



## Comparison of Analgesic Efficacy of Ultrasound Guided Ilioinguinal/Iliohypogastric Nerve Block and Transversus Abdominis Plane Block in Pediatric Unilateral Lower Abdominal Surgery

Pediyatrik Tek Taraflı Alt Batın Cerrahisinde Ultrasonografi Eşliğinde Yapılan İlioinguinal/Iliohipogastrik Sinir Bloğu ile Transversus Abdominis Plan Bloğunun Postoperatif Analjezik Etkinliğinin Karşılaştırılması

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# Comparison of Analgesic Efficacy of Ultrasound Guided Ilioinguinal/Iliohypogastric Nerve Block and Transversus Abdominis Plane Block in Pediatric Unilateral Lower Abdominal Surgery

## ABSTRACT

**Objective:** Regional techniques providing effective postoperative analgesia in pediatrics are controversial. We compared analgesic efficacy of ilioinguinal/iliohypogastric nerve and transversus abdominis plane blocks in children underwent abdominal surgery.

**Material and Method:** In this retrospectively designed study, a total of 60 patients aged between 2 and 12 years who underwent abdominal surgery were divided into two groups: Group I (n=30), which received an ilioinguinal/iliohypogastric nerve block, and Group II (n=30), which received a transversus abdominis plane block. Demographics, intraoperative heart rate, fentanyl consumption, duration of anesthesia and surgery, postoperative pain scores and time to first additional analgesic, number of patients requiring additional analgesia, and complications were recorded.

**Results:** The time to first postoperative analgesia requirement was similar between Group I and Group II ( $258 \pm 135$  min and  $193 \pm 94$  min, respectively  $p=0.369$ ). Demographics, intraoperative fentanyl consumption, duration of anesthesia and surgery were similar in both groups. Intraoperative heart rate and postoperative pain scores at 0th, 1st, and 2nd hours were comparable between the groups. Heart rate decreased significantly from baseline at 15 and 30 minutes within each group. Pain scores decreased significantly at 1st and 2nd hours compared to 0th hour within each group. The number of patients requiring additional analgesia in the first 24 hours postoperatively was similar between the groups. No patients experienced any complications.

**Conclusion:** Ilioinguinal/iliohypogastric nerve and transversus abdominis plane blocks provided similar analgesic efficacy in pain management after pediatric lower abdominal surgery. Both techniques could be preferable regional analgesia methods as part of a multimodal approach in this population.

**Keywords:** Acute postoperative pain, nerve block, pediatrics, regional anesthesia.

## ÖZET

**Amaç:** Pediatrik hastalarda etkin postoperatif analjezide rejyonal analjezi yöntemleri tartışmalıdır. Çocuklarda uyguladığımız ilioinguinal/iliohipogastrik sinir ve transversus abdominis plan bloklarının analjezik etkinliklerini karşılaştırmayı amaçladık.

**Gereç ve Yöntem:** Retrospektif olarak planlanan çalışmada abdominal cerrahi geçiren 2-12 yaş arası toplam 60 hasta ilioinguinal/iliohipogastrik sinir bloğu uygulananlar Grup I (n=30), transversus abdominis plan bloğu uygulananlar Grup II (n=30) olmak üzere iki gruba ayrıldı. Demografik veriler, intraoperatif kalp tepe atımı, fentanil miktarı, anestezi ve cerrahi süreleri, hastaların postoperatif ağrı skorları ile ilk analjezi ihtiyacına kadar geçen süre, ek analjezik ihtiyacı olan hasta sayısı ve komplikasyonlar kaydedildi.

**Bulgular:** Postoperatif ilk analjezi gereksinimi Grup I ve Grup II arasında benzerdi (sırasıyla  $258 \pm 135$  dakika ve  $193 \pm 94$  dakika  $p=0.369$ ). Demografik veriler, intraoperatif fentanil tüketimi, anestezi ve cerrahi süreleri iki grupta benzerdi. İntraoperatif kalp atım hızı ve postoperatif 0., 1. ve 2. saatlerdeki ağrı skorları gruplar arasında benzer bulundu. Grup içi analizlerinde her bir grupta kalp atım hızında 15. ve 30. dakikalarda başlangıç değerlerine göre anlamlı düşüş görüldü. Postoperatif ağrı skorları grup içi karşılaştırıldığında 1. ve 2. saatlerde 0. saate göre azalma gözlemlendi. Grup içi kalp atım hızı ve ağrı skorlarının zaman içerisinde gösterdiği değişimler gruplar arasında benzerdi. Postoperatif ilk 24 saatte ek analjezi ihtiyacı olan hasta sayısı gruplar arasında farklılık göstermedi. Hastalarda herhangi bir komplikasyona rastlanmadı.

**Sonuç:** İlioinguinal/iliohipogastrik sinir ve transversus abdominis düzlem blokları, pediatrik alt batin cerrahisi sonrası ağrı yönetiminde benzer analjezik etkinlik sağlamıştır. Çocuk popülasyonunun multimodal analjezi yaklaşımında her iki teknik de tercih edilebilir bölgesel analjezi yöntemleri olabilir.

**Anahtar Sözcükler:** Akut postoperatif ağrı, pediatri, rejyonal anestezi, sinir blok.

## Introduction

Pain is a common clinical complaint during the postoperative period. The inability of pediatric patients to express pain, particularly in younger populations, is challenging. Postoperative pain must be managed properly, as it affects not only the child who experiences pain after surgery, but also the parent, surgeon, and anesthesiologist. Moreover, effective pain control has a positive impact on recovery, hospital stay, and patient comfort (1,2).

Multimodal treatment, including regional methods, can be used in pediatric postoperative analgesia (1). The method of regional analgesia commonly used in children undergoing lower abdominal surgery is caudal epidural block (3). However, over the years, the known complications of neuraxial anesthesia have increased the tendency of clinicians to use peripheral blocks (4,5). Transversus abdominis plane (TAP) and ilioinguinal/iliohypogastric nerve (IL/IH) blocks are regional analgesia techniques that have become widespread with the increasing use of ultrasound (US) in the management of pain after abdominal surgery in children (6,7). The use of regional analgesia methods that reduce intraoperative anesthetic consumption, surgical stress, and pain is recommended for improved recovery after surgery in the pediatric population (8). There is no agreement on the appropriate regional analgesia technique owing to conflicting results regarding the analgesic efficacy of regional methods in pediatrics.

In our study, we investigated the analgesic efficacy of TAP and IL/IH blocks performed as regional analgesia methods in pediatric patients who underwent lower abdominal surgery. We aimed to compare the analgesic efficacy of these blocks with the time to first analgesia requirement as our primary outcome. In addition, we examined pain scores, intraoperative opioid consumption, hemodynamic effects, and the number of patients requiring additional analgesics as secondary outcomes.

## Material and Method

This study was conducted after obtaining approval from the Ethics Committee of the Şişli Hamidiye Etfal Training and Research Hospital (422/2015). Patients aged between 2 and 12 years with ASA I status, who underwent elective unilateral lower abdominal

surgery between March 2013 and February 2014 were retrospectively examined. Written informed consent was obtained from all the parents. The patients were divided into two groups according to the regional analgesia method. Patients who underwent IL/IH block were defined as Group I, and those who underwent TAP block were defined as Group II.

The laryngeal mask airway (LMA) was placed in patients and US-guided IL/IH or TAP blocks were applied using 0.3 mL/kg 0.25% bupivacaine following standard anesthesia induction. Demographics, intraoperative heart rate (HR), total fentanyl consumption, duration of anesthesia, and surgery were noted from medical records.

In our institute, we evaluated the pain and analgesic needs of pediatric patients in the post-anesthesia care unit using the face, leg, activity, cry, consolability (FLACC) scale, which results in a total score between 0-10 (0: no pain, 10: very severe pain), as shown in Table I (9). Patients routinely received 10 mg/kg paracetamol at the end of surgery. Patients whose FLACC scores were 4 and above at 0th, 1st, and 2nd hours postoperatively were administered additional analgesics.

The time that patients needed the first additional analgesic, the number of patients who required additional analgesia in the first postoperative two hours with FLACC score of >4, the number of patients who required analgesia between the second and 24th hours postoperatively, and complications were recorded.

### Statistical Analysis

The distribution of data was evaluated using the Kolmogorov-Smirnov test. Normally distributed quantitative data were analyzed using the Student t-test, and non-normally distributed quantitative data were analyzed using the Mann-Whitney U test. The chi-square test was used to analyze categorical data. Repeated measurements were evaluated using the paired t-test and Wilcoxon test. Statistical significance was accepted as  $p < 0.05$ .

## Results

Data from 60 patients were included in the statistical analysis: 30 in Group I and 30 in Group II. Demographics, intraoperative fentanyl consumption,

duration of anesthesia, and surgery were similar in both groups. (Table II)

**Table I.** Face Legs Activity Cry Consolability Scale

Categories	0	1	2
<b>Face</b>	No expression or smile	Occasional grimace, withdrawn or disinterest	Frequent to constant frown, clenched jaw, quivering chin
<b>Legs</b>	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
<b>Activity</b>	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
<b>Cry</b>	No crying (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
<b>Consolability</b>	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort

Intraoperative HR values in Group I and Group II before induction (initial), after insertion of the LMA, and at the 15<sup>th</sup> and 30<sup>th</sup> minutes were statistically similar. When the timewise change in HR within the group was examined, there was a statistically significant decrease after LMA at the 15<sup>th</sup> and 30<sup>th</sup> minutes in both groups compared to the initial HR values. Deceleration in HR did not show a statistically significant difference between the groups. (Table III)

**Table II.** Demographic and Operative Data

	Group I (n=30)	Group II (n=30)	p value
<b>Age (years)</b>	4.4±2.2	4.1±2.1	0.546
<b>Gender (female/male)</b>	11 (36.7%) / 19 (63.3%)	10 (33.3%) / 20 (66.7%)	0.787
<b>Weight (kg)</b>	17.4±4.9	16.3±4.7	0.366
<b>Duration of anesthesia (min)</b>	51±13.9	51.1±5.7	0.971
<b>Duration of surgery (min)</b>	34.8±14.8	31.7±6.9	0.299
<b>Total fentanyl amount(mcg)</b>	18.8±5.8	21.2±5.7	0.063

Data were expressed as mean ± standard deviation or number (percentage).

Group I: patients with ilioinguinal / iliohypogastric nerve block

Group II: patients with transversus abdominis plane block.

The FLACC scores at 0<sup>th</sup>, 1<sup>st</sup>, and 2<sup>nd</sup> hours were comparable between the groups. The timewise change of the FLACC scores within the group showed a statistically significant decrease at the 1<sup>st</sup> and 2<sup>nd</sup> hour compared to the 0<sup>th</sup> hour in both groups. This

decrease in the pain score was not statistically different between the groups. (Table IV)

**Table III.** Intraoperative Heart Rate Variations

		Group I (n=30)		Group II (n=30)		p value
		mean±sd	median (min/max)	mean±sd	median (min/max)	
HR	Initial	116.6±11.4	117 (94-135)	115.2±9.3	115 (99-135)	0.613
	After LMA	112.8±12.3	115 (82-130)	113.2±8.3	113 (99-135)	0.903
	15 <sup>th</sup> min	111.8±14	114 (84-141)	114±8.7	114 (97-135)	0.475
	30 <sup>th</sup> min	106.3±11.3	106 (85-138)	108.3±8.9	109 (90-129)	0.435
Variations in HR According to Initial Value Within Groups						
After LMA		-3.7±12.2	-2 (-28/-15)	-2±6.4	-3 (-20/-14)	0.502
15 <sup>th</sup> min		-4.7±16.8	-3 (-35/-34)	-1.2±9.3	-3 (-19/-22)	0.318
p value of timewise variations		<0.001		<0.001		
30 <sup>th</sup> min		-10.3±14.7	-10 (-48/-13)	-6.9±10	-7 (-26/-16)	0.295
p value of timewise variations		<0.001		<0.001		

HR, heart rate; LMA, laryngeal mask.

Group I: patients with ilioinguinal / iliohypogastric nerve block.

Group II: patients with transversus abdominis plane block.

The time to first additional analgesic requirement was 258 ± 135 min in Group I and 193 ± 94 min in Group II, and there was no statistically significant difference between the groups ( $p=0.369$ ). The number of patients who required additional analgesia in the first 2 hours postoperatively was similar between the groups: 5 (17%) patients in Group I and 7 (23%) patients in Group II ( $p=0.519$ ). Patients who needed additional analgesia between the 2nd and 24th hours were 5 (17%) patients in Group I and 6 (20%) patients in Group II, which was not statistically different between groups ( $p=0.739$ ). No postoperative complications were observed in the patients.

**Table IV.** Postoperative Pain Scores

		Group I (n=30)	Group II (n=30)	p value
		median(min-max)	median(min-max)	
FLACC score	0 <sup>th</sup> hour	1 (0-5)	1 (0-5)	0.981
	1 <sup>st</sup> hour	0 (0-4)	1 (0-4)	0.929
	2 <sup>nd</sup> hour	1 (0-3)	0 (0-5)	0.344
Variations in FLACC Score According to Initial Value Within Groups				
1 <sup>st</sup> hour		0 (-4/-3)	0 (-3/-1)	0.848
p value of timewise variations		<0.001		<0.001
2 <sup>nd</sup> hour		0 (-5/-3)	0 (-5/-3)	1
p value of timewise variations		<0.001		<0.001

FLACC score, Face Legs Activity Cry Consolability score.

Group I: patients with ilioinguinal/iliohypogastric block.

Group II: patients with transversus abdominis plane block.

## Discussion

Postoperative pain management is particularly important in the pediatric patient population. Pain can cause stress response, negatively affect recovery, deteriorate the child's comfort, and lead to anxiety in parents (1,2,10). The use of regional anesthesia techniques has become a significant part of multimodal pain management in children. This can be attributed to advancements in US technology, the safety and efficacy of US guidance in block performance, and the accustomed use of US (11). The Pain Committee of the European Society for Pediatric Anesthesiology has recommended US-guided peripheral blocks performed by experienced clinicians for postoperative pain treatment of children in lower abdominal surgeries (e.g., inguinal hernia and appendectomy) (12). Ilioinguinal/iliohypogastric and TAP blocks are frequently used regional analgesia methods in these surgeries. However, studies investigating these blocks in pediatric patient populations are scarce. Our study is one of the few studies to compare the postoperative analgesic efficacy of IL/IH and TAP blocks in pediatric patients.

A randomized controlled study concluded that the IL/IH block was more suitable than wound infiltration, as it provided better postoperative analgesia (13). In a similar study comparing TAP block with wound infiltration, children with TAP block had lower postoperative pain scores, and fewer patients needed additional analgesia (14).

In our study, we investigated the efficacy of US-guided IL/IH and TAP blocks in the pediatric population. We found that the time to first analgesic requirement, which was our primary outcome (258 min in IL/IH and 193 min in TAP), the pain scores, and the number of patients requiring additional analgesia were comparable. Similarly, Priyadarshini et al. reported no difference in the time to first analgesic requirement and additional analgesia need in their study, which examined these blocks in children undergoing open inguinal surgery (15).

Caudal epidural block is applicable in a wide range of surgeries as a traditional regional analgesia technique because it is efficacious and easy to learn (16). In a meta-analysis consisting of 1399 patients, which compared IL/IH and TAP blocks with caudal block, similarly to our study, the pain scores at 0th

and 2nd hours and additional analgesic requirement were close between IL/IH and TAP blocks (17). The authors stated that IL/IH and TAP blocks could be non-invasive alternative methods to caudal analgesia in pediatric genitourinary surgery because of the lower incidence of postoperative motor block and shorter time to first micturition compared to caudal analgesia (17).

In a large meta-analysis that reviewed various regional techniques in pediatric inguinal hernia repair (4636 patients), it was observed that the longest initial rescue analgesia time and the least need for rescue analgesics were achieved with TAP and quadratus lumborum blocks (18). We think that using anatomical landmark technique for IL/IH block performance may be one of the reasons for lower analgesic efficacy than US-guided TAP block. Failure rates of 28-45% were reported in IL/IH block applications with the traditional method, even performed by experienced clinicians (19). The study of Aveline et al., which showed that US-guided TAP block provided better analgesia in adult inguinal hernia repairs than conventional IL/IH block, also supports our opinion (20).

In our study, HR showed a decrease at the intraoperative 15th and 30th minutes compared to the initial values prior to induction in both blocks. Likewise, Karnik et al. observed a significant decrease in HR in the TAP block compared to local infiltration at the same follow-up times (21). Intraoperative fentanyl consumption was also similar between the groups, consistent with another pediatric study comparing these two blocks (22).

The primary limitation of our study was its retrospective design. As a result, pain assessments were limited to the data available patients' records, specifically the initial evaluations performed in the post-anesthesia care unit (PACU) during the first 2 hours postoperatively and the final pain scores recorded prior to discharge, approximately 24 hours after surgery. Intermediate time points could not be assessed due to lack of documented data. The third limitation was the absence of satisfaction questionnaires from surgeons and parents.

In conclusion, we observed that the IL/IH and TAP blocks had similar analgesic efficacy in pain management after pediatric lower abdominal surgery.

It appears that both IL/IH and TAP blocks are effective and could be preferable analgesia methods among regional techniques as part of multimodal analgesia in pediatric patients.

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