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Quadratus Lumborum Block versus Transversus Abdominis Plane Block for Postoperative Analgesia

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ABSTRACT

Objectives: To determine the efficacy of transversus abdominis plane block and quadratus lumborum block in pediatric lower abdominal surgeries.

Study Design: Quasi-experimental study.

Place and Duration of Study: Pak Emirates Military Hospital, Rawalpindi Pakistan, from Jan to Jul 2023.

Methodology: Forty-eight pediatric patients scheduled for unilateral repair of inguinal hernia under general anesthesia were enrolled in the study after random distribution in two groups, Group-T (Transversus Abdominis Plane Block) and Group-Q (Quadratus Lumborum Block). Postoperative pain intensity was evaluated with the Face, Legs, Activity, Cry, and Consolability Scale.

Results: There were 48 patients in the trial, with no discernible differences in demographics, American Society of Anaesthesiologists score, surgery type, or duration. In the first 24 hours following surgery, considerably fewer patients in the Quadratus Lumborum Block Group than in the Transversus Abdominis Plane Block Group needed analgesia (p-value <0.05). The one, four, six, and twenty-four hours Face, Legs, Activity, Cry, and Consolability Scale were determined to be lower in Group-Q compared to Group-T (p-value <0.05). Parent satisfaction scores inquired upon on a scale of 1-10, which turned out to be greater in Group–Q 9.00(9.00-8.00) as compared to Group-T 8.00(9.00-7.25), which was statistically significant (p-value =0.006).

Conclusions: This study concluded that transversus abdominis plane block is less effective than quadratus lumborum block for pain relief.

Keywords: Abdominal, Analgesia, Quadratus Lumborum Block, Transversus Abdominis Plane Block.

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INTRODUCTION

In multimodal analgesia approaches used in abdominal surgery, truncal blocks have a place. Transversus abdominis plane (TAP) blocks are now routinely used in lower and upper abdominal surgeries.[1,2] New strategies for the TAP block have emerged in recent years as a result of the usage of ultrasound.[3,4] A novel abdominal truncal block called the quadratus lumborum (QL) block is utilized for abdominal analgesia, thoracolumbar fascia medial aspect, and quadratus muscle.[5,6] In 2007, Blanco published the first description of the 'Type-1 QL block' (QL1), which is applied to the anterolateral portion of the QL muscle. In reference to the Shamrock strategy, the QL block was later improved and dubbed the posterior transmuscular (QL-TM) approach.[7] Local anesthesia infiltrated the quadratus muscle anteriorly using the (QL-TM) technique.[8] A 'Type-2 QL block' (QL2) described by Blanco *et al*., in which the injection location was purposefully shifted from the anterolateral side of the QL muscle to the posterior wall. Blanco *et al*., compared the QL2 block with the TAP block for pain relief in lower-segment caesarian section patients and concluded that the QL2 block was advantageous in all regards.[9] Öksüz *et al*., concluded that the QL technique is efficacious as compared to the TAP technique pain in pain management of pediatric lower abdominal procedures.[10]

No trials that we are cognizant of have compared a QL2 block to a conventional TAP block in pediatric inguinal hernia repair surgeries; therefore, we aimed at this quasi-experimental study.

METHODOLOGY

The quasi-experimental study was conducted at Pak Emirates Military Hospital, Rawalpindi Pakistan, from January to July 2023 after approval from the Institutal Ethical Research Committee (ERC Approval Number 484). With an OpenEpi sample size calculator, a sample size of 24 patients in each group was determined based on average subjects who desired pain relief in 24 hours (QL Block batch 0.20±0.41 and

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TAP Block batch 0.60±0.54) as determined by Öksüz *et al*.[10]

Inclusion Criteria: Children aged 1 to 7 years who were scheduled for general anesthesia unilateral inguinal hernia surgery with American Society of Anesthesiologists (ASA) status I and II were included.

Exclusion Criteria: Patients with infection or redness at the injection site, anatomical malformations or coagulation disorders, liver ailments were excluded.

Equal distribution in two groups was employed with consecutive non-probability sampling techniques (Group-Q and Group-T). The patients' parents gave their informed consent.

All patients received oral midazolam 0.5mg/kg prior to surgery. Electrocardiography, noninvasive blood pressure, and peripheral oxygen saturation were all observed in the operating room. With the help of a face mask that delivered 4% Sevoflurane and 2mg/kg Propofol along with oxygen, general anaesthesia was produced. The upper airway's protection was established with I-Gel. Sevoflurane 2% and 50% air in oxygen were employed to maintain anaesthesia.

After preserving the airway prior to surgery, Group-T (n-24) participants received a TAP block, while Group-Q (n-24) participants received a QL block after the patient's placement in the lateral position (Figure-1). Surgical site sterilization was ensured with povidone-iodine, and a high-frequency (10–18 MHz) ultrasound linear probe was wrapped in sterile sheaths.

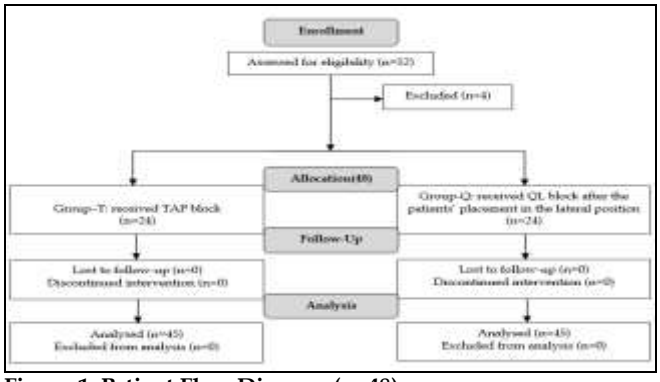


Figure-1: Patient Flow Diagram (n=48)

In Group Q, abdominal wall muscles were visualized with anterior and posterior probe positions relative to the iliac crest. The posterior boundary of the external abdominal oblique muscle was identified by posterolaterally tracking the muscle. The thoraco-lumbar fascia midline was identified as a bright hyperchromogenic line. Using an in-plane approach, a 22-gauge, 80-mm Quincke-type SonoPlex needle was introduced. A negative aspiration test confirmed the space; hence, the needle was positioned from anterolateral to posteromedial. Between the thoraco-lumbar fascia and the QL muscles, 0.5mL/kg of 0.2% bupivacaine was infiltrated.

The probe was positioned between the iliac crest and the anterolateral abdominal wall in the group receiving the TAP block. The transversus abdominis, internal abdominal oblique, and external abdominal oblique muscles were recognized. An in-plane approach was used to insert a Quincke-type SonoPlex needle, 22 gauge and 50mm in length. After performing a negative aspiration test with 0.5mL of normal saline to confirm the space with a hypoechoic picture and hydro dissection, the needle was positioned from anterolateral to posteromedial toward the TAP. Between the internal abdominal oblique and the transversus abdominis muscles, 0.5mL/kg 0.2% bupivacaine was injected. 07–10 minutes later, patients were operated on using a standardized procedure.

All patients received an IV dose of 15mg/kg of acetaminophen following surgery. Any complications encountered during the procedure were documented. In the surgery ward and recovery zone, pain levels were determined at one, four, six, and twenty-four hours with Face, Legs, Activity, Cry, and Consolability (FLACC Score) (Figure-2).[11]

Categories	0	1	2
Face	No particular expression or smile	Occasional grimace or frown; withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs; frequent complaint
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to; distractible	Difficult to console or comfort
Each category is scored on the 0-2 scale, which results in a total score of 0-10. **0:** Relaxed and comfortable **1-3:** Mild discomfort **4-6:** Moderate pain **7-10:** Sever discomfort or pain or both			

Figure-2: FLACC(Face, Legs, Activity, Cry, Consolability)

Participants were treated with an oral dose of 15mg/kg of acetaminophen in the ward with a pain score greater than 2. The main goal was whether analgesia was necessary for the first 24 hours, with secondary outcomes including the FLACC scores and the period that the first analgesic was needed. The

parents' levels of satisfaction were verbally recorded on a count of 1-10 scores.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis The median (IQR) of discrete variables were calculated, whereas frequency and percentage were used to analyze categorical data. Mann-Whitney U test and the chi-square test were applied. The *p*-value lower than or up to 0.05 was considered as significant.

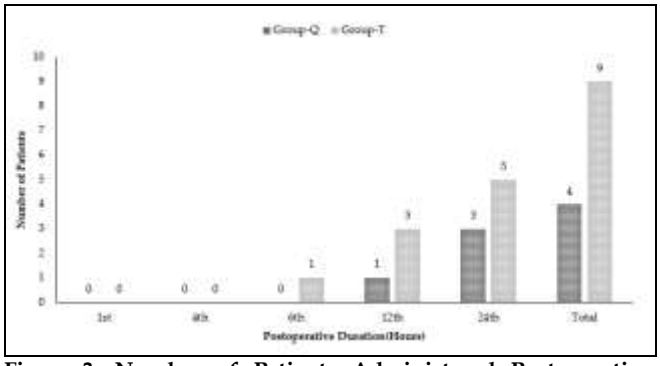
RESULTS

There were 48 patients in the trial, with no discernible differences in demographics, American Society of Anaesthesiologists score, surgery type, or duration (Table-I).

Table–I: Demographic and Clinical Profile (n=48)

Parameters		Group–Q (n=24)	Group–T (n=24)	*p*-value
Age (Years)		4.01±2.08	3.45±1.88	1.00
ASA Status	I	22(91.7%)	21(87.5%)	0.50
	II	2(8.3%)	3(12.5%)	
Gender	Male	23(95.8%)	22(91.7%)	0.50
	Female	1(4.2%)	2(8.3%)	
Surgical Duration(minutes)		51.83±4.24	51.83±5.70	0.35

During the initial twenty-four hours, considerably fewer patients in Group-Q desired analgesia than in Group-T (*p*-value <0.05), as illustrated in Figure-3.



Figure–3: Number of Patients Administered Postoperative Rescue Analgesia

The one, four, six, and twenty-four hour Face, Legs, Activity, Cry, and Consolability (FLACC Scale) determined less low in Group-Q compared to Group-T (*p*-value <0.05) enumerated in Table–II. However, no statistically notable difference was recorded at 1st hour (*p*-value 0.48).

None of the patients experienced any postoperative complications relevant to the modality. Parent satisfaction scores inquired upon on a scale of 1-10, which turned out to be greater in Group–Q 9.00(9.00 - 8.00) as compared to Group 8.00(9.00 - 7.25), which was statistically significant (*p*-value=0.006).

Table–II: FLACC (Face, Legs, Activity, Cry, Consolability) Scores Exhibited by Patients During Postoperative Period (24 Hours) (n=48)

Parameters		Groups		*p*-value
		Group-Q (n=24)	Group-T (n=22)	
1st Hour	Mild	24(100.0)	22(491.7%)	0.489
	Moderate	0(0%)	2(8.3%)	
4th Hour	Mild	23(95.8%)	14(58.3%)	0.008*
	Moderate	1(4.2%)	9(37.5%)	
	Severe	0(0%)	1(4.2%)	
6th Hour	Mild	22(491.7%)	11(45.8%)	0.003*
	Moderate	2(8.3%)	11(45.8%)	
	Severe	0(0%)	2(8.3%)	
12th Hour	Mild	23(95.8%)	10(41.7%)	<0.001*
	Moderate	1(4.2%)	13(54.2%)	
	Severe	0(0%)	1(4.2%)	
24th Hour	Mild	22(491.7%)	12(50.0%)	0.001*
	Moderate	2(8.3%)	12(50.0%)	
	Severe	0(0%)	0(0%)	

**Significant p-value calculated by Chi-Square Test*

DISCUSSION

The study's findings revealed that QL block is superior to TAP block in analgesia and efficacy. Numerous techniques have been used in low-abdominal surgery on children, including hernia repair and orchiopexy (transversus abdominis plane block, caudal block, ilioinguinal nerve block, and wound infiltration).[12] A recently evolved technique called the QL block can be employed in either lower or upper abdominal surgeries. For postoperative analgesia after children's upper and lower abdominal surgeries, the TAP block is a popular method. Under ultrasound direction, it is more dependable and simple to use, which has raised its appeal.[13]

When comparing the effectiveness of the TAP and QL2 blocks and local anesthetic blood levels in adults, Murouchi *et al*., demonstrated higher local anesthetic blood levels in the TAP block than when the QL2 block was employed, but the QL2 block was more effective.[14]

The QL2 block may be more dependable because the local anesthetic level in the blood was lower there than in the TAP block; this could be a justification for choosing the QL block for kids. Additionally, the surface configuration of the QL2 block may be performed in both supine and lateral positions, and it can be easily applied with a linear probe in children,

which could enhance its utility in patients undergoing abdominal surgery who require multimodal analgesia. There are theories about the QL block mechanism connected to the extent of the paravertebral local anesthetic area when TAP block and QL block efficacy are compared in abdominal surgery. Previous research has also suggested that the L1 anterior branch might not experience anesthesia when the conventional (lateral) TAP block is applied, and other investigations have confirmed L1 involvement in the application of the TAP block. There is not much information in the literature that explains how QL blocks are used for post-op pain relief in children.[15,16]

Visoiu and Yakovleva were the first researchers to document the utilization of a catheter to administer analgesia with a QL block in a lateral site during pediatric colostomy repair. Following a nephrectomy, the pediatric population with Wilms tumors received continuous QL block through the use of a catheter.[17] Baidya *et al*., employed a QL-TM block with a single-dose injection trans muscularly between the psoas major and the QL in pyeloplasty implementation carried out on five pediatric patients in the lateral position, and it was observed that postoperative analgesia was successful.[18]

In a pediatric patient undergoing laparoscopic appendectomy, Murouchi *et al*., described the intramuscular technique and found effective analgesia with the bilateral application of a QL-IM block.[19]

Three patients in the QL block group were administered 7mg/kg stat ibuprofen at the earliest time of the 15th hour as their sole source of analgesia for the first 24 hours following surgery. The first single dosage of 7mg/kg ibuprofen was administered to ten patients in the TAP block group at the 10th hour. Some children required analgesia at home after being discharged, which can be accounted for by the child becoming more active and subsequently experiencing pain.

Comparative studies of the transversus abdominis plane block, quadratus lumborum block, and wound infiltration in abdominal surgery patients are desperately needed in this field.

LIMITATION OF STUDY

The inability to infer the sensory block level of the trans-versus abdominis plane block and quadratus lumborum block among children may have been a study drawback.

CONCLUSION

This study concluded that the transversus abdominis plane block is less effective than the quadratus lumborum block for pain relief.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AKJ & NS: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

AAQ & AK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

HMT & UEM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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