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ORIGINAL ARTICLE

Erector spinae plane block for managing acute postmastectomy pain - single center experience from the Institute for Oncology and Radiology of Serbia

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Summary

Introdution: The most common oncological surgery in the female population is breast cancer surgery, according to the high incidence of breast cancer. Different intensities of postoperative pain usually follow mastectomy with axillary dissection. The erector spine plane (ESP) is a newly defined regional anesthesia technique for analgesia of the chest wall. In this study we report the success and the effect of ESPB on immediate postoperative analgesic pain in the Institute for Oncology and Radiology of Serbia.

In a study involving women scheduled for mastectomy with axillary dissection, we report the success and impact of ESPB on immediate postoperative pain management at the Institute for Oncology and Radiology of Serbia.

Methodology: Thiscase series study included 25 female patients with breast cancer indicated for unilateral mastectomy and axillary dissection in our center, between 18.01.2023 and 01.05.2023. who received ESP block with general anesthesia and their pain scores, analgesic requirements and nausea in the postoperative period. Data on pain scores and rescue analgesia requirements were collected at standardized intervals postoperatively.

Results: The average age of 25 women patients was 56.8 years. The mean heart rate was 72.08 at the beginning, and the value dropped to 65.32 beats/min during the intraoperative period. The pain intensity was highest in the 12th hour postoperatively and the incidence of patients with pain was the lowest, while at the 24th hour, we registered that significantly fewer patients received Rescue Analgesia.

Conlusion: Our results showed that the patients who received the ESP block had satisfactory postoperative pain control, as indicated by lower NRS scores.

Keywords: breast cancer surgery, postoperative pain management, regional anesthesia

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INTRODUCTION

The most common oncological surgery in the female population is breast cancer surgery, according to the high incidence of breast cancer (1). Different intensities of postoperative pain usually follow mastectomy with axillary dissection. Poor management of acute postoperative pain may lead to chronic pain, which affects approximately 25 to 60% of patients (2). Complex breast innervation in combination with extensive surgery requests good postoperative analgesia (3). Thoracic epidural (1), thoracic paravertebral block (4), pectoral blocks (5), and serratus plane block (6) are commonly used regional anesthesia techniques in breast surgery. Paravertebral block (PVB) is a challenging technique because of the anatomic proximity of the pleura and the central neuraxial system. The erector spine plane (ESP) is an alternative block, an interfascial block, and a newly defined regional anesthesia technique for analgesia of the chest wall.

The first description of the ESP block was in 2016 (7). ESP block has been used to treat acute and chronic pain in the torso and upper and lower limbs since this period (8, 9). The proposed mechanism of action is interpreted in many studies. Imaging studies show that only a tiny fraction of injectate enters paravertebral and epidural spaces within the first 30–60 min, and the vast majority remains within the erector spine muscle compartment (10, 11). Imaging studies in live subjects generally show injectate spread to the dorsal rami, para-vertebral space, neural foramina, and the epidural space, although the latter is less consistent (12). Penetration via diffusion into the paravertebral space continues over a prolonged period. This evidence is supported by a report in which preoperative sensory loss over two dermatomes progressed to six dermatomes in the postoperative period (13). ESPB provides all benefits associated with the gold standard thoracic epidural anesthesia for postoperative pain management and lacks hemodynamic side effects (14).

This study includes women scheduled for mastectomy with axillary dissection, evaluating the success of ESP block administered at the T4 level and its impact on immediate postoperative pain management.

METHODOLOGY

This is a case series study, which included 25 female patients with breast cancer indicated for unilateral mastectomy and axillary dissection who received ESP block with general anesthesia in our center between 18 January 2023 and 1 May 2023.

The study did not include patients who underwent any other type of peripheral block alone or in addition to ESP block with general anesthesia.

This initial patient cohort aims to illustrate the course of their postoperative analgesia, pain intensity, and incidence of nausea and vomiting within the first 24 hours. However, further investigation is needed.

DATA COLLECTION

A standard perioperative analgesia plan is applied to all patients who undergo a regional anesthesia technique at our institute, and a standardized regional anesthesia data collection form is used to collect all patient data. All patients undergoing regional anesthesia give informed consent for all procedures in anesthesia and the use of their data in medical studies.

In the preoperative period, prior to entering the operating room (OR), all patients received a standard protocol including Acetaminophen 1g (a mild analgesic unlikely to significantly impact postoperative pain intensity), Controloc 40 mg, Dexason 4 mg as an antiemetic, and prophylactic antibiotics.

After premedication, patients were positioned prone **(Figure 1)**, and the transverse process of the 4th thoracic vertebra was located using a Siemens Acuson P500 ultrasound. This was achieved by counting vertebrae from the spinous process of the 7th cervical vertebra. After antiseptic preparation of the skin with 10% povidone-iodine, an Erector Spinae Plane (ESP) block was performed under Ultra-sound guidance utilizing the in-plane technique **(Figure 2)**. Local infiltration with 1% Lidocaine was applied at the needle entry site before inserting a 21G, 100mm needle in alignment with the Ultra-sound probe until the contact with the transverse process was achieved. Following negative aspiration, 1 to 3 mL of saline solution was injected, confirming the elevation of

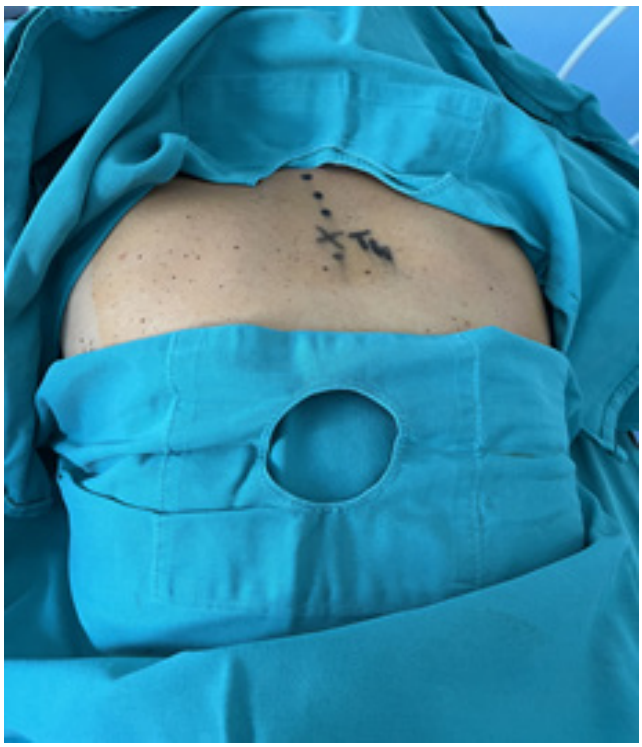


Figure 1. Prone position of the patient

Figure 2. Needle position at the Transverse process at the T4 level

the fascia of the erector spinae muscle of the transverse process **(Figure 3)**. The ESP block was completed with a single-shot injection of 0.5% Bupivacaine, administered in a volume of 20 mL.

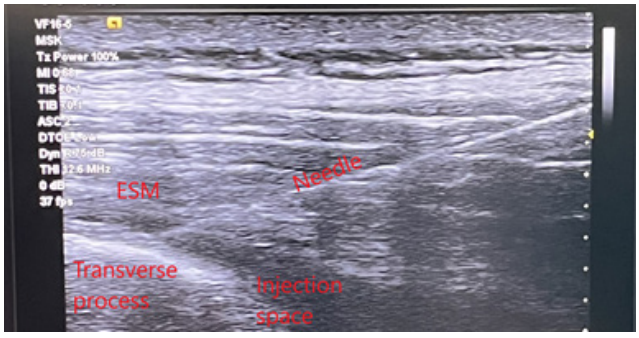


Figure 3. Ultrasound-guided ESB performance at the T4 level

After half an hour of ESP block, the patient entered the OR and anesthesia induction was performed. All patients were induced in general anesthesia using Fentanyl (1-2mcg/kg introduction dose) and Propofol; i-gel masks were applied for mechanical ventilation (volume control mode was used on GE Avance CS2 Pro device).Vitals (heart rate and blood pressure) were measured every five minutes. Anesthesia was maintained using sevofluran in combination with oxygen and air. Half an hour before the end of surgery, all patients received Ondansetron 4mg, as an antiemetic and Tramadol 100 mg (given that dose correction based on age is not required). After anesthesia weaning, we started recording pain intensity, using a numeric rating scale (NRS), and nausea and vomiting. For rescue analgesia (RA), we used a non-steroid anti-inflammatory drug, or Tramadol. For patients with NRS higher than 3, we applied Diclofenac 75mg; for those with NRS higher than 6, we used Tramadol of 100 mg. All analgesics and their application times were noted in detail in patient files.

All included patients were ASA 2 score patients, as we excluded patients with ASA 3 and higher scores. The following data were collected for all patients undergoing ESP block: age, hemodynamic data (mean arterial pressure and heart rate on induction, intraoperatively), Fentanyl amount intraoperatively, the general presence of pain, and NRS after weaning on the 6th, 12th, and 24th hour after surgery, the need for rescue analgesia and events like nausea in 6th, 12th, and 24th hour.

STATISTICS

Statistic software SPSS 23.0 was used for statistical data processing. The descriptive statistics used the following methods: central tendency (arithmetic mean value, median) and variability measures (standard deviation, minimal and maximal value). Fisher exact and Pearson's chi-square tests were used to examine the differences in the incidence of observed category characteristics between subjects in the group.

RESULTS

The average age of 25 female patients was 56.8 years, Med 55 (36 y-82 y), body mass index between 18.5 and 30, and in all patients, ASA score was 2. The results are shown in **Table 1**.

Table 1. Patients demographic data, Mean ± SD; Med (min-max)), n= 25

Age	56.80 ± 11.9: 55 (36 - 82)
BMI 18.5-30	100%
ASA 1/2/3	0/25/0 (0%/100%/0%)

ASA – American Society of Anesthesia, BMI-Body Mass Index

Table 2. Comparision of Hemodynamic parameters

MAP and HR	Mean ± SD; Med (min-max)	p
MAP Induction (mmHg)	84.3 ± 17.85 ; 84 (55-115)	0.11
MAP Intraoperative (mmHg)	77.72 ± 12.75; 77 (59-103)	
HR at induction (beats/min)	72.08 ± 13.25; 70 (60-120)	**< 0.05**
HR intraoperatively (beats/min)	65.32 ± 7.80; 60 (55-85)	

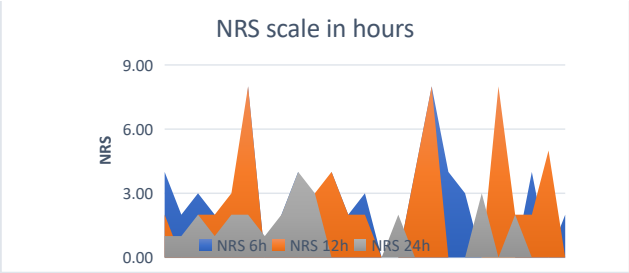
MAP- Mean Arterial pressure
HR- Heart rate

Hemodynamic results are shown in **Table 2**. At the beginning of anesthesia, the mean MAP was 84.3 mmHg with the lowest value of 55mmHg and the highest of 115mmHg, and in the intraoperative period, there was a slight drop in the mean MAP, which was 76.7mmHg, the lowest MAP was 59 and the highest was 103 mmHg. There is no statistically significant difference in mean MAP values between the induction and the intraoperative period. Heart rate **(Table 2)** was 72.08 at the begin-

ning, and there was a drop in value to 65.32 beats/min in the intraoperative period. A statistically significant difference was observed in HR values, with intraoperative HR being lower than HR at anesthesia induction ($p < 0.05$).

Table 3. Pain characteristics

Hours after surgery	6h	12h	24h
Incidence of pain n (%)	15 (60)	16 (64)	13 (52)
p	>0.05	>0.05	>0.05
NRS (0-10), Mean ± SD Med (Min-Max)	2.36 ± 2.34 2 (0 – 8)	2.36 ± 2.58 2 (0 – 8)	1.04 ± 1.21 1 (0 – 4)



Graph 1. NRS scale in hours

Characteristics of pain are shown in **Table 3**, **Graph 1**. In the first 6 hours upon surgery, we observed the lowest incidence of pain in 60% of patients. The mean NRS score was 2.36 Med 2, and the highest registered pain intensity was 8. The incidence of pain was highest in the 12th hour; the pain was present in 64% with a mean NRS score of 2.36, Med 2, and the highest intensity of pain was 8. In the 24th hour, the incidence of pain was 52%, the mean NRS score was 1.04, Med 1, and the highest pain level was 4.

Table 4. Rescue analgesia, nausea, and vomiting, n = 25

Hours after surgery	Rescue Analgesia	*p*	Nausea & Vomitus	*p*
6h	11 (44%)	0.549	4 (16%)	0.061
12h	13 (52%)	0.841	0	**0.001**
24h	4 (16%)	**<0.001**	0	**<0.001**

Graph 2. RA in 6th and 24th hours (RA - Rescue Analgesia)

The results of rescue analgesia use and events (nausea and vomiting) are shown in **Table 4** and **Graph 2**. Up to the 6th hour and at the 12th hour, there was no statistically significant difference between the number of patients who received RA and those who did not ($p > 0.05$). In the 24th hour, statistically significantly fewer patients received RA, four vs 21 ($p<0.001$). In the 6th hour, there were only four and the in the12th and 24th hour, we overlooked patients with nausea or vomitus, with statistical significance, retrospectively p 0.006, 0.001, <0.001, **Graph 2.**

DISCUSSION

Our study showed mild hemodynamic changes in mean MAP and HR, which decreased in the intraoperative period. In the study of Dubilet et al. (15), patients who were treated with an incisional ESP block in addition to standard pain control treatment after surgery presented significantly lower heart rate and systolic and diastolic blood pressure parameters compared to the control group (p from 0.03 to <0.001). We registered an intraoperative decrease in mean MAP that did not have statistical significance. However, the mean HR dropped significantly from 72 to 65/min in the intraoperative phase ($p< 0.05$). The local anesthetic is thought to spread within this potential space and diffuse into abutting structures, such as the paravertebral and epidural spaces (containing spinal nerves, dorsal rami, and ventral rami) (16), lateral cutaneous nerves (contained by the serratus anterior and intercostal muscles) (13), and even the quadratus lumborum (at low thoracic and lumbar levels) (17). So, we assumed that such hemodynamic changes could be related to the local anesthetic effect that gradually diffused from the erector spinae compartment to the paravertebral and neuraxial space. Still, severe hemodynamic changes are rare. According to this assumption, some imaging and dissection studies indicate that only a tiny fraction of injectate enters paravertebral and epidural spaces within the first 30–60 minutes. Most injectate remains within the erector spinae muscle compartment (10, 11). Penetration via diffusion into the paravertebral space may continue over a prolonged period (7). The erector spinae plane block (ESPB) is a simple fascial plane block alternative to an epidural block and PVB, with fewer side effects (18). It appears to be an effective analgesic technique at many levels and functions as an alternative when the PVB or epidural block is contraindicated (19). We certainly do not exclude the fact that perhaps only good analgesia impacted hemodynamics.

In our study, the highest incidence of pain was after 12 hours in 64% of patients, which corresponds to the duration of the block and the time of weakening of the drug's effect. Within each 6-, 12-, and 24-hour period individually, there was no significant difference in the number of patients who experienced pain and those who did not (15, 20).

The average pain intensity in all intervals was less than 3, considered mild pain. Postoperatively, the intensity of pain was weak up to 12 h, while after 24 h, the intensity of pain was even lower.

The need for RA was significantly higher up to the 12th hour, while at the 24th hour, we registered that significantly fewer patients received RA. While in the study of Dubilet et al. patients treated with a preincisional ESP block demon-

strated significantly lower VAS scores at 60 minutes 4, 8, and 12 hours following the surgery, compared to the control group of patients with conventional postoperative analgesia ($p < 0.001$). In contrast to our study, at 24 h following surgery, VAS score levels were significantly lower in patients in the control compared to the ESP group ($p < 0.001$ and 0.01).

We believe that the ESP block applied preoperatively provided good patient results, considering that the average pain value in all hours was low according to the NRS scale, while in 24 hours, it was below 2. According to the results of the consumption of RA in our study, up to 24 hours, the ESP block achieved its most potent effect between the 12th and 24th hour.

The frequency of nausea and vomiting is low, and there is a significant difference in the number of patients reporting these complaints across all time intervals. Given that breast surgery and female gender are significant risk factors for the occurrence of nausea, we believe that the good impact of the ESP block in terms of reducing the use of opiates postoperatively and lowering pain intensity postoperatively in all phases probably influenced the absence of a very unpleasant event in the form of vomiting.

We believe that our findings from this study could serve as a foundation for further research into the management of postmastectomy pain and contribute to the development of innovative treatment strategies for acute pain and the prevention of chronic pain.

CONCLUSION

In this study, we performed Ultrasound-guided unilateral preincision ESP blocks alongside the standard pain protocol for postoperative analgesia. Our results showed that the study

group who received the ESP block along with the standard protocol had reasonable postoperative pain control, as indicated by lower NRS scores and lower incidence rates of postoperative nausea and vomiting.

These were our observations and assumptions based on the data obtained, for more concrete conclusions a larger-scale study is needed.

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ERECTOR SPINAE PLANE BLOK KAO TRETMAN AKUTNOG BOLA NAKON MASTEKTOMIJE - ISKUSTVO JEDNOG CENTRA INSTITUTA ZA ONKOLOGIJU I RADIOLOGIJU SRBIJE

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Sažetak

Uvod: Najčešća onkološka operacija u ženskoj populaciji je operacija raka dojke, u skladu sa visokom incencijom istog. Različiti intenziteti postoperativnog bola obično prate mastektomiju sa disekcijom aksile. *Erector spinae plane* (ESP) kao alternativni blok, je interfascijalni blok, novodefinisana tehnika regionalne anestezije za analgeziju zida grudnog koša.

U ovoj studiji, koja uključuje žene predložene za mastektomiju sa disekcijom aksile na Institutu za onkologiju i radiologiju Srbije, ispitujemo efekte ESP bloka na neposredan postoperativni bol.

Metodologija: Ovom serijom slučajeva obuhvaćeno je 25 pacijentkinja sa karcinomom dojke indikovanih za unilateralnu mastektomiju sa disekcijom aksile, koje su primile ESP blok uz opštu anesteziju u našem centru u periodu od 18.01.2023. do 01.05.2023.

Rezultati: Prosečna starost pacijentkinja bila je 56,8 godina. Prosečna srčana frekvencija bila je 72,08 otkucaja u minuti i došlo je do pada vrednosti na 65,32 otkucaja u minuti u intraoperativnom periodu. Intenzitet bola bio je najviši ali učestalost pacijentkinja sa bolom najmanji u dvanaestom satu, dok smo u dvadesetčetvrtom satu registrovali da je značajno manji broj pacijentkinja primio dodatnu analgeziju.

Zaključak: Naši rezultati su pokazali da su pacijentkinje iz ispitivane grupe, koje su primile ESP blok uz standardni protokol, imale zadovoljavajuću kontrolu postoperativnog bola, na šta ukazuju niži NSB skorovi. Ovi rezultati zahtevaju dalje studije kojima bi se potvrdila definitivna efikasnost ESP bloka u postoperativnoj kontroli bola nakon mastektomije.

Ključne reči: hirurgija raka dojke, kontrola postoperativnog bola, regionalna anestezija

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