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COMPARATIVE ANALYSIS OF THE EFFECTIVENESS OF TRADITIONAL POSTOPERATIVE ANALGESIA AND ESP BLOCK IN RADICAL BILATERAL MASTECTOMY

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Abstract

Introduction: According to the Global Cancer Observatory, breast cancer occupies a leading position in the world. According to the Bureau of National Statistics, in the structure of oncological morbidity, breast cancer ranks first (13.2%); lung cancer (10.0%) ranks second, colorectal cancer (9.3%) ranks third, and stomach cancer (7.4%) ranks fourth. Numerous studies and meta-analyses provide valuable data on the frequency, nature and risk factors of pain syndrome after mastectomy. According to studies, the frequency of occurrence of POPS after mastectomy varies from 20% to 68%, depending on the criteria for assessing the study and the nature of pain. In this regard, we, within the framework of the project "Creation and implementation of innovative methods for treating oncological diseases" conduct a comparative prospective study in patients with radical mastectomy. We present the intermediate results of the data obtained.

Aim: to conduct a comparative analysis of the effectiveness of traditional postoperative analgesia and erector spinae plane (ESP) block in radical mastectomy.

Materials and methods: the study was conducted at NROC in Astana. The study involved 40 patients after radical bilateral mastectomy

Results: Both groups included patients who underwent bilateral radical mastectomy. In both groups, general endotracheal anesthesia was performed using inhalation anesthesia. Thus, the first registration of pain in the control group occurred after 57.7±16.3 minutes, while in the main group the first intense pain according to VAS more than 5 points was registered after 713.8±129.8 minutes ($p<0.05$).

Conclusion. Thus, the results obtained in our study show the high and reliable effectiveness of the ESP block in the early postoperative period in patients with radical mastectomy. Publications of peer-reviewed journals also emphasize the high importance of regional anesthesia in the prevention of postoperative complications during mastectomy. Moreover, these are not single effects, but a complex improving patient outcomes after radical bilateral mastectomy.

Keywords: Radical mastectomy, postoperative analgesia, ESP block, postoperative pain syndrome

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Резюме

СРАВНИТЕЛЬНЫЙ АНАЛИЗ ЭФФЕКТИВНОСТИ ТРАДИЦИОННОГО ПОСЛЕОПЕРАЦИОННОГО ОБЕЗБОЛИВАНИЯ И ESP БЛОКА ПРИ РАДИКАЛЬНОЙ ДВУСТОРОННЕЙ МАСТЭКТОМИИ

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Введение. Рак молочной железы по данным глобальной обсерватории рака занимает лидирующую позицию в мире. По данным бюро национальной статистики в структуре онкологической заболеваемости на первом месте находится рак молочной железы (13,2%); на втором – рак легкого (10,0 %), на третьем – колоректальный рак (9,3 %), на четвертом – рак желудка (7,4 %). Многочисленные исследования и мета-анализы, проведенные в различных странах, предоставляют ценные данные о частоте, характере и факторах риска болевого синдрома после мастэктомии. Согласно исследованиям, частота появления ПОБС после мастэктомии варьирует от 20% до 68%, в зависимости от критериев оценки исследования и характера болевых ощущений. В этой связи, нами, в рамках проекта «Создание и внедрение инновационных методик лечения онкологических заболеваний» проводится сравнительное проспективное исследование у пациенток при радикальной мастэктомии. Мы представляем промежуточные результаты полученных данных.

Цель: провести сравнительный анализ эффективности традиционного послеоперационного обезболивания и erector spinae plane (ESP) блока при радикальной мастэктомии.

Материалы и методы: исследование проведено в Национальном научном онкологическом центре г. Астана. В исследовании приняли участие 40 пациенток после радикальной двусторонней мастэктомии.

Результаты: В обеих группах участвовали пациентки, которым выполнялась двусторонняя радикальная мастэктомия. В обеих группах проводилась общая эндотрахеальная анестезия с применением ингаляционной анестезии. В послеоперационном периоде в контрольной группе отмечалось скорое развитие болевого синдрома, в отличие от основной группы. Так первая регистрация боли в контрольной группе наступала через $57,7 \pm 16,3$ минут, в тоже время в основной группе первая интенсивная боль по ВАШ более 5 баллов регистрировалась через $713,8 \pm 129,8$ минут ($p < 0,05$). Интенсивности болевого синдрома, в группах также имело выраженное отличие.

Заключение. Таким образом полученные в нашем исследовании результаты показывают высокую и достоверную эффективность ESP блока в раннем послеоперационном периоде у пациенток при радикальной мастэктомии. В публикациях рецензируемых журналов так же подчеркивается высокая значимость регионарного обезболивания в профилактике послеоперационных осложнений при мастэктомии. При чем это не единичные эффекты, а комплексное улучшение исходов у пациентов при радикальной двусторонней мастэктомии.

Ключевые слова: Радикальная мастэктомия, послеоперационное обезболивание, ESP блок, послеоперационный болевой синдром.

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Түйіндеме

РАДИКАЛДЫ ЕКІ ЖАҚТЫ МАСТЭКТОМИЯДАҒЫ ДӘСТҮРЛІ ОПЕРАЦИЯДАН КЕЙІНГІ АНАЛЬГЕЗИЯ МЕН ESP БЛОКАДАСЫНЫҢ ТИІМДІЛІГІН САЛЫСТЫРМАЛЫ ТАЛДАУ

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Кіріспе: Ғаламдық қатерлі ісік обсерваториясының мәліметтері бойынша сүт безі қатерлі ісігі әлемде жетекші орын алады. Ұлттық статистика бюросының мәліметі бойынша онкологиялық сырқаттанушылық құрылымында сүт безі обыры бірінші орында (13,2%); екінші орында өкпе обыры (10,0%), тоқ ішек обыры (9,3%) үшінші, асқазан обыры (7,4%) төртінші орында. Бұл факт, соның салдары ретінде, онкомаммологиядағы жоғары хирургиялық белсенділікті анықтайды. Бұл алаңдатарлық өсу тиімді емдеу стратегияларын және операциядан кейінгі салдарға, соның ішінде мастэктомиядан кейінгі ауырсыну синдромына назар аударуды талап етеді. Зерттеулерге сәйкес, мастэктомиядан кейін POPS пайда болу жиілігі зерттеуді бағалау критерийлеріне және ауырсыну сипатына байланысты 20% -дан 68% -ға дейін өзгереді. Осыған байланысты біз «Онкологиялық ауруларды емдеудің инновациялық әдістерін құру және енгізу» жобасы аясында радикалды мастэктомиямен ауыратын науқастарға салыстырмалы перспективалық зерттеу жүргіземіз. Алынған мәліметтердің аралық нәтижелерін ұсынамыз.

Зерттеудің мақсаты: радикалды мастэктомиядағы дәстүрлі операциядан кейінгі ауырсынуды басу және ESP блокадасының тиімділігіне салыстырмалы талдау жүргізу.

Материалдар мен әдістер: зерттеу Астана қаласындағы Ұлттық ғылыми онкология орталығында жүргізілді. Зерттеуге радикалды екі жақты мастэктомиядан кейін 40 пациент қатысты.

Нәтижелері: Екі топқа екі жақты радикалды мастэктомия жасалған науқастар кірді. Екі топта да севофлуранмен ингаляциялық анестезияны қолдану арқылы жалпы эндотрахеальді анестезия, фентанилмен анальгезия, бұлшықет релаксациясына деполяризациялаушы (полсуксан) және деполяризацияланбайтын (ромеран) бұлшықет босаңсытқыштарын біріктіру арқылы қол жеткізілді. Операциядан кейінгі кезеңде бақылау тобы негізгі топқа қарағанда ауырсыну синдромының қарқынды дамуын атап өтті. Осылайша, бақылау тобындағы ауырсынудың бірінші тіркелуі $57,7 \pm 16,3$ минуттан кейін орын алса, негізгі топта 5 баллдан жоғары ҚҚС бойынша бірінші интенсивті ауырсыну $713,8 \pm 129,8$ минуттан кейін тіркелді ($p < 0,05$).

Қорытынды. Осылайша, біздің зерттеуімізде алынған нәтижелер радикалды мастэктомиясы бар науқастарда операциядан кейінгі ерте кезеңде ESP блокадасының жоғары және сенімді тиімділігін көрсетеді. Рецензияланған журналдардың жарияланымдарында мастэктомия кезінде операциядан кейінгі асқынулардың алдын алуда аймақтық анестезияның жоғары маңыздылығы да атап өтіледі. Сонымен қатар, бұл жалғыз әсерлер емес, екі жақты радикалды мастэктомиядан кейінгі пациенттің нәтижелерін жақсартатын күрделі.

Түйін сөздер: Радикалды мастэктомия, операциядан кейінгі ауырсынуды басу, ESP блокадасы, операциядан кейінгі ауырсыну синдромы.

Дәйексөз үшін:

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Introduction

Breast cancer takes the leading position in the world, according to the Global Cancer Observatory (Fig. 1).

According to the Bureau of National Statistics of the Republic of Kazakhstan, lung cancer consistently ranks the first by the mortality (16.3%), followed by stomach cancer

(12.0%), colorectal cancer (10.6%) and breast cancer (8.1%). By the oncological morbidity, breast cancer ranks the first (13.2%); lung cancer ranks the second (10.0%), colorectal cancer ranks the third (9.3%) and stomach cancer ranks the fourth (7.4%) (Fig. 2).

Most common site per country. Absolute numbers, Incidence, Both sexes, in 2022 (excl. NMSC)

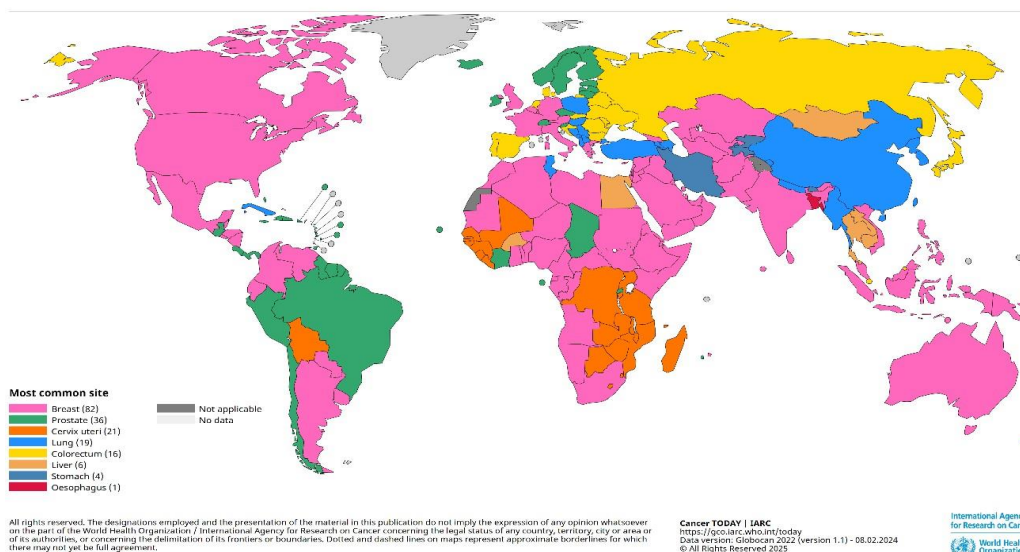


Figure 1. Cancer prevalence by country in 2022 [1].

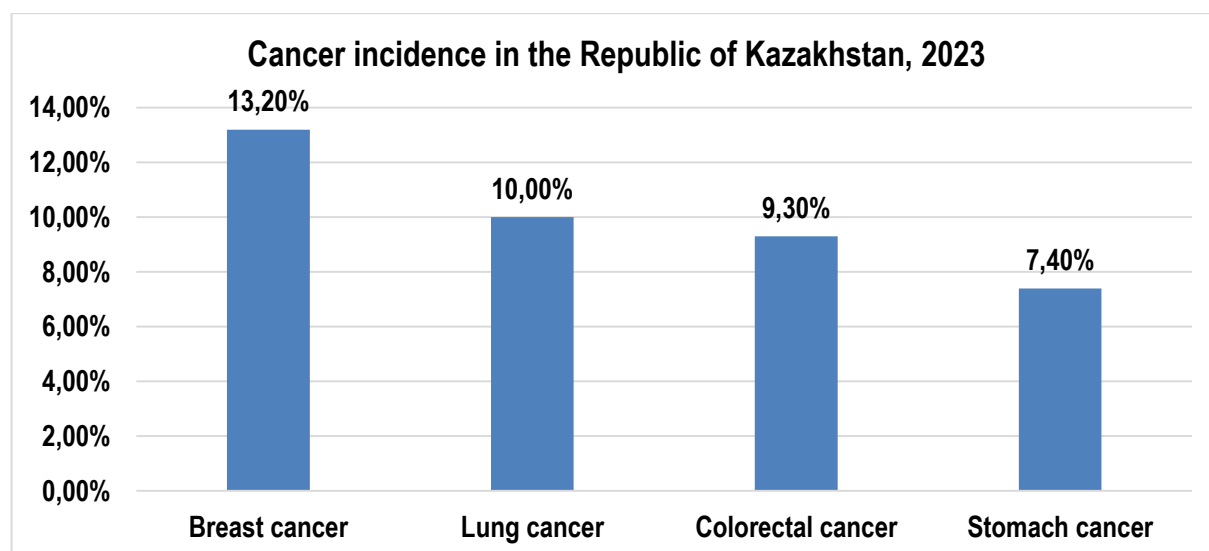


Figure 2. Cancer incidence in the Republic of Kazakhstan, 2023.

Relevant data, as a consequence, leads to high surgical activity in oncomammology. This alarming increase requires effective treatment strategies and attention to postoperative complications, including pain after mastectomy. Growing awareness of the importance of patient quality of life: modern healthcare trends increasingly focus not only on treatment effectiveness but also on quality of life after surgery. More than 60% of patients who have undergone mastectomy express concern about possible postoperative complications, including pain syndrome [3]. This highlights the need for integrated approaches to pain management and improving the quality of life of patients after surgery. Economic implications: post-mastectomy pain also has a significant economic impact. The average annual cost of treating patients with chronic post-mastectomy pain is over \$5,000 per patient [4]. Given the increasing incidence of breast cancer, effective pain management is essential for reducing the economic burden on healthcare.

Numerous studies and meta-analyses conducted in various countries provide valuable data on the incidence, nature and risk factors of postmastectomy pain. According to researches, the incidence of postmastectomy pain varies from 20% to 68%, depending on the study assessment criteria and the nature of the pain (5). Some patients experience transient pain, that gradually resolves within a few months after surgery, while others, it may become chronic and last for years. Studies also emphasize the importance of proper postmastectomy pain management. A multimodal approach, including pharmacological therapy, physical rehabilitation, and psychological support, may be most effective in reducing pain and improving patients' quality of life (6).

In this regard, as part of the "Creation and Implementation of Innovative Cancer Treatment Methods" project, we are conducting a comparative prospective study of patients undergoing radical mastectomy. We present the interim results of the data obtained.

Aim: To carry out a comparative analysis of the effectiveness of traditional postoperative analgesia and erector spinae plane (ESP) block in radical mastectomy.

Materials and Methods: The study was conducted at the National Research Oncology Center in Astana. Forty patients underwent radical bilateral mastectomy. The study group consisted of 20 patients who received postoperative pain relief using an erector spinae plane (ESP) block. The control group consisted of 20 patients who received traditional postoperative pain relief using narcotic and non-narcotic analgesics.

Inclusion criteria:

- Patients over 18 years of age and under 75 years of age;
- Patients undergoing bilateral radical mastectomy;
- Patients who signed informed consent to participate in the study

- ECOG=1-2 points

- ASA=1-3

Exclusion criteria:

- Severe thoracic injuries
- Allergic reactions to the drug
- Refusal to participate
- ECOG = 3 and more points
- ASA = 4 and more points
- Neurodegenerative diseases
- Limitations:
 - no randomization,
 - the study demonstrates interim results of the research.

All patients received intravenous anesthesia + endotracheal inhalation anesthesia.

Conventional pain management was performed in the control group using opioid analgesics and/or non-narcotic analgesics. Promedol 2% (1 ml) was used as a narcotic analgesic for pain greater than 6 points on the visual analogue scale. It was administered intramuscularly at intervals of 4-6 hours, 3-4 times, until the pain decreased to 3 points or less. Ketoprofen 100 mg intramuscularly was used as a non-narcotic analgesic for pain greater than 4 points on the visual analogue scale.

Erector Spinae Plane (ESP) block was used for postoperative pain relief in the study group. ESP block was

performed under ultrasound guidance using 30 ml of 0.75% Ropivacaine solution at the T5 and T6 levels.

Taking into account the nature and location of the surgical intervention, functional tests included the following movements:

- 2 deep breaths
- Taking a sitting position in bed with legs lowered
- Raising arms in front of yourself

The performance of functional tests was assessed twice: after 12 and 24 hours.

Assessment of pain syndrome and functional status were combined in a dynamic pain control chart (Fig. 3).

In the early postoperative period (0-24 hours after surgery), medical personnel assess both pain syndrome and functional state.

Erector Spinae Plane block is a blockade of the erector spinae muscle, creating a broad sensory block extending over 5-7 segments. This regional anesthesia technique, performed under ultrasound guidance, involves injecting a local anesthetic into the interfascial space between the transverse processes of the vertebrae and the erector spinae muscle, blocking the spinal nerves and, consequently, anesthetizing the area innervated by them. A linear ultrasound transducer was used for the procedure.

КАРТА ДИНАМИЧЕСКОГО КОНТРОЛЯ БОЛИ

ДАТА: _____

ФИО: _____

№ истории: _____

Описание степени боли с помощью слов	0	1	2	3	4	5	6	7	8	9	10
Шкала лиц Вонга-Бонкера	отсутствует	лёгкая боль	умеренная боль	умеренная боль	умеренная боль	умеренная боль	умеренная боль	умеренная боль	умеренная боль	умеренная боль	умеренная боль
Шкала переносимости боли	отсутствует	боль можно игнорировать	мешает деятельности	мешает концентрации	мешает основному потребностям	мешает основному потребностям	мешает основному потребностям	мешает основному потребностям	мешает основному потребностям	мешает основному потребностям	мешает основному потребностям

Значения ВАШ через 3 часа

0	1	2	3	4	5	6	7	8	9	10
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Значения ВАШ через 6 часов

0	1	2	3	4	5	6	7	8	9	10
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Значения ВАШ через 12 часов

0	1	2	3	4	5	6	7	8	9	10
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Значение ВАШ в момент появления боли. ДАТА _____ ВРЕМЯ _____

0	1	2	3	4	5	6	7	8	9	10
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Применение анальгетиков

ВРЕМЯ										
Кетотоп										
Ксефокам										
Трамалол										
Промедол										
Другое										

ESP block was performed before inducing general anesthesia. Given the bilateral mastectomy, the block was performed on both sides.

For statistical analysis of the data, the obtained research results were entered into a database prepared in Microsoft Excel XP, and statistical processing was performed using SPSS version 26. The data processing system included automated quality control of information preparation (excluding values that did not correspond to the numerical series according to the Smirnov criterion), processing of survey results, and data grouping according to specified criteria. Parametric and nonparametric methods were used in the analysis. Continuous values are presented as arithmetic means and standard errors ($M \pm m$). Comparison of quantitative characteristics was performed using the Student's t-test. If the numerical series did not meet the boundary criteria for the applicability of the Student's t-test (lack of a normal distribution of values or equality of variances according to the Kolmogorov-Smirnov criterion), a nonparametric method was used (Mann-Whitney in independent groups or Wilcoxon for the dynamics of indicators in one group).

The threshold for statistical significance was $p < 0.05$.

Визуально-Аналоговая Шкала (ВАШ)

Способ оценки степени выраженности болевого синдрома.

Это метод который помогает понять, как сильно больно пациенту.

0 – БОЛИ НЕТ

5 – УМЕРЕННАЯ (СРЕДНЯЯ БОЛЬ)

10 – НЕВЫНОСИМАЯ (УЖАСНАЯ, ШЫДАМСЫЗ АУЫРСЫНУ) БОЛЬ

Боль больше 6 – 7 баллов требует применения наркотических анальгетиков

Для оценки спрашиваем у пациента на сколько баллов по его мнению можно оценить боль от 0 до 10

Функциональные пробы

➤ Через 12, 24 часа

➤ Сесть

	Через 12 часов	Через 24 часа
Спокойное выполнение – 0		
Выполняет с затруднением – 1		
Не выполняет – 2		

➤ Сделать 2 глубоких вдоха

	Через 12 часов	Через 24 часа
Спокойное выполнение – 0		
Не выполняет – 1		

➤ Поднять руки в стороны

	Через 12 часов	Через 24 часа
Подняли на 90° – 0		
Подняли на 45° – 1		
Не подняли руки – 2		

Figure 3. A dynamic pain control chart.

Results

Both groups included patients undergoing bilateral radical mastectomy. General endotracheal anesthesia was administered in both groups, including inhalational sevoflurane and fentanyl analgesia. Muscle relaxation was achieved with a combination of depolarizing (polsuxan) and

non-depolarizing (romeran) muscle relaxants. The patients' medical history included a diagnosis of breast cancer, no metastatic lesions, and previous chemotherapy courses. The surgical technique involved bilateral mastectomy. The characteristics of the groups are described in Table 1.

Table 1.

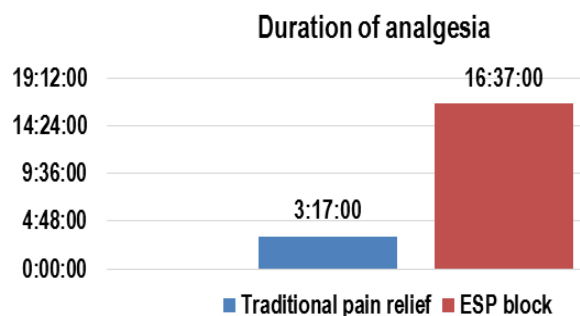
Characteristics of groups.

Indicator	Control group, n=20	Study group, n=20	Statistical significance indicator, p
Age, years	48,3±2,5	47,7±3,2	p>0,05
BMI, kg/m ²	24,9±3,5	25,3±4,1	p>0,05
Duration of surgical intervention, min	183 ±44,1	173 ±56,1	p>0,05
Duration of IVF, min	231±44,1	257±26,3	p>0,05

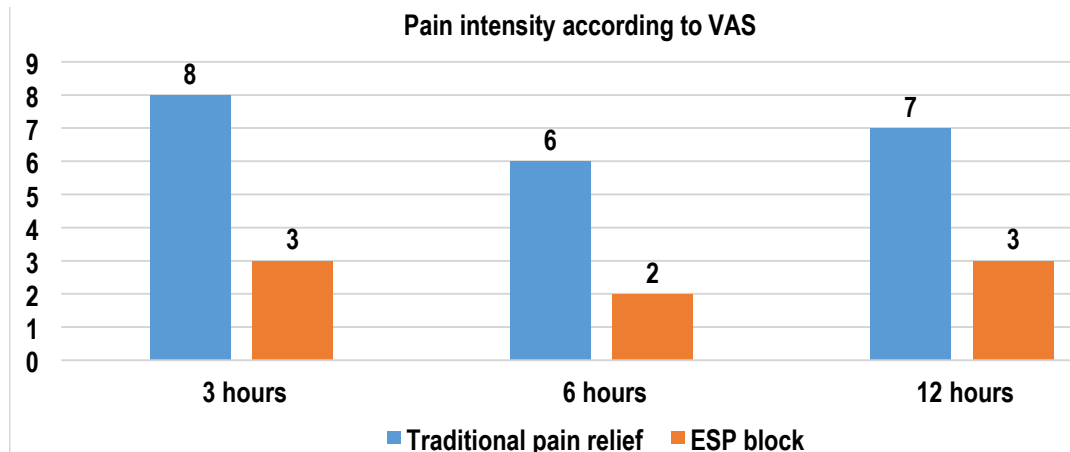
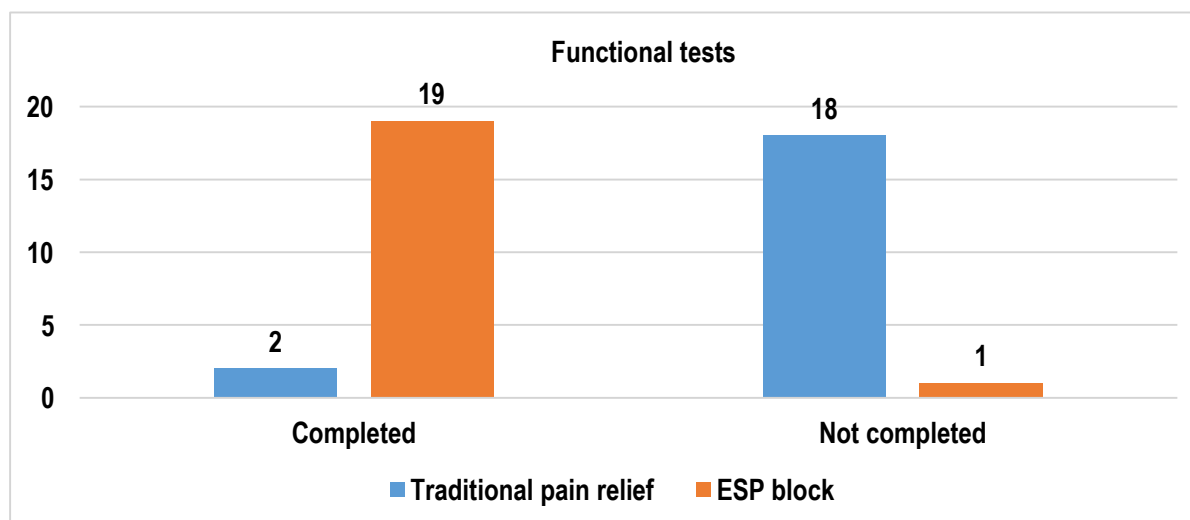
In the postoperative period, the control group experienced a more rapid onset of pain than the study group. The first pain in the control group occurred after 57.7±16.3 minutes, while in the study group, the first intense pain (VAS score >5) was recorded after 713.8±129.8 minutes (p<0.05).

A significant difference in the duration of analgesia between these groups is also observed. In the study group, pain relief lasted more than 16 hours, while in the traditional postoperative pain relief group, it did not exceed 5 hours (Fig. 4).

Regarding pain intensity, there were also significant differences between the groups. VAS assessments were conducted after 3, 6, and 12 hours. The results are shown in Figure 5.

**Figure 4. Duration of analgesia in groups, hours**

We assessed the quality of life in the early postoperative period by analyzing the effectiveness of functional tests performed by patients (Fig. 6).

**Figure 5. Intensity of pain syndrome in groups, points.****Figure 6. Results of functional tests performed by patients.**

Discussion

The results of our study show quite optimistic and convincing evidence for the use of the ESP block for postoperative pain relief, which is confirmed, among other things, by publications and studies from major centers involved in oncomammology.

We reviewed 11 mixed-design studies: a systematic review and meta-analysis, addressing postoperative pain relief in breast oncology. It should be noted that regional pain relief techniques were primarily considered by researchers from Southeast Asia, while the use of pharmacological pain relief was examined by European authors. Seven of the 11 publications focused on regional postoperative analgesia, and four of the 11 focused on the use of pharmacological pain relief techniques.

These studies highlight the high importance and need for effective postoperative analgesia in breast oncology. There are over 8,200 patients undergoing breast surgery in the abovementioned researches.

Ying Zhang *et al.* [7] mentioned that the ESP block not only provides high levels of pain relief but also reduces opioid analgesic consumption. Compared with the general analgesic group, the observational group showed a significant reduction in morphine consumption during the first 24 hours after surgery, with a mean difference (MD) of -7.67 mg [95% confidence interval (CI) 10.35 to -5.00] ($P < 0.01$). Furthermore, the ESP block group demonstrated lower pain scores than the control group at four time points (1, 6, 12, and 24 hours after surgery). The results of our study, despite its small sample size, confirm the findings of our colleagues.

Grape S. *et al.* [8,9] found that the use of regional postoperative analgesia reduces the incidence of postoperative nausea and vomiting. This finding was confirmed in our study, although this was not the objective of our study.

One of the key findings of our study was the initial request for analgesia after awakening. Similar results were obtained in the study by Qianchuang Sun Q. *et al.* [10]. Compared to traditional methods of postoperative anesthesia using opioid analgesics, the duration of this period was four times longer. In our study, this period reached up to 20 hours, with a median of 16 hours 37 minutes.

Speaking of postoperative pain relief, it's important to highlight other methods for overcoming this formidable obstacle in the postoperative period. Ehsan Motaghi *et al.*, Ajit S. Rai *et al.*, and Yaodan Bi *et al.* [11, 12, 13] thoroughly examined the use of gabapentin, ketamine, and dexamethasone as adjunctive measures to overcome postoperative pain and neuropathy in patients undergoing mastectomy. Their results demonstrated relatively high efficacy rates; however, they lacked the versatility, accessibility, and safety of regional postoperative pain relief methods.

Another important parameter, which we also documented, was in the studies of Sheng Huan *et al.*, N Byager *et al.*, and B Versyck *et al.*: a reduction in the intensity of postoperative pain syndrome with the use of regional anesthesia [14, 15, 16]. Pain intensity, as measured by VAS, which we also used, was significantly lower in the groups receiving regional anesthesia. Our

study also assessed patient function in the early postoperative period. These tests demonstrate the effectiveness of regional anesthesia in the postoperative period, allowing patients to transition to rehabilitation and reducing the risk of hypodynamic complications.

Conclusion

Therefore, the results obtained in our study demonstrate the high and reliable effectiveness of the ESP block in the early postoperative period in patients undergoing radical mastectomy. Peerreviewed journal publications also emphasize the significant role of regional anesthesia in preventing postoperative complications after mastectomy. These are not isolated effects, but rather a comprehensive improvement in patient outcomes after bilateral radical mastectomy. This has broad positive implications not only for the patient but also for the entire healthcare system, including significant pharmacoeconomic benefits, reduced hospital stays, and improved surgical outcomes.

Conflict of interest: The authors have no conflicts of interest.

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