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***Quadratus lumborum* block in pediatric patients – a case series**

Quadratus lumborum блок код педијатријских пацијената –
прикази болесника

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Quadratus lumborum блок код педијатријских пацијената – прикази болесника

SUMMARY

Introduction The quadratus lumborum block (QLB) was the first interfascial plane block introduced in Leskovac General Hospital thanks to the international teaching Kybele Inc. program in April 2017.

Outline of cases During the period from April 2017 to December 2019, 22 pediatric patients underwent various surgical procedures and had the QLB type 1 block as a part of a multimodal perioperative pain management plan. Unilateral QLB was provided for unilateral inguinal hernia repair, orchidopexy, testicular torsion repair, and open appendectomy. Bilateral QLB was provided for laparoscopic appendectomy and cholecystectomy. Decreased use of fentanyl and sevoflurane was noticed in the cases when QLB was performed preoperatively. All patients had well-controlled pain.

Conclusion QLB is a simple and safe technique. Clear sonographic landmarks allow it to be easily performed. QLB has great potential to improve and facilitate postoperative pain management.

Keywords: QLB; interfascial plane block; pediatrics

САЖЕТАК

Увод *Quadratus lumborum block (QLB)* је први интерфасцијални блок уведен у свакодневну клиничку праксу у Општој болници Лесковац. Његова примена почела је захваљујући међународном едукационом програму *Kybele Inc.* априла 2017. године.

Прикази болесника Од априла 2017. до децембра 2019. године, код 22 педијатријска пацијента подвргнута различитим хируршким захватима примењен је *QLB* у склопу мултимодалне периоперативне терапије бола. Једнострани блок примењен је код деце подвргнуте једностраној херниопластици, деторквацији, крипторхизму и отвореној апендектомији. Обострани *QLB* изведен је код деце за лапароскопску апендектомију и холецистектомију. Мања употреба фентанила и севофлурана примењена је код деце која су *QLB* добила преоперативно. Сви пацијенти имали су добру контролу бола.

Закључак *QLB* је једноставна и безбедна техника, а лако се изводи захваљујући прецизним ултразвучним маркерима који се лако идентификују. *QLB* има потенцијал да олакша и унапреди постоперативну терапију бола код деце.

Кључне речи: *QLB*; интерфасцијални блокови; педијатрија

INTRODUCTION

Ultrasound guided regional anesthesia techniques have decreased the number of failed blocks and increased patient safety [1]. According to published articles and multimodal pain management protocols, interfascial plane blocks have an important place in perioperative pain management. Quadratus lumborum block (QLB) was the first interfascial plane block that was introduced in Leskovac General Hospital in April 2017 [2]. It became a part of a multimodal pain management plan following abdominal, obstetric, gynecologic, and urologic surgery in adults and pediatric patients [3, 4].

CASE REPORTS

During the period from April 2017 to December 2019, 253 pediatric patients underwent surgical procedures at Leskovac General Hospital. Twenty-two of these patients had QLB as a part of a multimodal pain management plan: 3 following open inguinal hernia repair, 2 following testicular torsion repair, 1 following orchidopexy, 2 after open appendectomy, 12 after laparoscopic appendectomy, and 2 following laparoscopic cholecystectomy. Patients were 5-17 years old, in good health, without any previous medical history or prior surgery (Table 1).

All surgeries were done under general anesthesia. Anesthesia induction was done using either 2–3 mg/kg propofol or 4-5 mg/kg thiopental. Fentanyl 1–2 mcg/kg was given at induction, and repeated if needed. Sevoflurane in a 50% air/50% oxygen mixture with an end-tidal of 1–2 vol% was used as the maintenance agent. Acetaminophen 10-15 mcg/kg was used intravenously 15-20 minutes before the end of surgery. QLB was done either after induction of anesthesia, before incision (4 patients) or after surgery, before emergence from general anesthesia (18 patients). Unilateral block was provided for unilateral inguinal hernia repair, orchidopexy, testicular torsion repair, and open appendectomy. Patient undergoing laparoscopic surgeries had bilateral QLB. We used levobupivacaine 0.25% or bupivacaine 0.25% at dose of 2 mg/kg (max. 30ml) (Table 2). We used 22-gauge 50 mm needles for the peripheral nerve block, and the linear ultrasound probe as guidance. Decreased usage of fentanyl and sevoflurane was noticed in the cases where QLB was performed preoperatively.

All patients had well controlled pain. Younger patients (inguinal hernia repair, orchidopexy, and testicular torsion repair) had no pain medications postoperatively. After the emergence from anesthesia these patients spent their time sleeping and playing with toys. Their parents were very satisfied with the analgesia that was provided. The rest of the patients (13-17 year old) had acetaminophen per request, every 6 hours (Table 1). Eighteen of 22 patients left the hospital on postoperative day 1. Only patients that underwent open appendectomy and testicular torsion repair stayed in hospital past postoperative day 1. There were no complications regarding block performance.

This report, done according to the Declaration of Helsinki, was approved by the Ethical Committee of Leskovac General Hospital (approval no. 2023/2).

DISCUSSION

QLB is the ultrasound-guided local anesthetic injection in quadratus lumborum plane (Figure 1). It was described as a variant of the transversus abdominis plane (TAP) block by Dr. Rafael Blanco in 2007 [3]. Dr. Michaela Visoiu was the first one who used it for pain management following colon surgery in pediatric patient in 2013 [5]. QLB was used as a part of a multimodal pain management technique in pediatric patients that underwent nephrectomy [6], pyeloplasty [7], orchidopexy and, inguinal hernia repair [8–12], hip and femur surgery [13, 14], extracorporeal shock wave lithotripsy [15], and surgery for vesicoureteral reflux [16].

QLB can be learned relatively easily. It is a simple technique to perform due to clear sonographic markers [3] (Figure 1).

According to the results of many randomized controlled trials, QLB significantly decreases perioperative opioid use in adults [17, 18, 19], and children [11, 13, 14], and subsequently opioid side effects such as nausea and vomiting [18]. QLB prolongs time to the first request for rescue analgesic medication [11, 13, 14, 19], speeds ambulation and discharge from hospital [10, 19]. QLB has found its place in ERAS protocols [20].

Regional analgesia techniques reduce opioid consumption during general anesthesia perioperatively, and provide better postoperative pain control compared to pain control provided by either general anesthesia alone or general anesthesia plus local anesthetic wound infiltration [13, 14, 21]. Until few years ago, caudal block, TAP block, and ilioinguinal/iliohypogastric block were the most often used analgesic techniques for low abdominal surgery (inguinal hernia repair, and orchidopexy) in pediatric patients. Caudal block provides postoperative analgesia as good as TAP block, and both of them provide better analgesia than ilioinguinal/iliohypogastric block according to prospective randomized single-blinded study by Sahin et al. [22] Kendall et al. reached the same conclusion in their systematic review of 40 randomized controlled trials in 2018 [21]. Therefore, recently published data suggest that QLB provides significantly more effective, and longer lasting analgesia than caudal block in pediatric patients undergoing inguinal hernia repair,

orchidopexy, and ureteral reimplantation [10, 12, 16]. Also, patients with caudal blocks have significantly longer length of hospital stay [10]. Comparative studies show that QLB provides wider field of analgesia (T7 – T12) than TAP block (T10 – T12) [17, 23], more potent analgesia [8,10,24], and longer lasting analgesia (24–48 hours) than TAP block (8–12 hours) [8, 17, 23, 24]. Erector spinae plain block (ESPB) is a new interfascial plane block that provides similar postoperative analgesia to the QLB in pediatric patients undergoing lower abdominal surgery [25].

Complications with abdominal wall blocks are rare. There are no published cases of serious complications associated to QLB performance. Every regional block has some local anesthetic systemic toxicity (LAST) risk. Children are very sensitive to LAST, especially infants. The infants under 6 months old are at significantly greater risk of severe LAST than older children [26]. Caudal epidural block has the greatest risk of LAST [1]. Fluoroscopy guidance can decrease risk of LAST, but is not used often because of radiation exposure and spatial space requirements [27].

When it comes to QLB, having the needle tip on the screen during placement, and local anesthetic injection under ultrasound control increase safety level of block technique. QLB has significantly lower risk of LAST than TAP block [23]. There is no published case of LAST induced by QLB. However, we have to keep the risk in mind, and take measures to prevent LAST. It is suggested to calculate the maximal dose of local anesthetic for each patient based on lean body weight. It is advisable to use local anesthetic as a fractionated injection in aliquots of less than 5ml, with pauses of 30–45 seconds between injections followed by gentle aspiration. It is suggested to use epinephrine 15 mcg/ml as a marker of intravascular local anesthetic injection. It will increase the heart rate by ≥ 10 beats per minute or systolic blood pressure by ≥ 15 mmHg [1]. Epinephrine also delays local anesthetic resorption by inducing local vasoconstriction, and prolongs block duration. Patients should be monitored at least 30 minutes after block performance. According to the American Society of Regional Anesthesia and Pain Medicine (ASRA) recommendations, 20% lipid emulsion should be immediately available as a main treatment option in the case of LAST. Treatment of LAST should start with intravenous bolus of 1.5 ml/kg over 2–3 minutes followed by intravenous infusion of 0.25 ml/kg/min up to maximal dose of 12 ml/kg of 20% lipid emulsion [1].

Dr. Visoiu published 2 cases of intramuscular hematoma in 2 patients who had full heparinization one hour after QLB performance. After a few days, hematoma regressed, with no consequences left [28].

There is a published case of unexpected motor weakness following QLB in an adult patient [29]. Local anesthetic concentration could influence incidence of motor block development. Aksu and Gürkan [9] suggested QLB for postoperative pain management following ambulatory surgery. Their pediatric patients underwent inguinal hernia repair and had QLB for postoperative pain management. Patients left hospital 4–5 hours after surgery and had no QLB associated complications. Carefully ambulation is still advisable.

QLB has low risk of infection. It is advisable to use a clean technique for single shot and sterile technique if performed for a catheter for continuous infusion [20]. Walker et al. [26] stated that the risk of infection with regional anesthesia/analgesia techniques is likely associated with a longer duration of catheter use, and higher ASA status.

QLB as a part of multimodal pain management and ERAS protocol has been used in Leskovac General Hospital for almost 3 years. It was done in more than 400 patients. We had no complications associated with QLB performance.

Conflict of interest: None declared.

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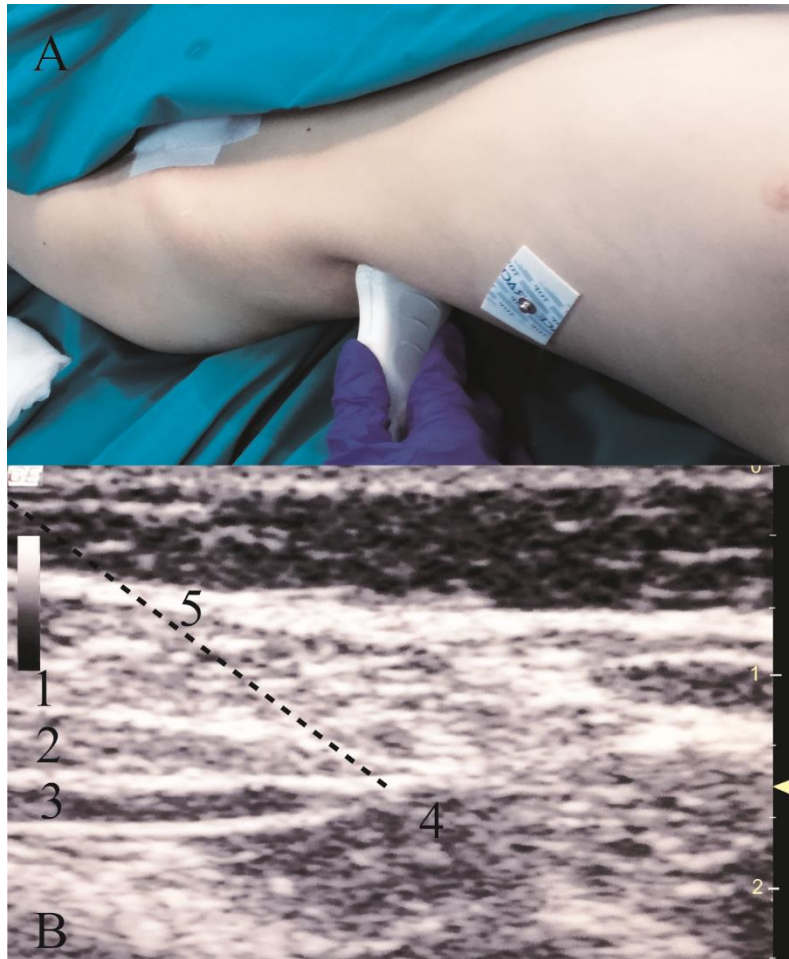


Figure 1. *Quadratus lumborum* block performance;

A: ultrasound probe position; B: ultrasound imaging; 1: external oblique muscle; 2: internal oblique muscle; 3: *transversus abdominis* muscle; 4: *quadratus lumborum* muscle; 5: needle direction

Table 1. Demographic, clinical, and acetaminophen consumption data

Type of surgery	Number of patients (male + female)	Age*	ASA	Acetaminophen before the end of surgery (mg/kg)	QLB 1 PreOP /PostOP	Pain treatment 24 hours postoperatively acetaminophen (10–15 mg/kg)
						Number of patients / number of doses
Open inguinal hernia repair	1 + 2	8.3 ± 2.5	I	10	UL 1/2	∅
Testicular torsion repair	2	11.5 ± 1.5	I	10	UL 1/1	∅
Orchidopexy	1	10	I	10	UL 1/0	∅
Open appendectomy	2 + 0	16 ± 1	I	15	UL 1/1	2/4
Laparoscopic appendectomy	10 + 2	15.6 ± 1.38	I	10	BL 0/6	6/∅ 4/2 2/4
Laparoscopic cholecystectomy	2 + 0	16 ± 1	I	10	BL 0/2	1/2 1/4

QLB1 – quadratus lumborum type 1; PreOP – preoperatively; PostOP – postoperatively;

UL – unilateral block; BL – bilateral block;

*Mean ± standard deviation

Pap

Table 2. Local anesthetic dose recommendation

Literature	Single shot		Continuous infusion		Maximal dose
	LA and concentration	Dose	LA and concentration	Rate	
Visoiu et al. [6]	ropivacaine 0.5%	10 ml	ropivacaine 0.2%	5 ml/h or 0.43 mg/kg/h	
Chakraborty et al. [7]	levobupivacaine 0.375%	5 ml	levobupivacaine 0.1%	5 ml/h	
Baidya DK. et al. [8]	ropivacaine 0.2%	0.5 ml/kg	Ø	Ø	
Öksüz et al. [9]	bupivacaine 0.2%	0.5 ml/kg	Ø	Ø	
Aksu et al. [10, 26]	bupivacaine 0.25%	0.5 ml/kg	Ø	Ø	20 ml
İpek et al. [11]	bupivacaine 0.25%	0.5 ml/kg	Ø	Ø	20 ml
Ahiskalioglu et al. [14]	bupivacaine 0.25%	0.5 ml/kg	Ø	Ø	
Yayik et al. [15]	bupivacaine 0.5% & lidocaine 2%	3 ml + 3 ml*	Ø	Ø	
Leskovac General Hospital Protocol	bupivacaine 0.25% or levobupivacaine 0.25%	0.4–0.8 [#] ml/kg	Ø	Ø	2 mg/kg or 30 ml

LA – local anesthetic;

*unilateral block; dose for a three-year-old patient;

[#]0.4 ml/kg – bilateral block; 0.6-0.8ml/kg – unilateral block;

°2 mg/kg is the maximal dose of bupivacaine, and levobupivacaine according to El-Boghdady et al. [1]