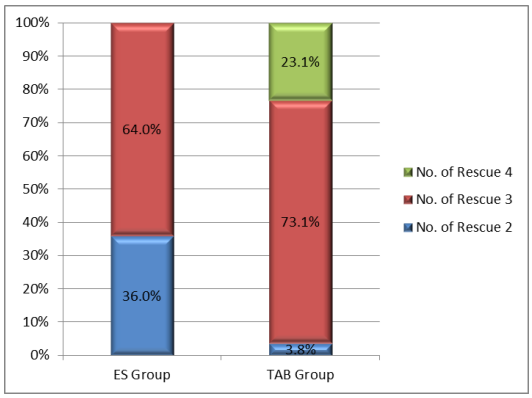

Fig 2: Comparison between ES Group and TAP Group according the number of rescue pethidine doses.

In terms of patient satisfaction in the first 24 hours, while there is a statistically meaningful variance between the E and T groups (satisfied and extremely satisfied in E group 22 patients (88 percent) vs. 21 patients (80 percent) i group, the difference is not statistically significant (Table 5).

Demographic data	ES Group *(n=25)*	TAP Group *(n=26)*	Test	p-value
Age (years)	31.88 ± 4.45	32.00 ± 4.10	t= 0.100	0.921
Sex Female Male	 9 (36.0%) 16 (64.0%)	 8 (30.8%) 18 (69.2%)	x^2= 0.157	0.692
BMI (Wt./(Ht.)^2)	26.16 ± 1.55	26.04 ± 1.59	t= 0.277	0.783
ASA I II	 17 (68.0%) 8 (32.0%)	 18 (69.2%) 8 (30.8%)	x^2= 0.009	0.925

Table 1: Comparison between the ES and TAP groups. regards of age (years), gender, BMI [wt/(ht)2], and physical state (ASA).

VAS score	ES Group *(n=25)*	TAP Group *(n=26)*	p-value
30min.	1.40 ± 0.50	1.46±0.51	0.661
2hrs.	1.40±0.50	1.46±0.51	0.658
4hrs.	1.88±0.60	1.89±0.59	0.973
8hrs.	2.96±0.68	3.92±0.69	<0.001**
12 hrs.	3.92±0.64	4.50±0.51	0.002*
16hrs.	4.00±0.65	4.02±0.63	0.997
VAS 24 hrs.	3.60±0.71	3.62±0.71	0.917

Table 2: VAS scores between the ES and TAP groups

Doses	ES Group *(n=25)*	TAP Group *(n=26)*	t-test	p-value
Dose (hours) 1st	9.16 ±1.07	7.65 ± 0.75	5.861	<0.001**
Total dose (mg)/ 24 hours	110.40±12.74	126.92±11.23	-4.918	<0.001**

Table 3: Comparison between ES Group and TAP Group regarding pethidine dosage postoperatively. Data expressed as Mean ± SD (*T-Independent Sample t-test; P-value>0.05 NS; *p-value <0.05 S; **p-value <0.001 HS).*

No. of rescue doses /day	ES Group *(n=25)*	TAB Group *(n=26)*	x2	p-value
2	9 (36.0%)	1 (3.8%)	12.642	*<0.05**
3	16 (64.0%)	19 (73.1%)		
4	0 (0.0%)	6 (23.1%)		

Table 4: Comparison between ES Group and TAP Group regarding the amount of rescue pethidine doses administered within the first 24 hours. (**p-value <0.05 S).*

	ES Group *(n=25)*	TAB Group *(n=26)*	p value
No satisfaction	3(12%)	5 (19.2%)	0.484
satisfied	10 (40%)	12 (46.1%)	0.658
highly satisfied	12(48%)	9 (34.7%)	0.336

Table 5: Comparison between ES Group and TAP Group regarding patient satisfaction

DISCUSSION

Pain after abdominal surgery already has both somatic and visceral elements, and the study outcome can be related to the fact that the two forms of block function differently in terms of mechanism or the site of action. Unilaterally, the ESP block provides prevalent, effective analgesia. This is attained by incorporating a local anaesthetic into the plane located between the ESM and the TP; the anaesthetic diffuses to block the spinal nerves via the paravertebral space.[6], [14]

On the other hand, TAP block is obtained by delivering a local anaesthetic into the plane between the internal and external oblique muscle. The spinal roots giving off the thoracolumbar nerves traverse this plane to supply sensation of the anterolateral abdominal wall;[15] as just a result, a TAP block should only be used to treat somatic pain caused by the T6-L1 ventral nerve branches being blocked. The scope of sensory block would vary considerably on the TAP block technique used [16]. Multiple numerous studies have reported that the standard US-TAP block- mid-axillary approach- greatly reduced pain and opioid use postoperatively, particularly following surgeries of the lower abdomin.[16, 17]

The duration of analgesia and period to first order analgesia were significantly longer in patients undergoing abdominoplasty surgeries under general anaesthesia who obtained an ESP block versus a TAP block, as per this study. During the first 8 and 12 post-operative hours, VAS scores were lower in the ESP group than in the TAP group and were also higher in the TAP group throughout the first 24 post-operative hours. The ESP group consumed less pethidine ultimately during the first 24 hours.

Tulgar et al. currently tested the usefulness of ESP block as a component of multimodal analgesia following laparoscopic cholecystectomy. In the block group, they used 40 mL 0.375 % bupivacaine to achieve bilateral ESP block at the level of T9. No intervention was used in the control group. And according to authors, ESP block reduced significantly post-operative pain level and tramadol usage. The current study conducted all block procedures of 20 mL 0.25% bupivacaine to ensure that the amount of local anaesthetic used in each participant was consistent. In the ESP group, post-operative pethidine consumption was diminished by more than 15%The primary explanation for this discrepancy; that ESP blocks allow for a greater distribution of local anaesthetic in the fascial dermatomal plane than TAP does. [18]

A recent research demonstrated that TAP technique provides strong analgesia across the anterior abdominal wall; Nevertheless, TAP block was less efficient in the lateral section of the abdominal wall, with virtually no analgesic effectiveness at the posterior abdominal wall. TAP block rapidly diminished from anterior to posterior sides of the abdominal wall, according to the authors. [19]

Despite the recorded success of these studies,[19,20] the primary explanation for this discrepancy was believed to be that ESP techniques had a larger dermatomal distribution of the local anaesthetic agent than TAP. This was shown in a recent cadaveric

analysis in which it was demonstrated that ESP block resulted in release of local anaesthetic agent to the epidural space, neural foraminal, and intercostal nerves. [21]

The more widespread distribution of the local anaesthetic agent may have a wide coverage of dermatomes greater than the TAP. The ESP block blocks both somatic and visceral nerve fibers, making it an ideal analgesic abdominal surgery technique. When the ESP block is done at a lower dorsal level, it is shown that the local anaesthetic solution extends anteriorly and reaches the thoracic level of paravertebral space. Thus, ESP blockade has the ability to suppress communication between the sympathetic ganglia's rami communicants. [22]

Maged L. et al. discovered that when 60 women undergoing caesarean delivery received an ESP block, The duration of analgesia and the time it takes to request analgesia for the first time the length of analgesia and time to first order analgesia is significantly longer than when they received a TAP block. The ESP group administered less tramadol in general for the first 24 hours. Based on the fact that post caesarean delivery pain has both visceral component and somatic one, their observations can be driven by the fact that the two forms of block have distinct mechanisms and sites of action. [23]

Alshima et al. observed that bilateral UGESPB performed immediately after complete abdominal hysterectomy significantly lowered VAS score at all predicted time points and was very clinically meaningful at 30 minutes, 2 hours, 12, 16, 20, and 1day compared to TAP .[5]

Tulgar et al. discovered that the control group's post-operative VAS score was slightly higher over the early 12 hours postoperatively and equal to the ESPB post complete abdominal hysterectomy.[18]

Altiparmak et al. discovered that the ESP group had slightly lower Numeric Rating Scale ratings at 15 min, 30 min, and one hour post-operatively, as well as 12 and 24 hours relative to the subcostal TAP group following cholecystectomy.[23]

In terms of patient satisfaction, there was no significant disparity between the TAP and ESP groups., because the ESP group has a higher proportion of satisfied (satisfied and extremely satisfied) patients than the TAB group, probably because pain management is not the only factors that influence the satisfaction of patients following abdominoplasty, although a fundamental issue.

Bilateral ESP block has not been associated with any adverse events. Unfortunately, pneumothorax was the one of the earliest known consequence of ESP block along with a lower extremities motor impairment that was observed in a lady having caesarean delivery following bilateral ESP block. TAP block is thought to have had a low complexity rate. However, Various consequences have been observed following TAP block, including intraperitoneal misalignment of the TAP catheter with no harm to the organs, intrahepatic injection, especially in hepatomegaly, and allergic reaction. In addition, because of the TAP's link to the femoral nerve, short-term femoral nerve palsy is a likely possibility.[24]

While no adverse effects were identified for any block in the current study, the risks mentioned earlier should be addressed when conducting a TAP block.

CONCLUSION

Especially in comparison to the TAP block, the ESP block enables more reliable pain relief, longer duration of analgesia, extends the time to initial analgesic requirements, reduces pethidine usage, provides a higher safety analgesic method that could be used as a part of multimodal analgesia and also opioid-free regimens subsequent to abdominoplasty operations.

REFERENCES

1. Feng LJ. Painless Abdominoplasty: The efficacy of combined intercostal and pararectus blocks in reducing post- operative pain and recovery time. *Plast Reconstr Surg*. 2010;126(3):1723-32.
2. Morales R Jr, Mentz H 3rd, Newall G, et al. Use of abdominal field block injections with liposomal bupivacaine to control post-operative pain after abdominoplasty. *Aesthet Surg J*. 2013;1;33(8): 1148-53.
3. Taylor R, Pergolizzi JV, Sinclair A, et al. Transversus Abdominis block: clinical uses, side effects and future perspectives. *Pain Pract.* 2013; 13(4):332-44.
4. Brady RR, Ventham NT, Roberts DM, et al. Open Transversus Abdominis plane block and analgesic requirements in patients following right hemicolectomy. *Ann R Coll Surg Eng.* 2012; 94:327-30.
5. Alshaimaa A., Olfat A., and Mohamed A. Bilateral Ultrasound-Guided Erector Spinae Plane Block Versus Transversus Abdominis Plane Block on Postoperative Analgesia after Total Abdominal Hysterectomy. *Pain Physician*. 2020: 23:375-82
6. Forero M, Adhikary SD, Lopez H, et al. The erector spinae plane block. Reg Anesth Pain Med 2016;41(5):621–7.
7. Hannig KE, Jessen C, Soni UK, et al. Case report erector spinae plane block for elective laparoscopic cholecystectomy in the ambulatory surgical setting. *Case Rep Anesth*. 2018:5492527.
8. Forero M, Rajarathinam M, Adhikary S, et al. Continuous erector spinae plane block for rescue analgesia in thoracotomy after epidural failure: a case report. *A case reports* 2017;8(10):254–6.
9. Altiparmak, B., Korkmaz Toker, M., Uysal, A.I., et al. 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. *Journal of Clinical Anesthesia*. 2018; 54, 61-5.
10. Young MJ, Gorlin AW, Modest VE, et al. Clinical implications of the Transversus Abdominis plane block in adults. *Anesth Res Prac*. 2012;1-11.
11. Rafi AN. Abdominal field block: a new approach via the lumbar triangle. *Anaesthesia.* 2001;56(10):1024-6.
12. Taylor R, Pergolizzi JV, Sinclair A, et al. Transversus Abdominis block: clinical uses, side effects and future perspectives. *Pain Pract*. 2013; 13(4):332-44
13. Hebbard P. Subcostal Transversus Abdominis plane block under ultrasound guidance. *Anesth Analg.* 2008;106(2): 674-5
14. Ueshima H and Otake H. Similarities between the retrolaminar and erector spinae plane blocks. *Reg Anesth Pain Med*. 2017;42:123–4.
15. Tsai HC, Yoshida T, Chuang TY, et al. Transversus abdominis plane block: an updated review of anatomy and techniques. *Biomed Res Int*. 2017;2017:8284363.
16. Chou R, Gordon DB, de Leon-Casasola OA, et al. Management of Post-operative Pain: A Clinical Practice Guideline From the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Council. *J Pain.* 2016;17(2):131-57.
17. Chatrath C, Khetarpal R, Kumari H, et al. Intermittent transcutaneous electrical nerve stimulation versus transversus abdominis plane block for post-operative analgesia after Infraumbilical surgeries. *Anesth Essays Res* 2018;12(2):349–54.
18. Tulgar S, Kapakli MS, Senturk O, et al. Evaluation of ultrasound-guided erector spinae plane block for post-operative analgesia in laparoscopic cholecystectomy: a prospective, randomized, controlled clinical trial. *J Clin Anesth* 2018; 49(Sep):101–6.
19. Ma J, Jiang Y, Tang S, et al. Analgesic efficacy of ultrasoundguided subcostal transversus abdominis plane block. *Medicine (Baltimore)* 2017; 96(10):6309.
20. Ramkiran S, Jacob M, Honwad M, et al. Ultrasound-guided combined fascial plane blocks as an intervention for pain man- agement after laparoscopic cholecystectomy: a randomized control study. *Anesth essays Res* 2018;12(1):16–23.
21. Das Adhikary S, Bernard S, Lopez H, et al. Erector spinae plane block versus retrolaminar block. *Reg Anesth Pain Med* 2018;43(6):1.
22. Chin KJ, Malhas L and 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):372–6.
23. Altiparmak B, Toker Mk, Uysal AI, et al. Ultrasound-guided erector spinae plane block versus oblique subcostal transversus abdominis plane block for post-operative analgesia of adult patients undergoing laparoscopic cholecystectomy. *J Clin Anesth.* 2019; 57:31-6.
24. Boules ML, Goda AS, Abdelhady MA, et al. Comparison of Analgesic Effect Between Erector Spinae Plane Block and Transversus Abdominis Plane Block After Elective Cesarean Section: A Prospective Randomized Single-Blind Controlled Study. *J Pain Res*. 2020;19:1073-80.