Comparison between Caudal and TAP Blocks Post-Inguinal Surgery Analgesia in Children

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Abstract

Background: The optimal and lonely method to achieve typical analgesia post-inguinal surgeries in children is still not determined. This study compared the analgesic efficacy and adverse effects between caudal analgesia and TAP (Transversus Abdominis Plane) block. Methods: 40 children (male) between 3-9 years old, with parental consent and institutional board approval, undergoing elective inguinal hernia repair surgery, randomly divided in two groups were enrolled in this study. Both groups received induction on Sevoflurane, Fentanyl, Propofol and Atracurium (dose dependent), with laryngeal mask airway and mechanical ventilated, maintenance on Sevoflurane and smoothly recovered. The first group (C) received caudal analgesia of Bupivacaine 0.25% (1ml/kg). The second group (T) received TAP block of Bupivacaine 0.25% (0.5 ml/kg). Pain was assessed by CHEOPS (Children's Hospital of Eastern Ontario Pain Scale). Parents also assessed pain (after explain and orient them) with Wong-Baker scale 0 (no pain) and 10 (worst pain imaginable). Results: The first group (C) of patients had about 240 ± 30 minutes, while the second group (T) had about 360 ± 60 minutes, early ambulation and feeding and finally, most of them missed the pain till they were home discharged. Conclusion: TAP block enhances comfortable long-time post-op state for the patients, especially the young age group as they are hardly pain dealt off. Also TAP block has an easily performed procedure with less dose and complications compared to the caudal ones.

Key Words: Inguinal Surgery, Caudal Block, TAP Block.

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Introduction

Inguinal hernial repair is the most common scheduled sub-umbilical surgery done in day case pediatric surgical units.[1] For anatomical review; Abdominal wall nerves supply course through neuro-fascial transversus abdominis plane between internal oblique and transversus muscles. [1,2] Optimal analgesia is the target of the anesthesiologist post-operatively, many analgesic modalities have been tried; low-dose opioids, non-steroidal anti-inflammatory drugs, local wound infiltration, caudal epidural block, ilio-inguinal/ilio-hypogastric nerves block and TAP block. In this study, [6,7,8] I hypothesized that compared with caudal block, the USG TAP block would result in better post-operative pain relief after inguinal hernia surgery in pediatric patients. Caudal analgesia is the most common technique used in children for many years as a sole anesthetic aspect or combined with general one. It provides potent analgesia in sub-umbilical surgeries especially in groin area. [3,4,5] The ease of access to the sacro-coccygeal ligament and low risk of adjacent neural damage compared to the lumbar and thoracic levels; made the caudal approach is preferred in in children, limited time duration is the main disadvantage factor. [3,4,5]

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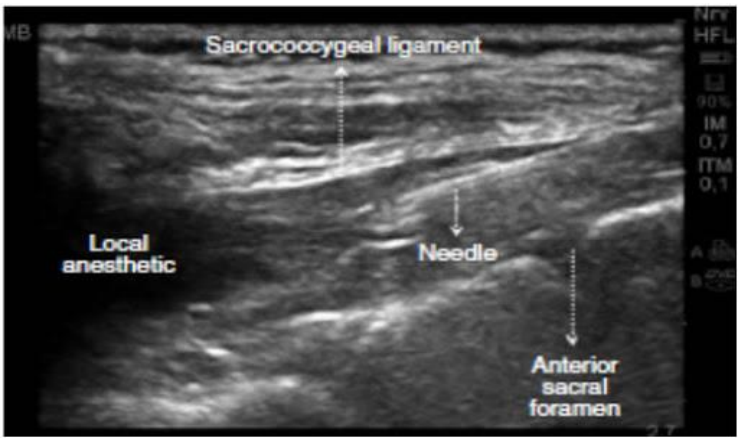
After the revolution of ultra-sound guided practice in anesthesiology mainly in regional field for the last decade, TAP block takes place for analgesia in lower abdominal surgeries for both adults and children. [8,9]



Methods

After parents' consents, informed and signed, also permission granted from the hospital administration board. Forty patients with pediatric age group (3-9) years, ASA (I&II), registered in the randomized clinical trial research. Forty patients divided into two groups; group (C) referred for Caudal and group (T) referred for TAP.

Exclusion criteria includes: parent's refusal, coagulopathies, local infection, vertebral deformity and drug allergy.

Group (C) received 1ml/kg of 0.25% Bupivacaine

Group (T) received 0.5ml/kg of 0.25% Bupivacaine

All patients underwent pre-anesthetic check, on operation theatre admission; multi-para monitoring of SPO_2, pulse rate, NIBP and ECG as base line parameters recorded. When i.v. line was secured, each patient pre-medicated with midazolam 0.05 mg/kg and fentanyl 2 µg/kg, ringer lactate started to be infused. After pre-oxygenation with 100%, induction started with propofol 2-2.5 mg/kg, sevoflurane concentration (3-5), and atracurium 0.5 mg/kg.

LMA (laryngeal mask airway) was in-situ with appropriate size and mechanical ventilation started. Maintenance was O_2 40% and sevoflurane (1-2) %.

Patients (C) were positioned left lateral decubitus, after delicate aseptic procedure, needle position (25 G) was confirmed by ultrasound guidance plus pop feeling during sacro-coccygeal ligament puncture. After negative aspiration free of CSF or blood; Bupivacaine (0.25%) 1ml/kg was injected.

While group (T) patients were positioned supine with abdominal exposure, skin and probe aseptically prepared for procedure, using linear array transducer probe (6-12 MHz). Probe placed over iliac crest revealed petit triangle, 22-G short beveled needle inserted in-plane. 0.25% of Bupivacaine (0.5 ml/kg) administered between internal oblique and transversus abdominis fascial sheath after visualization of the needle tip between these two muscles. Vital signs were recorded with 5 minutes interval throughout the surgery from the skin incision to the moment of dressing.

For blinding aspect of this study, the pain score recorded by another anesthesiologist who neither participated in the procedure of the block nor had been presented in the theatre.

Post-operative side effects (hypotension, bradycardia, respiratory depression, nausea and vomiting), duration of analgesia, frequency and dosage of added rescue analgesic (paracetamol 10mg/kg) enterally, all recorded.

Results

For 40 young age patients were included in this study, divided into 2 groups (20 patients in each group); group (C) Caudal and (T) for TAP.

There was no significant difference related to the demographic criteria; age, sex, weight, duration and procedure of the surgery. Vital signs records were stable and within normal limits (<20% of base-line readings).

CHEOP scores were recorded hourly for the first 6 hours, then two records at 9 and 12 hours post-operatively. There was good analgesic covering for the first four hours in both groups, but after that, CHEOPS began to rise in group (C), at the sixth hour, rescue analgesic was added to them.

While (T) group, CHEOPS started after the eighth hour. Single dose of rescue analgesia was given at home discharge after the last CHEOPS record (after 12 hours of surgery).

Post-operatively, two patients from group (C) suffered from urine retention about four hours. Also, four patients had nausea and vomiting once. While two patients from group (T) had nausea and vomiting just one time. Other complications were not reported at a significant level in both groups.

Figure 1 shows the interval plot of time pain lasting according to pain severity grades in the two groups of patients. According to the information provided by this figure, patients in caudal group have lower time of pain lasting in the first two grades of pain severity compared to their counterparts in TAP group. Moreover, time is less varied around the mean of caudal group, whereas time dispersion around the mean is very clear in the TAP group.

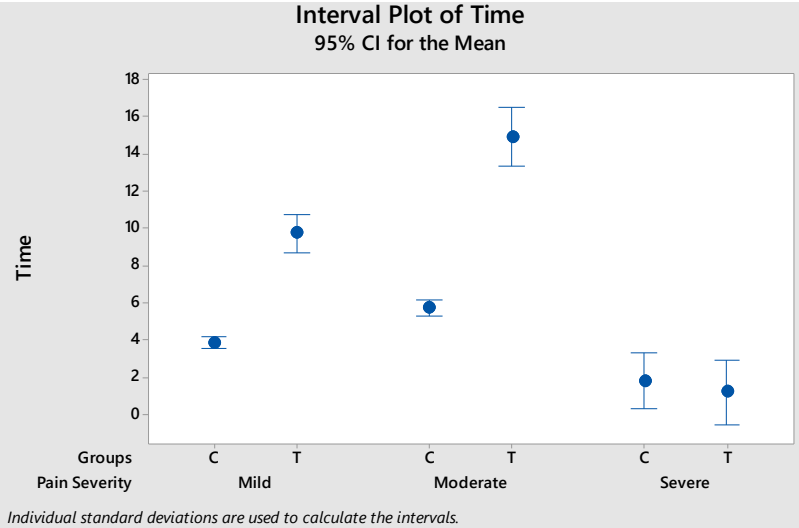


Figure 1. Interval plot of time pain lasting according to pain severity grades and groups of patients

The use of the two-sample t-test for comparing means time at different pain severity for the two groups of patients, revealed that caudal group scored significantly lower mean time at 0-3 and 4-7 pain severity levels than TAP group, whereas no significant difference detected at the pain severity level 8-10 (table 1). It can be concluded that patients in caudal group approaching pain relief state faster than patients in the TAP group.

Table 1. Two-sample t-test as performed on time of pain lasting at the levels of pain severity for patients in Caudal and TAP groups.

Pain severity	Caudal (N=20)	TAP (N=20)	t-test	
	Mean±Sd	Mean±Sd	t	p-value
0-3	3.850±0.636	9.700±2.140	-11.7	0.0001
4-7	5.737±0.923	14.900±3.320	-11.88	0.0001
8-10	1.800±3.220	1.200±3.690	0.55	0.587

In order to check whether time of pain lasting is associated with age of patient or not, simple linear correlation coefficients were obtained for age with the three pain severity levels for caudal and TAP groups separately. The results showed that age is not associated with pain severity (p-value >0.05). Nevertheless, correlation coefficients showed that time of pain lasting in the 4-7 grade of pain severity is positively associated with time of the first grade 0-3 of pain severity. This is true for both groups of patients. Time of pain lasting in the 8-10 grade of pain severity found to be negatively associated with time of pain lasting in 0-3 and 4-7 grades of pain severity (table 2).

Table 2. Correlation coefficients between time intervals according to pain severity and groups of patients

		0-3	4-7	8-10
0-3	Caudal	1	0.726	-0.125
	TAP	1	0.817	-0.71
4-7	Caudal	0.726	1	-0.364
	TAP	0.817	1	-0.762
8-10	Caudal	-0.125	-0.364	1
	TAP	-0.71	-0.762	1
Shadowed correlations are significant at p<005				

Table 3 shows the number and percentages of patients at each pain severity grade. Although, 25% of patients from caudal group went to the last grade of pain severity, but the maximum time spend in this grade is 8 hours, whereas 10% from TAP group spend a maximum of 12 hours at the last grade of pain severity.

Table 3. Number and percentages of patients at each pain severity grade from both groups.

Pain severity	Caudal		TAP	
	N	%	N	%
0-3	20	100	20	100
4-7	20	100	20	100
8-10	5	25	2	10

In order to predict time of pain lasting, simple linear regression equation was calculated for the time of pain lasting at the second grade of pain severity as a dependent variable and time of pain lasting at the first grade of pain severity as an independent variable. The equation was calculated twice, once for the caudal group and another for the TAP group. Figures 2 and 3 showed the equation for the caudal and TAP groups respectively. One the average, patients from the caudal group, need almost 4-7 hours to recover from the second grade of pain severity, while patients from TAP group need 9-20 hours to recover from the second grade of pain severity.

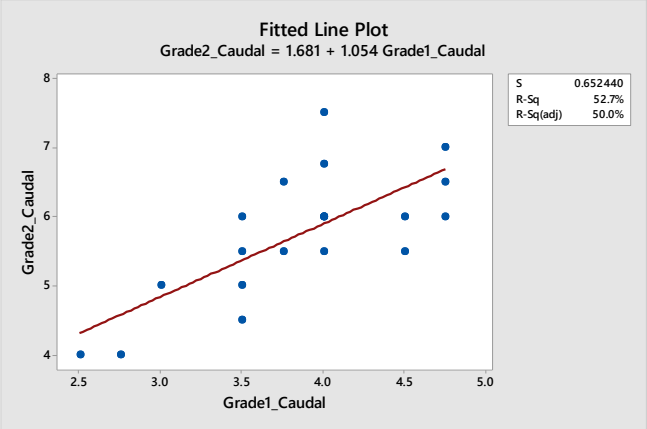


Figure 2. Simple linear regression of grade 2, time pain lasting on grade 1 in caudal group.

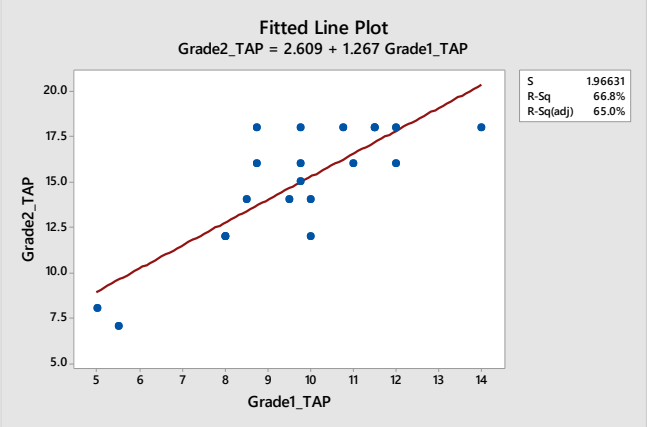


Figure 3. Simple linear regression of grade 2, time pain lasting on grade 1 in TAP group.

With respect to the dose of rescue analgesia, the Chi-square test for association was performed in order to test whether the administration of this dose is the same for both groups of patients or not. Chi-square test was 10 with 1 degree of freedom was significant at p-value=0002 (table 4).

Table 4. Cross classification of cases with and without rescue analgesia dose for the two groups of patients

Rescue analgesia	Caudal	TAP
YES	15	5
NO	5	15

Binary logistic regression was used to predict entries of table 4 with reference to the time of pain lasting at the second grade of pain severity. This model revealed 80% of correct classification with reference to the time of pain lasting (table 5).

Table 5. Estimates of the binary logistic regression for the rescue analgesia dose with the time of pain lasting at the second grade of pain severity.

	B	S.E.	Wald	df	Sig.	Exp(B)
Grade2	-0.373	0.104	12.871	1	0	0.688
Constant	3.671	1.037	12.546	1	0	39.303

Discussion

Ultra-sonograph considered a revolution in regional anesthesia, its uses covering the whole-body areas and facilitates access in the most difficult (previously) procedures. [10]

Optimal analgesia required for day care surgical cases as they almost home discharged at the same day (day zero). Nowadays, post-operative pain relief depends on NSAID's and opioids which have undesirable side effects especially in children. [10,13]

In this prospective randomized study, we compare the US guided TAP block with US guided caudal block for analgesic target post-operatively in two divided group of pediatric age group patients.

Caudal block was the almost lonely epidural (regional) analgesia used in children age group as easy access, confirmation and administration. Also, the less side effects. Now, the visual access and confirmation by ultrasound made caudal block is more familiar with the anesthetist. On the other hand, TAP block is born to be the common analgesia in lower abdominal surgeries with its safety and ease of usage by ultrasound. [12,15]

The results show that TAP block had prolonged time analgesic effect more than caudal block (up to

12 hours) till the patient discharged to home, as improved clinically and recorded statistically, also, reduced frequency of rescue analgesia consumed.

Following the time of analgesic status of the patients (CHEOPS), TAP & caudal shared the typical pain free time (first five hours) without rescue analgesia intervention. But, after that CHEOPS began to increase and the need for rescue analgesia is more noticed in caudal group (C) rather than TAP group (T).

One study, they concluded both TAP and caudal are effective in providing early post-operative analgesia in children. But USG-guided TAP block provided deeper and longer duration of analgesia. [10,11]

Another study compared the post-operative analgesic effect of USG-guided TAP block (0.3 mL/kg of Bupivacaine 0.25%) and caudal block (1.25 mL/kg of Bupivacaine 0.25%) in children undergoing pyeloplasty, they concluded that unilateral TAP block enhanced potent analgesia over epidural in the first 24 hours post-operatively. [12]

Another study comparing between TAP and caudal, they observed that pain was higher in TAP block group in the first 6 hours, but later, they noticed TAP block provided analgesic potency compared to caudal block after 6-24 hours post-operatively. Caudal analgesic superiority (in the first 6 hours) was attributed to the caudal block's coverage of visceral stimulation from the bladder spasm. [13]

In another study, TAP block was done blindly guided by Petit's triangle as a landmark in children. Significant low VAS pain scores in the first 48 hours at rest and movement were recorded. Blind TAP block may suggest para-vertebral spread of local anesthetics this explain longer duration and greater efficacy up to 48 hours post-operatively. [14]

Newly study suggest the superiority of TAP block on caudal one for post-operative inguinal surgeries in pediatric age group for more than 110 patients. [17]

In our study, we followed the pain score for 18 hours post-operatively, also, we noticed there is a reduced requirement for rescue analgesia in TAP block group. Vital signs intra-operatively in the 2 groups did not change significantly, also as mentioned in other studies. Post-operative complications such as nausea, vomiting and urine retention were not significant to be recorded, but less likely observed in TAP block group.

Conclusion

From our data and results, we conclude that TAP and caudal blocks have effective analgesia post-operatively in inguinal surgeries, but TAP block has more potency and longer duration, with lower dose comparatively and less complication with decreased dose and frequency demand of rescue analgesia.

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