

**COMPARISON OF POSTOPERATIVE PAIN BETWEEN ULTRASOUND-GUIDED
QUADRATUS LUMBORUM AND ULTRASOUND-GUIDED CAUDAL
EPIDURAL BLOCK IN CHILDREN UNDERGOING UNILATERAL
LOWER ABDOMINAL AND UROLOGICAL SURGERIES IN PHILIPPINE
CHILDREN'S MEDICAL CENTER: A RANDOMIZED CONTROLLED TRIAL**

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ABSTRACT

BACKGROUND: Ultrasound-guided quadratus lumborum block (QLB) is a regional anesthetic technique which can provide post op pain control for pediatric patients undergoing abdominal surgery. We hypothesized that the quadratus lumborum block would be as efficacious as a caudal block in providing pain control.

OBJECTIVE: To compare the postoperative analgesic effect of ultrasound-guided QLB versus ultrasound-guided caudal block among 1-6 years old children undergoing lower abdominal and urological surgeries in Philippine Children's Medical Center.

METHODS: This is a single blinded randomized control trial. 50 patients enrolled aged between 1 and 6 years. The patients were randomly classified into the caudal block group and quadratus lumborum block group. The primary outcome is the need for analgesia during the first 24 hours.

RESULTS: A significant difference in the proportion of patients who requested for rescue analgesia was observed with caudal block having more patients in need of analgesic (100% CB vs 48% QLB, $p < 0.001$). No postoperative complication was observed.

CONCLUSIONS AND RECOMMENDATIONS: The quadratus lumborum block was more effective in reducing the postoperative pain management during the initial 48 hours. Quadratus lumborum block is recommended for future pediatric procedures requiring postoperative pain control, safety, practicality and economy.

KEYWORDS: Analgesia, Postoperative Pain, Qlb

INTRODUCTION

Postoperative pain is commonly experienced after surgery and children tend to rely on a parent or guardian to give medication to help relieve the pain. One study showed that the children in the 'around the clock' group took more medication, but they did not have more relief [1]. The purpose of this study is to find the best alternative to decrease post-operative pain in children undergoing lower abdominal surgeries. The investigator will perform ultrasound-guided quadratus lumborum block (QLB) and the more commonly used caudal epidural block but coupled with ultrasound guidance in an

anesthetized children. The investigator plans to establish which technique is more advantageous in terms of postoperative pain control, safety, practicality and economy.

MATERIALS AND METHODOLOGY

The research design used was a single blinded control trial. Target patients aged 1-6 years old scheduled for lower abdominal and urological surgeries in PCMC. Patient sampling was randomized using computer generated random numbers (Random.org), this created a list of number and each number referred to one of the two groups.

Block randomization was used to ensure equality of the groups.

Sample size was computed using G*Power 3.1.9.2 a statistical software [2] for computing sample size. Based on the result of the study of Dogra et al [3] and Oksus et al [4] on percentage needing rescue analgesia with Caudal epidural block is 61.5%, and quadratus lumborum block is 12%, with Power 0.9 alpha 0.05, two tailed , a sample size a sample size of 44 was computed. Accounting for 10% dropout rate, a total sample size of 50 is needed.

This study aimed to include a total of fifty patients who underwent elective unilateral low abdominal and urological surgeries under general anesthesia with Laryngeal Mask Airway using Igel LMA. The patients were aged 1 to 6years with American Society of Anesthesiologists (ASA) physical status of I and

Preoperatively, all patients were evaluated, and parental consent was obtained. Exclusion criteria included known allergies to local anesthetics, infection or redness at the injection site, anatomic anomalies or coagulation disorders, severe obesity, liver, cardiac, renal, neurological/mental and upper or lower airway disease, or unwillingness to participate in the study.

Ultrasound guided quadratus lumborum block and ultrasound guided caudal block were done accordingly. The operation initiated 15 minutes after the block was applied, and all patients was operated

on with a standardized technique and was monitored every five minutes. At the end of surgery, paracetamol 15 mg/kg IV was administered to all patients. Patients was then extubated immediately after surgery and sent to PACU. Any complications occurring during the procedure was recorded and managed immediately. Complications such as hypersensitivity was immediately given anti-histamine medications such as diphenhydramine 1mg/kg and close monitoring afterwards. Hypotension and bradycardia were dealt with Atropine 0.02mg/kg and hydration. If postoperative vomiting occurs, Ondansetron 0.1mg/kg IV was given.

At the PACU, parent /guardian was instructed to assess the patient's pain using FLACC scoring. The researcher visited the patient at 24 hours and 48 hours if admitted, and was followed up by phone if outpatient if-reported data. Pain levels using a FLACC(Face, Legs, Activity, Cry, Consolability) scale [5] at one hour and at 2,6,12,24and 48 hours. Paracetamol 15mg/kg was administered to patients if the FLACC score was 4 or greater. Parents was instructed on how to use the FLACC score pain scale. Parents were instructed to give paracetamol 15mg/kg every 6 hours when patient had greater than 4 FLACC score at home. The anesthesiologist recorded the data received from the parents over the phone. Parents were asked to rate satisfaction using PPPM-SF Parents' Postoperative Pain Measure – Short Form [6] as well as adverse events. Cases of adverse events were managed accordingly.

The primary outcome was whether there is a need for analgesia in the first 24 hours. Secondary outcomes were the time the first analgesia was required and measured using FLACC scores and parent satisfaction. Satisfaction levels of the parents were given verbally as a level from 1 to 10, with the lowest level of satisfaction at a value of 1 and the highest level at 10. Intent to treat analysis was used. Patients who dropped out after the randomization procedure were analyzed in the group he / she was randomized.

Data gathered from the data abstraction form was encoded using Microsoft Excel 2010. Stata v14 MP was used for data analysis. Numerical variables such as age was summarized using mean and standard deviation. Categorical variables such as sex and surgical procedures was summarized as number. FLACC score was summarized and interquartile range. Chi-square test was used to compare whether there is difference in the need for rescue dose medications and patient satisfaction in the two groups. Mann Whitney U test was used to compare the FLACC score among the two groups with a p-value of <0.05 was considered significant.

RESULTS

A total of 50 patients were included in the study and no case deviated from the protocol. The patients were composed of 33 males (66%) and 17 females (34%) and the mean age is about 3 years old. Body Mass Index of patients were within normal range as well. Majority of patients for caudal

(96%) and quadratus lumborum (88%) blocks were categorized as ASA-PS I. Distribution of surgical procedure of patients are homogenous between the two groups.

Table 1. Demographic and clinical profile of patients (n=50)

	CB (n=25)	QLB (n=25)	p-value
Age, years	3.12 ± 1.76	2.72 ± 1.90	0.448*
Gender			0.765 [†]
Male	17 (68)	16 (64)	
Female	8 (32)	9 (36)	
Weight, kilograms	15.17 ± 4.91	12.94 ± 4.11	0.087*
Height, centimeters	84.6 ± 11.04	78.72 ± 13.12	0.093*
BMI (normal)	25	25	-
ASA PS			0.297 [†]
I	24 (96)	22 (88)	
II	1 (4)	3 (12)	
			0.9235
Urological procedure	14(56)	17(68)	
Lower abdominal procedure	11(44)	8(32)	

All patients under the caudal block group asked for rescue analgesia. A significant difference in the proportion of patients who requested for Rescue Analgesia between caudal block and quadratus lumborum block was observed, with caudal block having more patients in need of analgesic (100% CB vs 48% QLB, p<0.001).

Table 2. Need for Rescue Analgesia of patients (n=50)

	CB (n=25)	QLB (n=25)	<i>p-value</i>
Yes	25(100)	12(48)	<0.001 [†]
No	0	13(52)	<0.001 [†]

The median frequency of anesthesia taken for patients in the caudal block was significantly higher than that of the quadratus lumborum block. The median time to first analgesic use was 6 hours with patients in the caudal block and 2 hours with patients in the quadratus lumborum block (2 hours vs 6 hours, $p<0.001$). Analgesic use was observed more frequently in the caudal block than in the quadratus lumborum block from 2 to 24 hours post operation.

Table 3. Time to regional anesthesia and FLACC scores of children 1-6 years old undergoing unilateral lower abdominal and urological surgeries in Philippine Children's Medical Center (n=50)

	CB (n=25)	QLB (n=25)	<i>p-value</i>
	Median (Range); Frequency (%)		
Number of analgesia taken	(n=25)	(n=12)	<0.001 [†]
	4 (1-6)	1 (1-4)	

	CB (n=25)	QLB (n=25)	p-value
	Median (Range); Frequency (%)		
Time to first analgesic use, hours	(n=25)	(n=12)	0.001[‡]
	2 (2-6)	6 (2-24)	
Analgesic use due to FLACC score >4 [†]			
1 st hour	0	0	-
2 nd hour	16 (64.00)	2 (8.00)	<0.001
6 th hour	23 (92.00)	7 (28.00)	<0.001
12 th hour	21 (84.00)	6 (24.00)	<0.001
24 th hour	15 (60.00)	4 (16.00)	0.003
48 th hour	1 (4.00)	0	1.000

Parents were asked to answer the Parent's Post-Operative Pain Measure – Short Form (PPPM-SF) after observing their children during the 48-hour post-operation period. Patients under caudal block had a higher median score (median score of 8, ranges from 2 to 10) compared to those in the quadratus lumborum block (median

obvious change in behavior than those in the quadratus lumborum block.

Table 4. Parent's Post-Operative Pain Measure – Short Form of children 1-6 years old undergoing unilateral lower abdominal and urological surgeries in Philippine Children's Medical Center (n=50)

	CB n=25	QLB (n=25)	p-value
	Median (Range); Frequency (%)		
PPPM-SF score	8 (2-10)	1 (0-6)	<0.001[‡]
PPPM-SF			

score of 1, ranges from 0 to 6). Children's appetite was the most reported change in behavior (80%). Generally, more patients in the caudal block were reported to have an

	CB (n=25)	QLB (n=25)	p-value
	Median (Range); Frequency (%)		
Questions [†]			
Whine or complain more than usual	19 (76)	5 (20)	<0.001
Play less than usual	17 (68)	2 (8)	<0.001
Not do the things s/he normally does	15 (60)	0	<0.001
Act more worried than usual	18 (72)	1 (4)	<0.001
Act more quiet than usual	13 (52)	3 (12)	0.005
Have less energy than usual	19 (76)	2 (8)	<0.001
Eat less than usual	25 (100)	15 (60)	0.001
Hold the sore part of his/her body	4 (16)	1 (4)	0.349
Groan or moan more than usual	20 (80)	5 (20)	<0.001
Want to be close to you more than usual	12 (48)	6 (24)	0.140

There were no reported cases of adverse outcomes within 48 hours post-operation of patients.

DISCUSSION

This is a pioneer study with a single-blind, randomized clinical trial comparing the quadratus lumborum block and caudal block for postoperative pain relief after lower abdominal surgery in children in the Philippines. The results of the study showed that the QLB block provided a safe and more effective pain relief compared with the caudal block in lower abdominal surgery in children, such as hernia repair and orchidopexy.

Several studies have explored the efficacy of plane nerve block versus truncal and central nerve blockade. In one study, Blanco et al [7] [8] compared the efficacy of the TAP and QL blocks for postoperative analgesia in cesarean delivery operations. It was reported that the QL block was superior to the TAP block with respect to the duration of the effect, pain relief, opioid consumption, and the success of the block.

Visoiu and Yakovleva [9] were the first to report on providing analgesia with a catheter using a QL block in a lateral pediatric colostomy repair. al [10] applied continuous QL block with a catheter after a nephrectomy for Wilm's tumor in pediatric patients while in a supine position, and they also reported successful postoperative analgesia with this technique. In pyeloplasty performed on 5 children in the lateral position, Baidya et al [11] used a QL-TM

block with the application of a single-dose injection transmuscularly, between the psoas major and the QL; postoperative analgesia was reported successful. Murouchi [12] [13] described the intramuscular approach in a pediatric patient undergoing laparoscopic appendectomy equally reporting successful analgesia after bilateral application of a QL-IM block.

In our study, all patients who underwent caudal block needed rescue analgesia while only 48% of patients in the QLB group warranted this adjunct treatment. This result was significant with a p value of <0.001. This supports the claim of QLB having better pain control since it has more central origin. Distribution of the nerve anesthetized provides broader coverage on both somatic and visceral nervous system that last for 24-48 hours.

Results show that the patients in the CB group had significantly shorter time to request 1st analgesic regimen. The mechanism of the QL block has not been fully clarified. However, Carline et al [14] provided a possible mechanism of prolonged analgesia from QL block w

on spread of local anesthetic:

The QL block was determined to have a longer duration of effectiveness. These results were seen to be consistent with those of Blanco et al. [7][8] In this study, the QLB was observed to be statistically superior to the caudal block based on the FLACC scores at 1hour and at 2, 6, 12, 24 and 48 hours post-operatively.

Our results demonstrated better post-operative state based on PPPM-SF results 48-hour after surgery. PPPM-SF is inversely proportional to caregiver's level of satisfaction. Patients under caudal block had a higher median score of 8 (ranges from 2 to 10) compared to those in the quadratus lumborum block with a median score of 1 (ranges from 0 to 6). This indicates earlier return of patient to preoperative state. In the QLB group, patients are comfortable and calm consequently making the parents at ease.

In a case undergoing laparoscopic gynecological surgery, unilateral weakness was experienced in hip flexion and knee extension, which lasted for approximately 18 hours after the application of the QL block. However, this seems to be the only reported complication in literature. Blanco et al [8] reported that no complications were encountered in patients who had a cesarean delivery, particularly because the QL2 block is a superficial and safe block. In the current study, no complications developed in either group. However, there was not adequate power to show a difference in uncommon

No opioids were required, could be discharged early; the surgical team viewed these as positive aspects.

CONCLUSION AND RECOMMENDATION

Our results strongly support the use of quadratus lumborum block versus among children undergoing lower abdominal and urological surgeries due to its superior

postoperative analgesic effect as measured by: need for rescue analgesia, time to first rescue analgesic use, pain score using FLACC score and parent satisfaction using parent's PPMSF scores as compared to ultrasound-guided caudal block. Both techniques can be safely done in children. Limitation of this study is that we were unable to measure the dermatomal sensory block level of the QL block to the children aged 1 to 6 years compared with the caudal block.

Therefore, recommendation on the use of the different techniques of QLB, different anesthetic agents on different procedures should be done for future studies with comparison with patient's hemodynamic changes during intraoperative and postoperative monitoring in different age group. These aim to make clear criteria to assess the performance of each QL block in comprehensive aspects, which will contribute to the advancement of regional blocks.

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