



Effects of Ultrasonography-Guided Transversus Abdominis Plane Block on Postoperative Analgesia, Gastrointestinal Motility, and Mobilization in Patients Delivering Cesarean Delivery Under Spinal Anesthesia: A Retrospective Study

Spinal Anestezi Altında Sezaryen Doğum Gerçekleştiren Hastalarda Ultrasonografi Kılavuzluğunda Uygulanan Transversus Abdominis Plan Bloğun Postoperatif Analjezi, Gastrointestinal Motilite ve Mobilizasyon Zamanına Etkisi: Retrospektif Çalışma


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ABSTRACT

Aim: The aim of this study was to investigate the effect of ultrasonography (USG)-guided transversus abdominis plane (TAP) block on postoperative analgesia, gastrointestinal motility, and mobilization time in patients who had a cesarean section under spinal anesthesia.

Material and Methods: The follow-up forms of the total 81 patients who had elective cesarean delivery under spinal anesthesia between March 2022 and June 2022 were reviewed retrospectively. The patients were divided into two groups, 41 patients as the TAP block applied group (group T) and 40 patients as the control group (group C). Demographic data of patients, visual analog scale (VAS) values at postoperative 2nd-, 4th-, 6th-, 12th-, and 24th-hour, tramadol requirements, non-steroidal anti-inflammatory drug (NSAID) and tramadol consumption, postoperative nausea-vomiting (PONV) status, initial gas release times and mobilization times were analyzed.

Results: The VAS scores of the patients in group T at the postoperative period 2nd-, 4th-, and 6th-hour were significantly lower than those of group C ($p<0.001$). However, the rate of PONV ($p=0.006$), tramadol requirement ($p=0.002$), amount of tramadol ($p=0.003$) and NSAID consumed ($p<0.001$), and mobilization time ($p=0.005$) were significantly lower in patients in group T. The time until the passage of flatus was short in Group T, although it was not significant ($p=0.072$).

Conclusion: The USG-guided TAP block significantly contributes to multimodal analgesia after cesarean delivery and may contribute to the early mobilization of patients and the return of gastrointestinal functions.

Keywords: Obstetrical analgesia; postoperative pain; TAP block; cesarean section; early ambulation; gastrointestinal motility.

ÖZ

Amaç: Bu çalışmanın amacı, spinal anestezi altında sezaryen doğum yapan hastalarda ultrasonografi (USG) kılavuzluğunda uygulanan transversus abdominis plan (TAP) bloğun postoperatif analjezi, gastrointestinal motilite ve mobilizasyon zamanına etkisini araştırmaktır.

Gereç ve Yöntemler: Mart 2022 ile Haziran 2022 tarihleri arasında spinal anestezi altında elektif sezaryen doğum gerçekleştirmiş olan toplam 81 hastanın takip dosyaları geriye dönük olarak incelendi. Hastalar, 41 hasta TAP blok uygulanan grup (grup T) ve 40 hasta kontrol grubu (grup K) olmak üzere iki gruba ayrıldı. Hastaların demografik verileri, postoperatif dönem 2., 4., 6., 12. ve 24. saatlerdeki vizüel analog skala (VAS) değerleri, tramadol gereksinimleri, non-steroid anti inflammatuar ilaç (NSAİİ) ve tramadol tüketimleri, postoperatif bulantı-kusma (postoperative nausea-vomiting, PONV) durumları, ilk gaz çıkış zamanları ile mobilizasyon zamanları analiz edildi.

Bulgular: Grup T'deki hastaların postoperatif 2., 4. ve 6. saatlerdeki VAS skorları grup K'ye göre anlamlı olarak daha düşüktü ($p<0,001$). Bununla birlikte grup T'deki hastalarda PONV görülme oranı ($p=0,006$), tramadol gereksinimi ($p=0,002$), tüketilen tramadol ($p=0,003$) ve NSAİİ ($p<0,001$) miktarı ile mobilizasyon süresi ($p=0,005$) anlamlı olarak düşük saptandı. Grup T'de ilk gaz çıkışına kadar geçen süre kısa olmakla birlikte anlamlı değildi ($p=0,072$).

Sonuç: USG kılavuzluğunda uygulanan TAP bloğun sezaryen doğum sonrası multimodal analjeziye önemli katkı sağladığını ve hastaların erken mobilizasyonuna ve gastrointestinal fonksiyonların geri dönüşüne katkı sağlayabileceğini düşünüyoruz.

Anahtar kelimeler: Obstetrik analjezi; postoperatif ağrı; TAP blok; sezaryen doğum; erken ambulasyon; gastrointestinal motilite.

INTRODUCTION

Since most patients experience moderate to severe pain after cesarean delivery, it is essential to ensure pain control. Failure to provide pain palliation may affect the mother-infant bond, disrupt the care of the baby, and lead to difficulties in early breastfeeding. Although there are two components of postpartum pain: somatic (due to abdominal wall incision) and visceral (from the uterus), an essential component of pain originates from the abdominal wall incision (1). Difficulty in movement due to pain may delay mobilization and increase the risk of venous thromboembolism. Pulmonary complications may be triggered due to coughing due to pain and avoidance of deep breathing, and cardiac arrhythmias, hypertension, and myocardial ischemia may occur in patients exposed to severe pain for a long time (2,3).

Systemic or neuraxial opioids are frequently used to treat postoperative pain because they are effective against pain of both somatic and visceral origin. However, undesirable side effects such as nausea-vomiting, itching, decreased bowel movements or constipation, and respiratory and conscious depression may be observed (4). Enhanced recovery after surgery (ERAS) protocols emphasize transversus abdominis plane (TAP) block, which includes abdominal nerve block in multimodal analgesia, to reduce opioid consumption in providing postoperative pain control (5-7). Ultrasonography (USG) guided TAP block is a fascial plane block that can eliminate somatic pain by blocking the neural afferents of the abdominal wall between T6 and L1 between the internal oblique and transversus abdominis muscles and has become popular in postpartum patients as well (8-10).

This study investigates the effects of USG-guided bilateral TAP block on postoperative pain scores, analgesic consumption, mobilization time, and gastrointestinal functions in patients who had a cesarean delivery under spinal anesthesia.

MATERIAL AND METHODS

Study Design and Groups

After the approval of the Local Clinical Research Ethics Committee (date: 06.07.2022, no: 166) of the University of Health Sciences, Kanuni Sultan Süleyman Training and Research Hospital, this retrospective observational study was started following the principles of the Declaration of Helsinki.

Patients who had elective cesarean delivery under spinal anesthesia during the three months between March 1, 2022, and June 1, 2022, at the University of Health Sciences Turkey, Istanbul Kanuni Sultan Süleyman Training and Research Hospital, were retrospectively analyzed. All patients who met the inclusion criteria and had missing data were included in the study. Inclusion criteria for the study; American Society of Anesthesiologists (ASA) II physical status, 18 years of age and older, who underwent cesarean section with Pfannenstiel incision under spinal anesthesia. Exclusion criteria; Patients under 18 years of age, patients with intraoperative nausea and vomiting due to spinal anesthesia which do not go away in a short time, patients with severe preeclampsia or HELLP syndrome, patients with complicated diabetes who have ASA III physical status and need postoperative intensive care (Figure 1).

A total of 81 patients were divided into two groups the TAP block group (group T) and the control group without TAP block (group C). The visual analog scale (VAS) values of the patients at postoperative 2, 4, 6, 12, and 24 hours (0=no pain, 10=the most severe pain ever), diclofenac and tramadol requirements and consumption, postoperative nausea-vomiting (PONV, 0: none, 1: nausea without vomiting, 2: both nausea and vomiting), postoperative mobilization times and gastrointestinal motility were analyzed by accessing the time until passage of flatus from the patient follow-up forms.

In the gynecology and obstetrics clinic of our hospital, paracetamol (Rastamol 10 mg/mL vial, Haver Farma, Türkiye) 1 g 3x1 intravenous (iv) is administered as an analgesic in the postoperative period in all cesarean deliveries under general or spinal anesthesia. Diclofenac sodium (Dichloron 75 mg / 3 mL, Deva Farma, Türkiye) 75 mg intramuscularly 1 to 3 times is administered to patients who complain of pain despite paracetamol. If pain relief does not occur with diclofenac, tramadol hydrochloride (Tradolex 100 mg / 2 mL, Menta Farma, Türkiye) is infused 1 to 3 times iv in 100 ml of physiological saline. All patients included in the study were routinely administered 3x1 g paracetamol iv and diclofenac and tramadol were also administered according to pain complaints.

Spinal Anesthesia

In both groups, spinal anesthesia was performed by the same anesthesiologist and senior assistant using similar doses of drugs. Spinal anesthesia was performed with 20 mcg fentanyl and 8-10 mg 0.5% heavy bupivacaine, depending on the patient's height, using a 25 G Quincke spinal needle from the L3-L4 or L4-L5 interval in the sitting position. The surgical procedure was started when the sensory block level was T6 and the Bromage motor block level was 2-3.

Transversus Abdominis Plane (TAP) Block

TAP block was applied at the end of the operation to the patients who performed cesarean section under spinal anesthesia and accepted the block application. After skin antisepsis was achieved in the supine position, a linear

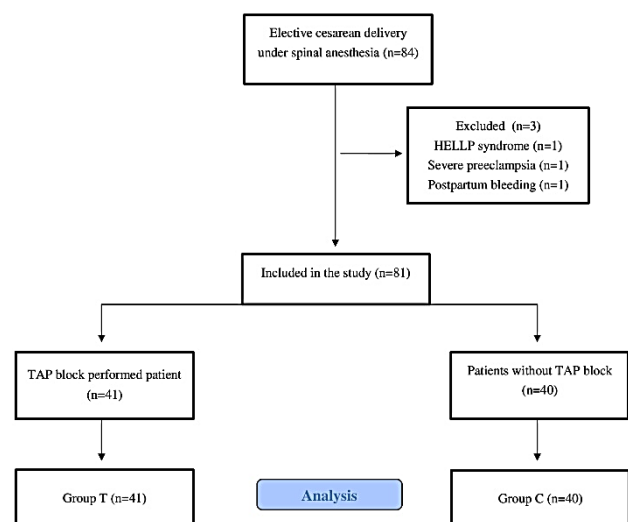


Figure 1. Flow chart of the study

probe was placed between the crista iliaca and coastal border under the guidance of USG (Esaote MyLabFive, Italy). The TAP was defined by providing the ideal image of the external oblique, internal oblique, and transversus abdominis muscles in the anterior part of the abdomen. With the in-plane technique, using a 100 mm 20 G block needle (Stimuplex Ultra 360, Braun, Japan), 20 ml of 0.25% bupivacaine (Bustesin 0.5% Vem Pharma, Türkiye) bilaterally on each side, the fascial plane between the internal oblique muscle and the transversus abdominis muscle injected. After the block, all patients were followed up in the recovery room for 45 minutes and transferred to inpatient services. No invasive procedure was applied to the patients in the control group at the end of the operation.

Postoperative Mobilization and Gastrointestinal Motility

Mobilization was defined as all activities in which the patient is out of bed, such as standing at the bedside, sitting in a chair, or taking a walk in the corridor (11). Motility is the ability to move, the power of movement, and mobility. Gastrointestinal motility is also explained as motility related to the stomach and intestines. The literature investigated the effect of different applications on gastrointestinal motility after cesarean delivery, and the time to first gassing was examined in many randomized controlled studies (12). Our study used the time until the passage of flatus recorded in inpatient wards to evaluate gastrointestinal motility. Similarly, standing, sitting in a chair, or walking was defined as mobilization.

Determination of Sample Size

A previous study was used to calculate the sample size (3). The authors determined that a 25% reduction in postoperative opioid consumption was significant in their pilot study, with a $p < 0.05$ and study power of 0.8; they determined that should be 28 patients in each group. All patients who had a cesarean section under spinal anesthesia who met the inclusion criteria between the relevant dates and had no missing data were included in our study.

Statistical Analysis

IBM SPSS v.26.0 program was used to analyze the data. Descriptive data are expressed as number of patients, percentage, mean and standard deviation, and distribution range. The conformity of the variables to the normal distribution was evaluated analytically (Shapiro-Wilk test) and visually (histogram). An Independent sample t-test was used to analyze data with normal distribution. The

Mann-Whitney U test was used to analyze data that did not show normal distribution. In the analysis of VAS scores within and between groups, repeated measures ANOVA test with Bonferroni post hoc comparisons was used. The Pearson chi-square and Fisher's exact tests were used to evaluate qualitative data. The significance level for all results was accepted as $p < 0.05$.

RESULTS

Between March 2022 and June 2022, 84 patients who underwent elective cesarean section under spinal anesthesia and whose records were not missing were reached. Three patients transferred to the surgical intensive care unit after cesarean section diagnosed with HELLP syndrome, preeclampsia, and postpartum hemorrhage were excluded from the study. A total of 81 patients were included in the study. After a cesarean delivery, 41 patients who underwent USG-guided TAP block were classified as Group T, and 40 patients without TAP block were classified as Group C (Figure 1).

The mean age of all patients in the entire study group was 28.0 ± 5.9 (range, 18-41) years, and all were in ASA II physical status. There was no statistically significant difference between the groups in terms of demographic characteristics.

POVN developed in 4.9% ($n=2$) of patients in group T and 27.5% ($n=11$) of patients in group C. Post-operative mobilization time was 5.7 ± 0.9 (range, 4-8) hours and 6.5 ± 1.2 (range, 4-9) hours in group T and group C, respectively. The mean time until the passage of flatus was 8.8 ± 1.6 (range, 6-13) hours in group T, while it was 9.7 ± 2.1 (range, 7-14) hours in group C (Table 1). The PONV rate was significantly lower, and post-operative mobilization time was considerably shorter in group T than in group C ($p=0.006$, and $p=0.005$, respectively). Although the mean time until the passage of flatus was found shorter in Group T than in Group C, it was not statistically significant ($p=0.072$).

When the VAS scores were analyzed, the 2nd-, 4th-, and 6th-hour VAS scores in Group T were significantly lower than in Group C ($p < 0.001$). There was no significant difference between the groups' 12- and 24-hour VAS scores ($p=0.801$, and $p=0.859$, respectively). In the TAP group, the 2nd- and 4th-hour VAS scores were significantly lower than the 6th-, 12th-, and 24th-hour VAS scores. However, there was no statistically significant difference between VAS scores in the control group (Table 2, Figure 2).

Table 1. Demographic data and some clinical characteristics of the patients

	Group T (n=41)	Group C (n=40)	p	Overall (n=81)
Age (years), mean \pm SD (min-max)	27.8 \pm 6.1 (18-41)	28.3 \pm 5.8 (18-41)	0.710	28.0 \pm 5.9 (18-41)
Height (cm), mean \pm SD (min-max)	160.0 \pm 4.1 (152-167)	160.0 \pm 5.8 (150-175)	0.765	160.0 \pm 5.0 (150-175)
BMI (kg/m ²), median (min-max)	29.6 (24.1-40.0)	28.8 (24.6-45.2)	0.184	29.3 (24.1-45.2)
ASA II physical status, n %	41 (100)	40 (100)	-	81 (100)
PONV, n %	2 (4.9)	11 (27.5)	0.006	13 (16.1)
Mobilization (hour), mean \pm SD (min-max)	5.7 \pm 0.9 (4-8)	6.5 \pm 1.2 (4-9)	0.005	6.1 \pm 1.2 (4-9)
Time until passage of flatus (hour), mean \pm SD	8.8 \pm 1.6 (6-13)	9.7 \pm 2.1 (7-14)	0.072	9.3 \pm 1.9 (6-14)

SD: standard deviation, min: minimum, max: maximum, BMI: body mass index, ASA: American Society of Anesthesiologists, PONV: postoperative nausea and vomiting

Table 2. Visual analogue scale values of the groups

	Group T (n=41)				Group C (n=40)			
	Mean	SD	SE	95% CI	Mean	SD	SE	95% CI
2nd-hour	2.41	0.5	0.11	2.19-2.63	4.27	0.8	0.13	4.01-4.54
4th-hour	2.70	0.7	0.13	2.45-2.95	4.57	0.9	0.14	4.30-4.85
6th-hour	3.17	0.7	0.13	2.90-3.43	4.80	0.9	0.16	4.48-5.11
12th-hour	4.41	0.6	0.11	4.19-4.63	4.38	0.7	0.12	4.13-4.62
24th-hour	4.12	0.7	0.16	3.90-4.34	4.15	0.7	0.12	3.91-4.38

SD: standard deviation, SE: standard error, CI: confidence interval

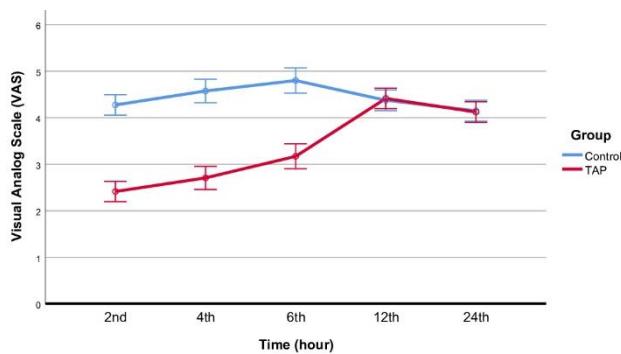


Figure 2. The mean visual analogue scale (VAS) scores of the groups in the first 24 hours.

Diclofenac was administered to 80.5% (n=33) of patients in group T and all of the patients in group C (p=0.005). Tramadol was required in 7.3% (n=3) of the patients in group T and 35% (n=14) in group C (p=0.002). The mean amount of diclofenac and tramadol administered in the first 24 hours postoperatively was 109.7±65.1 mg and 12.2±45.7 mg in group T, while it was 196.8±40.5 mg and 45.0±67.7 mg in group C, respectively. The amount of diclofenac (p<0.001) and tramadol (p=0.003) consumed postoperatively was significantly lower in group T. Local anesthetic systemic toxicity (LAST) was not observed in any patient after the TAP block.

DISCUSSION

In this study, we determined that a TAP block added to spinal anesthesia reduces the frequency of PONV, VAS scores in the first 6 hours postoperatively, mobilization times, and the need for opioids consumed in the postoperative period. In addition, the mean time until the passage of flatus was also lower in the TAP block group, although it was not significant.

It has been reported that more than 40% of patients in the postoperative period experience moderate or severe pain in the early period (13). ERAS protocols using evidence-based surgical principles have emphasized that TAP block is a simple and reliable analgesia technique in cesarean section, laparoscopic, and open abdominal operations to reduce opioid consumption as a part of multimodal analgesia (5,14). The widespread use of ultrasound and the clear visualization of the anatomy make the TAP block a safe and effective method for the multimodal postoperative analgesia technique in obstetric, urological, and lower abdominal surgery. Hebbard et al. (10) applied the ultrasound-guided TAP block technique for the first time. They reported that it has fewer potential complications than epidural analgesia and is an effective

alternative analgesia technique. In another study, 20 mL of 0.25% bupivacaine and USG-guided TAP block was applied to women who had a cesarean section, and it was reported that the 24-hour morphine consumption in the TAP block group was significantly reduced compared to the control group (15). Cansiz et al. (16) reported that USG-guided TAP block in cesarean section patients significantly reduced pain scores and tramadol consumption. In some randomized controlled studies investigating the effectiveness of TAP block, a placebo control group was formed by administering saline to the TAP (17,18). However, USG-guided TAP block application is not a risk-free technique, although it is safe and has a low risk of complications. Therefore, the ethical legitimacy of using interventional placebo-controlled regional analgesia is controversial. In our study, while a bilateral TAP block was applied to the TAP block group with 20 mL of 0.25% bupivacaine under USG guidance, no intervention was applied to the control group. Following the literature, 2, 4, and 6-hour VAS scores, nonsteroidal anti-inflammatory drug (NSAID), and tramadol requirement, NSAID, and tramadol consumption amount were significantly lower in patients who underwent TAP block.

Multimodal opioid-sparing analgesia approaches highlighted in ERAS protocols aim to reduce systemic opioid demand. Undesirable effects such as nausea, vomiting, constipation, delayed return of bowel movements, sedation, respiratory depression, hyperalgesia, and prolonged hospital discharge have increased the interest in analgesic modalities such as TAP block in postoperative analgesia (19-21). However, it has been reported that intrathecal morphine or opioid administration may contribute to postoperative analgesia and early mobilization by synergistic effect with local anesthetics in abdominal surgeries such as cesarean section and other surgeries (5,22). Zhang et al. (23) reported that preoperative TAP block with 0.6% concentration lidocaine in patients who underwent gynecological laparotomy reduced the incidence of perioperative opioid use and postoperative nausea, accelerated the recovery of bowel functions, shortened the hospital stay, and contributed to early postoperative mobilization. Another study emphasized that the incidence of PONV decreased significantly in patients who had a cesarean section because there was less need for opioids in the group that underwent TAP block. There was less need for antiemetics (24). Our study found that the mobilization time and incidence of PONV were significantly reduced in the group in which the TAP block was applied. The mean time until the passage of flatus we used to evaluate gastrointestinal motility was low in the TAP group, although

it was not significant (8.8 ± 1.6 vs. 9.7 ± 2.1 hours). In addition, we think that our 20 mcg intrathecal fentanyl administration to the patients in both groups positively affects postoperative analgesia and mobilization. Although patients who had a cesarean delivery in our clinic are requested to be mobilized at the sixth postoperative hour, mobilization times may be prolonged depending on the pain status of the patients or other factors. Consistent with the literature, we think significantly less opioid use and better pain palliation in the TAP block group may contribute to earlier mobilization and return of bowel movements.

USG-guided TAP block is generally safe and has a low complication rate. However, abdominal organ injuries, intraperitoneal injuries, intestinal hematoma, and LAST have been reported in TAP block performed both with the blind technique and USG guidance (25-27). It has been reported that the total dose should be 2-2.5 mg/kg in bupivacaine, and the maximum recommended dose in an adult patient is 175-225 mg (28). In our study, 100 mg of bupivacaine was used in the TAP block group, and LAST or other complications were not observed in any patient.

The major limitations of our study are its retrospective, single-center, and small sample size. The level of the sensory block before the TAP block was applied and the duration of the motor blockade after spinal anesthesia were not evaluated. Due to the insufficient number of Patient-controlled analgesia (PCA) devices used in our hospital, the amount of analgesic consumed in our study needed to be followed up with PCA. Therefore, pain assessment and analgesic consumption may not be optimal. The amount of analgesic consumed was determined according to the amount administered under a nurse's supervision and the patient's pain scores. Other conditions may affect patients' gastrointestinal motility (such as chewing gum). In addition, patient records cover the first 24 hours.

CONCLUSION

In conclusion, TAP block pain scores and analgesic requirements are reduced in pain control of patients who had a cesarean section under spinal anesthesia. In addition, we think it can contribute to the return of gastrointestinal motility with early mobilization, which is also emphasized in ERAS protocols because it contributes to pain palliation and reduces the amount of systemic opioids consumed.

Ethics Committee Approval: The study was approved by the Ethics Committee of Kanuni Sultan Süleyman Training and Research Hospital (06.07.2022, 166).

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REFERENCES

1. Sinatra R. Causes and consequences of inadequate management of acute pain. *Pain Med.* 2010;11(12):1859-71.
2. McDonnell NJ, Keating ML, Muchatuta NA, Pavy TJ, Paech MJ. Analgesia after caesarean delivery. *Anaesth Intensive Care.* 2009;37(4):539-51.
3. Mankikar MG, Sardesai SP, Ghodki PS. Ultrasound guided transversus abdominis plane block for postoperative analgesia in patients undergoing caesarean section. *Indian J Anaesth.* 2016;60(4):253-7
4. Tan TT, Teoh WH, Woo DC, Ocampo CE, Shah MK, Sia AT. A randomised trial of the analgesic efficacy of ultrasound-guided transversus abdominis plane block after caesarean delivery under general anesthesia. *Eur J Anaesthesiol.* 2012;29(2):88-94.
5. Çetin Arslan H, Arslan K. Eras management in obstetric and gynecological interventions. In: Demir C, editor. *Obstetrics and Gynecology II.* Ankara: Akademisyen Publishing House; 2022. p.57-62.
6. Oksar M, Koyuncu O, Turhanoglu S, Temiz M, Oran MC. Transversus abdominis plane block as a component of multimodal analgesia for laparoscopic cholecystectomy. *J Clin Anesth.* 2016;34:72-8.
7. Edney JC, Lam H, Raval MV, Heiss KF, Austin TM. Implementation of an enhanced recovery program in pediatric laparoscopic colorectal patients does not worsen analgesia despite reduced perioperative opioids: a retrospective, matched, non-inferiority study. *Reg Anesth Pain Med.* 2019;44(1):123-9.
8. Sahin ÖF, Aksoy Y, Kaydu A, Gökçek E. The effect of bilateral TAP block administration on analgesic consumption in cesarean operations under spinal anesthesia. *Ortadoğu Tıp Derg.* 2018;10(2):149-53. Turkish.
9. Aydogmus M, Sinikoglu S, Naki M, Ocak N, Sanlı N, Alagol A. Comparison of analgesic efficiency between wound site infiltration and ultra-sound-guided transversus abdominis plane block after cesarean delivery under spinal anaesthesia. *Hippokratia.* 2014;18(1):28-31.
10. Hebbard P. Subcostal transversus abdominis plane block under ultrasound guidance. *Anesth Analg.* 2008;106(2):674-5.
11. Kalisch BJ, Lee S, Dabney BW. Outcomes of inpatient mobilization: a literature review. *J Clin Nurs.* 2014;23(11-12):1486-501.
12. Pereira Gomes Morais E, Riera R, Porfirio GJ, Macedo CR, Sarmento Vasconcelos V, Souza Pedrosa A, et al. Chewing gum for enhancing early recovery of bowel function after caesarean section. *Cochrane Database Syst Rev.* 2016;10(10):CD011562.
13. Small C, Laycock H. Acute postoperative pain management. *Br J Surg.* 2020;107(2):e70-80.
14. Beverly A, Kaye AD, Ljungqvist O, Urman RD. Essential elements of multimodal analgesia in enhanced recovery after surgery (ERAS) guidelines. *Anesthesiol Clin.* 2017;35(2):e115-43.
15. Baaj JM, Alsatli RA, Majaj HA, Babay ZA, Thallaj AK. Efficacy of ultrasound-guided transversus abdominis plane (TAP) block for post-caesarean section delivery analgesia. *Middle East J Anaesthesiol.* 2010;20(6):821-6.

16. Cansiz KH, Yedekçi AE, Sen H, Ozkan S, Dagli G. The effect of ultrasound guided transversus abdominis plane block for cesarean delivery on postoperative analgesic consumption. *Gulhane Med J.* 2015;57(2):121-4.
17. Belavy D, Cowlshaw PJ, Howes M, Phillips F. Ultrasound guided transversus abdominis plane block for analgesia after caesarean delivery. *Br J Anaesth.* 2009;103(5):726-30.
18. El-Dawlatly AA, Turkistani A, Kettner SC, Machata AM, Delvi MB, Thallaj A, et al. Ultrasound-guided transversus abdominis plane block: Description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy. *Br J Anaesth.* 2009;102(6):763-7.
19. Wu CL, King AB, Geiger TM, Grant MC, Grocott MPW, Gupta R, et al. American Society for Enhanced Recovery and Perioperative Quality Initiative Joint Consensus Statement on perioperative opioid minimization in opioid-Naïve patients. *Anesth Analg.* 2019;129(2):567-7.
20. Allen BFS, Jablonski PM, McEvoy MD, Ehrenfeld JM, Shi H, King AB, et al. Implementation of an Enhanced Recovery Protocol (ERP) is associated with an increase in the perioperative use of non-opioid multimodal analgesia for non-ERP patients. *J Clin Anesth.* 2020;62:109694.
21. Colvin LA, Bull F, Hales TG. Perioperative opioid analgesia-when is enough too much? A review of opioid-induced tolerance and hyperalgesia. *Lancet.* 2019;393(10180):1558-68.
22. Meylan N, Elia N, Lysakowski C, Tramèr MR. Benefit and risk of intrathecal morphine without local anaesthetic in patients undergoing major surgery: meta-analysis of randomized trials. *Br J Anaesth.* 2009;102(2):156-67.
23. Zhang L, Jia Z, Gao T, Wang Y, Zhao Y, Li J, et al. A randomized controlled trial evaluating the effects of transversus abdominis plane block with compound lidocaine hydrochloride injection on postoperative pain and opioid consumption and gastrointestinal motility in patients undergoing gynecological laparotomy. *Front Mol Neurosci.* 2023;16:967917.
24. Srivastava U, Verma S, Singh TK, Gupta A, Saxena A, Jagar KD, et al. Efficacy of trans abdominis plane block for post cesarean delivery analgesia: A double-blind, randomized trial. *Saudi J Anaesth.* 2015;9(3):298-302.
25. Farooq M, Carey M. A case of liver trauma with a blunt regional anesthesia needle while performing transversus abdominis plane block. *Reg Anesth Pain Med.* 2008;33(3):274-5.
26. Lancaster P, Chadwick M. Liver trauma secondary to ultrasound-guided transversus abdominis plane block. *Br J Anaesth.* 2010;104(4):509-10.
27. Mukhtar K, Singh S. Transversus abdominis plane block for laparoscopic surgery. *Br J Anaesth.* 2009;102(1):143-4.
28. El-Boghdadly K, Pawa A, Chin KJ. Local anesthetic systemic toxicity: current perspectives. *Local Reg Anesth.* 2018;11:35-44.