BMC Anesthesiology

RESEARCH Open Access

Comparison of the effectiveness of transversalis fascia plane block and transversus abdominis plane block for postoperative analgesia in pediatric lower abdominal surgeries: prospective, single blinded study

Hasibe İrban[1] and Can Aksu[2*]

Abstract

Background Achieving adequate postoperative analgesia in the pediatric age group is also important in terms of future pain perception and chronic pain development in the subsequent period. The primary aim of our study was to compare the effects of Transversus Abdominis Plane (TAP) and Transversalis Fascia Plane (TFP) blocks on pain scores at the 6th postoperative hour in children undergoing lower abdominal surgery. Secondary aims include the observation of pain scores over the first 24 h postoperatively, the duration until the first analgesic requirement, the presence of postoperative nausea and vomiting symptoms, and the satisfaction of parents with the provided analgesia method.

Methods Patients aged between 1 and 7 years, classified as ASA I-II, who were scheduled for elective surgery for undescended testes and inguinal hernia, were included in our study. The study was designed as a prospective observational study. The patients were divided into two groups: TAP block ($n=42$) and TFP block ($n=42$). Intraoperative remifentanil consumption, hemodynamic parameters, postoperative FLACC pain scores, analgesic requirements, and the time of the first analgesic need were recorded for 24 h.

Results A total of 84 patients were included in the study. The groups were similar in terms of demographic data. No difference was found in FLACC pain scores between the groups that received both TAP and TFP blocks in patients followed for 24 h postoperatively ($p>0.05$). Intraoperative remifentanil consumption was similar in TAP blocks 74 (20–100) and TFP blocks 40 (24.75-71) µg, (p: 0.268). When calculating based on the first analgesic consumption for TAP and TFP groups, it is found that the median analgesic effect durations were 12 and 9 h, respectively, for the two groups.

*Correspondence:
Can Aksu
dr.aksu@gmail.com

Full list of author information is available at the end of the article

Conclusions In children undergoing lower abdominal surgery, ultrasound-guided TAP and TFP blocks have shown similar effects on pain scores and analgesic requirements for 24 h postoperatively. We believe that both blocks, which we found to provide analgesia without the need for opioids after lower abdominal surgery in pediatric patients, can be safely used in this patient group.

Clinical trials registration NCT06530147.

Keywords Lower abdominal surgery, Pediatric, Transversus abdominis plane block, Transversalis fascia plane block, Postoperative analgesia

Background

Lower abdominal surgeries, particularly inguinal hernia and undescended testis operations, are some of the most frequent procedures in daily pediatric surgery practice [1, 2]. Since these are generally outpatient operations, they are highly important in terms of the provision of perioperative care and adequate analgesia. The provision of adequate postoperative analgesia is important from the perspective of preventing future pain perception and the development of chronic pain in pediatric patients [3].

The growing use of ultrasonography (USG) has led to an increase in regional anesthesia techniques and the application thereof, and interfascial plane blocks have been described [4]. The transversus abdominis plane (TAP) block is one of the fascial plane blocks frequently employed in abdominal surgeries. Another technique used for this purpose is the transversalis fascia plane (TFP) block. This is performed with the administration of local anesthetic to the plane between the transversus abdominis muscle and the transverse fascia, the aim being to block the proximal branches of T12 and L1 [5, 6, 7, 8].

TFP is a relatively new and deeper block application. Although limited studies in adult patients have shown that TAP block is equivalent to TFP in terms of analgesia, to our knowledge, there is no study in the literature comparing these two regional techniques in pediatric patients [9, 10].

This study compares the postoperative pain effectiveness of the TFP and TAP blocks routinely employed to prevent postoperative pain in pediatric patients scheduled for lower abdominal surgery (inguinal hernia and undescended testis) in our clinic using Faces, Legs, Activity, Cry and Consolability (FLACC) pain scoring. Our primary aim was to compare postoperative pain scores for the TAP and TFP blocks at the sixth hour postoperatively in cases of pediatric lower abdominal surgery. Our secondary aims were to compare patient pain scores, additional analgesia requirements and types, times for first analgesia requirements and the presence of nausea-vomiting symptoms at 24-hour observations and parental satisfaction with the analgesia method provided.

Methods

The study was performed following receipt of the requisite ethical committee approval (KAEK/06.bl.02 & E-85521274-000-2290860). A clinical trials record was also made (NCT06530147).

Patients aged 1–7 years with American Society of Anesthesiologists (ASA) physical scores of I and II were included in the study. Individuals with disabilities, in intensive care, who were unconscious, and unable to provide consent, with ASA physical scores of III and IV, with severe systemic disease, with infection in the application site, with bleeding disorders, or operated using a different incision to that planned for any reason were excluded from the study.

Demographic data (age, sec, height, and weight) and ASA scores were recorded onto patient information forms. The patients were classified under two groups, TAP block (the TAP group, $n=42$) and TFP block (the TFP group, $n=42$). TAP or TFP blocks were applied in such a manner as to ensure a sufficient number of patients in each group. Once the regional anesthesia procedure had been performed by the researcher, the management of all other perioperative procedures and postoperative ward observation and treatment were carried out independently of that researcher.

Once the patients consenting to take part had been taken to the operating room, peripheral intravenous (iv) vascular access was established using a 24–26 Gauch (G) iv cannula. Standard monitoring including electrocardiography, peripheral oxygen saturation measurement (SpO2), and non-invasive blood pressure measurement was applied. These data were recorded as values prior to installation of the laryngeal mask. Anesthesia was induced with 2–3 mg/kg propofol and 1 µg/kg fentanyl. A laryngeal mask airway (LMA) (Hangzhou Tappa Medical Technology Co. Ltd., Dusseldorf, Germany) was then installed. Once airway safety had been established, the regional anesthesia technique (TAP or TFP block) appropriate to the patient was performed under ultrasound guidance (Esaote My Lab 6 US Florence, Italy) by the same anesthesiologist using 0.5 ml/kg 0.25% bupivacaine (Figs. 1 and 2).

Sevoflurane in a 40% oxygen (O2) and air mixture was applied for maintenance anesthesia. Remifentanil was

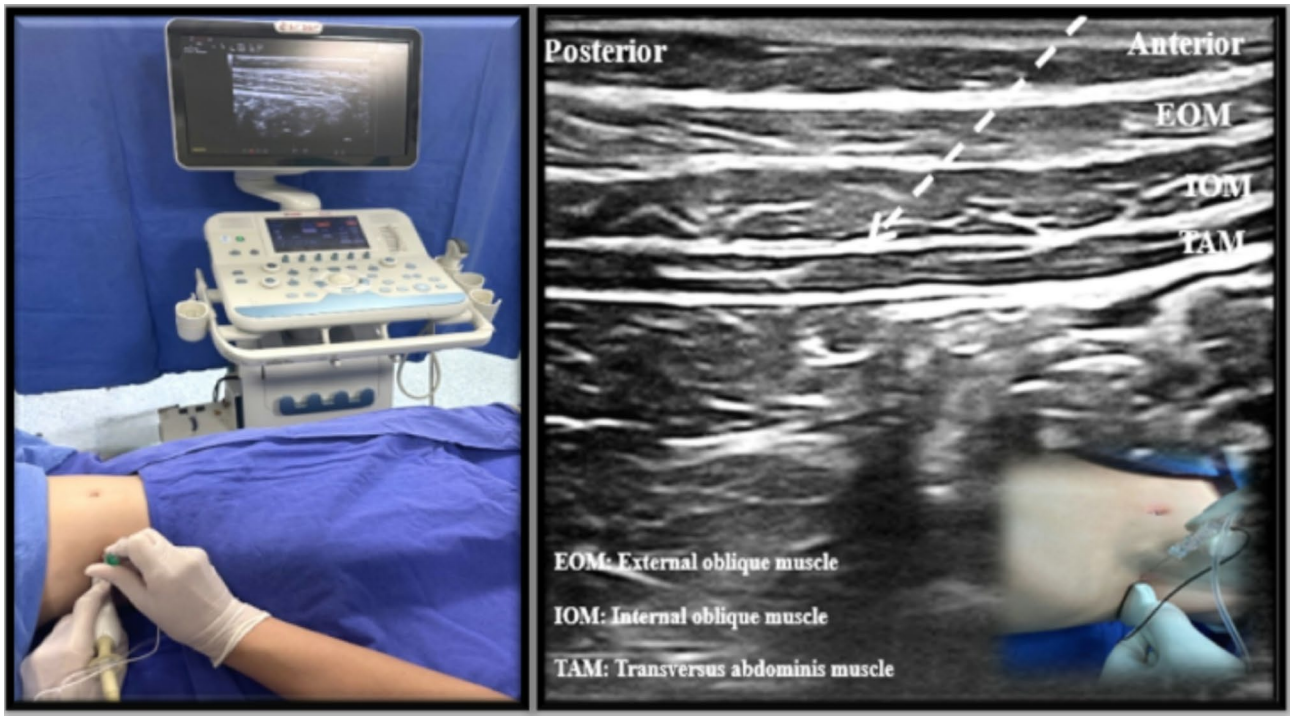

Fig. 1 Application of the TAP block and an ultrasound image

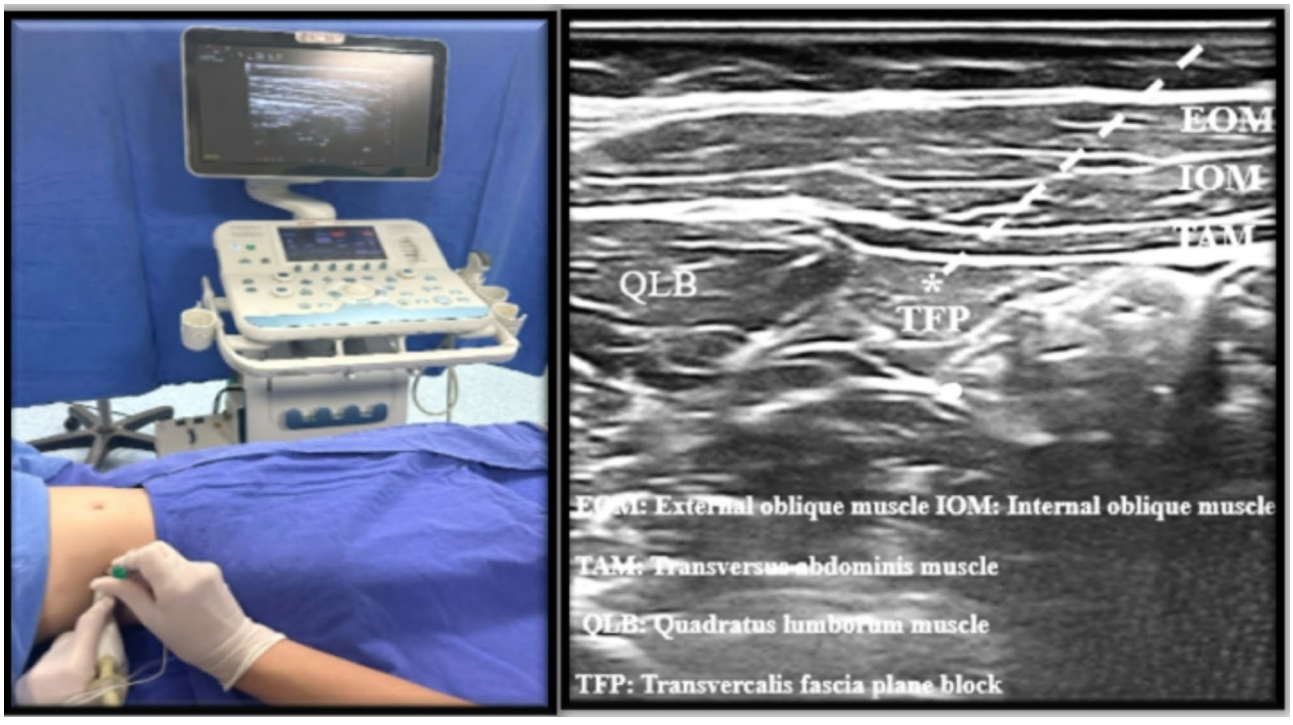

Fig. 2 Application of the TFP block and an image showing the needle

infused at 0.5–1 μg/kg/min iv for intraoperative analgesia, and the total amount of remifentanil consumed intraoperatively was recorded. The remifentanil infusion level was adjusted according to a ± 20% change in heart rate and/or systolic arterial pressure from baseline. Bispectral index (BIS) (Medtronic Medikal, Ümraniye, Türkiye) monitoring was employed to assess the depth of anesthesia, with a target of between 40 and 60.

Patients' hemodynamic parameters in the intraoperative period, heart rate, systolic arterial pressure (SAP), diastolic arterial pressure (DAP), SpO2, and BIS values, were recorded before placement of the laryngeal mask (T0), immediately after placement (T1), and at 15 min (T2), 30 min (T3), 60 min (T4), 90 min (T5), 120 min (T6), and 180 min (T7) Duration of anesthesia (from induction to removal of the LMA) was also recorded. Approximately 30 min prior to the end of the operation, both groups were administered 15 mg/kg iv paracetamol. At the conclusion of the operation, the patients were woken and transferred to the recovery unit.

In the postoperative period, patient pain in the recovery unit was evaluated by a pain technician using the FLACC scoring system, that value being recorded as hour 0. Pain scores at rest in the pediatric surgery ward were assessed and recorded by the same technician using the FLACC scoring system at hours 1, 2, 4, 6, 12, and 24. A pain score of 3 or lower was evaluated as adequate analgesia, while scores of 3 or above were interpreted as insufficient analgesia. Under the common protocol employed in our hospital's pediatric surgery ward, patients scoring 3–4 on the FLACC system were given 15 mg/kg, iv paracetamol, those scoring 5–6 were given 10 mg/kg ibuprofen in oral suspension. If the pain persisted, or in case of score of 7 or above, patients 0.025 mg/kg iv morphine as rescue analgesia. This routine procedure was not altered in this study. The analgesic agent with which pain resolved when pain was perceived, the time when the first analgesia requirement was felt, nausea-vomiting symptoms, and parental satisfaction (scored between a lowest value of 1 and a highest value of 5) were recorded at all time points when pain scores were measured.

Statistical analysis

Statistical evaluations were carried out on IBM SPSS version 20.0 software (IBM Corp., Armonk, NY, USA). Compatibility with normal distribution was examined using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Since normal distribution assumptions were not met, numerical variables were expressed as median (25th-75th percentile) values. Categorical variables were expressed as frequency (percentage) values. Intergroup comparisons were performed using the Mann-Whitney U test. Friedman's two-way ANOVA was applied for intergroup comparison of numerical variables. Multiple comparisons were carried out using the Dunn test. Relationships between categorical variables were assessed by means of chi-square analysis, and those between numerical variables using Spearman's correlation analysis. p values < 0.05 were regarded as sufficient for hypothesis tests.

The sample size was determined by means of power analysis with 80% power (1-β) and a 5% margin of error (α). The data in the "Quadratus Lumborum Block Versus Transversus Abdominis Plane Block in Children Undergoing Low Abdominal Surgery A Randomized Controlled Trial" [11] study were employed in the power analysis. The effect size was calculated as 0.66. A sample size of 76 patients, 38 in each group, was determined at the power analysis. We planned to conduct the study with 84 patients based on a potential 10% loss of data. The power analysis was conducted on G*Power 3.1.9.4 software.

Results

Eighty-four children who underwent unilateral lower abdominal surgery (inguinal hernia and undescended testis) under elective conditions in our pediatric surgery department were included in the study (Fig. 3). None of these were excluded for any reason during the study.

The demographic data of the 84 patients enrolled in the study are shown in Table 1. Comparisons revealed no significant differences between the groups in terms of age, sex, height, weight, or ASA physical scores ($p > 0.05$).

No significant differences were observed between the groups in terms of type of operation, duration of anesthesia, or intraoperative opioid consumption ($p > 0.05$) (Table 2).

No significant difference was determined between the groups' perioperative heart rates ($p > 0.05$).

With the exception of the 90 min time point, the two groups' mean arterial pressures were similar to one another ($p > 0.05$). However, mean arterial pressures at 90 min differed significantly ($p < 0.05$).

No significant differences were determined between the two groups' SpO2 and BIS values at any time points in the perioperative period ($p > 0.05$).

Since the numbers of patients who continued into the 120th and 180th minutes were not sufficient for analysis, p values could not be calculated for heart rate, mean arterial pressure, SpO2, or BIS values.

Comparison of FLACC pain scores between the TAP and TFP patient groups at postoperative hours 0, 1, 2, 4, 6, 12, and 24 revealed no significant differences between them ($p > 0.05$) (Table 3).

Due to the low numbers of patients in the TAP and TFP groups requiring postoperative first analgesia at postoperative hours 0, 1, 2, 4, 6, and 24, p values could not be calculated. Patient numbers at these time points were two, one, none, four, four, and one in the TAP group and one, none, two, four, four, and none, respectively, in the TFP groups. At the 12th hour, there were 13 patients in the TAP group and 11 in the TFP group ($p < 0.809$). No significant difference was determined between the TAP and TFP block groups in terms of first analgesia requirements at postoperative hours 6 and 12 ($p > 0.05$). The time to first analgesia requirement was calculated as a median (25-75th percentile) value. These values were 12 (4–12) hours in the TAP group and 9 (4–12) hours in the

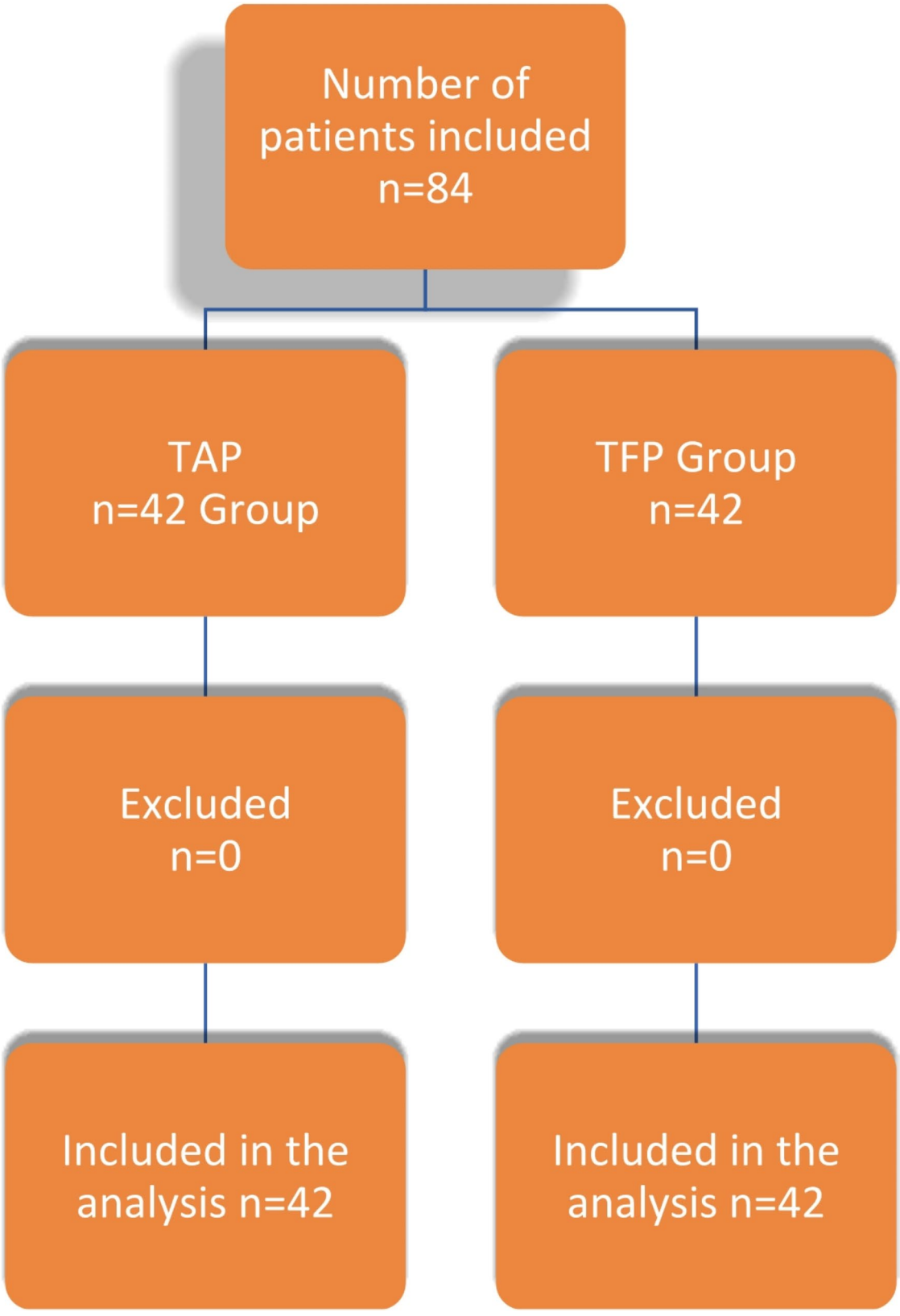

Fig. 3 Study flow chart

Table 1 Demographical data

	TAP Group (*n* = 42)	TFP Group (*n* = 42)	*p*
Age (months), median (IQR)	37.5 (21-74.25)	33 (21-58.5)	0.202[a]
Sex, *n* (%)			0.713[b]
Male	37 (88.1)	39 (92.9)	
Female	5 (11.9)	3 (7.1)	
Height (cm), median (IQR)	100 (85-118.5)	100 (87.25-110.25)	0.441[a]
Weight (kg), median (IQR)	16 (10.75–20.25)	15 (12–20)	0.921[a]
ASA class, *n* (%)			0.165[b]
I	31 (73.8)	37 (88.1)	
II	11 (26.2)	5 (11.9)	
Drug use, *n* (%)	5 (11.9)	3 (7.1)	0.713[b]

IQR: Interquartile range (25-75th percentile)

[a]Mann-Whitney U test was used

[b]Chi-square test was used

Table 2 Perioperative parameters between the groups

	TAP Group (*n* = 42)	TFP Group (*n* = 42)	*p*
Operation, *n* (%)			0.662[a]
Undescended testis	24 (57.1)	21 (50)	
İnguinal hernia	18 (42.9)	21 (50)	
Duration of anesthesia (min), median (IQR)	67.5 (45–90)	60 (52.5–75)	0.431[b]
Total amount of intraoperative opioid consumption (μg), median (IQR)	74 (20–100)	40 (24.75-71)	0.268[b]

IQR: Interquartile range (25-75th percentile)

[a]Chi-square test was used

[b]Mann-Whitney U test was used

Table 3 Postoperative FLACC scale measurements

FLACC scale	TAP (*n* = 42) Median (IQR)	TFP (*n* = 42) Median (IQR)	*p*[*]
Postoperative hour 0	1 (0.0–2)	1 (0.0–2)	0.738
Postoperative hour 1	1 (0.0–1)	1 (0.0–2)	0.889
Postoperative hour 2	1 (0.0-1.25)	1 (0.0–2)	0.560
Postoperative hour 4	1 (0.0–2)	1 (0.0–2)	0.921
Postoperative hour 6	1 (0.0–2)	1 (0.0–2)	0.870
Postoperative hour 12	2 (1–3)	2 (1–3)	0.909
Postoperative hour 24	1 (1–2)	1 (0.0–2)	0.608

IQR: Interquartile range (25-75th percentile)

*Mann-Whitney U test was used

Table 4 Postoperative Paracetamol consumption

		TAP (*n* = 42) *n* (%)	TFP (*n* = 42) *n* (%)	*p*[*]
Postoperative hour 0	Yes	2 (4.8)	1 (2.4)	NA
	No	40 (95.2)	41 (97.6)	
Postoperative hour 1	Yes	2 (4.8)	0 (0)	NA
	No	40 (95.2)	42 (100)	
Postoperative hour 2	Yes	1 (2.4)	2 (4.8)	NA
	No	41 (97.6)	40 (95.2)	
Postoperative hour 4	Yes	4 (9.5)	4 (9.5)	1.0
	No	38 (90.5)	38 (90.5)	
Postoperative hour 6	Yes	4 (9.5)	5 (11.9)	1.0
	No	38 (90.5)	37 (88.1)	
Postoperative hour 12	Yes	17 (40.5)	16 (38.1)	1.0
	No	25 (59.5)	26 (61.9)	
Postoperative hour 24	Yes	6 (14.3)	5 (11.9)	1.0
	No	36 (85.7)	37 (88.1)	

[*]Chi-square test was used

NA: Not applicable

TFP block, and the difference was not statistically significant (p:0.65). The time to first analgesia requirement in the entire patient group was 12 (4–12) hours.

Paracetamol requirements at postoperative hours 4, 6, 12, and 24 were similar in the two groups (Table 4). These figures were 4, 4, 17, and 6 patients respectively in the TAP group and 4, 5, 16, and 5 in the TFP group ($p > 0.05$). Due to the low number of patients in both groups at postoperative hours 0, 1, and 2, p values could not be calculated.

Ibuprofen requirements were present in one patient from each group at postoperative hour 12. One patient from the TFP required ibuprofen at postoperative hour 24. No patient from either group required morphine. No nausea-vomiting symptoms occurred in either group. Additionally, no complications developed during follow-up.

The families were asked about patients' analgesia management prior to discharge, with parental satisfaction scores of 4 (3.75-5) being determined in the TAP group

Table 5 Studies using the TAP and/or TFP blocks [9, 10, 11, 12, 13]

Author	Type of study	Comparison/ Patient number/ Surgery/ Patient group	Local anesthesia used for the block	Primary objective	Secondary objective	Result
Priya et al. [9]	Prospective, randomized, controlled, double blinded	-Posterior TAP, TFP -60 patients -unilateral inguinal hernia -Adult	-25 ml 0.25% bupivacaine and adjuvant 4 mg dexamethasone	24-hour numeric rating scale pain scores	Number of patients requiring rescue analgesia over 24 h	Posterior TAP and TFP were similar in terms of analgesic efficacy and patient satisfaction
López-González et al. [10]	Retrospective observational	-Anterior TAP and TFP -61 patients -Unilateral inguinal hernia -Adult	-30 ml 0.25% levobupivacaine	Postoperative pain (during rest and without exercise)	Sensorial block level, postoperative opioid consumption, complication, patient satisfaction	The TAP and TFP blocks were similar to one another in terms of analgesic effectiveness and postoperative opioid consumption
Öksüz et al. [11]	Prospective, randomized, controlled	-Quadratus lumborum block, TAP -50 patients - Unilateral inguinal hernia and undescended testis -Pediatric (1–7 years)	-0.5 ml/kg 0.2% bupivacaine	Analgesia requirements over a 24-hour period	FLACC pain scores were recorded over 24 h, time of first analgesia requirement, and parental satisfaction	The quadratus lumborum block yielded longer and more effective analgesia than the TAP block
Abdelbaser et al. [12]	Randomized, controlled, double blinded	-Saline, TFP -38 patients -Inguinal hernia -Pediatric (1–5 years)	-Saline -0.4 ml/kg 0.25% bupivacaine	Postoperative non-opioid requirement	Pain score, rescue analgesia time, parental satisfaction	The TFP block reduced postoperative analgesic requirements and postoperative pain intensity
Karadeniz et al. [13]	Prospective, randomized, controlled	-TAP -74 patients - Unilateral inguinal hernia -Pediatric (1–8 years)	-0.4 ml/kg 0.25% bupivacaine – 0.8 ml/kg 0.125% bupivacaine	FLACC pain scores were recorded over a 24-hour period	Total rescue analgesia dose, length of hospital stay, parental and surgeon satisfaction levels	The two groups were similar in terms of pain scores. No rescue analgesia requirement was observed after the postoperative 6th hour

Local anesthetic used in TAP and/or TFP blocks in lower abdominal surgery, doses and volumes, primary and secondary aims, and research findings

and 4 (4–5) in the TFP group. The difference was not statistically significant ($p > 0.05$).

Discussion

This study investigated the effectiveness in preventing postoperative pain of the TAP and TFP blocks in pediatric patients undergoing lower abdominal surgery (inguinal hernia and undescended testis) and, to our knowledge, this the first pediatric study in the literature. No significant difference was observed between the two groups in terms of FLACC pain scores investigated at postoperative hours 0, 1, 2, 4, 6, 12, and 24 ($p > 0.05$). The results of this study confirmed the hypothesis that the paravertebral spread produced by the TFP block would make no additional contribution in these surgeries, and that superficial block application would therefore be advantageous. In confirmation of that hypothesis, Priya et al.'s study [9] comparing the TAP and TFP blocks in adult patients undergoing inguinal surgery also showed no significant difference in postoperative pain scores with either block.

The number of studies in the literature using the TFP and/or TAP blocks in postoperative pain checks in patients undergoing inguinal hernia and undescended testis surgery is limited (Table 5) [9, 10, 11, 12, 13]. These studies have generally shown that, similarly to the present study, these techniques produce a reduction in patients' pain scores, provide effective analgesia, reduce analgesia requirements, and increase patient and family satisfaction.

So far as we are aware, only one study has evaluated effectiveness of TFP block for reducing postoperative pain scores and analgesic consumption in children undergoing inguinal hernia repair. Aldelbaser et al. [12] compared FLACC pain scores and pain levels at postoperative 30 min and at 2, 4, 6, 9 and 12 h with the TFP block compared to a control group. Those authors reported lower FLACC pain scores in the TFP block group. The present study differs from Abdelbaser et al. [12] in terms of methodology. We compared two different regional anesthesia technique instead of comparing one of them to a control group and found similar FLACC scores for both groups.

Ahiskalioglu et al.'s case series [6] involving two pediatric patients appears to be the first publication concerning analgesic consumption. Those authors applied the TFP

block to one patient scheduled for ureteroneocystostomy and to another scheduled for open inguinal hernia repair. Postoperative pain in the ureteroneocystostomy patient was evaluated over 24 h using the FLACC pain scoring system and was reported at between 0/10 and 1/10. Postoperative pain in the open inguinal hernia repair patient was evaluated over 24 h using the FLACC pain scoring system and determined at between 0/10 and 3/10, with the first analgesia requirement occurring at the 16th hour. Neither patient required rescue analgesia over 24-hour postoperative follow-up. Although this case series consists of two patients, we think it is important because it was the first report for pediatric patients. In both patients, FLACC scores were similar to those in our study. Unlike our results, it was stated that the first analgesic time was 16 h. While there were children in our study who did not need analgesics for more extended periods, it was generally observed that the first analgesic requirement occurred at the 12th hour in this patient group.

López-González et al. [10] compared the analgesic efficacy of an ultrasound-guided TFP block with anterior TAP (TAP-A) in adult patients undergoing inguinal hernia repair and described the two as similar. In that study, pain scores at rest were similar between the two groups, but higher in the TAP group. Our results also revealed comparable pain scores at rest in the two groups. Kösem et al. [14] performed a retrospective examination of patients who had undergone cesarean surgery and received either the TAP block, the TFP block, or no block. Those authors compared the time elapsing until the first analgesia requirement in the postoperative period. They reported no analgesia requirement in any of the patient groups in the first four-hour period, and no opioid requirement in the patients receiving blocks in the first 24 h. The patients given the TAP and TFP blocks received no dexketoprofen until the eighth and 12th hours, respectively, while 82% of the patients with no block required dexketoprofen between postoperative hours 4 and 8. The number of patients in the TFP group consuming dexketoprofen between hours 8 and 12 was significantly lower than that in the control group ($p = 0.009$). The TFP group also consumed significantly less dexketoprofen between hours 1 and 24 compared to the TAP and control groups ($p = 0.003$ and $p < 0.001$, respectively). The control group also consumed significantly more tramadol after 8 h than the two block groups. The differences in local anesthetic spreads of TFP and TAP might explain these results. Given that the TFP block is delivered into the perinephric adipose tissue, where the diffusion of local anesthetic is restricted, the probability of blocking the T12-L1 peripheral nerves densely is increased, possibly resulting in extended analgesic effectiveness. The broader interfascial region in TAP block application may lead to a reduced duration of analgesia owing to the more extensive dispersion of the local anesthetic [15]. Our study differs from Kösem et al. [14] regarding patient groups and type of surgery, although our results are comparable. Additionally, our study used paracetamol as the first-line analgesia method. Due to the learned component of pain, which plays a role in the formation of pain perception, the need for additional postoperative analgesics can be seen earlier and more frequently in the adult patient group. We believe that regional anesthesia techniques applied after induction before pain occurs in pediatric patients, as in our study, play a role in preventing the formation of this component of pain. We think that our results, which showed that the median time to the first analgesic requirement is the 12th hour, and almost only paracetamol use is enough to ameliorate the postoperative pain, support this claim.

Abdelbaser et al. [12] administered 0.5 μg/kg fentanyl when they detected a change in heart rate and mean arterial pressure exceeding 20% over baseline measured at 3-min intervals following skin incision in the intraoperative period. Mean intraoperative fentanyl consumption (μg/kg) was significantly lower in the TFP block group (1.10 ± 0.08) compared to the control group with no block (1.50 ± 0.51). Providing adequate intraoperative analgesia is important in terms of maintaining hemodynamic stability [16]. In contrast to Abdelbaser et al. [12], we employed continuous remifentanil infusion in the present study rather than bolus doses and, as in their study, we increased or reduced the infusion rate depending on the patient's hemodynamic parameters. Also in contrast to Abdelbaser et al., we evaluated the TFP block against a TAP block group rather than a control group. Our results revealed equivalent opioid consumption between the two groups, and no significant difference in hemodynamic parameters. One cause of this may be that we achieved a more stable opioid blood level and therefore more effective analgesia management due to the infusion application. We think that another reason, as shown in Abdelhamid et al.'s study [16], our comparison involved two effective regional anesthesia techniques, rather than a control group.

Sethi et al. [17] compared the caudal epidural block and TAP block in terms of postoperative analgesic effectiveness in adult patients scheduled for lower abdominal surgery. Those authors determined no significant difference between the two groups rescue analgesia requirements. The TAP block also reduced opioid consumption as much as the caudal epidural block. In the present study, morphine was not administered as rescue analgesia since the FLACC scores did not exceed 7 in either block group, and the subsequent FLACC values were low in patients who received ibuprofen. No nausea-vomiting was observed in any patient in the present study. We

attribute this to sufficient analgesia being provided and to the absence of opioid consumption in the postoperative period.

Parental satisfaction in pediatric cases receiving good pain palliation is high. The use of regional anesthesia methods as a component of multimodal analgesia has been shown to increase patient comfort as well as parental satisfaction by providing better analgesia [18]. In the present study, the parents of pediatric patients were highly satisfied after both the TFP and TAP blocks because their children's analgesic needs were low during the first 24 h postoperatively, they did not require additional analgesia, and their pain scores were low.

Although this study successfully achieved its primary and secondary aims, a number of limitations need to be considered. First limitation is that pain evaluation was restricted to at-rest FLACC measurements. Due to the need for patient cooperation, FLACC scoring evaluation with effort could not be performed in our study group. Although adult studies have compared dynamic and static NRS scores, we encountered no previous studies involving pediatric patients. This needs to be addressed in future studies.

Another limitation is that since our research was planned as an observational study and randomization was not applied, there is a possibility of bias. However, a number of precautions were adopted to avoid this. The two blocks applied were performed by the same researcher, and the patients peri- and postoperative monitoring was performed by teams not involved in the research. Postoperative pain observations were carried out by a pain technician blinded to the study groups. In addition, the patient and surgical term were unaware which block was to be performed. The data were also examined by another research and statistical team blinded to the study groups. However, despite all these precautions, the possibility of bias may not have been reduced as much as in randomized studies.

Conclusions

In conclusion, the TAP and TFP blocks applied as a component of postoperative and multimodal analgesia in patients undergoing lower abdominal surgery (undescended testis and inguinal surgery) provided effective postoperative analgesia. Therefore, we think that both regional anesthesia techniques can be used for this purpose in patients scheduled for lower abdominal surgery, according to clinical conditions and experience with these techniques.

Abbreviations

ASA	American Society of Anesthesiologists
BIS	Bispectral Index
FLACC	Faces, Legs, Activity, Cry, and Consolability
G	Gauch
IV	Intravenous
LMA	Laryngeal Mask Airway
NRS	Numeric Rating Scale
TAP	Transversus Abdominis Plane
TFP	Transversalis Fascia Plane
USG	Ultrasonography

Acknowledgements

We thank Associate Prof. Sibel Balcı from the Kocaeli University Department of Biostatistics and Medical Informatics for all her help with the statistical part of this study.

Author contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Hİ, CA]. The draft of the manuscript was written by [Hİ, CA]. All authors read and approved the final manuscript.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

All protocol were carried out in accordance with relevant guidelines and regulations, and had been approved by Ethic Committee prior of the study. Written informed consent was obtained from all patients' legal guardian(s). No violation of Helsinki Declaration was taken place during informed consent and data acquisition period. The study protocol had been approved by Ethic Committee of Kocaeli University Medical Faculty (KAEK/06.bl.02 & E-85521274-000-2290860) and This study was registered with clinicaltrials.gov (NCT06530147).

Consent for publication

N/A.

Conflict of interest

Can Aksu is a member of the Editorial Board of BMC Anesthesiology. Can Aksu is one of the guest editors of the Regional anesthesia for children and young adults collection.

Financial support

None.

Author details

[1]Clinic of Anesthesiology and Reanimation, Derince State Hospital, Kocaeli, Turkey
[2]Department of Anesthesiology and Reanimation, Kocaeli University, Kocaeli, Turkey

Received: 3 December 2024 / Accepted: 24 March 2025
Published online: 05 April 2025

References

1. Baird R, Guilbault MP, Tessier R, Ansermino JM. A systematic review and meta-analysis of caudal Blockade versus alternative analgesic strategies for pediatric inguinal hernia repair. J Pediatr Surg. 2013;48(5):1077–85.
2. Mitsui T. Effects of the prenatal environment on cryptorchidism: A narrative review. Int J Urol. 2021;28(9):882–9.
3. Kvanner Aasvang E, Kehlet H. Chronic pain after childhood groin hernia repair. J Pediatr Surg. 2007;42(8):1403–8.
4. Chin KJ, Pawa A, Forero M, Adhikary S. Ultrasound-Guided fascial plane blocks of the thorax: pectoral I and II, serratus anterior plane, and erector spinae plane blocks. Adv Anesth. 2019;37:187–205.
5. Hebbard PD. Transversalis fascia plane block, a novel ultrasound-guided abdominal wall nerve block. Can J Anaesth. 2009;56(8):618–20.

6. Ahiskalioglu A, Aydin ME, Doymus O, Yayik AM, Celik EC. Ultrasound guided transversalis fascia plane block for lower abdominal surgery: first pediatric report. J Clin Anesth. 2019;55:130–1.
7. Chin KJ, Chan V, Hebbard P, Tan JS, Harris M, Factor D. Ultrasound-guided transversalis fascia plane block provides analgesia for anterior Iliac crest bone graft harvesting. Can J Anesth. 2012;59(1):122–3.
8. Serifsoy TE, Tulgar S, Selvi O, et al. Evaluation of ultrasound-guided transversalis fascia plane block for postoperative analgesia in Cesarean section: A prospective, randomized, controlled clinical trial. J Clin Anesth. 2020;59:56–60.
9. Priya V, Shamim R, Singh B, Singh S, Bais PS, Prasad G. Comparative evaluation of pre-emptive analgesic efficacy of posterior transversus abdominis plane block with fascia transversalis plane block in adult patients undergoing unilateral inguinal hernia repair: A prospective, randomized, single-blind, two-arm parallel study. Saudi J Anaesth. 2024;18(2):211–7.
10. López-González JM, López-Álvarez S, Jiménez Gómez BM, Areán González I, Miramontes GI, Padín Barreiro L. Revista Española de anestesiología y reanimación Ultrasound-Guided transversalis fascia plane block versus anterior transversus abdominis plane block in outpatient inguinal hernia repair. Rev Esp Anestesiol Reanim (Engl Ed). 2016;63(9):498–504.
11. Öksüz G, Bilal B, Gürkan Y, et al. Quadratus lumborum block versus transversus abdominis plane block in children undergoing low abdominal surgery: A randomized controlled trial. Reg Anesth Pain Med. 2017;42(5):674–9.
12. Abdelbaser I, Mageed NA, El-Emam ESM, ALseoudy MM, Elmorsy MM. Preemptive analgesic efficacy of ultrasound-guided transversalis fascia plane block in children undergoing inguinal herniorrhaphy: a randomized, double-blind, controlled study. Korean J Anesthesiol. 2021;74(4):325–32.
13. Karadeniz MS, Atasever AG, Salviz EA, et al. Transversus abdominis plane block with different bupivacaine concentrations in children undergoing unilateral inguinal hernia repair: a single-blind randomized clinical trial. BMC Anesthesiol. 2022;22(1):355.
14. Kosem A, Ozcan MS, Iscan G, Ozden ES, Solmaz FA, Kirdemir P. Transversalis fascia plane block compared with transversus abdominis plane block for postoperative analgesia in Cesarean section under spinal anesthesia: A retrospective study. Anestezi Dergisi. 2024;32(1):11–9.
15. Celik EC, Ozbey I, Aydin ME, Yayik AM, Oral Ahiskalioglu E, Tor IH, Ahiskalioglu A. Efficacy of transversalis fascia plane block as a novel indication for varicocelectomy surgery: A prospective randomized controlled study. BMC Anesthesiol. 2023;23(1):48.
16. Abdelhamid BM, Khaled D, Mansour MA, Hassan MM. Comparison between the ultrasound-guided erector spinae block and the subcostal approach to the transversus abdominis plane block in obese patients undergoing sleeve gastrectomy: A randomized controlled trial. Minerva Anestesiol. 2020;86(8):816–26.
17. Sethi N, Pant D, Dutta A, Koul A, Sood J, Chugh PT. Comparison of caudal epidural block and ultrasonography-guided transversus abdominis plane block for pain relief in children undergoing lower abdominal surgery. J Clin Anesth. 2016;33:322–9.
18. Aksu C, Şen MC, Akay MA, Baydemir C, Gürkan Y. Erector spinae plane block vs quadratus lumborum block for pediatric lower abdominal surgery: A double blinded, prospective, and randomized trial. J Clin Anesth. 2019;57:24–8.

Publisher's note