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Transversalis Fascia Plane Block Compared with Transversus Abdominis Plane Block for Postoperative Analgesia in Cesarean Section Under Spinal Anesthesia: A Retrospective Study

Spinal Anestezi Altında Sezaryen Doğumda Postoperatif Analjezi için Transversalis Fasya Plan Bloğunun Transversus Abdominis Plan Bloğuyla Karşılaştırılması: Retrospektif Bir Çalışma

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ABSTRACT

Objective: Transversalis fascia plane (TFP) and transversus abdominis plane (TAP) blocks are used for postoperative analgesia in many lower abdominal procedures such as cesarean section. This study aimed to retrospectively compare the postoperative effects of TFP and TAP blocks for postoperative multimodal analgesia in patients who underwent cesarean section under spinal anesthesia.

Methods: We retrospectively searched electronic medical records to identify patients who underwent cesarean section under spinal anesthesia between November 2021 and June 2022. A total of 497 patients were identified, and 120 patients were included that meet our criteria in our analysis. The patients were divided into three groups: TFP, TAP, and control. Data were obtained from the files of the patients.

Results: The block groups had significantly lower numeric rating scale (NRS) scores, less non-steroidal anti-inflammatory drug consumption, and lower complications than the control group. No opioid consumption was observed in the block groups. Although no non-steroidal anti-inflammatory drug consumption until the 4th hour and no opioid consumption until the 8th hour were observed in the control group, the need for additional analgesics increased as time passed. While the TFP group needed analgesics later than the TAP group, the NRS scores and total analgesic consumption were lower ($p<0.001$). Patient satisfaction was higher in the block groups than in the control group ($p<0.001$).

Conclusion: Transversalis fascia plane and TAP blocks are effective as part of multimodal analgesia in cesarean section. The TFP block is superior to the TAP block in terms of pain scores, additional analgesic requirements, and patient satisfaction.

Keywords: Cesarean section, postoperative pain, ultrasound-guided regional anesthesia, transversus abdominis plane block, transversalis fascia plane block

ÖZ

Amaç: Transversalis fasya plan (TFP) ve transversus abdominis plan (TAP) blokları, sezaryen gibi birçok alt karın ameliyatında postoperatif analjezi amacıyla kullanılmaktadır. Bu çalışmada, spinal anestezi altında sezaryen operasyonu geçiren hastalarda postoperatif multimodal analjezi için TFP ve TAP bloklarının postoperatif etkilerinin retrospektif olarak karşılaştırılması amaçlandı.

Yöntem: Kasım 2021 ile Haziran 2022 arasında spinal anestezi altında sezaryen operasyonu geçiren hastaları belirlemek için elektronik tıbbi kayıtları geriye dönük olarak araştırdık. Toplam 497 hasta belirlendi ve kriterlerimizi karşılayan 120 hasta analizimize dahil edildi. Hastalar TFP, TAP ve kontrol olmak üzere üç gruba ayrıldı. Veriler hastaların dosyalarından elde edildi.

Bulgular: Blok grupları, kontrol grubuna göre önemli ölçüde daha düşük sayısal derecelendirme ölçeği (NRS) skorlarına, daha az steroidal olmayan anti-inflamatuar ilaç tüketimine ve daha düşük komplikasyonlara sahipti. Blok gruplarında opioid tüketimi gözlenmedi. Kontrol grubunda 4. saate kadar nonsteroid antiinflamatuar ilaç tüketimi, 8. saate kadar opioid tüketimi görülmemesine rağmen zaman geçtikçe ek analjezik ihtiyacı arttı. Transversalis fasya plan grubu analjeziklere TAP grubuna göre daha geç ihtiyaç duyarken, NRS skorları ve toplam analjezik tüketimi daha düşüktü ($p<0,001$). Blok gruplarında hasta memnuniyeti kontrol grubuna göre daha yüksekti ($p<0,001$).

Sonuç: Transversalis fasya plan ve TAP blokları sezaryen doğumda multimodal analjezinin bir parçası olarak etkilidir. Transversalis fasya plan bloğu ağrı skorları, ek analjezik gereksinimleri ve hasta memnuniyeti açısından TAP bloğundan üstündür.

Anahtar sözcükler: Sezaryen, postoperatif ağrı, ultrason eşliğinde rejyonal anestezi, transversus abdominis plan bloğu, transversalis fasya plan bloğu

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INTRODUCTION

Childbirth is an intensely painful and complex experience, accompanied by feelings of happiness and anxiety for a woman. Advancements in surgical and anesthetic techniques have played a significant role in making cesarean section the preferred mode of delivery (1,2).

Today, neuraxial anesthesia, especially spinal anesthesia alone, is the most preferred and simple technique in cesarean section. However, this choice may vary depending on the mother's preference, obstetric reasons, and the anesthesiologist's experience (3,4).

A significant proportion of women experience severe postpartum pain after cesarean section, which may delay recovery and return to normal daily activities, reduce the quality of neonatal care, including breastfeeding, by disrupting the mother-infant bond, and affect the psychosocial well-being of the mother (4,5).

The use of intrathecal long-acting opioids is considered a cornerstone for cesarean section pain management. However, practitioners may not choose opioids due to their well-known undesirable side effects (2,4,6,7). Recently, the application of peripheral nerve blocks has increased due to the widespread use of ultrasound among anesthesiologists and the avoidance of opioids in a multimodal analgesic strategy (8-10). Erector spinae plane (ESP), quadratus lumborum (QL), transversus abdominis plane (TAP), and transversalis fascia plane (TFP) blocks have been reported to be effective in managing cesarean section pain (7,8,11). However, evidence to determine which technique is more effective is insufficient.

This study aimed to retrospectively compare the effectiveness of ultrasound-guided TFP and TAP blocks for postpartum analgesia in patients who underwent cesarean section under spinal anesthesia at our institution primarily focusing on postoperative additional analgesic consumption. Our secondary objectives were to investigate the time to first analgesic request, patients' pain levels, complications, and patient satisfaction.

MATERIAL and METHODS

Patients and Data Collection

A total of 497 patients who underwent elective cesarean section using the Pfannenstiel method under spinal anesthesia between November 1, 2021, and June 1, 2022, were retrospectively evaluated. Patients who had an American Society of Anesthesiologists (ASA) physical status score <3, had a body mass index (BMI) <35 kg m^{-2}, had a cesarean section under spinal anesthesia in elective conditions and with or without TFP or TAP blocks were included in the study. All patients (n=497) who met the inclusion criteria and reached the data of all patients in 6 months were included in our study even though the sample size was determined 99 participants using an a priori power analysis with the G-power program (12).

Patients who had an ASA physical status score ≥3, had a BMI ≥35 kg m^{-2}, had a cesarean section under general anesthesia, had more than one surgical intervention in the same session, had a pregnancy-related disease, had a mental disorder, had an emergency cesarean section, had insufficient or missing data, and refused to participate were excluded from this study (Figure 1). After applying the exclusion criteria, 120 patients were analyzed and divided coincidentally, equally into the TAP block group (TAP group, n=40), the TFP block group (TFP group, n=40), and the spinal anesthesia group (control group, n=40).

This study was approved by the local institutional review board of the Ethical Committee for Clinical Research of the Suleyman Demirel Universitiy, Faculty of Medicine (Date: June 20, 2022, Decision number: 13/180, chairman of ethics committee: Mekin Sezik). Written informed consent was obtained from the patients.

Demographic data, including age, BMI, comorbidity, and the ASA physical status, were collected from preoperative anesthesia evaluation forms. The time to first analgesic request, the analgesic consumption in the postpartum 24 h, the numeric rating scale (NRS) scores of movement and rest in the postpartum 24 h, and complications were also obtained by examining the anesthesia, algology, nursing assessment forms and the hospital's data processing system. The recorded NRS scores were grouped by getting the mean values at the 0–4, 4–8, 8–12, and 12–24 h intervals, respectively. The number of patients using non-steroidal anti-inflammatory drugs and opioids at the same time intervals was also determined. Patient satisfaction was assessed using a 5-point Likert scale by phone (very poor, poor, moderate, very good, and excellent).

Based on the data obtained from the anesthesia follow-up forms, it was determined that the same dose and volume of local anesthetic agent (20 mL, 0.25% bupivacaine solution) were administered to all patients who performed plane blocks, and intrathecal morphine was not used in any patients. The examination of the nursing assessment forms showed that all patients were routinely administered 4 g of paracetamol intravenously per day. Additionally, it was determined that 50 mg of dexketoprofen was given to those with an NRS score of 4-5 and 50 mg of tramadol to those with an NRS score of 6 and above, whether plane blocks were performed or not.

Statistical Analysis

Statistical analysis was performed using the Statistical Pack-

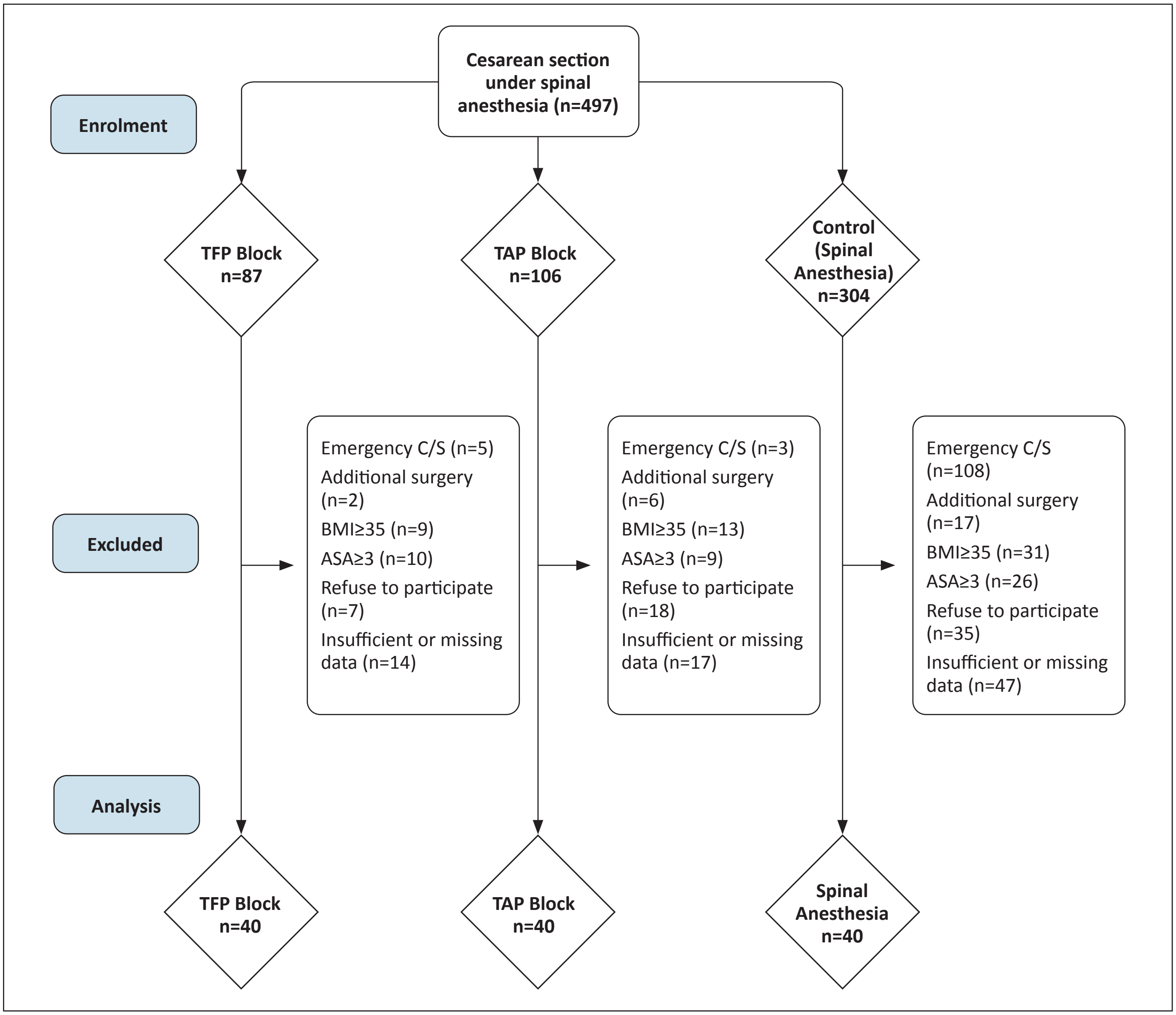

Figure 1: Flow diagram of the retrospective study design. **TFP:** Transversalis fascia plane, **TAP:** Transversus abdominis plane, **BMI:** Body mass index, **ASA:** American Society of Anesthesiologists, **C/S:** Cesarean section.

age for the Social Sciences version 26 (IBM Corp., Armonk, NY, USA). The normality assumption was examined using the Kolmogorov–Smirnov test. Normally distributed continuous variables were compared using a one-way analysis of variance, and non-normally distributed continuous and ordinal variables were compared using the Kruskal–Wallis test. Categorical variables were compared using the chi-square or Fisher exact test. Data were presented as the number of patients, mean ± standard deviation, or median (min–max). The statistical significance threshold was set at p<0.05.

RESULTS

Of the 497 patients enrolled in this study, 377 were excluded, and data from the remaining 120 patients were analyzed. No statistically significant differences in the demographic data were observed between groups (Table I).

The NRS scores at rest and during movement at 0–4, 4–8, 8–12, and 12–24 h intervals were significantly higher in the control group than in the TAP and TFP groups (all $p<0.001$). No significant differences in the NRS scores at rest and during movement at the 0–4 h interval were observed between the TFP and TAP groups. However, the NRS scores at rest and during movement at the 4–8, 8–12, and 12–24 h intervals were significantly lower in the TFP group than in the TAP group (all $p<0.001$) (Table II). The NRS scores could not be reached after 24 h.

Table I: Patient Demographics

	TFP group Mean ± SD	TFP group Median (min-max)	TAP group Mean ± SD	TAP group Median (min-max)	Control group Mean ± SD	Control group Median (min-max)	P
Age (years)	29.13 ± 5.97	30 (19-40)	30.55 ± 6.04	30 (20-43)	30.70 ± 7.01	29 (19-43)	0.599*
BMI (kg m^{-2})	28.50 ± 2.78	28.5 (22-34)	28.62 ± 3.23	28 (24-34)	28.37 ± 2.90	28 (23-34)	0.978*
	Yes/No		**Yes/No**		**Yes/No**		
Comorbidity (n)	8/32		10/30		11/29		0.548†

*Kruskal–Wallis test; †chi-square test. **BMI:** Body mass index, **SD:** Standard deviation, **TFP:** Transversalis fascia plane, **TAP:** Transversus abdominis plane.

Table II: Average NRS Scores at Rest and During Movement

	TFP group Median (min–max)	TAP group Median (min–max)	Control group Median (min–max)	P
At rest				
0-4 h	0 (0-0)[a]	0 (0-1)[a]	1 (0–2)[b]	<0.001†
4-8 h	0 (0-1)[a]	1 (0-1)[b]	2 (1–4)[c]	<0.001†
8-12 h	1 (0–2)[a]	2 (1–3)[b]	3 (2-3)[c]	<0.001†
12-24 h	1 (0–3)[a]	2 (1–4)[b]	4 (2–5)[c]	<0.001†
On movement				
0-4 h	0 (0-0)[a]	0 (0-1)[a]	2 (0–3)[b]	<0.001†
4-8 h	0 (0–2)[a]	1 (0–2)[b]	4 (2–6)[c]	<0.001†
8-12 h	1 (0–2)[a]	2 (1–4)[b]	3 (2–7)[c]	<0.001†
12-24 h	2 (0–4)[a]	3 (2–5)[b]	5 (3–7)[c]	<0.001†

†Chi-Square test; [a,b,c]Post-hoc analysis. **SD:** Standard deviation, **BMI:** Body mass index, **TFP:** Transversalis fascia plane, **TAP:** Transversus abdominis plan, **NRS:** Numeric rating scale.

All patients in the control group consumed no analgesics in the first 4 h. In the block groups, no patient consumed tramadol up to postpartum 24 h. It was found that the TAP and TFP groups did not consume dexketoprofen until the 8th and 12th h, respectively. Between the 4-8 h, 82% of patients in the control group consumed dexketoprofen (n=33, p<0.001). Between 8-12 h, significantly fewer patients consumed dexketoprofen only in the TFP group than in the control group (p=0.009). Between 12-24 h, the TFP group consumed significantly less dexketoprofen than the TAP and control groups (respectively p=0.003; p<0.001). After the 8th h, it was determined that the control group consumed significantly more tramadol than the block groups (respectively p=0.017; p<0.001; p<0.001).

The time to first analgesic request was significantly longer in the TFP group than in the control and TAP groups (all p<0.001) (Table III). No postoperative complications were observed in the TFP group. The incidence of hypotension (15%) and postoperative nausea and vomiting (PONV) (40%) was significantly higher in the control group than in the block groups (p<0.001; p<0.001) (Table IV).

Regarding patient satisfaction, the block groups were significantly better than the control group (p<0.001). Additionally, the TFP group was significantly more satisfied than the TAP group (*p*<0.001) (Table V). No dissatisfaction was observed in the block groups. However, only one patient in the TAP group stated that her satisfaction was moderate.

DISCUSSION

In this retrospective study, examining patient satisfaction, time to first analgesic request, and NRS scores showed that the TFP block provided better analgesia than the TAP block. In contrast, they were found to have a similar effect regarding opioid consumption in the first 24 h postoperatively.

Although cesarean delivery is associated with a more extended hospital stay and higher cost than vaginal delivery, the cesarean delivery rates have increased by up to 32% in the last decade. This increase may be due to the fear of deterioration of the pelvic anatomy of the patients, the perception that cesarean section is safer, and the expectation of not hav-

Table III: Patients Who Required Rescue Analgesia

	TFP group Mean ± SD	TAP group Mean ± SD	Control group Mean ± SD	P
Time to first analgesic request (h)	27.28 ± 2.14[a]	22.28 ± 3.96[b]	7.35 ± 1.21[c]	<0.001‡
NSAID consumption	**TFP group n (%)**	**TAP group n (%)**	**Control group n (%)**	**P**
0–4 h	0 (0%)	0 (0%)	0 (0%)	-
4–8 h	0 (0%)[a]	0 (0%)[a]	33 (82%)[b]	<0.001†
8–12 h	0 (0%)[a]	2 (5%)[a]	7 (17%)[b]	0.009†
12–24 h	2 (5%)[a]	18 (45%)[b]	40 (100%)[c]	<0.001†
Opioid consumption				
0–4 h	0 (0%)	0 (0%)	0 (0%)	-
4–8 h	0 (0%)[a]	0 (0%)[a]	2 (5%)[b]	0.017†
8–12 h	0 (0%)[a]	0 (0%)[a]	9 (22%)[b]	<0.001†
12–24 h	0 (0%)[a]	0 (0%)[a]	18 (45%)[b]	<0.001†

†Chi-Square test; ‡one-way analysis of variance; [a,b,c]Post-hoc analysis. **NSAID:** Non-steroidal anti-inflammatory drug, **SD:** Standard deviation, **BMI:** Body mass index, **TFP:** Transversalis fascia plane, **TAP:** Transversus abdominis plane, **h:** hour.

Table IV: Complications Seen in Patients

	TFP group n (%)	TAP group n (%)	Control group n (%)	P
PONV	0 (0%)[a]	1 (2,5%)[a]	16 (40%)[b]	
Hypotension	0 (0%)[a]	0 (0%)[a]	6 (15%)[b]	<0.001†
Dizziness	0 (0%)[a]	1 (2.5%)[a]	2 (5%)[a]	

†Chi-square test; [a,b,c]Post-hoc analysis. **PONV:** Postoperative nausea and vomiting, **TFP:** Transversalis fascia plane, **TAP:** Transversus abdominis plane.

Table V: Patient Satisfaction

	TFP group n (%)	TAP group n (%)	Control group n (%)	P
Excellent	38 (95%)[a]	29 (72.5%)[b]	0 (0%)[c]	
Very good	2 (5%)[a]	10 (25%)[b]	0 (0%)[a]	
Moderate	0 (0%)[a]	1 (2.5%)[a]	14 (35%)[b]	<0.001†
Poor	0 (0%) [a]	0 (0%) [a]	14 (35%) [b]	
Very poor	0 (0%) [a]	0 (0%) [a]	12 (30%) [b]	

†Chi-square test; [a,b,c]Post-hoc analysis. **TFP:** Transversalis fascia plane, **TAP:** Transversus abdominis plane.

ing labor pain (13). Within the scope of enhanced recovery after surgery protocols, which aim to optimize postpartum outcomes, neuraxial blocks are considered the preferred anesthesia method in cesarean section, and multimodal analgesia methods that minimize opioid use as much as possible in terms of perioperative analgesia are preferred (14).

Current guidelines recommend low-dose long-acting neuraxial opioids for post-cesarean analgesia (7,14). However, practitioners avoid opioid use, as at our institution. A randomized controlled study by Kupiec et al., which showed that the TAP block is effective in cesarean section, revealed that all patients were operated on under spinal anesthesia (15). They did not use intrathecal opioids due to insufficient follow-up and possible complications that opioids may cause. Furthermore, Tulgar and Serifsoy reported that they did not use additional opioids in spinal anesthesia in their cases (16,17). They reported that the TFP block was influential in the cesarean section for the first time in the literature. In our study, intrathecal opioids were not used in any of the patients who underwent cesarean section under spinal anesthesia. This may be due to the prejudice and fear that opioid use in the postoperative period may cause annoying side effects, such as PONV, pruritus, sedation, respiratory depression, and urinary retention, in the patients and delay discharge. Interfacial plane blocks are frequently applied in lower abdominal surgeries, including cesarean section. Previous meta-analyses found that regional techniques, such as wound infiltration, TAP block, and QL block, did not provide an additional analgesic benefit when used with neuraxial opioids but had significant benefits in the absence of long-acting neuraxial opioids (18,19).

At our institution, cesarean section is routinely performed via a Pfannenstiel incision. The applied regional blocks should target both visceral and somatic components of pain to provide adequate postoperative analgesia. For superior post-cesarean analgesia, sensory blockade of all subcostal, iliohypogastric, and ilioinguinal nerves is required, and the TAP block may be insufficient to provide this (8,16,20). Lee et al. indicated that the L1 (iliohypogastric and ilioinguinal) nerve was merely blocked in half of the cases in the TAP block (21). Khanna et al. compared the efficacy of QL and TAP blocks in cesarean section with spinal anesthesia without opioids and found that the QL block was significantly better than the TAP block regarding the number of patients requiring rescue analgesia (15% vs. 75%). Furthermore, they found significant differences in favor of the QL block regarding the time to first rescue analgesia (22). A prospective randomized study comparing ESP and TAP blocks in patients undergoing cesarean section with spinal anesthesia without opioids showed that ESP block is better than ESP block regarding the time to first rescue analgesia and the total analgesic requirement (23). In this study, the TFP block was significantly better than the TAP block regarding the time to first analgesic request and NRS scores between the 4^{th} and 24^{th} h. Patient satisfaction was also better in the TFP block group. Techniques such as QL, ESP, and TFP blocks may be superior to the TAP block because local anesthetics can spread to the paravertebral space and relieve somatic and visceral pain.

Although the TFP block, first described by Hebbard in 2009, is considered a variant of QL block-1, it differs in terms of application point and spread of local anesthetics (20,24,25). However, the superiority of these two techniques against each other has not been demonstrated. Some studies have reported that the TFP block is technically easier for reasons such as its application in the supine position and the use of a linear probe (25-27). However, in this study, we did not find any data showing the technical ease of the procedures.

The analgesic effect of the TFP block has been demonstrated in different types of surgeries and age groups (16,24,28-30). However, few studies have demonstrated this effect in cesarean section. Serifsoy et al. found that the TFP block in the first 24 h significantly reduced the analgesia requirement in patients who underwent cesarean section under general anesthesia (20). Aydin et al. also showed that the TFP block decreased opioid consumption for 24 h compared with placebo in the cesarean section under spinal anesthesia and increased patient satisfaction (11). These results were consistent with those of this study. Chilkoti et al. compared the TFP block with wound infiltration in terms of both acute and chronic post-cesarean section pain and found that the TFP block was more effective in the first 24 h period (31). This result is consistent with that found in this study. Although they did not find statistical significance, a reduction in neuropathic pain and improved quality of life were observed with the TFP block in the chronic period. In this study, we could not access long-term data after discharge.

In contrast to this study, Lopez-Gonzalez et al. found that TFP and TAP blocks were equally effective regarding analgesic efficacy and ease of procedure in patients with unilateral inguinal hernia surgery (30). Additionally, they reported that a higher level of sensory block was achieved in the TFP group. This may be due to the differences in the incision type in the operations. The TFP block primarily targets the anterior and lateral cutaneous branches of the T12 and L1 intercostal nerves. Since more proximal lateral branches will be blocked with TFP block, subcostal, ilioinguinal, and iliohypogastric nerves are more likely to be blocked than TAP block (Figure 2 and 3). Rahimzadeh et al. compared the TFP block with the TAP block in patients who underwent cesarean section with spinal anesthesia and found no significant difference in terms of the time to first analgesic request, visual analog scale scores in the first 36 h postoperatively, and patient satisfaction (32). This difference with the study of Rahimzadeh et al. may be due to the fact that the volumes of local anesthetics used were not the same (15 mL vs. 20 mL). In this study, the NRS scores after the 4^{th} h were significantly higher in the TAP group than in the TFP group. The TFP block was also significantly better than the TAP block in terms of time to first analgesic request. Although no patients were dissatisfied with the block groups in the study, it was found that patients with the TFP block were more satisfied than those with the TAP block. Additionally, although opioids were not needed in the first 24 h postpartum in the block groups, patients with the TAP block consumed significantly more dexketoprofen after the 4^{th} h.

Regarding complications in patients with the TFP block, which is a newer block than the TAP block, we encountered only one case in the literature reporting that hip flexor and quadriceps weakness developed in the postoperative period (33). In this study, we did not encounter any complications recorded in the TFP group, whereas one patient in the TAP group had

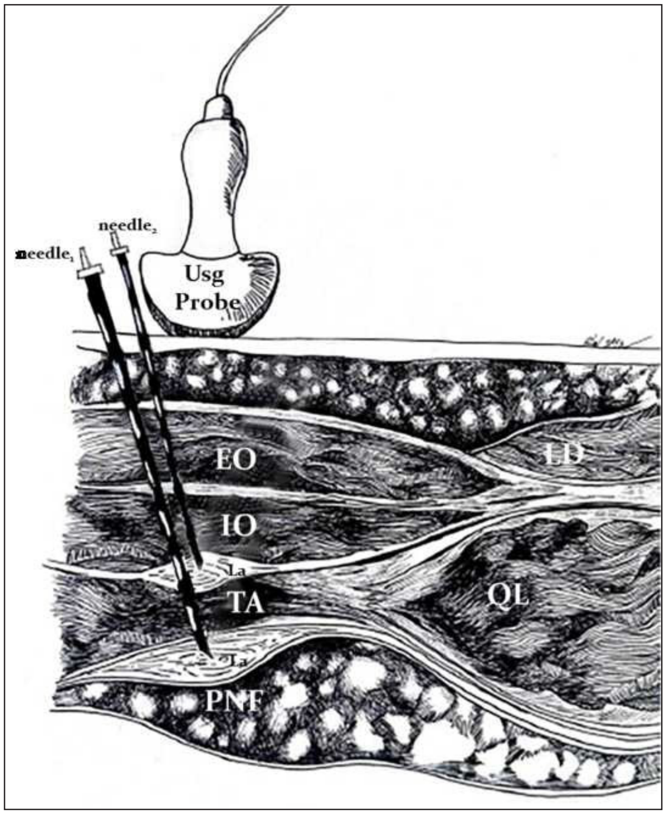

Figure 2: Anatomical drawings of muscle planes during trasnversalis fascia plane block and transversus abdominis plane block executions. Needle$_1$ tip indicates transversalis fascia plane block and needle$_2$ tip indicates transversus abdominin plane block. **EO:** external oblique muscle, **IO:** internal oblique muscle, **TA:** transversus abdominis muscle, **LD:** latissimus dorsi muscle, **QL:** quadratus lumborum muscle, **PNF:** perinephric fat tissue, **La:** local anesthetic.

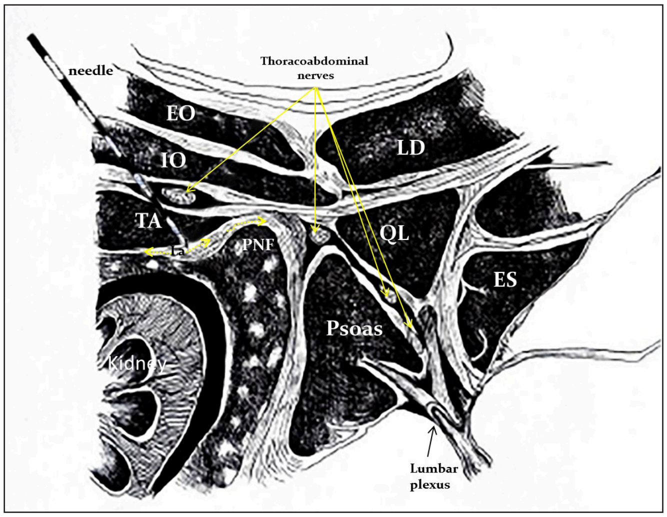

Figure 3: Indicates the injection point of transversalis fascia plane block and local anesthetic spread between transversus abdominis muscle and its eclosing transversalis fascia. **EO:** External oblique muscle. **IO:** Internal oblique muscle. **TA:** Transversus abdominis muscle. **PNF:** Perinephric fat tissue. **QL:** Quadratus lumborum muscle. **ES:** Erector spinae muscle. **LD:** Latissimus dorsi muscle.

PONV, and one patient had dizziness. Additionally, significantly higher PONV and hypotension rates were observed in the control group. We expected a higher rate of hypotension, especially in the patients in the TFP group, due to the possibility of local anesthetic spreading in the paravertebral space and causing sympathetic blockade, but we concluded that insufficient analgesia was the cause of it being higher in the control group.

This study had some limitations regarding its retrospective design. The total evaluated sample size was small due to strict exclusion criteria. Although reaching equal groups in retrospective studies is not common, our study demonstrated this feature without manipulation. Insufficient data and the fact that the pain follow-up forms were not recorded until the patients were discharged caused difficulties. Therefore, NRS scores and analgesic consumption after 24 h could not be evaluated. Additionally, data on the ease of application of the blocks, especially the approach with which the TAP block was made, could not be reached from the follow-up forms.

CONCLUSION

In conclusion, although the TFP block is better than the TAP block, both blocks can be considered effective in preventing opioid consumption and achieving high patient satisfaction rates. Further studies with larger sample sizes and long-term follow-up are needed to show which block is more effective. Providing analgesia with spinal anesthesia without opioids could be improper and old-fashioned. Multimodal opioid-sparing analgesia methods performed by applying truncal blocks seem to be the sine qua non for cesarean section.

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AUTHOR CONTRIBUTIONS

Conception or design of the work: AK, MSO
Data collection: AK, MSO, ESO
Data analysis and interpretation: GI, FAS
Drafting the article: MSO, GI
Critical revision of the article: MSO, FAS, PK
The author (AK, MSO, GI, ESO, FAS, PK) reviewed the results and approved the final version of the manuscript.

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