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ORIGINAL ARTICLE

Effect of erector spinae plane block on postoperative intravenous morphine consumption in open subcostal nephrectomy: A prospective randomized clinical trial

Erektör spina plan bloğunun açık subkostal nefrektomilerde postoperatif intravenöz morfin tüketimine etkisi: Randomize prospektif klinik çalışma

Erkan ATICI,[1] Zehra İpek ARSLAN,[1] Hasan YILMAZ[2]

Summary

Objectives: We began with the hypothesis that the erector spinae plane block (ESPB) would decrease postoperative morphine consumption in patients scheduled for open subcostal nephrectomy.

Methods: After obtaining ethics committee approval and informed patient consent, American Society of Anesthesiologists I-II, 46 patients between the ages of 18 and 65 who were scheduled for elective nephrectomy with an anterior subcostal incision were included in this study. Patients were randomly divided into two groups, the ESPB and the control group, using the sealed envelope technique. In the ESPB group, ESPB was applied with 20 mL of 0.25% bupivacaine at the T_{10} level at the block corner before being taken to the operating room. Patient-controlled analgesia with intravenous morphine was applied to both the ESPB and the control groups.

Results: Intraoperative remifentanil consumption in the ESPB group was statistically significantly less than in the control group (1069.5±211.54 micrograms versus 1471.4±202.21 micrograms) (p<0.001). Postoperative morphine consumption of the patients was also lower in the ESPB group (16.8±4.13 milligrams versus 33.65±6.91 milligrams) (p<0.001). The numeric rating scales of the patients in the ESPB group were lower than in the control group (p<0.001). The additional analgesic requirements of patients were less in the ESPB group (35% vs 95%, p<0.001). Patient satisfaction was higher in the ESPB group compared to the control group (p=0.009). Nausea was lower in the ESPB group than in the control group (p=0.007).

Conclusion: Preemptive administration of ESPB is a safe and beneficial analgesic method in patients undergoing open subcostal nephrectomy.

Keywords: Analgesia; erector spinae plane block; fascial plane block; nephrectomy; pain; patient-controlled analgesia.

Özet

Amaç: Erektör spina plan bloğunun (ESPB), açık subkostal nefrektomiye giren hastalarda postoperatif morfin tüketimini azaltacağı hipotezinden yola çıktık.

Gereç ve Yöntem: Etik kurul onayı ve bilgilendirilmiş hasta onamı alındıktan sonra çalışmamıza; ASA I-II, 18-65 yaş aralığında, elektif şartlarda anterior subkostal kesi ile nefrektomi operasyonu planlanan 46 hasta dahil edildi. Hastalar kapalı zarf yöntemiyle rastgele ESPB ve Kontrol olmak üzere iki gruba ayrıldı. ESPB grubuna, ameliyathane odasına alınmadan önce blok köşesinde T_{10} seviyesinden 20 ml %0.25 bupivakain ile erektör spina plan bloğu yapıldı. Her iki gruba da intravenöz morfin ile hasta kontrollü analjezi yöntemi uygulandı.

Bulgular: ESPB grubunda intraoperatif remifentanil tüketimi Kontrol grubuna kıyasla istatistiksel olarak belirgin şekilde azdı (1069.5±211.54 µg vs 1471.4±202.21 µg) (p<0.001). Hastaların postoperatif morfin tüketimleri de ESPB grubunda azdı (16.8±4.13 mg vs 33.65±6.91 mg) (p<0.001). ESPB grubundaki hastaların Numerik Derecelendirme Skalaları kontrol grubuna kıyasla daha düşüktü (p<0.001). Hastaların ek analjezik ihtiyacı ESPB grubunda daha azdı (%35 vs %95, p<0.001). ESPB grubunda hasta memnuniyeti Kontrol grubuna kıyasla daha fazlaydı (p=0.009). Bulantı, ESPB grubunda Kontrol grubuna kıyasla azdı (p=0.007).

Sonuç: Nefrektomi operasyonu geçiren hastalarda preemptif ESPB uygulanması güvenli ve faydalı bir analjezik yöntemdir.

Anahtar sözcükler: Ağrı; analjezi; erektör spina plan bloğu; fasyal plan bloğu; hasta kontrollü analjezi; nefrektomi.

[1]Department of Anesthesiology and Reanimation, Kocaeli University Faculty of Medicine, Kocaeli, Türkiye
[2]Department of Urogenital Surgery, Kocaeli University Faculty of Medicine, Kocaeli, Türkiye

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Correspondence: Dr. Zehra Ipek Arslan. Kocaeli Üniversitesi Tıp Fakültesi, Anesteziyoloji ve Reanimasyon Anabilim Dalı, Kocaeli, Türkiye.
Phone: +90 - 262 - 303 79 46 **e-mail:** zehraipek48@gmail.com

Introduction

Postoperative pain is acute pain that begins with surgical trauma and gradually decreases with the healing of the tissue. Despite developing anesthesia methods and surgical techniques, postoperative pain remains an important problem for anesthesia, surgery, and the patient. The severity of this pain depends on the anesthesia technique, location and size of the surgery, and the emotional, physiological, and sociocultural structure of the patient. With pain relief, the rehabilitation period of the patients accelerates, thromboembolic complications caused by the metabolic-endocrine response decrease, the duration of hospital stay shortens, and the cost is reduced. At the same time, relieving pain, preserving the cognitive functions of patients, and preventing the development of chronic pain are critical in terms of improving the quality of life.[1,2]

The standard treatment for T_1 renal tumors is partial nephrectomy, and radical nephrectomy is also another standard treatment for T_2 tumors and localized masses not treatable by partial nephrectomy. Partial or radical nephrectomy can be performed with either open, laparoscopic, or robotic surgery. Open partial or radical nephrectomy generally requires a large and painful incision below the costal arch.[3]

Erector spinae plane block (ESPB) was first described by Forero et al.[4] for the treatment of thoracic neuropathic pain. This technique is highly preferred among clinicians because of its effectiveness, easy applicability, and safety. Erector spinae plane block provides a multi-dermatomal sensory block where the local anesthetic spreads to the paravertebral area, affecting the dorsal and ventral branches of the thoracic spinal nerves as well as the sympathetic ganglia formed by the thoracic spinal nerves.[4] ESPB is performed by injecting a local anesthetic between the erector spina muscles (m. iliocostalis, m. longissimus, m. spinalis) and the transverse process of the vertebra under the guidance of ultrasonography (USG).[5]

The primary goal of this study is to investigate the effect of ESPB on postoperative intravenous (iv) morphine consumption in patients undergoing open subcostal nephrectomy. Secondary objectives are to investigate the effect of ESPB on intraoperative iv remifentanil consumption, hemodynamic parameters, postoperative additional analgesic requirement, postoperative pain using the Numeric Scoring System (NRS), nausea-vomiting, patient satisfaction, and duration of hospital stay.

Material and Methods

Ethics Committee approval was obtained (dated 03/2020 and the decision number KIA 2020/96). Detailed information about the study was provided to the patients and both written and verbal consent were obtained at the anesthesia polyclinic preoperatively. Patient recruitment started after the study was registered at https://clinicaltrials.gov (NCT04686890). This study was conducted in patients scheduled to undergo elective open nephrectomy by the Urology Clinic in the operating room of the University Faculty Hospital. This trial was carried out in accordance with the Helsinki Declaration of 1975, as revised in 2013.

In this prospective, randomized, controlled clinical study, 46 patients with American Society of Anesthesiologists (ASA) physical scores I and II, aged between 18 and 65, and scheduled for elective open partial or radical subcostal nephrectomy were included. Excluded were those who did not accept the procedure or whose consent could not be obtained, patients with ASA risk scores III-IV, aged under 18 or over 65, body mass index (BMI) ≥35, unable to cooperate, hypersensitive to the drugs to be used or their components, infection in the area to be treated, or coagulopathy. Patients with spinal/paravertebral deformities or contraindications to block application were also excluded.

Patients were evaluated preoperatively in the anesthesia polyclinic. The demographic data of the patients (age, gender, ASA score, height, weight, BMI, additional diseases) were recorded in the preoperative patient evaluation form. Patients were randomly divided into two groups: those with ESPB (ESPB group; n=23) and those without ESPB (control group; n=23). The closed envelope method was used for group assignment (Fig. 1).

For patients in the ESPB group, the block was administered at the block unit. Routine anesthesia monitoring was performed, measuring electrocardiogram (ECG), oxygen saturation (SpO_2), noninvasive

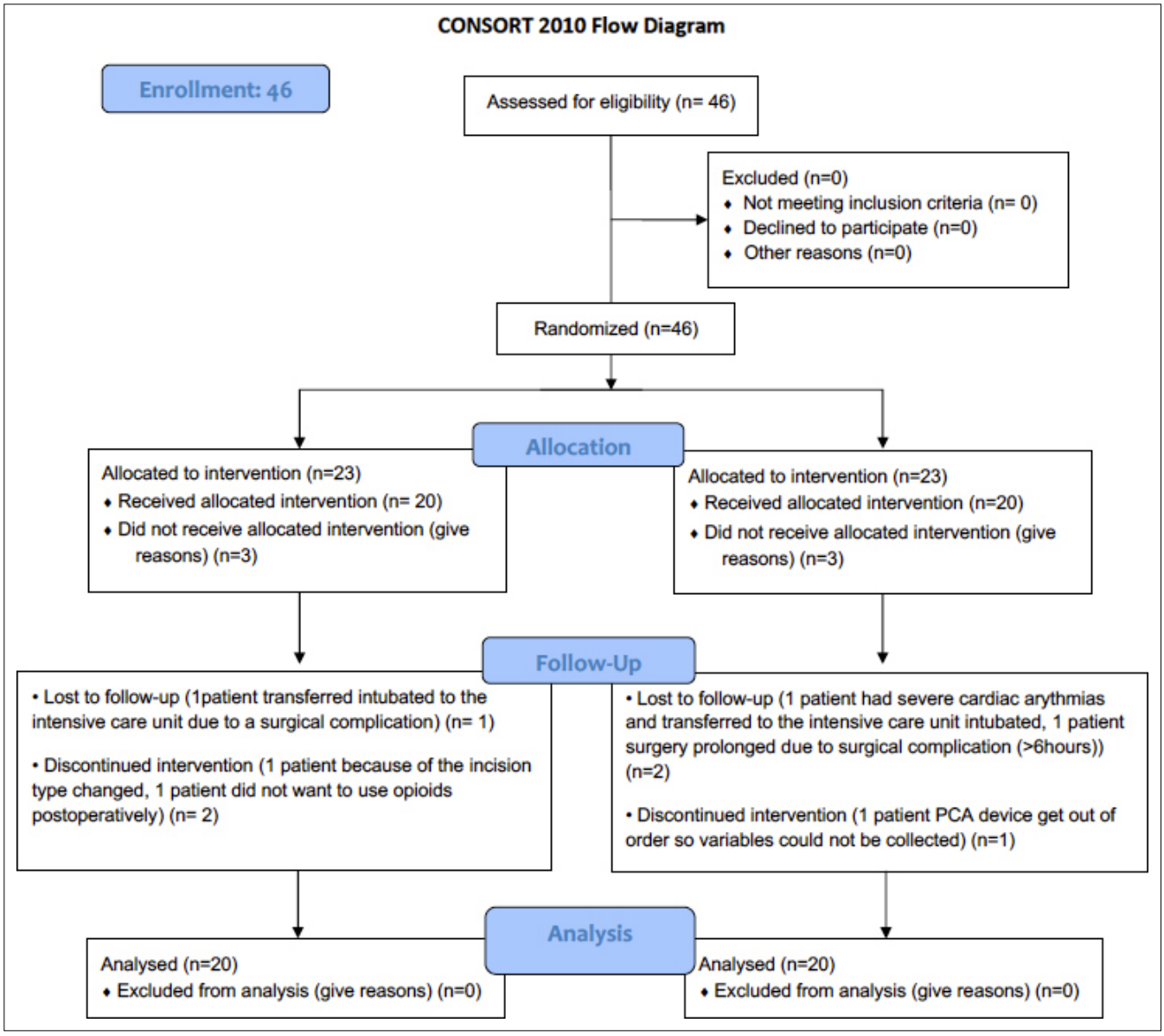

Figure 1. Consort flow diagram.

blood pressure every 5 minutes, and vascular access was established with a 20 Gauge (G) intravenous (iv) cannula. Premedication was administered to the patients by iv administration of 0.04 mg/kg midazolam (Zolamid® 5 mg/5 cc, DEFARMA İlaç San. ve Tic. Ltd. Şti.). The patients were then placed in the prone position. After skin sterilization at the block area, a high-frequency linear ultrasound probe (Esaote My Lab 6, US Florence, Italy) was placed transversely in the midline to visualize spinous processes. The sympathetic nerve fibers of the kidney create the autonomic plexus around the renal artery, reaching the T8-L2 spinal segments. The upper urinary tract surgical incision pain is related to the T6-T10 intercostal nerve dermatome. A cadaveric study suggested performing the block at T_{10} level as it was shown that local anesthetic spreads 4 levels up and down from the block site.[6] The lower end of the scapula at the T_7 vertebrae was identified and marked with a sterile surgical drawing pen. The USG probe slid from the T_7 level to the T_{10} vertebra level, then 2–3 cm lateral to the planned site of nephrectomy, visualizing the transverse protrusion, trapezius, and erector spina muscles (Fig. 2). A 22 G, 80 millimeter (mm) block needle with an extension line (Braun, Melsungen, Germany) was used in the in-plane approach on USG. The needle passed through skin, subcutaneous tissue, and trapezius, latissimus dorsi, erector spinae muscles in the craniocaudal direction. Needle location was confirmed by hydro-dissection with 1 ml of saline solution. The block was applied with 20 mL of 0.25% bupivacaine (Marcaine® 0.5% AstraZeneca

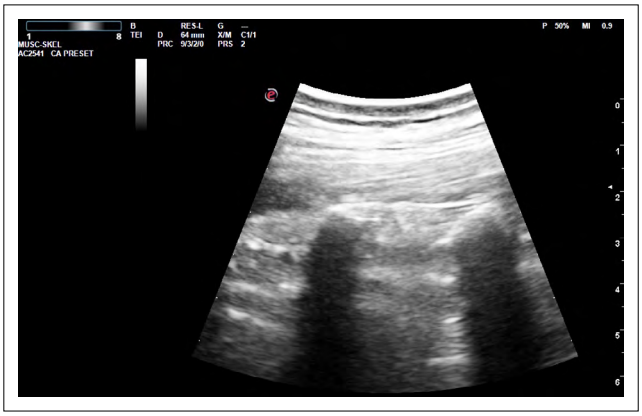

Figure 2. USG image of the ESPB at T10-T11 level.

İlaç San. ve Tic. Ltd. Şti.), and the spread of local anesthetic was monitored linearly. After the dermatomal level assessment with a pinprick test, the patient was transferred to the operating theatre. In the control group, patients were taken to the preoperative care unit before the operation, vascular access was established with a 20 G iv cannula, and premedication was administered by 0.04 mg/kg iv midazolam. Then the patient was transferred to the operating theatre.

Standard anesthesia monitoring, including ECG, SpO_2, noninvasive blood pressure every 5 minutes, heart rate (HR), and end-tidal carbon dioxide ($ETCO_2$), was applied for all patients taken into the operating room. After initiating iv crystalloid fluid therapy for the patients, iv 2–3 mg/kg propofol (Propofol®1% Fresenius 1 g/100 mL, Fresenius Kabi İlaç San. ve Tic. Ltd. Şti.), 1 µg/kg fentanyl (Talinat® 0.1 mg, Vem İlaç San. ve Tic.) was used for anesthesia induction. Then, muscle relaxation was achieved with 0.6 mg/kg rocuronium (Esmeron® 10 mg/mL, Merck Sharp Dohme İlaçları Ltd. Şti.). Sevoflurane (Sevorane®100%, AbbVie Tibbi İlaçlar San. ve Tic. Ltd. Şti) in a mixture of 40% oxygen (O_2) + air was used for anesthesia maintenance. The bispectral index was used for monitoring the depth of anesthesia (BIS, Medtronic Medical, Ümraniye, Türkiye) and the level was set between 40–60. For perioperative analgesia, remifentanil iv (Ultiva 1 mg, Glaxo Smith Kline İlaçları San. ve Tic. A.Ş) was continuously administered at a rate of 0.05–1 µg/kg/min and the dosage was adjusted according to the changes in hemodynamic parameters. The total amount of remifentanil consumed intraoperatively was recorded. The patient was placed in a standard flank position on the operating table with a kidney rest placed underneath the patient. An approximately 12 cm subcostal nephrectomy incision was performed with nearly the same technique described by Haberal et al.[6]

Hemodynamic parameters of the patients in the perioperative period (HR, SAP, DAP, MAP, SpO_2, BIS values) were recorded; before anesthesia induction (T_0), after intubation (T_1), and following the 5th (T_2), 15th (T_3), 30th (T_4), 60th (T_5), 120th (T_6), and at the 180th minute (T_7) after intubation by an anesthesia technician who was blinded. Approximately 30 minutes before the end of the operation, iv 1 gram paracetamol (Parol® 10 mg/mL, Atabay Kimya San. ve Tic. A.Ş.), iv 1 mg/kg tramadol (Contramal® 100 mg ampule, Mefar İlaç San. Tic. A.Ş.), iv 20 mg tenoxicam (Oxamen-L® 20 mg, Mustafa Nevzat İlaç San. A.Ş.) and iv 8 mg ondansetron (Zofer® 8 mg 4 mL, Adeka İlaç San. Ş.) were administered as a bolus. At the end of the operation, the patients were extubated and taken to the postanesthesia recovery unit.

In addition, a PCA device (Abbott Acute Pain Manager-APM, Pain Manager Provider, IL 60064 Abbott Laboratories-North Chicago, USA) with morphine (Morphine® HCL 0.01 g ampule, Galen İlaç Sanayi Tic, İstanbul, Türkiye) 0.5 mg/mL in a volume of 100 mL and 2 mL bolus was administered with a 15-minute lock time and a four-hour limit of 12 mg. No loading dose was administered.

Numeric Rating Scale (NRS) scores of patients were recorded at postoperative 1st, 3rd, 6th, 12th, and 24th hours as (no pain: 0, unbearable pain: 10). Intravenous morphine consumption, occurrence of nausea and vomiting, and possible complications related to block and/or surgery were recorded by an anesthesia technician who was unaware of the patient's group at the urology service. If the patient complained of nausea and vomiting, then an additional 4 mg of iv ondansetron was administered. In all patients, if the NRS was 4 or more, then an additional 1 g of paracetamol iv was administered. During the follow-up, if the NRS score did not decrease and the NRS was 6 or more, an additional 1 mg/kg tramadol was administered intravenously as salvage analgesia. At the end of the postoperative 24th hour, patient satisfaction was recorded (1: not satisfied at all, 2: somewhat satisfied, 3: moderately satisfied, 4: quite satisfied) on the day before they were to be discharged by a blinded anesthesia technician.

Table 1. Demographic data of patients

	ESPB group (n=20)	Control group (n=20)	p
Age (years)	52.50±9.36	51.45±9.36	0.725
BMI (kg/m^2)	28.35±1.63	27.95±3.30	0.631
Gender (male/female)	13/7	14/6	1.000
ASA (I / II)	6/14	5/15	1.000
Additional disease (diabetes mellitus/hypertension /other)	4/3 /7	3/7/5	0.551

ESPB: Erector spinae plane block; Kg: Kilogram; m: Meter; BMI: Body mass index; ASA: American Society of Anesthesiologists. Values are mean±standard deviation (or SEM) or as numbers (n).

Statistical Analyses

Statistical evaluation was performed using IBM Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM Corp., Armonk, NY, USA). The compliance of the data to normal distribution was evaluated using the Shapiro-Wilk test.

Normally distributed continuous variables were expressed as mean±standard deviation (mean±SD), while not normally distributed continuous variables were expressed as median (25th–75th percentiles).

In calculating the differences between groups, the independent sample t-test was used for normally distributed data, and the Mann-Whitney U test was used for not normally distributed data. Relationships between categorical variables were shown as numbers or percentages and evaluated by Chi-square analysis. In the test of two-sided hypotheses, $p<0.05$ was considered statistically significant. For the sample size calculation based on our preliminary study, it was detected that postoperative 12th-hour morphine consumption was higher in the control group than in the ESPB group (10.4±3.36 vs 6.8±2.58). With "$\alpha=0.05$, $1-\beta=0.95$" taken into account, the effect size was calculated as 1.20. As a result of the power analysis of the study, it was determined that 20 people per group would be included in the ESPB and the control groups. However, due to possible exclusions, our study was planned to be conducted on 23 patients per group.

Results

Forty-six patients scheduled for an open nephrectomy operation under elective conditions were included in our study. However, data could not be collected in the ESPB group (n=23) because the incision type changed during surgery in 1 patient, 1 patient did not want to use opioids postoperatively and PCA was stopped, and 1 patient was taken to the intensive care unit intubated postoperatively due to surgery-related complications, resulting in the inability to obtain NRS follow-ups in the first hours. In the control group (n=23), data collection was hindered because 1 patient had severe intraoperative cardiac arrhythmias and their hemodynamics deteriorated, leading to their postoperative transfer to the intensive care unit, in 1 patient the surgery was prolonged due to surgical complications, and in 1 patient the PCA device malfunctioned. As a result, a total of 40 patients were analyzed, including the ESPB group (n=20) and the control group (n=20). Age, BMI, gender, ASA physical status, and additional diseases of patients were compared. There was no statistically significant difference between the groups (Table 1).

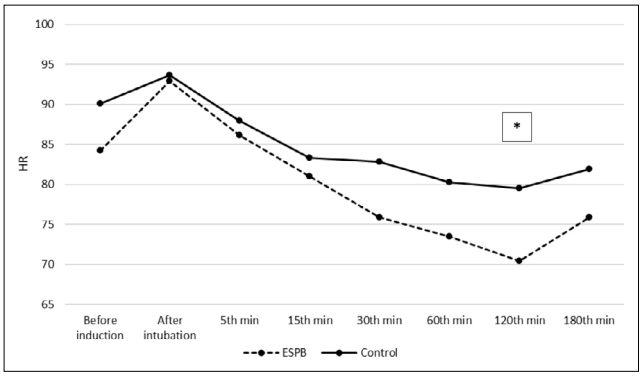

Figure 3. Heart rate values of patients. This graph presents the heart rate values of patients before anesthesia induction, after intubation, 5 minutes after intubation, 15 minutes after intubation, and at subsequent 15-minute intervals until the end of the surgery.

Heart rate values were comparable, except at the 120th minute, the ESPB group values were found to be statistically lower compared to the control group (p=0.001) (Fig. 3).

Table 2. Perioperative IV remifentanil consumption amounts, postoperative intravenous morphine consumptions, and postoperative additional analgesic requirements of the patients

	ESPB group (n=20)	Control group (n=20)	p
Perioperative remifentanil consumption (µg)	1069.5±211.54	1471.4±202.21	<0.001#
Postoperative total morphine consumption (mg)	16.8±4.13	33.65±6.91	<0.001#
Postoperative additional analgesic requirement (parol/parol+contramal)	6/1	7/12	<0.001#

ESPB: Erector spinae plane block; #: p<0.001; µg: Microgram; mg: Milligram

Table 3. Variables of discharge time, satisfaction levels, and occurrence of nausea in patients

	ESPB (n=20)	Control (n=20)	p
Discharge time (days)	3.05±0.22	3.15±0.37	0.621
Patient satisfaction (moderate/very satisfied)	3/17	12/8	0.009*
Nausea (yes/no)	9/11	18/2	0.007*

ESPB: Erector spinae plane block; *: p<0.05.

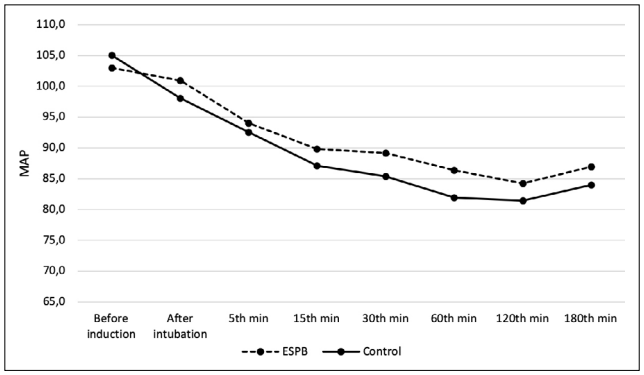

Figure 4. Mean arterial pressure (MAP) values of patients. This graph displays the mean arterial pressure (MAP) values of patients before anesthesia induction, after intubation, 5 minutes after intubation, 15 minutes after intubation, and at subsequent 15-minute intervals until the end of the surgery.

When SAP, DAP, and MAP (Fig. 4) and BIS values were compared, no statistically significant difference was found among the groups at all time intervals.

Perioperative iv total remifentanil consumption and postoperative iv morphine consumption and postoperative additional analgesic requirements were lower in the ESPB group than in the control group (p<0.001, p<0.001, p<0.001, respectively) (Table 2).

In the ESPB group, NRS values were statistically lower when compared to the control group at the postoperative 1st, 6th, and 12th hours (p<0.001) (Fig. 5).

Patient discharge times were similar between the groups (Table 3).

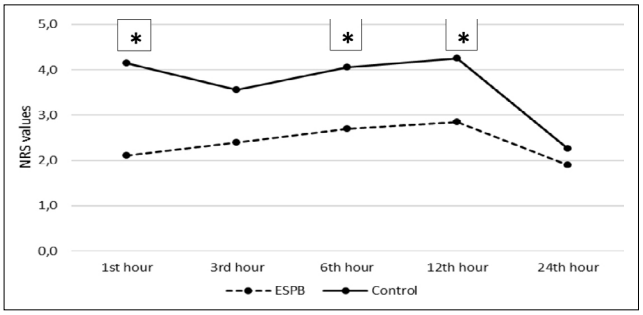

Figure 5. Numeric Rating Scale (NRS) values of patients. This graph shows the Numeric Rating Scale (NRS) values of patients at the postoperative 1st, 3rd, 6th, 12th, and 24th hours.

Patients' satisfaction levels were higher and nausea was lower in the ESPB group than in the control group (p=0.009, p=0.007, respectively) (Table 3).

No allergic reaction or respiratory distress was observed in any of the patients included in the study.

Discussion

Preemptive analgesia involves administering analgesic treatment before surgical insult or tissue injury as preventative analgesia prior to the painful stimulus. This approach aims to reduce sensitivity to painful stimuli before the development of central sensitization. Preemptive analgesia is considered the most effective method to reduce analgesic consumption and postoperative pain in the postoperative period.[7,8] The generally accepted view of postoperative pain is that its pathogenesis is multifactorial. There-

fore, pain elimination should be approached with multimodal analgesia strategies. Opioids, traditionally used in postoperative pain treatment, have been increasingly replaced by preemptive analgesia incorporating multimodal analgesia techniques.[7,8]

In a study with 51 patients who underwent belt lipectomy, analyzed retrospectively, ESPB was applied preemptively with 25 mL of 0.25% bupivacaine at the bilateral L1 level, while the control group did not receive a block. The study showed significant reductions in perioperative and postoperative opioid (fentanyl) consumption in the ESPB group. Additionally, patient first mobilization times were shorter, and VAS (visual analogue scores) were lower in the ESPB group.[9] A review of 125 studies indicated that single-shot ESPB had satisfactory outcomes in both acute and chronic pain management. Published studies and case reports demonstrated that ESPB has a lower complication rate than other blocks and is also easy to perform.[10] Similarly, in our study, perioperative opioid (remifentanil) consumption and postoperative additional analgesic requirements in the ESPB group were lower than in the control group. Our data indicate that ESPB not only has postoperative analgesic efficacy but also that its duration of action can last up to 24 hours. Another finding supporting this in our study is that patients in the ESPB group had significantly lower NRS scores in the first postoperative 24 hours.

Contrary to our results, a study involving 60 patients who underwent percutaneous nephrolithotomy and received ESPB with 20 mL of 0.5% bupivacaine at the T_8 level compared to conventional intravenous analgesia, found that the first analgesic requirement time was longer, VAS scores were lower, and the rescue analgesic requirement (tramadol and paracetamol) was decreased.[11] Similar findings regarding VAS and postoperative fentanyl consumption in the ESPB group were observed during Video-Assisted Thoracic Surgery and breast surgery.[12,13]

In patients undergoing breast surgery, ESPB was applied at the T_4 level with 20 mL of 0.25% bupivacaine, followed by postoperative iv morphine PCA. It has been reported that ESPB significantly reduces morphine consumption at the 1st, 6th, 12th, and 24th hours postoperatively. Also, the NRS scores of patients in this group were lower than those in the control group.[14]

In another study comparing the efficacy of ESPB, the administration of 30 mL of 0.5% bupivacaine at the T_{11} level was investigated in 56 patients who underwent percutaneous nephrolithotomy and compared to a sham block group using 30 mL of saline. This study demonstrated that intraoperative fentanyl and postoperative 24-hour morphine consumption decreased and the first analgesic PCA requirements were prolonged in the ESPB group. Patient satisfaction scores were indeed higher.[15]

Thanks to ESPB, there was a decrease in the total amount of opioids consumed and side effects such as nausea and vomiting in patients who underwent laparoscopic cholecystectomy and lipectomy.[9,16] The initial studies on erector spina plan block were in the form of case reports. These publications helped to understand the efficacy of ESPB. In one of these case reports, bilateral ESPB was applied with 0.5% ropivacaine at the T_7 transverse process level in 4 patients undergoing ventral hernia repair, increasing the quality of analgesia and decreasing opioid consumption in the block-administered patients.[17]

In fresh cadavers, three-dimensional computed tomography images taken after a single-level ESPB at the T_7 transverse process level showed that the injected local anesthetic agent proceeded in the caudal-cephalic direction and spread to the paravertebral area.[18] Caudal-cephalic extension is thought to be facilitated by the thoracolumbar fascia extending throughout the posterior thorax and abdomen and continuing with the nuchal fascia in the neck. This explains the ability of ESPB to provide analgesic effects across a wide range of dermatomes from the C7-T2 level to the L2-3 level. With the paravertebral spread of the local anesthetic agent, not only the ventral and dorsal rami of the spinal nerves are blocked, but also the roots that transmit the sympathetic fibers. Therefore, ESPB can provide visceral as well as somatic analgesia.[19] This explains the analgesic effect of ESPB in nephrectomy operations.

In radical retropubic prostatectomy, USG-guided single-injection ESPB administered from the lower thoracic level (T9-L2) has been shown to provide effective and long-lasting postoperative analgesia. Providing effective analgesia with a single injection and minimizing potential risks by reducing the num-

ber of repeated invasive procedures are other prominent advantages of ESPB.[20] In our study, we found that postoperative NRS scores of patients were lower up to 24 hours with ESPB at the T_{10} level with a single injection. This demonstrates that the duration of action can extend up to 24 hours, providing analgesia in a minimally invasive way.

In a post-ESPB pinprick test performed on a male patient undergoing a nephrectomy operation at the T_7 level, it was shown that there was a sensory block between T_2 and T_{10}.[21] The use of ultrasound (USG) has become a routine practice for regional anesthesia and nerve blocks. The most significant advantage of using USG in regional blocks is that it reduces the local anesthetic dose and complications. It is very advantageous to determine the correct needle position with regional anesthesia and to monitor the distribution of local anesthetics in real-time under the guidance of USG.[10] In the literature, ESPB has been tried in-plane and out-of-plane in the parasagittal and transverse planes. Many published studies have been done in-plane in the parasagittal plane. When the block is applied in the parasagittal plane, the caudal and cephalic spread of local anesthetic is more clearly seen. In the in-plane approach, the risk of pleural puncture and entry into the neural foramina with extremely deep injection is reduced compared to the out-of-plane approach.[10] In our study, we applied in-plane ESPB in the parasagittal plane. We had the chance to observe the simultaneous craniocaudal spread of local anesthetic with the ESPB we performed under the guidance of USG. At the same time, we believe that complications can be prevented with correct needle positioning and anatomical appearance.

The importance of patient satisfaction in the process of relieving postoperative pain has been demonstrated. Likewise, in our study, the satisfaction of the patients in the group that underwent ESPB was statistically significantly higher than the group that did not.[19] We think that the main reason for this may be that preemptive ESPB not only provides good analgesia but also reduces opioid-related side effects by reducing the need for opioids in the intraoperative and postoperative periods.[22]

Referring to the limitations of our study, firstly, since we did not follow the NRS scores of the patients in the first 24 hours postoperatively, we could not evaluate the long-term effects on pain scores and complications. Second, since we did not question the socioeconomic and educational levels of the patients, a standardization could not be established because pain is a subjective concept and pain treatment is patient-specific. Third, we used BIS monitoring to monitor the depth of anesthesia in the intraoperative follow-up of the patients, and fourth, we did not perform a sham block in the control group. It would be more meaningful to include the end-tidal concentrations and minimum alveolar concentration (MAC) values of the maintenance volatile agent in the study, along with BIS monitoring.

In conclusion, we believe that preemptive application of ESPB in open nephrectomy operations can be an effective method in terms of significantly reducing perioperative and postoperative analgesic consumption, reducing minor complications such as nausea and vomiting, and increasing patient satisfaction. Erector spinae plane block could be applied, and these results could also be generalized to all abdominal or thoracic surgeries.

Conclusion

Based on our study investigating the analgesic effect of preemptive ESPB in open nephrectomy operations:

1. Preemptive ESPB significantly reduces the amount of perioperative opioid (remifentanil) consumption.
2. ESPB significantly reduces postoperative opioid (morphine) consumption.
3. ESPB reduces the need for additional analgesics in the postoperative period.
4. ESPB significantly reduces postoperative pain in nephrectomy operations.
5. ESPB reduces the rates of nausea and vomiting in patients by reducing opioid consumption.
6. ESPB increases patient satisfaction.

Ethics Committee Approval: The Kocaeli University Clinical Research Ethics Committee granted approval for this study (date: 05.02.2020, number: KIA 2020/96).

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