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In Major Abdominal Surgeries, For Postoperative Analgesia, Should ESP Block or TAB Block Be Used?

Büyük Karın Ameliyatlarında, Postopertif Analjezisi İçin Esp Blok mu Yoksa Tab Blok mu Kullanılmalıdır?

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ABSTRACT

Background: Postoperative pain management is a fundamental component of perioperative care. In major abdominal surgery, the transversus abdominis plane (TAP) block and the erector spinae plane (ESP) block are increasingly used as components of multimodal analgesia. This study aimed to compare the postoperative analgesic efficacy of ESP block and TAP block in patients undergoing major open abdominal surgery.

Materials and Methods: Demographic characteristics, postoperative pain scores, analgesic consumption, postoperative nausea and vomiting (PONV), time to first analgesic request, mobilization time, time to oral intake, discharge time, adverse events, and patient satisfaction were retrospectively recorded for patients who underwent major abdominal surgery and received either an ESP or a TAP block.

Results: The ESP group had lower unadjusted maximum VAS scores at rest VAS scores during the first 24 postoperative hours and lower maximum VAS scores during movement than the TAP group. However, because preoperative baseline pain numerical rating scale differed significantly between groups, a baseline-adjusted (rank ANCOVA) analysis was performed; after adjustment, the resting VAS difference was no longer statistically significant, and the movement VAS difference was of borderline significance. A group-by-time interaction was significant for resting VAS but not for movement VAS. In the ESP group, tramadol requirements were lower; the time to first analgesic request was longer; mobilization and oral intake occurred earlier; antiemetic use was lower; and late PONV (6–24 h) was less frequent. Patient satisfaction and time to discharge did not differ significantly between groups. After Bonferroni correction for multiple time-point comparisons, only the resting VAS differences at 12 and 24 h remained statistically significant.

Conclusion: In this retrospective cohort study, ESP block improved recovery after major open abdominal surgery compared with TAP block, as evidenced by longer time to first analgesic request, lower tramadol use, earlier mobilization, and less late PONV. After adjustment for baseline pain, the unadjusted advantage did not persist for resting pain and remained borderline for movement pain; only the resting pain trajectory differed significantly between groups over time.

Keywords: Erector spinae plane block, transversus abdominis plane block, postoperative analgesia, major abdominal surgery, patient satisfaction

ÖZ

Amaç: Postoperatif ağrı yönetimi perioperatif bakımın temel bileşenlerinden biridir. Büyük karın cerrahilerinde transversus abdominis plan (TAP) bloğu ve erektör spina plan (ESP) bloğu multimodal analjezinin bir parçası olarak giderek daha sık kullanılmaktadır. Bu çalışmada, büyük açık karın cerrahisi uygulanan hastalarda ESP bloğu ile TAP bloğunun postoperatif analjezik etkinliğinin karşılaştırılması amaçlandı.

Gereç ve Yöntemler: Büyük karın cerrahisi geçiren ve ESP veya TAP bloğu uygulanan hastaların demografik özellikleri, postoperatif ağrı skorları, analjezik tüketimi, postoperatif bulantı ve kusma (PONV), ilk analjezik istemine kadar geçen süre, mobilizasyon zamanı, oral alım zamanı, taburculuk zamanı, yan etkiler ve hasta memnuniyeti retrospektif olarak kaydedildi.

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ÖZ

Bulgular: ESP grubunda ilk 24 saatteki düzeltilmemiş maksimum istirahat VAS skoru ve hareket sırasındaki maksimum VAS skoru TAP grubuna göre daha düşüktü; ancak ameliyat öncesi bazal ağrı NRS skorları da gruplar arasında anlamlı farklılık gösterdiğinden, bazal değere göre düzeltilmiş (rank ANCOVA) bir analiz yapıldı. Bu düzeltme ile istirahat VAS farkı istatistiksel anlamlılığını yitirdi, hareket VAS farkı ise sınırda kaldı. Grup×zaman etkileşimi istirahat VAS için anlamlı bulunurken, hareket VAS için anlamlı bulunmadı. Tramadol gereksinimi daha düşük, ilk analjezik istemine kadar geçen süre daha uzun, mobilizasyon ve oral alım daha erken, antiemetik kullanımı daha düşük ve geç dönem PONV (6–24 saat) daha az sıktı. Hasta memnuniyeti ve taburculuk zamanı gruplar arasında anlamlı farklılık göstermedi. Çoklu zaman noktası karşılaştırmaları için Bonferroni düzeltmesi sonrasında, yalnızca 12. ve 24. saatteki istirahat VAS farkları istatistiksel olarak anlamlı kaldı.

Sonuç: Bu retrospektif kohortta, ESP bloğu TAP bloğuna kıyasla analjezik istemini geciktirdiği, tramadol gereksinimini azalttığı, mobilizasyonu hızlandırdığı ve geç PONV'u azalttığı görülmüştür. Bazal ağrı skorları hesaba katıldığında, istirahat ağrısındaki avantajın anlamlılığını yitirdiği, hareket ağrısında ise sınırda kaldığı; sadece istirahat ağrısı seyrinin zaman içinde gruplar arasında anlamlı düzeyde farklılık gösterdiği görüldü.

Anahtar Kelimeler: Erektör spina plan bloğu, transversus abdominis plan bloğu, postoperatif analjezi, büyük karın cerrahisi, hasta memnuniyeti

Introduction

Laparoscopic surgery is increasingly preferred for many abdominal procedures because it is associated with smaller incisions, earlier mobilization, and greater patient satisfaction. Nevertheless, open surgery remains necessary for many major abdominal procedures, including extensive oncologic and gynecologic operations (1-3). Large incisions and the presence of drains may result in pain over a wider area, delayed mobilization, and an increased risk of postoperative complications. Effective postoperative pain management is therefore a fundamental component of perioperative care. With the widespread use of ultrasonography (US), fascial plane blocks, such as the erector spinae plane (ESP) and transversus abdominis plane (TAP) blocks, have been increasingly incorporated into multimodal analgesic strategies for major abdominal surgery.

The TAP block, first described by Rafi (4) in 2001, provides somatic analgesia to the anterior and lateral abdominal wall by targeting the thoracolumbar nerves within the TAP. The ESP block, described by Forero et al. (5) in 2016, is a paraspinal fascial plane block in which local anesthetic spread may extend toward the paravertebral space, potentially providing both somatic and visceral analgesia.

This study aimed to compare ESP block and TAP block with respect to postoperative pain, analgesic requirements, postoperative adverse effects, mobilization, oral intake, discharge time, and patient satisfaction in patients undergoing major open abdominal surgery.

Materials and Methods

Study Design and Patient Population

This retrospective, comparative, observational study included patients aged >18 years with American Society of Anesthesiologists (ASA) physical status II–III who underwent major open abdominal surgery, including surgery for abdominal malignancy, hysterectomy with or without bilateral salpingo-oophorectomy (TAH/TAH-BSO), and surgery for abdominal masses. Patients undergoing laparoscopic surgery, pediatric or pregnant patients, patients with infection at the block site, patients with neurological disorders that could affect pain pathways (e.g., peripheral neuropathy), patients with coagulopathy, patients receiving anticoagulant therapy that could not be discontinued, or patients with severe hepatic or renal failure were excluded. The study included procedures performed between January 1, 2022 and December 31, 2024 following approval by Elazığ Fethi Sekin City Hospital Ethics Committee (meeting number: 2024/5-22, date: 05.12.2024). The study was conducted in accordance with the Declaration of Helsinki and reported in accordance with the STROBE Statement. Written informed consent for the regional anesthesia procedure and its potential risks was obtained before surgery as part of routine clinical care.

Anesthesia Procedure

After completion of surgery, while the patients remained under general anesthesia, the surgical site was disinfected with 10% povidone-iodine and draped using sterile technique. An ultrasound-visible Tuohy needle was used for block administration.

In the ESP block group, bilateral ultrasound-guided ESP blocks were performed at the T8–T9 vertebral level. A total volume of 40 mL of 0.25% bupivacaine (100 mg) was administered bilaterally, with 20 mL injected on each side. A linear ultrasound probe was placed in a parasagittal orientation to identify the erector spinae muscle and the corresponding transverse process. After hydrodissection confirmed the appropriate fascial plane between the erector

spinae muscle and the transverse process, local anesthetic was injected into that plane.

In the TAP block group, a linear ultrasound probe was positioned between the subcostal margin and the iliac crest to visualize the external oblique, internal oblique, and transversus abdominis muscles. After hydrodissection between the internal oblique and transversus abdominis fascial planes, 20 mL of 0.25% bupivacaine (50 mg) was injected on each side, for a total volume of 40 mL (100 mg) per patient.

At the end of surgery, inhalational anesthetics were discontinued and sugammadex was administered to reverse neuromuscular blockade. After adequate recovery of neuromuscular function and spontaneous ventilation, patients were extubated and transferred to the post-anesthesia care unit. Patients with a Modified Aldrete Score of ⩾9 were transferred to the ward. When additional postoperative analgesia was required, paracetamol, morphine, tramadol, and/or dexketoprofen were administered according to the institutional analgesic protocol.

Measurements

Patient demographic characteristics and operative duration were recorded. Mean arterial pressure (MAP) was recorded preoperatively, at the predefined post-block measurements, and at 0, 1, 2, 4, 6, 8, 12, and 24 h postoperatively. Pain intensity was assessed using the visual analog scale (VAS) at rest and during movement at the specified postoperative time points. Data on time to first analgesic request, additional analgesic consumption, patient satisfaction, mobilization time, time to oral intake, discharge time, adverse effects, antiemetic use (ondansetron), and complications were extracted from patient records and the hospital's electronic database. Patient satisfaction with postoperative analgesia was recorded on a 5-point scale, with higher scores indicating greater satisfaction.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). A sample size adequacy calculation was performed using G*Power version 3.1. The primary outcome was defined as the maximum resting VAS score during the first 24 postoperative hours. Using the Wilcoxon–Mann–Whitney test for two independent groups, an assumed medium-to-large standardized effect size of 0.6, anchored to the 24 h postoperative VAS pain-score comparison between ESP and TAP block reported by Elshazly et al. (22) (ESP: 2.10 ± 0.48 vs. TAP: 2.43 ± 0.63; Cohen's d ≈ 0.59), a two-sided α of 0.05, and 80% power, the estimated minimum sample size was 47 patients per group (94 in total). The final analyzed sample comprised 103 patients (51 ESP and 52 TAP), exceeding this minimum. Normality of continuous variables was assessed using the Shapiro–Wilk test. Because most continuous variables deviated from normality, non-parametric tests were used as the primary analytical strategy. Continuous variables are presented as median and interquartile range (IQR). Between-group comparisons were performed using the Mann–Whitney U test, with the standardized test statistic, Z, and two-sided p values reported. An independent-samples t-test was used for the single variable that met the approximate normality assumption (the second post-block MAP measurement). Categorical variables are presented as n (%) and compared using the Pearson chi-square test or Fisher's exact test when expected cell counts were <5. Within-group changes in MAP, resting VAS, and movement VAS across repeated time points were assessed using the Friedman test. Because preoperative baseline pain numerical rating scale (NRS) differed significantly between groups (see Results), a rank-based analysis of covariance (Conover–Iman rank ANCOVA), with baseline NRS as the covariate, was also performed for the two primary analgesic outcomes (maximum resting and maximum movement VAS during the first 24 postoperative hours) to determine whether the unadjusted between-group difference persisted after accounting for this imbalance. A formal group-by-time interaction for resting and movement VAS was tested separately by fitting a two-way mixed-design ANOVA to rank-transformed VAS scores (patient as the repeated-measures unit, group as the between-subjects factor, time as the within-subjects factor). Because Mauchly's test indicated a violation of sphericity for both domains, Greenhouse–Geisser-corrected p values are reported for the interaction term. For the time-point-specific between-group VAS comparisons, Bonferroni correction was applied to account for the number of time points compared within each VAS domain (resting, n = 7; movement, n = 8), and both uncorrected and Bonferroni-corrected p values are reported. A p value <0.05 was considered statistically significant.

Results

A total of 103 patients were included: 51 in the ESP group and 52 in the TAP group. Median age was 58 years (IQR, 17) in the ESP group and 63 years (IQR, 15) in the TAP group; the difference was not statistically significant (U = 1061.5, Z = −1.745, p=0.081). Sex distribution, ASA physical status, comorbidities, and types of surgery were similar between groups (Table 1). The median operative duration was 190 min (IQR, 115) in the ESP group and 147.5 min (IQR, 76.3) in the TAP group, between groups (U = 1572.5, Z = 1.626, p = 0.105).

Table 1. Demographic characteristics and types of surgery according to study groups.

Variable		ESP (n = 51)	TAP (n = 52)	Total (n = 103)	Test statistics	p value
Age median (IQR)		58 (17)	63 (15)	61 (16)	U = 1061.5 Z = −1.745	0.081
Sex, male		19 (37.3%)	18 (34.6%)	37 (35.9%)	χ^2 = 0.078	0.780
ASA	**II**	23 (45.1%)	32 (61.5%)	55 (53.4%)	χ^2 = 2.797	0.094
	III	28 (54.9%)	20 (38.5%)	48 (46.6%)		
Comorbid disease	**HT**	20 (39.2%)	12 (23.1%)	32 (31.1%)	χ^2 = 3.131	0.077
	CAD	4 (7.8%)	2 (3.8%)	6 (5.8%)	Fisher's exact test	0.437
	COPD	10 (19.6%)	19 (36.5%)	29 (28.2%)	χ^2 = 3.649	0.056
	DM	7 (13.7%)	7 (13.5%)	14 (13.6%)	χ^2 = 0.002	0.969
Type of surgery	Abdominal mass	6 (11.8%)	3 (5.8%)	9 (8.7%)	χ^2 = 7.100	0.131
	Other major abdominal surgery	2 (3.9%)	8 (15.4%)	10 (9.7%)		
	Hysterectomy ± BSO	16 (31.4%)	22 (42.3%)	38 (36.9%)		
	Colon cancer	20 (39.2%)	13 (25.0%)	33 (32.0%)		
	Stomach cancer	7 (13.7%)	6 (11.5%)	13 (12.6%)		
Operative duration, min Median (IQR)	Operative duration, min Median (IQR)	190 (115)	147.5 (76.3)		U = 1572.5 Z = 1.626	0.105

Continuous variables are expressed as median (IQR) and categorical variables as n (%).Unless otherwise indicated, the Pearson chi-square test was used. α = 0.05. ESP, erector spinae plane block; TAP, transversus abdominis plane block; ASA, American Society of Anesthesiologists; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; BSO, bilateral salpingo-oophorectomy; HT, hypertension.

MAP changed significantly over time in both groups (Friedman test; p < 0.001 for each group). The second post-block MAP measurement differed significantly between groups (p = 0.005), whereas the remaining between-group MAP comparisons were not statistically significant (all p > 0.05). Overall, the two groups showed broadly similar perioperative hemodynamic patterns (Figure 1).

The maximum resting VAS score during the first 24 postoperative hours was lower in the ESP group than in the TAP group (U = 1006, Z = −2.111, p = 0.027).The maximum VAS score during movement was also lower in the ESP group (U = 971.5, Z = −2.338, p = 0.016).Preoperative baseline pain NRS categories differed significantly between groups (χ^2 = 12.258, p = 0.002),with a greater proportion of patients in the TAP group reporting an NRS score of 0 (73.1% vs. 41.2%). Postoperative tramadol requirements differed between groups (χ^2 = 9.673, p = 0.008); no patient in the ESP group required 200 mg of tramadol, compared with 17.3% of patients in the TAP group. Use of morphine, NSAID, and paracetamol did not differ significantly between groups (all p > 0.05; Table 2).

The time to first analgesic request was significantly longer in the ESP group (U = 1726.5, Z = 2.642, p = 0.008). Mobilization occurred earlier in the ESP group (U = 630, Z = −4.591, p < 0.001), as did oral intake (U = 905.5, Z = −2.774, p = 0.003). Antiemetic use (ondansetron) was lower in the ESP group (χ^2 = 6.229, p = 0.013), and late PONV (6–24 h) was less frequent in the ESP group (χ^2 = 5.113, p = 0.024). Time to discharge did not differ between groups (p = 0.339); patient satisfaction scores were similar (p = 0.135). Pruritus was more frequent in the TAP group (17.3% vs. 2.0%, p = 0.016). Other complications, including infection, hematoma, hypotension, and urinary retention, did not differ significantly between groups (Table 3).

For movement-related VAS scores, the ESP group reported lower pain scores at 0 h (U = 1022.5, p = 0.039) and 8 h (U = 996, p = 0.026), whereas between-group differences at the remaining time points were not statistically significant (Figure 2). Resting VAS scores were lower in the ESP group at 0 h (U = 961, p = 0.012), 6 h (U = 975.5, p = 0.018), 12 h (U = 873.5, p = 0.002), and 24 h (U = 668.5, p < 0.001) (Figure 3). After Bonferroni correction for the number of time points compared within each VAS domain, only the resting VAS differences at 12 h (corrected p = 0.015) and 24 h (corrected p < 0.001) remained statistically significant; the resting VAS differences at 0 h and 6 h and all movement VAS time-point differences (including 0 h and 8 h) no longer reached significance after correction (all corrected p > 0.08). Within-group Friedman analyses demonstrated significant changes over time in resting and movement VAS scores and MAP in both groups (Table 4).

To address the confounding effect of the baseline NRS imbalance identified above and to formally test whether the two groups' pain trajectories differed over time, two

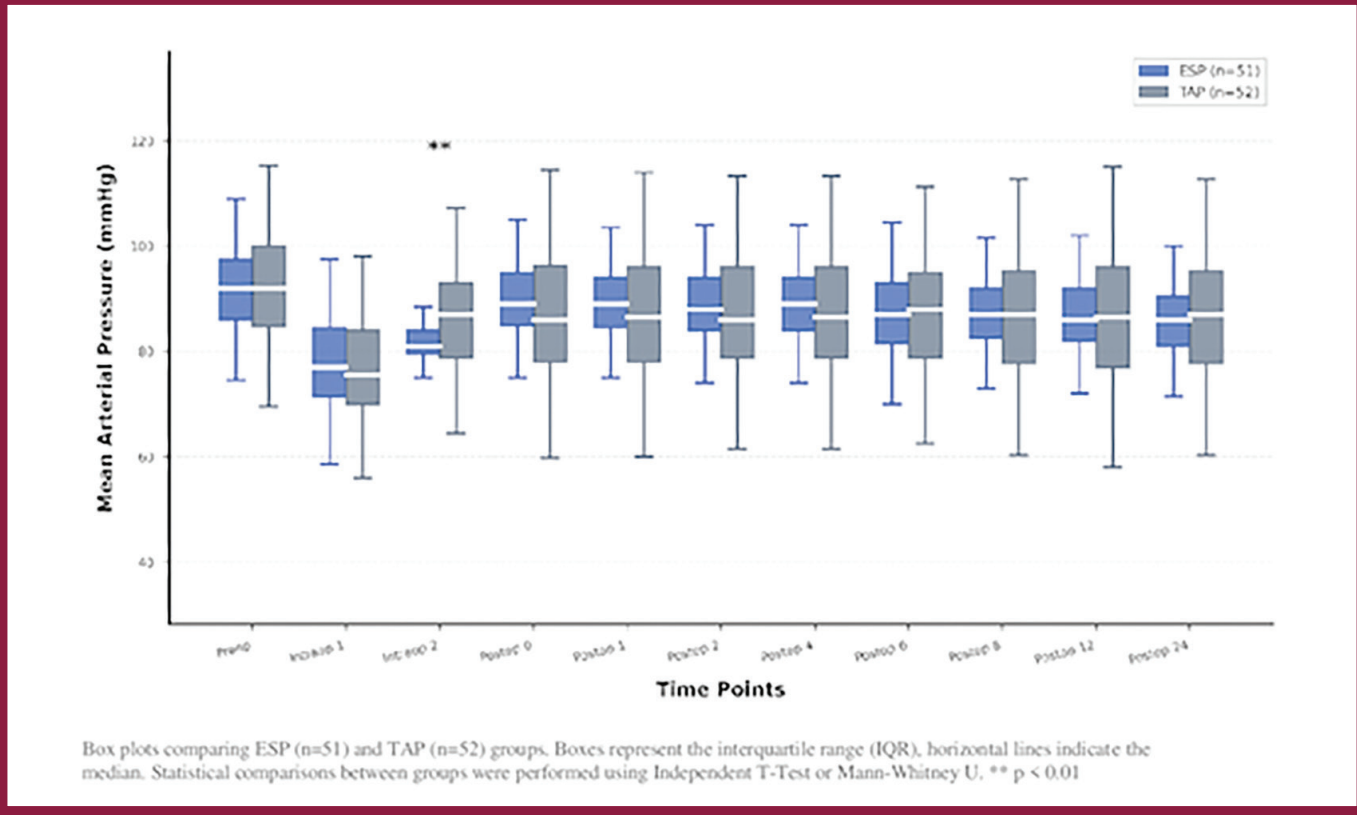


Figure 1. Perioperative mean arterial pressure by study group.

Table 2. Primary analgesic outcomes and postoperative analgesic consumption.

Variables			ESP group (n = 51)	TAP group (n = 52)	Test statistic	p value
Primary pain outcomes	Maximum resting VAS (0–24 h) Median (IQR)		4 (2)	4 (1)	U = 1006, Z = −2.111	0.027
	Maximum movement VAS (0–24 h) Median (IQR)		6 (1.5)	6 (2)	U = 971.5, Z = −2.338	0.016
	Preoperative baseline pain NRS	0	21 (41.2%)	38 (73.1%)	χ^2 = 12.258	0.002
		1	15 (29.4%)	10 (19.2%)		
		2	15 (29.4%)	4 (7.7%)		
Postoperative analgesic consumption	Morphine, median (IQR) [verify unit]		0 (1)	0 (2)	U = 1147, Z = −1.181	0.154
	NSAID (Dexketoprofen 2x25 mg)		32 (62.7%)	37 (71.2%)	χ^2 = 1.676	0.195
	Paracetamol	2000 mg	20 (39.2%)	27 (51.9%)	χ^2 = 1.676	0.195
		3000 mg	31 (60.8%)	25 (48.1%)		
	Tramadol	None	7 (13.7%)	6 (11.5%)	χ^2 = 9.673	0.008
		100 mg	44 (86.3%)	37 (71.2%)		
		200 mg	0 (0%)	9 (17.3%)		

Continuous variables are expressed as median (IQR), and categorical variables as n (%). A p value <0.05 was considered statistically significant. Pearson chi-square or Fisher's exact test was used for categorical variables as appropriate. NSAID, non-steroidal anti-inflammatory drug; NRS, numerical rating scale; VAS, visual analog scale.

Table 3. Postoperative evaluation, complications and side effects.

Variable			ESP group (n = 51)	TAP group (n = 52)	Test statistic	p value
Recovery and functional outcomes	Time to first analgesic request (min), median (IQR)		244 (56.5)	219.5 (75.5)	U = 1726.5 Z = 2.642	0.008
	Time to oral intake [verify unit], median (IQR)		5 (1.5)	5 (1)	U = 905.5 Z = −2.774	0.003
	Time to mobilization [verify unit], median (IQR)		7 (2)	9 (2)	U = 630 Z = −4.591	<0.001
	Time to discharge [verify unit], median (IQR)		52 (23)	54 (18)	U = 1181 Z = −0.956	0.339
	Patient satisfaction (1–5)	3	13 (25.5%)	7 (13.5%)	χ^2 = 3.998	0.135
		4	31 (60.8%)	41 (78.8%)		
		5	7 (13.7%)	4 (7.7%)		
Side effects and complications	Antiemetic use (ondansetron)		16 (31.4%)	29 (55.8%)	χ^2 = 6.229	0.013
	PONV (0–6 h)		16 (31.4%)	21 (40.4%)	χ^2 = 0.908	0.341
	PONV (6–24 h)		3 (5.9%)	11 (21.2%)	χ^2 = 5.113	0.024
	Infection		5 (9.8%)	2 (3.8%)	Fisher's exact test	0.269
	Hematoma		2 (3.9%)	1 (1.9%)	Fisher's exact test	0.618
	Hypotension		2 (3.9%)	5 (9.6%)	Fisher's exact test	0.437
	Pruritus		1 (2.0%)	9 (17.3%)	Fisher's exact test	0.016
	Urinary retention		3 (5.9%)	6 (11.5%)	Fisher's exact test	0.488

Continuous variables are expressed as median (IQR), and categorical variables as n (%). A p value <0.05 was considered statistically significant. Fisher's exact test was used when expected cell counts were <5. PONV, postoperative nausea and vomiting.

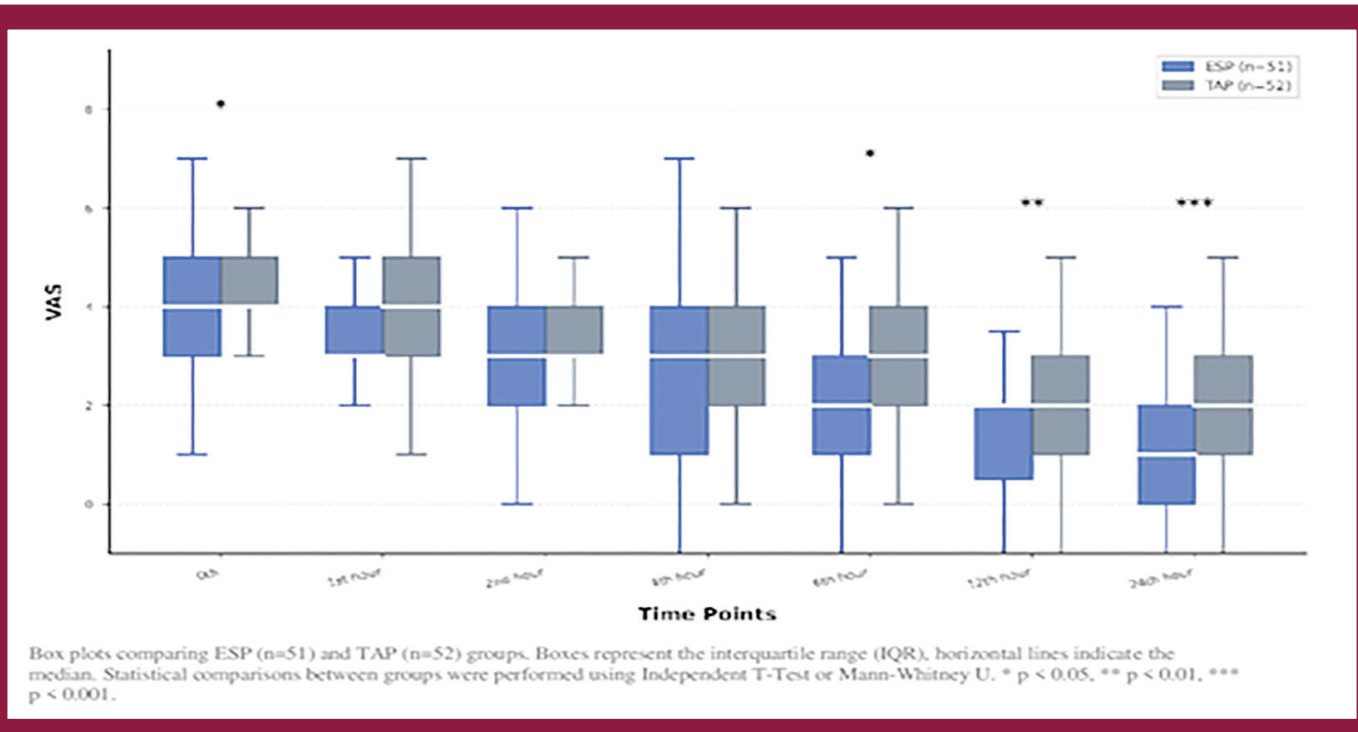


Figure 2. Visual analog scale (VAS) scores during movement by study group.

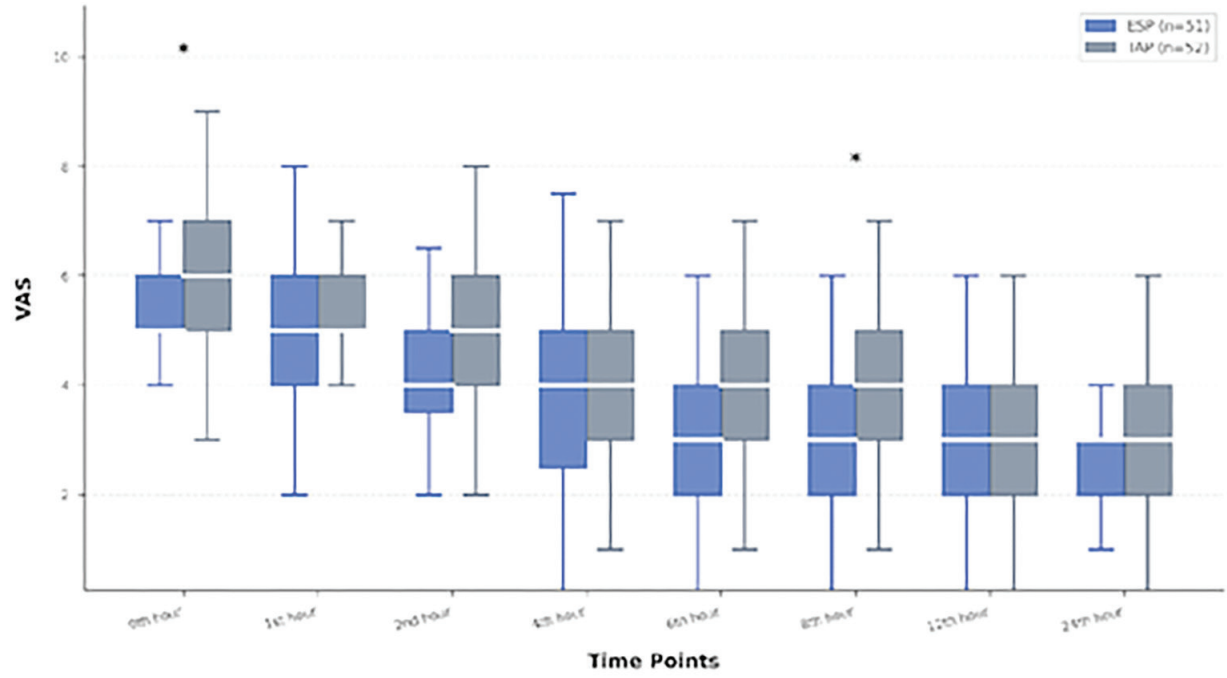


Figure 3. Visual analog scale (VAS) scores at rest by study group.

additional analyses were performed. First, the unadjusted between-group difference in maximum resting VAS attenuated to non-significance after rank-based adjustment for baseline NRS ($F(1,100) = 2.62$, adjusted $p = 0.108$), and the unadjusted difference in maximum movement VAS attenuated to a borderline non-significant level ($F(1,100) = 3.90$, adjusted $p = 0.051$). Second, the group-by-time interaction was statistically significant for resting VAS ($F(6,606) = 8.40$, Greenhouse–Geisser-corrected $p < 0.001$) but not for movement VAS ($F(7,707) = 0.98$, Greenhouse–Geisser-corrected $p = 0.419$), indicating that between-group divergence in resting pain trajectories—but not in movement-related pain—changed significantly over the first 24 postoperative hours (Table 5).

Discussion

In this retrospective comparison of ESP and TAP blocks for major open abdominal surgery, ESP block was associated with lower unadjusted maximum postoperative pain scores at rest and during movement, a longer time to first analgesic request, lower tramadol requirements, earlier mobilization and oral intake, lower antiemetic use, and reduced late PONV. Between-group differences in movement-related VAS scores were nominally significant at 0 and 8 h, while resting VAS scores were nominally lower in the ESP group at 0, 6, 12, and 24 h. After Bonferroni correction for multiple time points, only the 12 h and 24 h resting differences remained significant. After adjustment for the baseline NRS imbalance (rank ANCOVA), the overall difference in maximum resting VAS was no longer significant, and the difference in maximum movement VAS was only borderline. A formal group-by-time interaction test showed that resting-pain trajectories, but not movement-pain trajectories, diverged significantly between groups over the first 24 postoperative hours (Table 5). Patient satisfaction and time to discharge did not differ significantly between groups. These findings should be interpreted in the context of the retrospective design and the significant baseline imbalance in preoperative pain scores.

Effective postoperative analgesia is a key component of perioperative care. Inadequately controlled pain may delay mobilization, impair respiratory and muscular function, and contribute to persistent postsurgical pain and prolonged opioid exposure (6,7). Systemic non-steroidal anti-

Table 4. Within-group repeated-measures analysis of mean arterial pressure and pain scores over time, by group.

Time point	ESP group (n = 51) median (IQR)	TAP group (n = 52) median (IQR)
Mean arterial pressure (mmHg)		
Preop	92 (12)	92 (15)
Post-block 1	77 (13)	76 (14)
Post-block 2	81 (4)	87 (14)
0 h	89 (10)	86 (18)
1 h	89 (10)	86 (18)
2 h	88 (10)	86 (17)
4 h	89 (10)	86 (17)
6 h	87 (12)	88 (16)
8 h	87 (10)	87 (18)
12 h	86 (10)	86 (19)
24 h	86 (10)	87 (18)
Friedman test (within-group, across all time points): ESP χ^2 = 263.74, df = 10, p < 0.001; TAP χ^2 = 202.14, df = 10, p<0.001		
Resting VAS (0–10)		
0 h	4.0 (2.0)	4.0 (1.0)
1 h	3.0 (1.0)	4.0 (2.0)
2 h	3.0 (2.0)	3.0 (1.0)
4 h	3.0 (3.0)	3.0 (2.0)
6 h	2.0 (2.0)	3.0 (2.0)
12 h	2.0 (1.5)	2.0 (2.0)
24 h	1.0 (2.0)	2.0 (2.0)
Friedman test (within-group, across all time points): ESP χ^2 = 255.28, df = 6, p < 0.001; TAP χ^2 = 246.19, df = 6, p < 0.001		
Exercise VAS (0–10)		
0 h	5.0 (1.0)	6.0 (2.0)
1 h	5.0 (2.0)	5.0 (1.0)
2 h	4.0 (1.5)	5.0 (2.0)
4 h	4.0 (2.5)	4.0 (2.0)
6 h	3.0 (2.0)	4.0 (2.0)
8 h	3.0 (2.0)	4.0 (2.0)
12 h	3.0 (2.0)	3.0 (2.0)
24 h	3.0 (1.0)	3.0 (2.0)
Friedman test (within-group, across all time points): ESP χ^2 = 242.81, df = 7, p < 0.001; TAP χ^2 = 305.40, df = 7, p < 0.001		

Continuous variables are expressed as median (IQR). Within-group changes across measured time points were assessed using the Friedman test. These analyses evaluate change over time within each group and do not constitute a formal group-by-time interaction test. A p value <0.05 was considered statistically significant. MAP, mean arterial pressure; VAS, visual analog scale; ESP, erector spinae plane block; TAP, transversus abdominis plane block.

inflammatory drugs (NSAIDs) and opioids remain widely used, but their dose-limiting adverse effects differ: NSAIDs cause gastrointestinal and renal toxicity, whereas opioids cause nausea, vomiting, pruritus, sedation, and respiratory depression. These considerations support the use of multimodal and regional analgesic techniques to reduce reliance on systemic analgesics.

Intravenous lidocaine has analgesic and anti-inflammatory properties and has been evaluated as an adjunct for postoperative pain and recovery (8). Neuraxial techniques, including epidural analgesia and intrathecal opioids, may also provide effective analgesia after major abdominal surgery; however, their potential complications and practical limitations should be considered (9,10).

With the increasing use of US, fascial plane blocks have become important components of multimodal postoperative analgesia for abdominal surgery. ESP and TAP blocks, the two techniques evaluated in the present study, differ in their anatomical targets and expected patterns of analgesic coverage. Evidence for ESP block in major open abdominal surgery remains relatively limited, with much of the early literature consisting of case reports, case series, and studies comparing ESP block with systemic or neuraxial analgesic techniques. The present study therefore provides data from a direct comparison of two fascial plane block techniques in major open abdominal surgery.

The ESP block is a relatively recent technique. Atici et al. reported reduced perioperative opioid requirements in patients undergoing open subcostal nephrectomy who received ESP block (11). Yazar et al. (12) similarly reported lower postoperative pain scores and improved Quality of Recovery-15 scores after percutaneous nephrolithotomy. Restrepo-Garces et al. (13) described effective postoperative analgesia using bilateral continuous ESP block after open radical cystoprostatectomy with urinary reconstruction, and Ose et al. (14) reported effective continuous ESP analgesia after intestinal resection and hernia repair. Elshafie et al. (15) found that ESP block as part of an opioid-free anesthetic strategy was associated with low opioid consumption in patients undergoing hepatic resection. Choudhary et al. (16) compared intrathecal morphine, thoracic epidural analgesia, and ESP block after major open gastrointestinal surgery and reported differences in quality of recovery and adverse-effect profiles among the techniques.

TAP block was introduced into clinical practice before ESP block and is included among regional analgesic strategies discussed in Enhanced Recovery After Surgery recommendations (17). It is particularly effective for somatic pain arising from the anterior abdominal wall, but its impact on postoperative opioid consumption has varied across studies. Cai et al. (18) found TAP block to provide

Table 5. Baseline-adjusted (rank ANCOVA) and group-by-time interaction analyses for postoperative resting and movement VAS scores.

Analysis	Outcome	Statistic	p value
Unadjusted between-group comparison	Max. resting VAS (0–24 h)	U = 1006, Z = −2.111	p = 0.027
Unadjusted between-group comparison	Max. movement VAS (0–24 h)	U = 971.5, Z = −2.338	p = 0.016
Baseline (NRS)-adjusted comparison[a]	Max. resting VAS (0–24 h)	F(1,100) = 2.62	p = 0.108
Baseline (NRS)-adjusted comparison[a]	Max. movement VAS (0–24 h)	F(1,100) = 3.90	p = 0.051
Group × time interaction[b]	Resting VAS (0–24 h, 7 time points)	F(6,606) = 8.40	p < 0.001 (GG-corrected)
Group × time interaction[b]	Movement VAS (0–24 h, 8 time points)	F(7,707) = 0.98	p = 0.419 (GG-corrected)

[a]Rank-based analysis of covariance (Conover–Iman method): outcome and covariate rank-transformed, then analyzed by two-way ANOVA with preoperative baseline pain NRS (rank) as covariate and group as fixed factor; F and p refer to the group effect after adjustment. [b]Two-way mixed-design ANOVA fitted to rank-transformed VAS scores (patient as the repeated-measures unit); Greenhouse–Geisser (GG)-corrected p reported because Mauchly's test indicated a violation of sphericity for both domains (resting VAS: W=0.037, χ^2 (20) = 324.83, p < 0.001, ε = 0.444; movement VAS: W = 0.134, χ^2 (27) = 198.15, p < 0.001, ε = 0.592).

better analgesia than local wound infiltration in a meta-analysis. Chang et al. (19) reported improved analgesia after open gynecologic surgery, particularly for vertical incisions, without a significant reduction in opioid consumption. In the EXPLANE randomized trial, Turan et al. (20) found that TAP block with liposomal bupivacaine provided analgesia comparable to continuous epidural analgesia for major abdominal surgery, although opioid consumption and hypotension profiles differed between groups. Dhondt et al. (21) concluded that locoregional techniques, including TAP block, can provide effective analgesia after laparotomy for gynecologic cancer and may be useful when epidural analgesia is unsuitable. The predominantly somatic distribution of TAP block may partly explain why systemic opioids can still be required for visceral pain after major abdominal surgery.

Direct comparisons of ESP and TAP blocks in major abdominal surgery remain limited, and many studies involve laparoscopic procedures. Elshazly et al. (22) reported more effective analgesia, a longer time to first analgesic requirement, and favorable bowel-recovery outcomes with ESP block compared with TAP block after laparoscopic bariatric surgery. Altıparmak et al. (23) found that ESP block provided better postoperative analgesia and reduced tramadol consumption compared with oblique subcostal TAP block after laparoscopic cholecystectomy, and Abdelhamid et al. (24) reported similar findings in patients undergoing sleeve gastrectomy. In a meta-analysis of eight studies including 542 patients, Zewdu et al. (25) found ESP block to be more effective than TAP block for pain at rest and during movement. Another meta-analysis suggested that ESP block may offer advantages in abdominal surgery, including a longer time to first analgesic request (26). Naja et al. (27), in a study of bilateral paravertebral blocks rather than ESP or TAP blocks, also demonstrated that timing of regional block administration may influence postoperative analgesic efficacy. In the present study, ESP block was associated, on descriptive analysis, with lower unadjusted maximum pain scores and lower tramadol requirements; however, this pain-score advantage was substantially attenuated after adjustment for the baseline NRS imbalance between groups, and none of the movement VAS time-point differences remained significant after correction for multiple comparisons (Table 5).

Postoperative nausea and vomiting (PONV) is a common adverse effect after major abdominal surgery and may be influenced by perioperative opioid exposure. In the present study, early PONV (0–6 h) did not differ significantly between groups, whereas late PONV (6–24 h) and ondansetron use were lower in the ESP group. This finding is consistent with the possibility that differences in postoperative analgesic requirements may affect PONV, although the retrospective design does not permit causal inference.

Previous studies evaluating regional analgesic techniques have reported reductions in pain, opioid consumption, and PONV in selected surgical populations (28-30). However, findings are not uniform across procedures and block techniques. Zewdu et al., for example, did not identify consistent differences in all opioid-related outcomes between ESP and TAP blocks in laparoscopic surgery (25). Differences in surgical invasiveness, block technique, local anesthetic regimen, and baseline patient characteristics may contribute to heterogeneity across studies. In our cohort, early PONV was similar between groups, while late PONV occurred less frequently after ESP block. Consistent with these findings, a recent meta-analysis of five randomized controlled trials involving 372 patients demonstrated that ESPB was associated with significantly lower postoperative pain scores and reduced 24-hour opioid consumption compared with oblique subcostal TAP block in patients undergoing laparoscopic cholecystectomy, although the clinical significance of the observed reduction in pain scores could not be established (31).

Complications related to fascial plane blocks are generally uncommon, but their occurrence may depend on technique and operator experience. In the present study, pruritus was more frequent in the TAP group, whereas infection, hematoma, hypotension, and urinary retention did not differ significantly between groups. Earlier mobilization, earlier oral intake, and a longer time to the first analgesic request were observed in the ESP group, but discharge time was similar between groups.

Study Limitations

The main limitations of this study are its retrospective, single-center design and the resulting risks of selection bias and residual confounding. The surgical procedures were heterogeneous, which may have influenced postoperative pain and recovery outcomes. In addition, preoperative pain scores differed significantly between groups. When this imbalance was formally accounted for using a rank-based ANCOVA (Table 5),the between-group difference in maximum resting VAS was no longer statistically significant, and the difference in maximum movement VAS was attenuated to a borderline level, indicating that part of the unadjusted analgesic advantage attributed to ESP block may instead reflect this baseline imbalance rather than a true treatment effect. A group-by-time interaction test further showed that the two groups' resting-pain trajectories, but not their movement-pain trajectories, diverged significantly over the first 24 postoperative hours. These adjusted findings should be regarded as more conservative and more informative than the unadjusted comparisons, and the primary conclusions of this study have been tempered accordingly.

Conclusion

This retrospective cohort study found that while the ESP block was associated with faster recovery milestones—such as earlier mobilization, earlier oral intake, and reduced opioid requirements—compared to the TAP block after major open abdominal surgery, it did not demonstrate a robust analgesic advantage once baseline pain score imbalances were accounted for. Because these findings are limited by the retrospective design and baseline discrepancies, they remain strictly hypothesis-generating rather than confirmatory. Consequently, adequately powered prospective randomized trials with balanced baseline characteristics are required to definitively determine whether ESP block provides a genuine analgesic benefit over TAP block in this surgical setting.

Ethics

Ethics Committee Approval: The study was approved by Elazığ Fethi Sekin City Hospital Ethics Committee (meeting number: 2024/5-22, date: 05.12.2024). The study was conducted in accordance with the Declaration of Helsinki and reported in accordance with the STROBE Statement.

Informed Consent: Written informed consent for the regional anesthesia procedure and its potential risks was obtained before surgery as part of routine clinical care.

Footnotes

Authorship Contributions

Surgical and Medical Practices: Ü.K., M.Ö., Concept: Ü.K., M.Ö., Design: Ü.K., M.Ö., Data Collection or Processing: Ü.K., M.Ö., Analysis or Interpretation: Ü.K., M.Ö., Literature Search: Ü.K., M.Ö., Writing: Ü.K., M.Ö.

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