Original Article

MEDICINE PALLIATIVE CARE

DOI: 10.47582/jompac.1768711

J Med Palliat Care. 2025;6(5):481-486

The efficacy of ultrasound-guided regional anesthesia on chronic postoperative pain in patients who underwent caesarean section: a retrospective study

Serpil Şehirlioğlu, Veysel Dinç

Department of Anesthesiology and Reanimation, Gaziosmanpaşa Training and Research Hospital, University of Health Sciences, İstanbul, Turkiye

Cite this article as: Şehirlioğlu S, Dinç V. The efficacy of ultrasound-guided regional anesthesia on chronic postoperative pain in patients who underwent caesarean section: a retrospective study. *J Med Palliat Care*. 2025;6(5):481-486.

Received: 19.08.2025 ◆ **Accepted**: 10.09.2025 ◆ **Published**: 24.10.2025

ABSTRACT

Aims: Chronic postsurgical pain (CPSP) is an well-recognised complication following caesarean delivery and may adversely affect maternal quality of life. Effective postoperative analgesia has been suggested to reduce the risk of CPSP. This study aimed to evaluate the effect of ultrasound-guided regional blocks, applied as part of multimodal analgesia, on the incidence and characteristics of CPSP after caesarean section under spinal anaesthesia.

Methods: This retrospective, single-center cohort study included women aged 18–40 years with singleton pregnancies who underwent elective caesarean section under spinal anaesthesia between January 2024 and March 2025. Patients were divided into two groups: Group RA (regional anesthesia), who received multimodal analgesia with either anterior quadratus lumborum block or ilioinguinal–iliohypogastric nerve block, and group non-RA, who received standard systemic analgesia alone. Data were obtained from anaesthesia and postoperative analgesia records. Patients were contacted by telephone after completing ≥90 postoperative days to assess their pain status. Neuropathic features such as burning, tingling, itching, and numbness were also evaluated.

Results: A total of 191 patients were included: 90 in group RA and 101 in group non-RA. The demographic characteristics of the two groups were comparable. The incidence of CPSP at three months was 27.8% in group RA and 28.7% in group non-RA (p=0.886). All pain was localised to the incision site and was mostly mild and intermittent. No significant differences were found between the groups for burning (8.9% in group non-RA vs. 8.9% in group RA), tingling (10.9% in group non-RA vs. 7.8% in group RA), and itching (25.7% in group non-RA vs. 16.7% in group RA). However, the rate of numbness was significantly higher in the non-RA group compared to the RA group (20.8% vs. 10.0%, p=0.041).

Conclusion: The incidence of CPSP at ≥3 months after caesarean delivery was similar between patients receiving regional blocks and those treated with standard analgesia. However, regional blocks were associated with a lower frequency of certain neuropathic symptoms, suggesting a potential qualitative benefit in postoperative pain management.

Keywords: Caesarean delivery, multimodal analgesia, chronic pain, chronic postsurgical pain, fascial plane blosks

INTRODUCTION

Caesarean delivery (CD) rates have been increasing worldwide.[1] Early postoperative complications associated with surgery are well recognised. In addition, it is crucial to carefully evaluate and analyse long-term complications. Chronic postsurgical pain (CPSP) is defined as pain persisting for at least three months after surgery, which is continuous or recurrent in nature, not attributable to pre-existing causes or other conditions, and arises as a consequence of the surgical procedure itself. CPSP following CD negatively affects maternal quality of life and may lead to clinical, psychological, and social problems.

The incidence of CPSP after caesarean section has been reported to vary widely depending on demographic characteristics, sociocultural factors, and the surgical and anaesthetic techniques applied. It is estimated to occur in approximately 15–25% of patients at three months, around 10% at six months, and about 5% at twelve months postoperatively.[2,3]

Biological factors such as surgical trauma, nerve injury, scar formation, and adhesions play a role in the development of CPSP. In addition, severe acute postoperative pain, inadequate analgesia, preoperative anxiety or depression, smoking, and a history of previous caesarean section have also been identified as risk factors.[4,5] However, the findings reported in the current literature are heterogeneous, and the impact of modifiable risk

Corresponding Author: Serpil Şehirlioğlu, drserpilsahin@gmail.com

factors and analgesic strategies on long-term pain remains insufficiently clear.

In recent years, multimodal analgesia approaches and regional blocks have been increasingly employed in CD to reduce postoperative pain.[6-9] For this purpose, techniques such as the quadratus lumborum block (QLB) and ilioinguinal–iliohypogastric (II-IH) nerve blocks, which provide effective analgesia in the lower abdomen, are used.

Compared with standard protocols using only systemic analgesics, these techniques may provide more effective analgesia and reduce opioid requirements. Nevertheless, evidence regarding their impact on the development of chronic pain is limited.

Our hypothesis was that regional blocks, used as an effective analgesic method within multimodal analgesia after caesarean section, would reduce the incidence of chronic pain and enhance analgesic efficacy compared with the standard regimen alone. This assumption was based on the notion that effective postoperative analgesia decreases the incidence of chronic pain.[10]

The primary aim of the study was to compare the presence of chronic pain persisting for more than 90 days after surgery between patients who did and did not receive a regional block. The secondary aim was to compare the characteristics of pain (such as burning, tingling, itching, numbness) and its impact on quality of life between the two groups.

METHODS

Ethics

This study was conducted as a retrospective, single-center study at Gaziosmanpaşa Training and Research Hospital. Ethical approval was obtained from the Non-interventional Clinical Researches Ethics Committee of Medipol University Hospital (Date: 14.08.2025, Decision No: 967). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Following ethical approval, the medical records of patients who underwent elective caesarean section under spinal anaesthesia between 1 January 2024 and 1 March 2025 were retrospectively reviewed.

Patient Selection

The study included patients classified as ASA physical status II, aged between 18 and 40 years, with singleton pregnancies, who underwent elective caesarean section under spinal anaesthesia with a Pfannenstiel incision. Patients who underwent an additional surgical procedure in the postoperative period or developed complications, as well as those who could not be followed up at the third postoperative month, were excluded.

Patients with a history of chronic analgesic or opioid use, neurological or psychiatric disorders, difficulty in communication, chronic medical conditions, ASA III status, or a body-mass index (BMI) greater than 35 kg/m^2 were also excluded.

In our clinic, spinal anaesthesia is the preferred technique for CD. Since patients undergoing caesarean section under general anaesthesia do not experience the discomfort associated with needle insertion, regional blocks are performed only in those operated under spinal anaesthesia. For this reason, only women with singleton pregnancies who underwent CD under spinal anaesthesia were included in the present study.

Spinal Anaesthesia and Postoperative Analgesia Protocol

In our clinic, all patients underwent standard monitoring (electrocardiography, noninvasive blood pressure measurement, and pulse oximetry) and a standard anaesthesia technique. Spinal anaesthesia was performed at the L3–4 or L4–5 interspace using a 25-gauge Spinocan needle and achieved with 12 mg of intrathecal bupivacaine. Postoperative analgesia in the delivery ward was routinely provided with 1 g paracetamol every 6 hours, and 75 mg diclofenac administered intramuscularly when the resting NRS was ≥4. The same protocol was applied to all women following CD.

Intervention and Group Definitions

In our clinic, regional blocks may be performed in appropriate patients and under suitable conditions for postoperative multimodal analgesia following caesarean section. Bilateral anterior QLB or II-IH nerve blocks are most commonly preferred. Block applications are performed after completion of the surgical procedure, with all patients transferred to the block room and monitored under standard conditions. In our clinic, both written and verbal informed consent for block procedures is routinely obtained from all patients prior to block administration.

Anterior QLB procedure: In our clinic, anterior QLBs are routinely performed with patients placed in the lateral decubitus position under ultrasound guidance, using a convex ultrasound transducer. The sonoanatomical landmarks typically include the quadratus lumborum muscle, the psoas major muscle, and the transverse process. The needle is advanced using an in-plane approach, with the tip targeted between the quadratus lumborum and psoas major muscles. A standard volume of 20 ml of 0.25% bupivacaine is administered on each side after negative aspiration.

II-IH nerve block procedure: In our clinic, II-IH nerve blocks are commonly performed in the supine position under ultrasound guidance with a linear transducer. The needle is advanced into the fascial plane between the transversus abdominis and internal oblique muscles, and 20 ml of 0.25% bupivacaine is administered bilaterally.

Group RA: Patients who received the multimodal analgesia protocol were assigned to this group. These patients underwent either bilateral anterior QLB or II-IH nerve block.

Group non-RA: Standard analgesia group. Patients who did not receive any regional block were allocated to this group.

Data Collection and Outcomes

Data were retrospectively obtained from the patients' anaesthesia records and postoperative analgesia follow-up forms. Demographic characteristics and ASA scores were documented in the anaesthesia and analgesia records. Postoperative chronic analgesia data were retrieved from individual analgesia follow-up forms maintained for each patient. Chronic pain records for patients who had completed ≥90 days (3 months) after CD were obtained through telephone interviews conducted by two independent investigators.

If patients still reported pain at or beyond this time point, additional details regarding the characteristics of the pain were obtained. Patients were asked about the origin of the pain and whether it exhibited neuropathic features. Neuropathic pain was assessed by inquiring about the presence of symptoms such as burning, tingling, itching, and numbness, which were recorded. In addition, if the pain persisted after the completion of the third postoperative month, patients were asked to describe its intensity as mild, moderate, or severe. Patients were also questioned about whether the pain was continuous or intermittent, whether it interfered with daily activities, whether additional analgesics were required, and whether the pain necessitated hospital admission.

The primary outcome of this study was the comparison of chronic pain at the end of the third postoperative month between patients who underwent caesarean section under spinal anaesthesia with a regional block and those who received standard analgesia. The secondary outcomes were the comparison of pain intensity (mild, moderate, severe) and neuropathic characteristics (burning, tingling, itching, numbness) among patients who reported chronic pain.

Statistical Analysis

Descriptive statistics were expressed as mean, standard deviation, median, minimum, maximum, frequency, and percentage values. The distribution of variables was assessed using the Kolmogorov–Smirnov test. Quantitative independent variables that did not follow a normal distribution were analysed with the Mann–Whitney U test. Qualitative independent variables were analysed with the Chi-square test. All statistical analyses were performed using SPSS version 28.0 (IBM Corp., Armonk, NY). A p-value of <0.05 was considered statistically significant.

RESULTS

Between January 1, 2024, and March 1, 2025, a total of 2480 patients underwent cesarean delivery under spinal anesthesia. Of these, 191 patients who completed postoperative 3-month follow-up were included in the study. The CONSORT flow diagram is presented in Figure 1.

A total of 90 patients were assigned to group RA and 101 patients to group non-RA.

The demographic characteristics of the two groups were comparable (Table 1).

The presence of chronic pain persisting for ≥3 months postoperatively was similar between the groups (p=0.886, Table 2). Intermittent pain persisting for ≥3 months was reported in 27.8% of patients in group RA and 28.7% of patients in group non-RA.

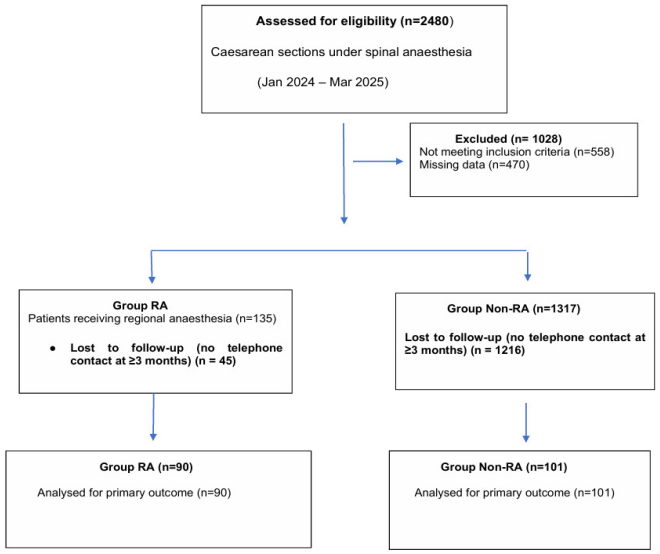

Figure 1. Flowchart

Table 1. Comparison of demographic data among groups

	Group non-RA (n=101)	Group RA (n=90)	p
	Med (Q1-Q3)	Med (Q1-Q3)	
Age (yr)	27 (23-32)	29 (25-34)	0.189
BMI (kg/m²)	25.7 (23.4-28.5)	27.1 (23.8-29.4)	0.126
Number of cesarean sections	2 (1-3)	2 (1-3)	0.502

Group non-RA: Standard analgesia group, Group RA: Multimodal analgesia group. BMI: Body-mass index. Values are expressed as median (Q1–Q3), where Q1 and Q3 represent the first and third quartiles, respectively. The distribution of variables was assessed using the Kolmogorov–Smirnov test. Since the data did not follow a normal distribution, comparisons between groups were performed using the Mann–Whitney U test. A p-value <0.05 was considered statistically significant.

Table 2. CPSP incidence and pain characteristics by group

	Group non-RA (n=101)	Group RA (n=90)	p
	n (%)	n (%)	
CPSP incidence			
Yes	29 (28.7)	25 (27.8)	0.886
No	72 (71.3)	65 (72.2)	
Pain intensity (in patients with CPSP)			
Mild	21 (72.4)	15 (60)	
Moderate	8 (27.6)	9 (36)	0.412
Severe	0 (0)	1 (4)	

Group non-RA: Standard analgesia group, Group RA: Multimodal analgesia group. CPSP: Chronic postsurgical pain. Values are presented as number (percentage). Comparisons between groups were performed using the chi-square test for categorical variables. *: p-value <0.05 was considered statistically significant.

In all cases, the pain was localised to the incision site. There was no significant difference between the groups in terms of pain intensity (Table 2).

Among patients who developed CPSP, the characteristics of pain were evaluated. The incidence of burning (8.9% in group non-RA vs. 8.9% in group RA, p=0.996), tingling (10.9% in group non-RA vs. 7.8% in group RA, p=0.462), and itching

(25.7% in group non-RA vs. 16.7% in group RA, p=0.127) symptoms was similar between the groups. However, numbness was reported significantly more often in the non-RA group compared to the RA group (20.8% vs. 10.0%, p=0.041) (**Table 3, Figure 2**).

Table 3. Comparison of neuropathic symptom profiles between groups

	Group non-RA (n=101)		Group RA (n=90)		
	n	%	n	%	p
Burning	9	8.9	8	8.9	0.996
Tingling	11	10.9	7	7.8	0.462
Itching	26	25.7	15	16.7	0.127
Numbness	21	20.8	9	10.0	0.041*

Group non-RA: Standard analgesia group, Group RA: Multimodal analgesia group. Values are presented as number (percentage). Comparisons between groups were performed using the Chi-square test for categorical variables. *: p-value <0.05 was considered statistically significant.

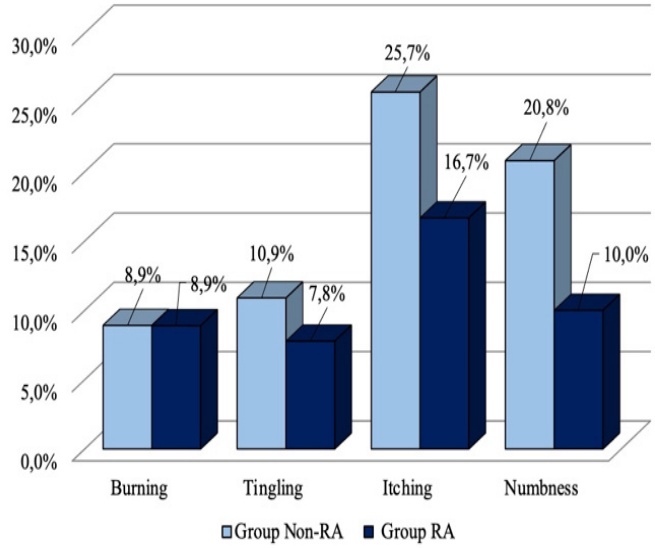

Figure 2. Incidence of neuropathic symptoms in group non-RA and group RA

DISCUSSION

The results of this study demonstrated that the incidence of chronic pain at ≥3 months postoperatively was similar between patients who underwent caesarean section under spinal anaesthesia with a regional block and those managed with standard analgesia alone. However, numbness weas observed to be less frequent in patients who received multimodal analgesia compared with those in the standard analgesia group.

One of the important factors in the aetiology of chronic pain is the management of analgesia in the early postoperative period.[10,11] In recent years, fascial plane blocks have been increasingly used as part of opioid-free analgesia to provide effective postoperative pain control in mothers. For postoperative analgesia following caesarean section, both the Enhanced Recovery After Surgery (ERAS) protocols and the PROSPECT guidelines recommend the use of regional blocks.[12-14] QLB blocks were first described by Blanco[15] and later the anterior QLB was developed by Borglum.[16] QLB is known to provide both somatic and visceral analgesia.[17] II-IH nerve blocks can also be safely used for incision site analgesia after CD.[18,19] Effective maternal analgesia facilitates neonatal care, promotes early mobilisation, reduces postoperative complications and hospital costs, and consequently enables the mother's earlier return to normal life.

In this study, the incidence of CPSP at ≥3 months postoperatively was 27.8% in the regional block group and 28.7% in the non-regional block group, showing comparable rates between the two groups. Reported incidences of CPSP in the literature vary widely, ranging from 15% to 30%. Ciechanowicz et al.[2] reported an incidence of 16.7% (95% CI: 13.1–20.4) at 3 to <6 months in a systematic review and meta-analysis, although substantial heterogeneity (I^2: 94–97%) was noted. Similarly, Borges et al.[4] found a CPSP incidence of 25.5% at three months after caesarean section in a large prospective cohort, which is in line with our findings. In their analysis, Borges et al.[4] also identified anxiety, smoking, and postoperative analgesia as modifiable risk factors that could be strategically addressed in the management of CPSP. Variations across studies are likely influenced by methodological differences, patient characteristics, and analgesic strategies.

In the current study, neuropathic symptoms such as burning, tingling, itching, and numbness at the incision site were observed in some patients at the end of the third postoperative month. Burning rates were comparable between the groups. Tingling and itching tended to be less frequent in the block group, although the differences did not reach statistical significance. Numbness, however, was significantly more prominent in patients who did not receive a block. These findings suggest that chronic postoperative pain may be associated not only with nociceptive but also with neuropathic mechanisms.

Similarly, in the literature, CPSP following CD has been reported to exhibit neuropathic features in a subset of patients. This has been attributed to potential nerve injury or regeneration at the incision site, as well as neural irritation secondary to scar tissue formation. Roca et al.[19] demonstrated that neuropathic features identified in the first postoperative week were associated with an increased risk of developing chronic pain at three months. Our findings therefore support the clinical importance of evaluating the neuropathic component when assessing CPSP.

The findings of the present study did not support our hypothesis that regional blocks, in addition to providing effective analgesia in the acute postoperative period, would also reduce the incidence of chronic pain. We believe that this result may be related to the relatively small sample size, the demographic characteristics of our patients, and the variability introduced by different investigators conducting the pain assessments.

The II-IH nerves lie close to the incision site in caesarean operations, and surgical injury to these nerves may contribute to CPSP. II-IH blocks provide effective somatic analgesia in the surgical field and may reduce acute postoperative pain. In contrast, anterior QLB not only ensures somatic coverage of the lower abdominal dermatomes but also has the potential for visceral analgesia due to paravertebral spread.[16,21,22]

These properties suggest that anterior QLB may be particularly valuable in preventing CPSP by providing more comprehensive analgesia and supporting neuromodulation in the early postoperative period. Consistently, we observed less hypoesthesia at the incision site in patients who received regional blocks, which may reflect the acute efficacy of these techniques.

All patients who reported chronic pain localised their pain to the incision site; none described deep pelvic or visceral pain. The pain complaints of all patients were intermittent rather than continuous. The intensity of pain was comparable between the two groups. In both groups, patients predominantly described the pain as mild and intermittent. In the standard analgesia group, eight patients reported moderate pain, while nine patients in the multimodal analgesia group described moderate pain. Only one patient in the block group reported severe pain. However, no patient in either group reported a persistent need for analgesics or the necessity of hospital admission due to pain. Moreover, none of the patients in either group considered their pain experience to have a negative impact on daily life.

When patients with CPSP were evaluated for neuropathic features, symptoms such as burning, tingling and itching were similar between the groups. Hypoesthesia, however, were less common in the regional group compared with the non-block group. Numbness was one of the most frequently reported symptoms, and its lower incidence in the multimodal analgesia group may suggest a potential effect of the block applications.

Limitations

This study has certain limitations that should be acknowledged. First, it was a retrospective, single-center study with a relatively small sample size, which may limit the generalisability of the findings. Second, patients were contacted by telephone after the third postoperative month to assess chronic pain. Although a standardised questionnaire was used, the fact that interviews were conducted by two different investigators could have introduced subjective variability. Furthermore, the reliance on patients' self-reported descriptions of symptoms represents an inherently subjective measure.

Another limitation is that only the third-month outcomes were available, and longer follow-up (e.g., six or twelve months) could have provided a more comprehensive assessment of CPSP. Furthermore, as pain was assessed by telephone interviews, validated tools such as DN4 questionnaire could not be applied, and neuropathic features were evaluated only through patient-reported symptoms (burning, tingling, itching, numbness).

Despite these limitations, the study contributes to the growing body of evidence on CPSP after CD by specifically addressing the role of regional blocks and evaluating neuropathic symptomatology, which is often under-reported in this patient population.

CONCLUSION

In this retrospective cohort study, the incidence of CPSP at three months following CD was similar between patients who received regional blocks as part of multimodal analgesia and those managed with standard analgesia alone. However, neuropathic symptoms such as itching and numbness were observed less frequently in the block group, suggesting a potential role of regional blocks in influencing the qualitative characteristics of CPSP.

These findings highlight that while regional blocks may not necessarily reduce the overall incidence of CPSP, they could contribute to improving the quality of postoperative pain management by alleviating certain neuropathic symptoms. Larger, prospective, multicenter studies with longer follow-up periods and validated neuropathic pain assessment tools are warranted to further elucidate the impact of regional blocks on chronic pain outcomes after CD.

ETHICAL DECLARATIONS

Ethics Committee Approval

Ethical approval was obtained from the Non-interventional Clinical Researches Ethics Committee of Medipol University Hospital (Date: 14.08.2025, Decision No: 967).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

Acknowledgment

We would like to express our sincere gratitude to Ertan Koç for his invaluable assistance in the statistical analysis of this study.

REFERENCES

1. Betran AP, Ye J, Moller AB, Souza JP, Zhang J. Trends and projections of caesarean section rates: global and regional estimates. *BMJ Glob Health*. 2021;6(6):e005671. doi:10.1136/bmjgh-2021-005671
2. Ciechanowicz S, Joy RR, Kasmirski J, Blake L, Carvalho B, Sultan P. Incidence, severity, and interference of chronic postsurgical pain after cesarean delivery: a systematic review and meta-analysis. *J Clin Anesth*. 2025;104:111832. doi:10.1016/j.jclinane.2025.111832

3. Wang LZ, Huang JY, Hu HJ, Xia F. Incidence of chronic postsurgical pain after caesarean delivery: a systematic review and meta-analysis. *Anaesthesia*. 2025;80(7):834-845. doi:10.1111/anae.16596
4. Borges NC, de Deus JM, Guimarães RA, et al. The incidence of chronic pain following cesarean section and associated risk factors: a cohort of women followed up for three months. *PLoS One*. 2020;15(9):e0238634. doi:10.1371/journal.pone.0238634
5. Richez B, Ouchchane L, Guttmann A, et al. The role of psychological factors in persistent pain after cesarean delivery. *J Pain*. 2015;16(11):1136-1146. doi:10.1016/j.jpain.2015.08.001
6. Yetik F, Yilmaz C, Karasu D, Haliloğlu Dastan N, Dayioğlu M, Baytar Ç. Comparison of ultrasound-guided quadratus lumborum block-2 and quadratus lumborum block-3 for postoperative pain in cesarean section: a randomized clinical trial. *Medicine (Baltimore)*. 2022;101(49):e31844. doi:10.1097/MD.0000000000031844
7. Tanggaard K, Nielsen MV, Holm UHU, et al. No quadriceps muscle weakness following anterior quadratus lumborum block compared with placebo: a randomized, non-inferiority, blinded, volunteer trial. *Reg Anesth Pain Med*. 2025;50(7):568-574. doi:10.1136/rapm-2024-105313
8. Salama ER. Ultrasound-guided bilateral quadratus lumborum block vs. intrathecal morphine for postoperative analgesia after cesarean section: a randomized controlled trial. *Korean J Anesthesiol*. 2020;73(2):121-128. doi:10.4097/kja.d.18.00269
9. Giral T, Delvaux BV, Huynh D, et al. Posterior quadratus lumborum block versus intrathecal morphine analgesia after scheduled cesarean section: a prospective, randomized, controlled study. *Reg Anesth Pain Med*. 2024:rapm-2024-105454. doi:10.1136/rapm-2024-105454
10. de Brito Cançado TO, Omais M, Ashmawi HA, Torres ML. Chronic pain after cesarean section. Influence of anesthetic/surgical technique and postoperative analgesia. *Rev Bras Anestesiol*. 2012;62(6):762-774. doi:10.1016/S0034-7094(12)70177-0
11. Bollag L, Lim G, Sultan P, et al. Society for obstetric anesthesia and perinatology: consensus statement and recommendations for enhanced recovery after cesarean. *Anesth Analg*. 2021;132:1362-1377. doi:10.1213/ANE.0000000000005257
12. Roofthooft E, Joshi GP, Rawal N, et al. PROSPECT Working Group* of the European Society of Regional Anaesthesia and Pain Therapy and supported by the Obstetric Anaesthetists' Association. PROSPECT guideline for elective caesarean section: updated systematic review and procedure-specific postoperative pain management recommendations. *Anaesthesia*. 2021;76(5):665-680. doi:10.1111/anae.15339
13. Roofthooft E, Joshi GP, Rawal N, et al. PROSPECT Working Group of the European Society of Regional Anaesthesia and Pain Therapy. PROSPECT guideline for elective caesarean section: an update. *Anaesthesia*. 2023;78(9):1170-1171. doi:10.1111/anae.16034
14. Blanco R, Ansari T, Girgis E. Sezaryen sonrası postoperatif ağrı için Quadratus lumborum bloğu: randomize kontrollü bir çalışma. *Eur J Anaesthesiol*. 2015;32:812-818.
15. Børglum J, Moriggl B, Jensen K, et al. Ultrasound-guided transmuscular quadratus lumborum blockade. *Br J Anaesth*. 2013;111:3. doi:10.1093/bja/el_9919
16. Elsharkawy H, El-Boghdadly K, Barrington M. Quadratus lumborum block: anatomical concepts, mechanisms, and techniques. *Anesthesiology*. 2019;130(2):322-335. doi:10.1097/ALN.0000000000002524
17. Bessmertnyj AE, Antipin EE, Uvarov DN, Sedyh SV, Nedashkovsky EV. Comparison of the effectiveness of ilioinguinal-iliohypogastric blockade and transversus abdominis plane block for analgesia after cesarean section. *Anesteziol Reanimatol*. 2015;60(2):51-54.
18. Jin Y, Li Y, Zhu S, Zhu G, Yu M. Comparison of ultrasound-guided iliohypogastric/ilioinguinal nerve block and transversus abdominis plane block for analgesia after cesarean section: a retrospective propensity match study. *Exp Ther Med*. 2019;18(1):289-295. doi:10.3892/etm.2019.7540
19. Rodríguez Roca MC, Brogly N, Gredilla Diaz E, et al. Neuropathic component of postoperative pain for predicting post-cesarean chronic pain at three months: a prospective observational study. *Minerva Anestesiol*. 2021;87(12):1290-1299. doi:10.23736/S0375-9393.21.15654-8
20. Niklasson B, Georgsson Öhman S, Segerdahl M, Blanck A. Risk factors for persistent pain and its influence on maternal wellbeing after cesarean section. *Acta Obstet Gynecol Scand*. 2015;94(6):622-628. doi:10.1111/aogs.12613
21. Öksüz G, Bilal B, Gürkan Y, et al. Quadratus lumborum block versus transversus abdominis plane block in children undergoing low abdominal surgery: a randomized controlled trial. *Reg Anesth Pain Med*. 2017;42(5):674-679. doi:10.1097/AAP.0000000000000645
22. Şehirlioğlu S, Moralar DG, Ozakin O, Aydemir T, Ergul F. Anterior quadratus lumborum block versus modified perichondrial thoracoabdominal nerve block (m-TAPA) for postoperative analgesia following laparoscopic cholecystectomy: a randomized controlled trial. *BMC Anesthesiol*. 2025;25(1):393. doi:10.1186/s12871-025-03281-x