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CASE REPORT / ПРИКАЗ БОЛЕСНИКА

Quadratus lumborum block in pediatric patients – a case series

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

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 to the 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].

REPORTS OF CASES

During the period from April 2017 to December 2019, 253 pediatric patients underwent surgical procedures at the Leskovac General Hospital. Twenty-two of these patients had QLB as a part of a multimodal pain management plan: three following open inguinal hernia repair, two following testicular torsion repair, one following orchidopexy, two after open appendectomy, 12 after laparoscopic appendectomy, and two following laparoscopic cholecystectomy. The 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 of propofol or 4–5 mg/kg of thiopental. A dose at 1–2 μg/kg of fentanyl was given at induction, and repeated if needed. Sevoflurane in a 50% air and 50% oxygen mixture with an end-tidal of 1–2 vol% was used as the maintenance agent. Acetaminophen at a dose of 10–15 mg/kg was used intravenously 15–20 minutes before the end of surgery. QLB was done either after induction of anesthesia, before incision (four 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. 30 ml) (Table 2). We used 22-gauge 50 mm needles for the peripheral nerve block, and the linear ultrasound probe as guidance. Decreased use of fentanyl and sevoflurane was noticed in the cases where QLB was performed preoperatively.

All the 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 years old) had acetaminophen per request, every six 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.

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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	Ø
Testicular torsion repair	2	11.5 ± 1.5	I	10	UL 1/1	Ø
Orchidopexy	1	10	I	10	UL 1/0	Ø
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/Ø
						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; ASA – status according to the American Society of Anesthesiologists;
*mean ± standard deviation

Table 2. Local anesthetic dose recommendation.

Literature	Single shot		Continuous infusion		Maximal dose
	LA and concentration	Dose	LA and concentration	Rate	
Visoiu and Yakovleva [5]	ropivacaine 0.5%	10 ml	ropivacaine 0.2%	5 ml/h or 0.43 mg/kg/h	
Chakraborty et al. [6]	levobupivacaine 0.375%	5 ml	levobupivacaine 0.1%	5 ml/h	
Baidya DK. et al. [7]	ropivacaine 0.2%	0.5 ml/kg	Ø	Ø	
Öksüz et al. [8]	bupivacaine 0.2%	0.5 ml/kg	Ø	Ø	
Aksu et al. [9, 25]	bupivacaine 0.25%	0.5 ml/kg	Ø	Ø	20 ml
İpek et al. [10]	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% and 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; 0.6–0.8 ml/kg – unilateral block;
2 mg/kg is the maximal dose of bupivacaine and levobupivacaine according to El-Boghdadly et al. [1]

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

DISCUSSION

QLB is the ultrasound-guided local anesthetic injection in the *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 to use 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 and children, and subsequently opioid side effects such as nausea and vomiting [11, 13, 14, 17, 18, 19]. QLB prolongs time to the first request for rescue analgesic medication and speeds up ambulation and discharge from hospital [10, 11, 13, 14, 19]. QLB has found its place in the enhanced recovery after surgery (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 a 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 the prospective randomized single-blinded study by Sahin et al. [22].

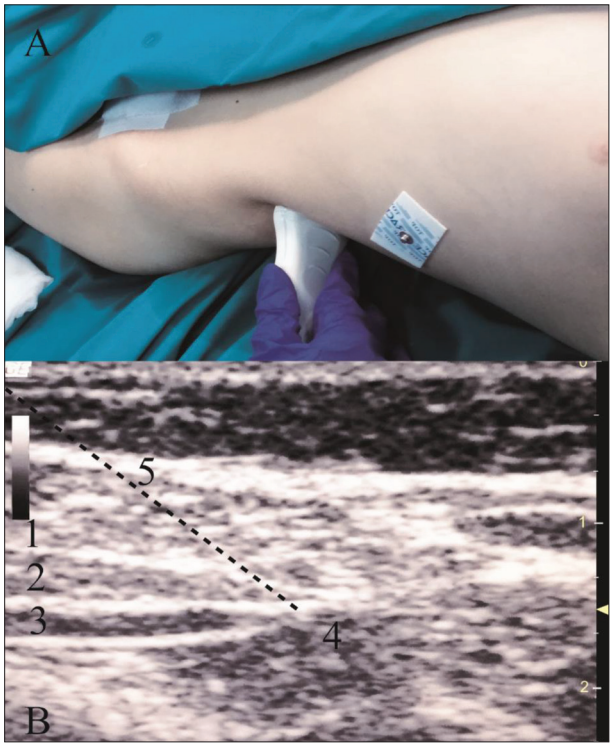

Figure 1. *Quadratus lumborum* block performance;
A: ultrasound probe position; B: ultrasound imaging; 1: external oblique muscle; 2: internal oblique muscle; 3: *transversus abdominis* muscle; 4: *quadratus lumborum* muscle; 5: needle direction

Kendall et al. [21] reached the same conclusion in their systematic review of 40 randomized controlled trials in 2018. 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 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 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 with QLB performance. Every regional block has some local anesthetic systemic toxicity (LAST) risk. Children are very sensitive to LAST, especially infants. Infants younger than six months are at a significantly greater risk of severe LAST than older children [26]. Caudal epidural block has the greatest risk of LAST [1]. Fluoroscopy guidance can decrease the risk from LAST, but is not used often because of radiation exposure and spatial requirements [27].

With regard to QLB, having the needle top on the screen during placement and local anesthetic injection under ultrasound control increases the safety level of the block technique. QLB has a 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 the 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 5 ml, with pauses of 30–45 seconds between injections, followed by gentle aspiration. It is suggested to use epinephrine at a dose of 15 μg/ml as a marker of intravascular local anesthetic injection. It will increase 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 recommendations, 20% lipid emulsion should be immediately available as a main treatment option in the case of LAST. The treatment of LAST should start with intravenous bolus of 1.5 ml/kg over a period of 2–3 minutes, followed by intravenous infusion of 0.25 ml/kg/minute up to the maximal dose of 12 ml/kg of 20% lipid emulsion [1].

Visoiu and Pan [28] published two cases of intramuscular hematoma in two patients who had full heparinization one hour after QLB performance. After several days the hematoma regressed without consequences.

There is a published case of unexpected motor weakness following QLB in an adult patient [29]. Local anesthetic concentration could influence the 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. The patients left hospital 4–5 hours after surgery and had no QLB-associated complications. Careful 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 a higher status according to the American Society of Anesthesiologists.

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

Conflict of interest: None declared.

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Quadratus lumborum блок код педијатријских болесника – прикази болесника

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САЖЕТАК

Увод *Quadratus lumborum* блок (*QLB*) први је 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 болесника 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 примећена је код деце која су *QLB* добила преоперативно. Сви болесници су имали добру контролу бола.

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

Кључне речи: *QLB*; интерфасцијални блокови; педијатрија