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Ultrasound-guided nerve block for pediatric inguinal herniorrhaphy

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ABSTRACT

Background and aim: Regional anesthesia is one of the best options anesthetic technique, it was very difficult to be used in pediatrics anesthesia, now a days it becomes more easier and safer with the era of high-quality ultrasound. This study aimed to assess the effectiveness of ultrasound-guided nerve block (ilioinguinal/iliohypogastric; II/IH) in pediatric unilateral inguinal herniorraphy, time for first analgesic dose, parents, surgeon satisfaction and complication.

Patients and methods: The study was done in Zagazig university hospital after approval of the ethical committee. Induction of anesthesia using sevoflorane MAC (Minimal Alveolar Concentration) 4%-6% then Laryngeal Mask Airway was inserted (LMA). Ultrasound-guided (ilioinguinal/iliohypogastric) nerve block was performed on 20 male pediatric patients their age ranged from 4 to 10 years old with ASA status I and II, with unilateral inguinal hernia. hemodynamics as heart rate (HR) blood pressure systolic/diastolic (SBP/DBP) was reported also Children Infants Postoperative Pain (CHIPPS) score was recorded every 2 h until 12 h and time for first analgesic dose also reported.

Results: Our result showed no significant changes in heart rate (HR) and blood pressure (BP) at skin incision; HR (95 ± 8), BP (97.6±/50 ± 5) and intraoperative HR (93.5 ± 6), BP (99.6 ± 9/51 ± 4) compared with the basal readings; HR (113 ± 10), BP (104 ± 12/53 ± 6). Pain score was evaluated using (ChIPPS), it started to increase after 4 to 5 h and reported by first analgesic dose (5.2 ± 1.5) that managed by paracetamol (15 mg/kg/day). Surgeon and parents were satisfied. Early ambulation and less hospital stay. Less complications (no motor block or urine retention).

Conclusion: Ultrasound-guided (ilioinguinal and iliohypogastric) nerve block was found to be an ideal intraoperative anesthetic and postoperative analgesic for unilateral inguinal herniorrhaphy in children with no complications.

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Ultrasound-guided; nerve block; pediatric; inguinal herniorrhaphy

1. Introduction

Pediatric inguinal herniorrhaphy is commonly performed procedure under general anesthesia in combination with regional anesthesia [1]. Regional anesthesia as epidural, spinal or peripheral nerve block as (ilioinguinal/iliohypogastric) with local anesthetic agents [2].

The ilioinguinal and iliohypogastric nerves, arising from the first lumbar spinal root, as well as by the lower intercostal nerves, arising from T11 and T12 will cover the surgical field for inguinal herniorrhaphy [3].

One of the commonly used peripheral nerve block techniques in pediatric anesthesia is Ilioinguinal/Iliohypogastric (II/IH) nerve block which becomes very easy and simple. The era of ultrasound usage helps in real-time visualization of needle tip and decrease the risk of complication [4,5].

The aim of this study is to evaluate effectiveness of ultrasound-guided ilioinguinal/iliohypogastric nerve block with local anesthetic intraoperatively and postoperatively in pediatric unilateral inguinal herniorrhaphy.

2. Patients and methods

This study was approved by the Institutional Ethical Committee in Zagazig University from August 2018 to January 2019. Informed concents were taken from children's parents. A total of 20 children ASA I & II scheduled for unilateral inguinal hernia repair. General anesthesia was induced with MAC 4-6% sevoflorane via a facemask. After insertion of IV line, LMA was placed and anesthesia was maintained with 2% sevoflorane.

2.1. Inclusion criteria

Male patients with ASA class I or II; their age ranged from 4 to 10 years old undergoing unilateral inguinal herniorrhaphy.

2.2. Exclusion criteria

Parents refusal, bilateral inguinal hernia, known allergy to amide-type local anesthetics, local infection or anatomic malformation at the site of the block, history of other medical conditions, preexisting coagulopathy, emergency surgery.

All patients included in the study were subjected to full history taking, complete clinical examination including the groin examination with assessment of

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their body weight, blood pressure, heart rate and oxygen saturation and laboratory evaluations by CBC, liver and kidney function tests and coagulation profile.

After induction of general anesthesia with sevoflorane, Laryngeal Mask Airway (LMA) was placed. Monitoring ECG, heart rate, pulse oximetry (Spo2), blood pressure. Patients were in supine position, we used SonoSite M-turbo ultrasound machine (USA) a linear high-frequency (13–6 MHz) transducer was used.Under complete aseptic preparation, linear probe was placed on the anterior abdominal wall along the line joining the Anterior Superior Iliac Spine (ASIS) and the umbilicus. Position the probe such that the bony shadow of ASIS was visible on one side of the image. Identifying the peritoneum, transverses abdomens muscle and internal oblique muscle. The ilioinguinal and iliohypogastric nerves were seen in close proximity to each other as two small round hypoechoic structures with a hyperechoic border Figure 1. They lie in the plane between the internal oblique muscle and the transverses abdomen muscle close to ASIS [6]. During real-time visualization of needle tip negative aspiration was done; Then, 0.3 ml/kg bupivacaine 0.25% was injected (maximum volume, 15 ml) Figure 2. Skin incision was done after 110 min from starting the procedure. Vital signs were recorded every 10 min. Monitoring of pulse oximetry, blood pressure and pain intensity using pain score (Children, Infants, Postoperative Pain Scale, ChIIPPS; Table 1) [7] and First call for systemic analgesics was reported postoperatively every 2 h for 12-h recurrent pain was managed by 15 mg/kg rectal paracetamol, if ChIIPPS (more than3). Postoperative complication as nausea, vomiting, urine retention and motor block, also parents and surgeon satisfaction was assessed. First call for supplemental analgesics and total dose of systemic analgesia within 12 h was recorded.

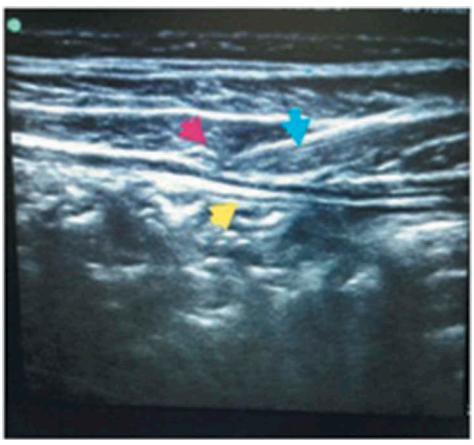

Figure 1. Blue arrow = needle red arrow = IL/IH yellow arrow peritoneum.

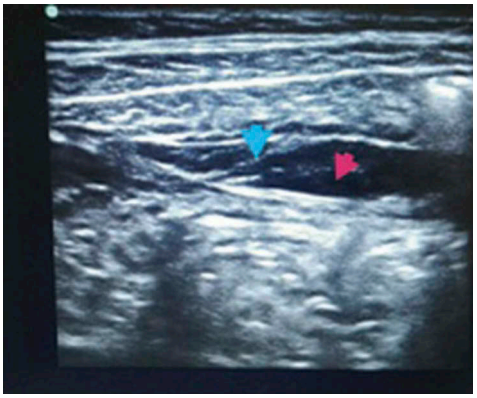

Figure 2. Blue arrow = needle red arrow = injectate nerves.

Table 1. Children and infants postoperative pain scale (ChIPPS) (Buttner and Finke, 2000).

Item	Score 0	Score 1	Score 2
Crying	None	Moaning	Screaming
Facial expression	Relaxed smiling	Wry mouth	Grimacing
Posture of the trunk	Neutral	Variable	Rear up
Posture of the legs	Neutral	Kicking	Tightened
Motor restlessness	None	Moderate	Restless

Total score according to the scale:
- 0–3: No requirement for treating pain.
- 4–10: Progressively greater need for analgesia.

Behavior scale and/or physiological stress parameter

2.3. Statistical analysis

All data were collected, tabulated and statistically analyzed using SPSS 20. Quantitative data were expressed as the mean ± SD and qualitative data were expressed as percentage. Continuous data were checked for normality by using the Shapiro Wilk test. Percent of categorical variables were compared using the Chi-square test. All tests were two-sided, p-value < 0.05 was considered statistically significant (S), and p-value ≥ 0.05 was considered statistically insignificant (NS).

3. Results

Ultrasound-guided ilioinguinal and iliohypogastric nerves were successful in all cases. There was no clinical evidence of complications such as small bowel or major vessel puncture.

Table 2 Comparison between basal HR, skin incision, intraoperative and postoperative.

Table 3 comparison between basal, skin incision, intraoperative and postoperative SBP.

Table 4 comparison between basal, skin incision, intraoperative and postoperative DBP

Table 5 shows the pain score (ChIPPS) was less than 3(no need for analgesia) until 12 h postoperatively when it started to increase and paracetamol suppositories were given.

Table 6 shows total amount of analgesics within 12 h postoperatively, as the 15% of patients received only one analgesic dose while 85% received two analgesic doses within 12 h. So no much analgesia needed and it

Table 2. Comparison between basal HR, skin incision, intraoperative and postoperative.

Basal HR	Skin incision	Intraoperative	Postoperative			
113 ± 10	**111 ± 8**	111 ± 6	**110 ± 5**	**110 ± 5.7**	**118 ± 0.1**	**120 ± 2**
			2 h	4 h	6 h	12 h
P value	0.49	0.44	0.23	0.25	**0.03***	**0.039***

P value more than 0.05 is non significant .
P value ≤ 0.05 sig.*

Table 3. Comparison between basal, skin incision, intraoperative and postoperative SBP.

Basal SBP mean± SD	SBP at Skin incision mean± SD	Intraoperative SBP mean± SD	Post operative SBP mean± SD 4 h	6 h	12 h
104 ± 12	*97.6 ± 8*	*99.6 ± 9*	*98.7 ± 9*	*98 ± 7.6*	98 ± **8**
P value	**0.054**	**0.197**	**0.122**	**0.066**	**0.07**

P value more than 0.05 significant.

Table 4. Comparison between basal, skin incision, intraoperative and postoperative DBP.

Basal DBP mean± SD	DBP at Skin incision mean± SD	Intraoperative DBP mean± SD	Post operative DBP mean± SD 4 h	6 h	12 h
53 ± 6 ±**4**	50 ± 5	51 ± 4	52 ± **6**	50 ± 6	**50**.
P value	**0.09**	**0.22**	**0.6**	**0.12**	**0.1**

P-value ≥ 0.05 non sig.

Table 5. Postoperative ChIPPS level of Ultrasound-guided ilioinguinal block for pediatric inguinal hernia (Buttner and Finke, 2000).

	Ultrasound-guided ilioinguinal block	
	no	%
Chipps2 hours		
.00	15	75
1.00	1	5
2.00	3	15
3.00	1	5
Chipps4 hours		
.00	4	20
1.00	7	35
2.00	4	20
3.00	5	25
Chipps6 hours		
.00	3	25
1.00	2	10
2.00	6	30
3.00	8	40
Chipps8 hours	15	75
4	5	25
5		
Chipss12 hours		
4.00	18	90
5.00	2	10

was only paracetamol suppositories. Also, there was no patient complained of urine retention or motor block, as early ambulation was noticed.

Table 7 shows surgeon and parents satisfaction, nearly all was satisfied with the results of the block.

4. Discussion

Pain is an unpleasant sensation that can not be expressed, especially in children. Postoperative analgesia should be with cautious specially narcotic usage due to respiratory depression effect, vomiting, aspiration, and up to psychic trauma from pin Perak [8].

Acute postoperative pain still undermanaged Despite the advances of perioperative pain management. So usage of regional anesthesia for inguinal herniorrhaphy via different approaches and blocks is a good option [9].

In children, most nerves are relatively superficial allowing high-resolution imaging through the ultrasound. Direct visualization of the nerves, vessels, tendons and bones helps in targeting nerves by local anesthetic and hence reduces the risk of intraneuronal, intravascular or intraperitoneal injection. So real-time ultrasonic visualization of ilioinguinal and iliohypogastric nerves improves the block and decreases the risk of complications [10,11]

Table 6. Postoperative analgesic dose, complication and motor block for Ultrasound-guided ilioinguinal block for pediatric inguinal hernia.

	Ultrasound-guided ilioinguinal block	
	No	%
1st call for analgesia***		
Analgesic dose	3	15
One		
Two	15	85
Three	0	0
1st time to call for analgesia	4.8 ± 1.6*	
Total analgesic dose **	240 ± 30** (180–280)	
Postoperative nausea & vomiting		
No	10	52.5
One time	8	44.3
Two time	2	3.3
Complication urinary retention		
Absent	20-	100.0-
Present		
Motor block		
Absent	20	100
Presents	-	-

As 15% of patients received only one analgesic dose while 85% received two analgesic doses within 12 h. So no much analgesia needed and it was only paracetamol suppositories. Also, there was no patient complained of urine retention or motor block, as early ambulation was noticed. * = prolonged time of analgesic. ** = small analgesic dose. *** = only two time calling for analgesia in 12 h.

Table 7. Postoperative parents and surgeon satisfaction of Ultrasound-guided ilioinguinal block for pediatric inguinal hernia.

	Ultrasound-guided ilioinguinal block group	
	No	%
Parents satisfaction		
Good	2	10
Very good	18	90
Surgeon satisfaction		
Good	2	10
Very good	18	90

We performed an ultrasound ilioinguinal/iliohypogastric nerve block for 20 pediatric male patients with unilateral inguinal hernia. Aimed to assess the analgesic effect of ultrasound-guided ilioinguinal/iliohypogastric nerve blocks with local anesthetic intraoperatively and postoperatively in pediatric unilateral inguinal herniorrhaphy.

In this study, the precise administration of low volume local anesthetics under ultrasound guidance resulted in effective ilioinguinal/iliohypogastric nerve block in children with a reduced failure rate and no complications. This in agreement with Willschke et al.; as he found that ultrasound ilioinguinal/iliohypogastric had durable analgesic effect with no complication [12]

Also our study showed the heart rate (HR) at basal, skin incision, intraoperatively and at 2 and 4 h postoperatively were nearly the same.

Lihua et al. [13], on the other hand, found that ultrasound-guided ilioinguinal/iliohypogastric nerve block in pediatric one-day surgery causes decrease in heart rates and mean arterial pressure (MAP) compared to the control group.

Jagannathan et al. [14] found that there was no significant difference in mean arterial pressure in between ilioinguinal nerve block and caudal block.

Geze et al. [15] reported that ultrasound ilioinguinal/iliohypogastric nerve blocks were generally well tolerated intraoperatively and all patients maintained pulse and heart rate within normal ranges.

Regarding blood pressure, both systolic blood pressure and diastolic blood pressure was maintained within normal in the perioperative periods.

Khedkar et al. [16] showed that systolic blood pressure (SBP) was maintained throughout the study and the diastolic blood pressure (DBP) and the heart rate (HR) showed non-significant difference in both groups throughout the study.

Ravi et al. [17] found that the MAP (mean arterial pressure) values are slightly higher in caudal group when compared to ilioinguinal group which was statistically not significant.

We found that pain score (ChIPPS score) was less than 3 up to 4 h postoperatively so no need for analgesics and progressive increase in pain (Buttner and Finke, 2000).

Also, we found that 15% of patients received only one analgesic dose and 85% received two analgesic doses in 12 h and it was paracetamol suppositories only.

In this study we found no complication as urine retention and motor block also, Geze et al. said that there was no patient complained from urine retention or motor block [15].

Also in agreement with our study, Abdellatif found in his study that ultrasound ilioinguinal/iliohypogastric nerve block effective and had durable analgesia with less complication than caudal block [18].

In agreement with us, Paul, Xue et al. found that ilioinguinal blocks are effective, safe techniques for inguinal hernia repair. As there is no need for routine intravenous opioids, decreasing the side effects of these drugs [19,20].

5. Conclusion

Ultrasound-guided ilioinguinal/iliohypogastric nerve block was found to be an ideal intraoperative and postoperative analgesic for unilateral inguinal herniorrhaphy in children, regarding the quality of analgesia with less pain scores and longer duration of analgesia with low volume of local anesthetics, hemodynamic stability and less complications.

Disclosure statement

No potential conflict of interest was reported by the author.

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