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ORIGINAL ARTICLE

Investigation of efficacy of erector spinae plane block administered in different volumes on intraoperative opioid consumption and postoperative analgesia in breast surgery: Randomized, prospective, double-blind study

Meme cerrahisinde farklı volümlerde uygulanan erektör spina düzlem bloğunun intraoperatif opioid tüketimi ve postoperatif analjezi üzerindeki etkinliğinin araştırılması: Randomize, prospektif, çift kör çalışma

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Summary

Objectives: We investigated the efficacy of the erector spinae plane block, which has been proven to be effective in breast surgery, on intraoperative opioid consumption and postoperative analgesia when administered in different volumes with the same concentration of local anesthetic.

Methods: This study is designed as randomized, prospective, and double-blind. Seventy patients aged between 18–70 years, undergoing ASA I-III elective breast surgery, were included. Unilateral erector spinae plane block was achieved by administering 20 mL of 0.375% bupivacaine hydrochloride in 35 patients in Group I and 30 mL of 0.375% bupivacaine hydrochloride in 35 patients in Group II. The analgesic requirement of the patients was monitored with the surgical plethysmographic index throughout the surgery. Intraoperative and postoperative opioid consumption, rescue analgesic requirements in the first 24 hours, and NRS scores at the 10th minute, 1st hour, 6th hour, 12th hour, and 24th hour postoperatively were recorded.

Results: Both intraoperative and postoperative opioid consumptions were similar between groups (p>0.05). The number of involved dermatomes was significantly higher in Group II (p<0.05). No significant difference was found between postoperative NRS scores (p>0.05).

Conclusion: In elective breast surgery, erector spinae plane block administered at the same concentration in 20 or 30 mL volumes does not make a difference in opioid consumption and postoperative analgesia.

Keywords: Analgesia; mastectomy; pain.

Özet

Amaç: Bu çalışmada, meme cerrahisinde etkinliği kanıtlanmış erektör spina düzlem bloğunun farklı volümlerde, aynı konsantrasyonda lokal anestezik ile uygulanması durumunda intraoperatif opioid tüketimi ve postoperatif analjezi üzerindeki etkinliği araştırıldı.

Gereç ve Yöntem: Çalışma, randomize, prospektif ve çift-kör olarak dizayn edildi. Çalışmaya, 18–70 yaş arası ASA I-III, elektif meme cerrahisi geçirecek 70 hasta dahil edildi. Grup I'deki 35 hastaya %0.375'lik bupivakain hidroklorür 20 ml ile, Grup II'deki 35 hastaya %0.375'lik bupivakain hidroklorür 30 ml ile unilateral erektör spina düzlem bloğu yapıldı. Ameliyat süresince cerrahi pletismografik indeks ile hastaların analjezik ihtiyacı monitörize edildi. Hastaların intraoperatif ve postoperatif ilk 24 saat opioid tüketimleri ve kurtarıcı analjezik ihtiyaçları ile postoperatif 10. dakika, 1. saat, 6. saat, 12. saat ve 24. saatteki NRS skorları kaydedildi.

Bulgular: Hem intraoperatif hem de postoperatif opioid tüketimi gruplar arasında benzerdi (p>0.05). Tutulan dermatom sayıları Grup II'de anlamlı derecede yüksekti (p<0.05). Postoperatif NRS skorları arasında istatistiksel fark saptanmadı (p>0.05).

Sonuç: Elektif meme cerrahisinde, aynı konsantrasyonda 20 veya 30 ml volümlerde uygulanan erektör spina düzlem bloğu, opioid tüketimi ve postoperatif analjezi üzerinde fark oluşturmamaktadır.

Anahtar sözcükler: Ağrı; analjezi; mastektomi.

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Introduction

Postoperative pain is a predictable, short-term, self-limiting consequence of physical injury, typically caused by the surgical procedure. It is an adaptive response that promotes healing by restricting movements and behaviors that could potentially result in further tissue trauma.[1] Inadequate postoperative pain management remains a major clinical problem, leading not only to poor outcomes in the early postoperative period but also to an increased risk of persistent pain.[2]

Breast surgery is one of the most common surgeries performed in women, and moderate to severe acute pain has been reported in 30–50% of patients and persistent pain in 8–25% of patients after surgery.[3,4] Postoperative pain management is challenging due to the complex innervation of breast tissue.[5] Pain control is usually achieved with a combination of oral and intravenous (iv) analgesics as well as regional techniques such as local anesthetic infiltration, intercostal block, paravertebral block, and thoracic epidural anesthesia.[6] Regional blocks administered in breast surgery have been shown to reduce postoperative pain scores, decrease opioid requirement, postoperative nausea and vomiting, decrease pulmonary complications, and shorten the duration of stay in the post-anesthesia care unit (PACU).[7,8]

The erector spinae plane (ESP) block is an ultrasound-guided fascial area block first described in 2016 by Forero et al.[9] for thoracic neuropathic pain. In anatomical and radiological fresh cadaveric studies, it has been observed that it affects the dorsal and ventral branches of the thoracic nerves. The analgesic efficacy of the ESP block in breast surgery has been proven by various studies, but studies on the clinical differences when administered in different volumes are limited.[10,11]

In our study, we aimed to compare the effects of the ESP block administered with the same concentration and different volumes of local anesthetic before breast surgery on intraoperative and postoperative opioid consumption, the need for rescue analgesics, and postoperative nausea and vomiting.

Material and Methods

The study was conducted as a prospective, randomized, controlled, and double-blind trial in a tertiary university hospital in accordance with the principles of the Declaration of Helsinki. The approval of the local ethics committee (decision numbered 2021/435) and the Pharmaceuticals and Medical Devices Agency (12.03.2021/E.766486) were obtained before the study. Written informed consent was obtained from all volunteers who agreed to participate in the study. Patients aged 18–70 years with American Society of Anesthesiologists (ASA) physical status I-III, undergoing elective breast surgery were included in the study, whereas patients with a body mass index>35 kg/m^2, body weight<60 kg, patients with a local skin infection in the site where the needle will be inserted, known allergy to any of the drugs to be used in the study, coagulopathy, chronic opioid consumption, hepatic and/or renal failure, and those who did not agree to participate in the study were excluded. Patients were randomized by lottery using the closed opaque envelope technique. This was carried out by a healthcare professional who was not involved in the study. Patients who underwent preoperative unilateral ESP block with 20 ml of bupivacaine hydrochloride (HCl) at a concentration of 0.375% were assigned to Group I, while patients who underwent ESP block with 30 ml of bupivacaine HCl at a concentration of 0.375% were assigned to Group II.

Preoperatively, all patients were instructed on an 11-point numerical rating scale (NRS; 0: no pain, 10: the most severe pain imaginable) to assess the severity of postoperative pain. The demographic data of the patients including sex, age, height, weight, body mass index (BMI), and ASA scores were recorded. Electrocardiograms, peripheral oxygen saturation, and non-invasive blood pressure measurements were monitored in the operating room, and crystalloid infusion was started at a dose of 10 ml/kg/h by providing IV access with a 22-gauge cannula. Patients were sedated with 0.03 mg/kg midazolam, and ultrasound-guided unilateral ESP block was performed approximately 30 min before the induction of anesthesia. All patients underwent breast surgery under the same general anesthesia. The anesthesia induction of the patients was achieved by administering 40 mg of lidocaine, 2 mg/kg propofol, and 0.6 mg/kg rocuronium. Concomitantly, remifentanil infusion was started at a dose of 0.1 mcg/kg/min. Anesthesia maintenance of intubated patients with a train of four (TOF) of 0% was achieved with 0.5–1 minimum

alveolar concentration (MAC) desflurane inhalation and remifentanil infusion. During surgery, the surgical plethysmographic index (SPI) was used to monitor the analgesic needs of the patients, and the remifentanil infusion dose was changed by 10% so that the SPI was between 30 and 50, and total intraoperative remifentanil consumption was recorded.

The duration of surgery and the type of surgery (mastectomy, breast-conserving surgery) were recorded. Systolic arterial pressure (SBP), diastolic arterial pressure (DBP), mean arterial pressure (MAP), heart rate (HR), and SPI values were recorded at baseline, at the beginning of surgery, and every 10 min during surgery. For postoperative analgesia, 1 mg/kg tramadol iv slow bolus was administered 30 min before the end of the surgery. 0.1 mg/kg of ondansetron was administered intravenously as an antiemetic. Patients who were extubated with TOF values≥90% at the end of surgery were admitted to the PACU. Patients were kept in the PACU until the Modified Aldrete Score reached 9 and then transferred to the relevant clinic. IV PCA device was used for postoperative analgesia. PCA was programmed with tramadol at a dose of 5 mg/ml without basal infusion dose, 4 ml per bolus, and a lock-out time of 10 min.

The administration of the Erector Spinae Plane Block

The block was performed at the T4 vertebra level. The patients were placed in the prone position, and the T7 vertebra, corresponding to the level of the lower ends of the scapula, was identified. Then the T4 vertebra was identified by palpation. The skin preparation was performed using 10% povidone-iodine. The targeted injection site was subcutaneously anesthetized with 1 ml of 2% lidocaine. Using a linear probe covered with a sterile drape at a frequency of 8 MHz with ultrasonography guidance (Esaote My Lab Six, Genova, Italy), first the T4 spinous process was visualized in the horizontal plane in the midline, then the probe was turned to the longitudinal plane, and the transverse process approximately 3 cm lateral from the midline and the erector spinae muscle on it were visualized. A 22-gauge, 50–80 mm block needle (Stimuplex A; B Braun, Melsungen, Germany) was advanced in-plane craniocaudal, and the transverse process was touched. Then, after the needle was minimally withdrawn and confirmed by hydrodissection that it was between the erector spinae muscle and the transverse process, 20 ml of 0.375% or 30 ml of 0.375% bupivacaine HCl was administered to this plane, and the local anesthetic spread was monitored simultaneously by USG. The volume of the drug administered was not known by the research assistant who performed the block and the patient who underwent the block. The loss of hot-cold sensation 2 dermatomes below and above the T4 dermatome level 30 min after the block was performed was considered that the block was achieved. Patients in whom the block failed were excluded. The number of blocked dermatomes was also noted.

Pain Assessment and Analgesia Protocol

Postoperative patients' pain scores and rescue analgesic needs were evaluated in the PACU and surgical ward using a resident blinded to the groups. NRS was used to assess the severity of pain. Postoperative NRS values at 10 min, 1 hour, 6 hours, 12 hours, and 24 h and tramadol consumption (PCA DEL(delivery) and DEM(demand) values) at 1 hour, 6 hours, 12 hours, and 24 hours were recorded. Rescue analgesia was administered according to the NRS values of the patients, and the time of the first rescue analgesia requirement was also recorded. An NRS of≥4 was considered inadequate analgesia, and 1 g paracetamol was administered as iv slow infusion. After 30 min, the patient was re-evaluated, and if the NRS was still 4 or higher, 20 mg tenoxicam was administered as iv slow infusion. Total opioid consumption and total rescue analgesic requirement in the first 24 h postoperatively were recorded. The presence of nausea and vomiting in the postoperative 24-h period was also recorded. The severity of nausea was rated by the patients on a 4-point scale (0: none, 1: mild, 2: moderate, 3: severe). In the presence of moderate to very severe nausea and vomiting, additional ondansetron at a dose of 0.1 mg/kg was administered intravenously.

Primary and Secondary Outcome Measures

The primary outcome measure of the study was intraoperative remifentanil consumption. Secondary outcome measures were NRS scores at 5 different time points (postoperative 10th minute, 1st hour, 6th hour, 12th hour, and 24th hour) and total opioid consumption and rescue analgesic requirement in the first 24 h postoperatively.

Statistical Analysis

The data obtained as a result of the research were analyzed in a computer environment with the SPSS (Statistical Package for Social Sciences) 18.0 package program. In descriptive analyses, frequency data were expressed as numbers (n) and percentages (%), while numerical data were expressed as mean±standard deviation (SD), minimum–maximum, and median (1st quartile–3rd quartile). The chi-square test was used to compare categorical data. The compatibility of the numerical data with the normal distribution was analyzed by the Kolmogorov-Smirnov test. The distribution of normally distributed numerical data in two independent groups was analyzed by Independent Samples T-test, the distribution of non-normally distributed numerical data was analyzed by Mann-Whitney U-test, and the distribution of numerical data in more than two groups was analyzed by One-Way ANOVA test. Tukey or Tamhane Post Hoc analysis was used for variables for which the ANOVA test was significant. The relationship between the two numerical variables was analyzed by Pearson Correlation analysis. Correlation relationships: r=0.05–0.30 indicates a low or insignificant correlation, r=0.30–0.40 indicates a low-moderate correlation, r=0.40–0.60 a moderate correlation, r=0.60–0.70 a good correlation, r=0.70–0.75 as very good correlation, r=0.75–1.00 as excellent correlation. The changes in the NRS score, MAP, HR, and SPI data in Group I and Group II over time were analyzed by the Repeated Measure ANOVA test. The results were analyzed at a 95% confidence interval and considered significant at $p<0.05$ level.

Determination of Sample Size

The sample size of the study was calculated with the G*Power 3.1.9.4 program based on a preliminary data set consisting of 12 patients in the 20-ml local anesthetic group and 13 patients in the 30 ml local anesthetic group. According to the pilot trial results, remifentanil consumption was 620.2±206.2 mcg in the 20 ml group and 668.2±250.37 mcg in the 30 ml group. The sample size that would create a 10% difference in remifentanil consumption was calculated as 33 patients for both groups with 90% power and a 5% margin of error. Considering the possible losses, a total of 70 patients were planned to be included in the study, 35 patients for each group.

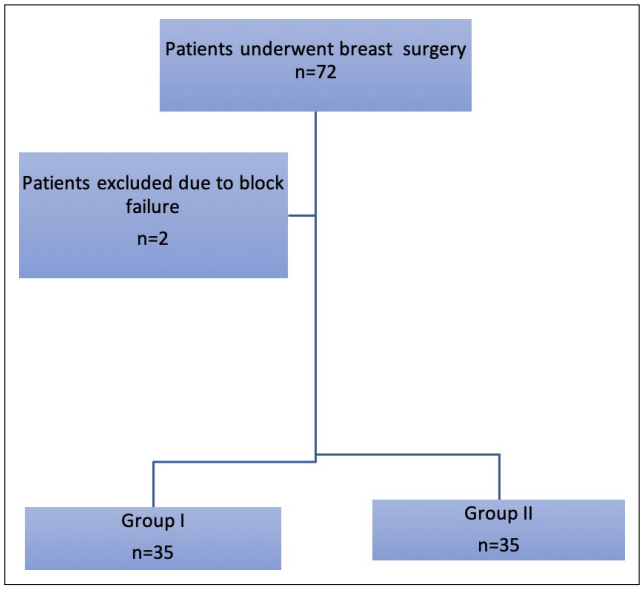

Figure 1. Flowchart of study.

Table 1. The comparison of demographic data of the groups with the duration of surgery

	Group I Mean±SD	Group II Mean±SD	p
Age (years)	52.34±14.67	52.57±12.41	0.944
Weight (kg)	71.68±9.20	78.51±9.83	**0.004**
Height (cm)	159.85±3.97	161.77±5.24	0.090
BMI (kg/m²)	28.06±3.50	30.01±3.60	**0.025**
The duration of surgery (min)	78.22±22.55	80.54±30.84	0.721

SD: Standard deviation; BMI: Body Mass Index.

Results

A total of 72 female patients who underwent surgery for breast cancer were included in the study. Two patients were excluded due to block failure (Fig. 1). The mean age of the patients included in the study was 52.45±13.49 years. A comparison of age, weight, height, BMI, and duration of surgery according to the groups is presented in Table 1. The mean weight and BMI were significantly lower in Group I than in Group II (p=0.004, p=0.025).

A significant difference was found between the groups in terms of dermatome involvement (p=0.001). The number of patients with T2-6 dermatome involvement was higher in Group II (Group I: 19 patients, Group II: 25 patients). A comparison of ASA scores, type of surgery, and dermatome involvement between the groups is presented in Table 2.

Table 2. Comparison of ASA scores, type of surgery, and dermatome involvement of patients

	Group I		Group II		p
	n	%	n	%	
ASA					0.275
ASA-1	2	5.7	6	17.1	
ASA-2	28	80.0	23	65.7	
ASA-3	5	14.3	6	17.1	
Surgery type					0.423
Right mastectomy	12	34.3	8	22.9	
Right BCS	9	25.7	9	25.7	
Left mastectomy	9	25.7	15	42.9	
Left BCS	5	14.3	3	8.6	
Dermatome involvement					**0.001**
T1-8	2	5.7	9	25.7	
T2-5	14	40.0	1	2.9	
T2-6	19	54.3	25	71.4	

ASA: The American Society of Anesthesiologists; BCS: Breast-conserving surgery.

Table 3. Distribution of NRS scores between groups over time

	Group I (ESP 20 ml)				Group II (ESP 30 ml)				p
	NRS score <4		NRS score ≥4		NRS score <4		NRS score ≥4		
	n	%	n	%	n	%	n	%	
Postop 10th minute	27	77.1	8	22.9	32	91.4	3	8.6	0.101
Postoperative 1st hour	29	82.9	6	17.1	24	68.6	11	31.4	0.163
Postoperative 6th hour	33	94.3	2	5.7	32	91.4	3	8.6	0.500
Postoperative 12th hour	35	100.0	–	–	35	100.0	–	–	
Postoperative 24th hour	35	100.0	–	–	35	100.0	–	–	

ESP: Erector spinae plane block; NRS: Numeric Rating Scale.

No significant difference was found between the groups in intraoperative MAP, HR, and SPI values, whereas the variation of all these parameters with time was significantly different within each group (p=0.001 for MAP, p=0.001 for HR, p=0.004 for SPI). The median postoperative 10th minute NRS score was 1.50 (0.00–3.00), the 1st hour median was 3.00 (2.00–3.25), the 6th hour median was 1.50 (0.00–3.00), and the 12th hour median was 1.00 (0.00–2.00). The median postoperative 24th hour NRS score was 0.00 (0.00–1.00). When the change in postoperative NRS scores over time was analyzed, no significant difference was found between the groups (p=0.344), whereas the change in NRS scores over time within each group was significant (p=0.001). The distribution of the number of patients with NRS scores <4 and ≥4 between groups according to time is given in Table 3.

Intraoperative remifentanil and postoperative tramadol consumption were similar between the groups (p>0.05) (Table 4). Postoperative rescue analgesic requirement was detected in 12 patients (34.3%) in Group I and 14 patients (40%) in Group II. There was no significant difference between the groups in terms of postoperative rescue analgesic requirement (p=0.805). Postoperative nausea and vomiting were detected in 9 patients (25.7%) in Group I and 6 patients (17.1%) in Group II (p=0.561). Moreover, no significant difference was found in postoperative nausea and vomiting.

Table 4. Comparison of intraoperative remifentanil and postoperative tramadol consumption

	Group I Mean±SD	Group II Mean±SD	p
Tramadol (mg)			
1st hour	85.14±51.86	89.14±80.05	0.805
6th hour	178.5±96.15	194.28±203.87	0.687
12th hour	240.57±119.85	225.71±201.206	0.709
24th hour	288.82±142.80	284.57±222.39	0.925
Remifentanil consumption (mcg)	555.29±195.54	616.79±227.65	0.230

SD: Standard deviation.

Table 5. Relationship between remifentanil consumption and perioperative characteristics

	Remifentanil consumption Mean±SD	p
ASA		0.796
ASA-1	537.65±283.86	
ASA-2	591.65±207.97	
ASA-3	595.20±195.03	
Surgery type		**0.001**
Right mastectomy	643.02±170.01	
Right BCS	422.15±135.28	
Left mastectomy	669.47±223.61	
Left BCS	562.05±238.43	
Postoperative rescue analgesic use		**0.027**
Yes	658.80±215.68	
No	543.04±201.52	
Postoperative nausea-vomiting		0.234
Yes	644.40±165.35	
No	570.12±222.80	

SD: Standard deviation; LA: Local anesthetic; ASA: The American Society of Anesthesiologists; BCS: Breast-conserving surgery.

Remifentanil consumption according to the perioperative characteristics of patients who underwent breast surgery is presented in Table 5. Remifentanil consumption was significantly different according to the type of surgery (p=0.001). The reason for this difference was that remifentanil consumption was lower in patients who underwent right breast-conserving surgery compared with other types of surgery. Remifentanil consumption in patients who were administered postoperative rescue analgesics was significantly higher than in patients who were not administered rescue analgesics (p=0.045). Furthermore, there was a positive correlation between the duration of surgery and remifentanil consumption in both groups (p=0.001).

Discussion

In the present study, the effect of ESP block, which has been proven to be effective in breast surgery, on opioid consumption and postoperative pain when administered in different volumes was investigated. Although the block administered at different volumes made a difference in dermatome involvement, it did not make a difference in opioid consumption and postoperative pain scores, as well as in the need for rescue analgesics and postoperative nausea and vomiting.

Postoperative acute pain is a normal response to surgical procedures, but it can also lead to a number of complications.[12] In addition to suppressing the stress response to surgery, effective pain control minimizes the need for opioids and general anesthetics so that the immune system does not become compromised.[13] With the use of multimodal approaches, acute postoperative pain may be reduced by decreasing receptor activity and local hormonal response, which constitute the pathophysiology of pain.[14,15] In addition to blocking receptor activity that is responsible for pain formation, local anesthetics reduce the stress response that results from surgical procedures.[16] While many guidelines still consider opioids to be a cornerstone in the management of postoperative pain,[15,17] some studies recommend avoiding opioid use, using them as a last resort, or at least reducing the doses of opioids required to deal with adverse events in patients.[18–20] As part of multimodal analgesia in breast surgery, various techniques are used, including local anesthetic in-

filtration, intercostal block, paravertebral block, thoracic epidural anesthesia, pectoral nerve block, and ESP block.[21–23] In the study, we performed preoperative ESP block as a part of multimodal anesthesia. As pharmacologic agents, we preferred to use opioids and, if needed, paracetamol and tenoxicam as rescue, and with this method we found the median NRS score below 4 in all periods in both groups. There was also no significant difference in postoperative opioid consumption between the groups. This result suggests that effective analgesia can be achieved with both volumes in breast surgery.

Plane blocks are volume-dependent blocks, and the greater the volume, the greater the increase in dermatomal spread is expected. Higher concentrations are required for surgical anesthesia, whereas lower concentrations are sufficient for postoperative analgesia.[24] Besides, a high concentration of local anesthetic can provide better diffusion into the paravertebral space and a more effective nerve block.[25] In a case series, Forero et al.[26] provided sensory block in the T2-T10 dermatome space with 30 ml of 0.5% ropivacaine HCl at the T9 level and in the T4-T8 dermatome space with 25 ml of 0.5% ropivacaine HCl at the T8 level in ESP block administered to patients who developed pain syndrome after thoracotomy. Altıparmak et al.[27] divided 42 patients who were scheduled for mastectomy into 2 groups, and administered ESP block at the T4 level to Group I with 0.375% bupivacaine HCl in a volume of 20 ml and to Group II with 20 ml of 0.25% bupivacaine HCl. Postoperative tramadol consumption and NRS scores were lower in Group I, whereas no difference was found in intraoperative fentanyl consumption. When designing the present study, we predicted that a higher volume of local anesthetic at the same concentration would enable wider dermatomal spread and less opioid consumption. In Group II, where we administered 30 ml volume, the number of dermatomes involved was significantly higher and the dermatomes between T2-T6 were the most blocked dermatomes in both groups. However, we found no difference in terms of opioid consumption and NRS scores. We are of the opinion that ESP block administered with 20 ml volume of bupivacaine HCl at 0.375% concentration is adequate to achieve effective analgesia in breast surgery, supporting the study of Altıparmak et al.[27]

The primary outcome measure of the study was intraoperative opioid consumption in the block administered in different volumes. We found no difference in intraoperative remifentanil consumption between the two groups. In the literature, no difference was found in intraoperative opioid consumption in studies comparing blocks in breast surgery, whereas in all studies using a control group, it was found that intraoperative opioid consumption decreased in the block groups.[28–31] In the study in which the same volume of bupivacaine HCl at different concentrations and ESP block were compared between the groups, no difference was found in intraoperative fentanyl consumption.[27] Meanwhile, we did not detect any difference in intraoperative opioid consumption with different volumes and the same concentration of bupivacaine HCl. This result suggests that 30 ml volume is not superior in terms of analgesic efficacy in ESP block with 0.375% bupivacaine HCl. Although the results indicate that 20 ml is adequate for analgesic efficacy, further studies are needed to determine the efficacy of lower volumes.

Intraoperative dose adjustment of remifentanil is often adjusted according to the change in hemodynamic parameters. It is well-known that a nociceptive stimulus results in increased sympathetic activity and a decrease in parasympathetic activity, causing a rise in heart rate and blood pressure. However, under general anesthesia, these hemodynamic responses can be affected by many factors such as intravascular volume status, diabetes, chronic hypertension, and the use of antihypertensive medication.[32] A number of studies have demonstrated that SPI is superior to hemodynamic parameters for the assessment of pain.[33] In the study, remifentanil dose adjustment was performed under the guidance of SPI monitoring and hemodynamic parameters (MAP, HR) were similar between the groups. We believe that remifentanil infusion titrated with SPI monitoring enables stability in hemodynamic parameters. There was no significant difference between the groups regarding the duration of surgery. Furthermore, there was a positive correlation between the duration of surgery and remifentanil consumption in both groups. We expected this result since remifentanil infusion begins with induction and continues throughout the procedure. This finding also supports the idea that volume difference has no

impact on intraoperative remifentanil consumption. We found that remifentanil consumption was less in patients who underwent right breast-conserving surgery than in other surgical groups. While there was no significant difference between the groups regarding the duration of surgery, a significant difference was found between the type of surgery and duration of surgery (p=0.000). The mean duration of surgery was 57.21 min in those who underwent right breast-conserving surgery, and it was significantly shorter than in those who underwent other surgeries. The mean dermatome involvement of the patients who underwent right breast-conserving surgery was 5 levels, and there was no difference between the other groups. Thus, we consider that the decrease in remifentanil consumption in patients who underwent right breast-conserving surgery is primarily related to the short duration of surgery.

High-dose intraoperative remifentanil use causes hyperalgesia, increasing postoperative opioid consumption.[34] Postoperative pain scores and opioid consumption were higher in patients who underwent major abdominal surgery and received high-dose remifentanil compared to low-dose remifentanil infusions.[35] A study comparing intraoperative fentanyl with remifentanil showed higher pain scores and increased opioid requirement in the remifentanil group in the first 24 and 48 hours postoperatively. The same study found that intraoperative remifentanil use was associated with an increased pain score up to 3 months after surgery.[36] Although there was no significant difference between the groups in terms of remifentanil consumption and postoperative opioid consumption, we found that remifentanil consumption was relatively high in patients requiring rescue analgesics. We believe that this result is related to opioid hyperalgesia.

ESP block significantly reduces NRS scores and postoperative opioid consumption in breast surgery. Yet, the number of studies examining whether a specific concentration and volume of the local anesthetic will be sufficient for breast surgery is limited. In a study comparing 0.375% bupivacaine HCl with 0.25% bupivacaine HCl administered in 20 ml volume, the higher concentration was found to be more effective. In the same study, NRS scores were found to be within acceptable limits in the group administered at low concentrations.[27] There are publications that general anesthesia masks the toxicity of local anesthesia in some patients who underwent ESP block.[37] Administration of high concentrations and high volumes in underweight patients may cause difficulties in administration due to the maximum permissible doses of local anesthetics. Based on the results of the studies in the literature and our study, there were no significant differences in NRS scores and opioid consumption at different volumes and concentrations. Thus, considering the cost-benefit ratio, ESP block applied with 20 ml volume of 0.375% concentration bupivacaine HCl seems more appropriate in breast surgery. However, randomized controlled trials comparing different volumes and concentrations with higher case numbers should be conducted to determine the effective and safe volume and concentration in breast surgery.

Limitations

The study had some limitations. The difference in the type of surgery performed and the fact that the surgeries were not performed by the same surgical team may have had an effect on pain scores and opioid consumption. Moreover, if there was a control group without block, we could have shown the effectiveness of the 20 ml volume more objectively, especially in intraoperative opioid consumption and achieving adequate analgesia.

Conclusion

In conclusion, ESP block in 20 ml or 30 ml volumes applied with the same concentration of local anesthetic in breast surgery did not significantly affect intraoperative opioid consumption, postoperative opioid consumption, and pain scores. Therefore, we suggest that the ESP block applied with a volume of 20 ml is sufficient in breast surgery. Nevertheless, further randomized trials comparing different volumes and concentrations are needed to determine the optimum volume and drug concentration.

Ethics Committee Approval: The Türkiye Pharmaceuticals and Medical Devices Agency granted approval for this study (date: 23.03.2021, number: 2021/435).

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