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Comparison of Ultrasound-Guided Transversus Abdominis Plane Block vs Caudal Block for Postoperative Analgesia After Lower Abdomen Surgery in Children

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Öz

Amaç: Kaudal anestezi çocuklarda alt batın cerrahilerinde postoperative analjezide kullanılan popüler bir tekniktir. Anestezisitler Kaudal bloğun sınırlamalarından ötürü alternatif rejyonel anestezi tekniklerini araştırmak zorunda kalmışlardır. Çalışmamızda; kaudal blok ve ultrason yardımlı Transversus abdominis plane (TAP) bloğun postoperatif analjezide etkinliğini ve güvenilirliğini karşılaştırmayı amaçladık.

Gereç ve Yöntem: Çalışma ASA 1-II, 2-10 yaş aralığında alt batın cerrahisi operasyonu olan hastalarda yapıldı. grup C de (kaudal blok, n: 31), 0,3 mL.kg-1 ve grup T (TAP blok, n: 30), 0,5 mL.kg-1 0,25 % levobupivacaine ameliyat sonunda uygulandı. Hastalar postoperatif 0., 1., 4., 6. saatlerde revize edilmiş yüzler skalası (FPS-R) kullanılarak ağrı skorları açısından değerlendirildi. Analjezik tüketimi, komplikasyonlar ve yan etkiler kaydedildi.

Bulgular: İki grup arasında demografik verilerde anlamlı bir fark yoktu. TAP bloğu için kullanılan lokal anestezik miktarı kaudal bloktan daha fazlaydı (T: 8,3 ± 4,3 ml> C: 4,1 ± 0,9 ml) (p <0,05). FPS-R'yi 0. saatte karşılaştırdığımızda, TAP bloğu postoperatif ağrıda kaudal bloğa göre daha etkiliydi (p <0,05). Tüm hastaların %22'ü (n: 14) analjezik gerektiriyordu. İki grup arasında anlamlı fark yoktu.

Tartışma ve Sonuç: Sonuç olarak, alt abdominal pediatrik cerrahide postoperatif ağrı yönetiminin erken döneminde TAP bloğu ve kaudal blok basit, güvenli ve etkili analjezik yöntemlerdir.

Anahtar Kelimeler: Kaudal blok, TAP blok, ultrason, postoperatif analjezi, pediyatrik

Abstract

Introduction: Caudal anesthesia is a very popular postoperative analgesia technique for pediatric lower abdominal surgery. Because of the limitations of caudal block anesthesiologists need to search for alternative regional anesthesia techniques. This study aims to compare the effects and safety of Ultrasound-assisted TAP block and caudal block in postoperative analgesia.

Materials and Method: The study was conducted in ASA grade I-II, 2-10 years aged cases scheduled for lower abdominal surgery. At group C (caudal block, n:31), 0,3 mL.kg-1 and at group T (TAP block, n:30), 0,5 mL.kg-1 0,25 % levobupivacaine applied at the end of surgery. Patients were assessed for the quality of pain relief by using faces pain scale-revised (FPS-R) at 0., 1., 4., 6., hours of the postoperative period. Analgesic consumption, complications and adverse effects was recorded.

Results: Between two group there were no significant differences at demographical data. The local anesthetic volume used for TAP block was more than caudal block (T:8,3±4,3 ml> C: 4,1±0,9 ml) (p<0,05). When we compared the FPS-R at 0. hour, TAP block was more efficient at postoperative pain than caudal block (p<0,05). 22% of all patients (n:14) required analgesic. There were no significant differences between two groups.

Conclusion: In conclusion TAP block and caudal block are simple, safe and effective analgesic methods in early period of postoperative pain management in lower abdominal pediatric surgery.
Key words: Caudal block, TAP block, ultrasound, postoperative analgesia, pediatric

1. Introduction

Postoperative analgesia will allow the child to mobilize earlier, and also improves the functional recovery and sleep. An ideal postoperative pain management would be the one that is safe, simple, cost effective and has low incidence of side-effects and complications. Regional anesthesia is commonly used for pain relief after lower abdominal surgery in pediatric patients.

Especially caudal anesthesia and epidural catheter placement are most preferred techniques. Caudal anesthesia is simpler technique compared to other central blocks and commonly used for urological and lower abdominal procedures of children since it improves recovery and enhances postoperative analgesia. Unfortunately, coagulation disorders and congenital abnormalities (meningomyelocele, tethered cord) limit the application of neuraxial blocks.

Transversus abdominis plane (TAP) block has been known as an effective postoperative analgesia technique in adults [1, 2, 3, 4]. But there are a few studies examined the efficacy and the safety of TAP block for postoperative analgesia in pediatric patients [1, 5, 6].

The present study was designed to evaluate to compare postoperative analgesic efficacy and safety of caudal block and TAP block in pediatric patients, who undergo lower abdominal surgery.

2. Materials and Methods

This retrospective study was conducted in XXX Turkey, between January and December 2014. The local institutional Ethics Committee gave approval for the study number 02.12.2015/20478486-396. American Society of Anesthesiologists physical status I–II, 61 patients aged between 2 and 10 years scheduled for elective lower abdominal surgery are enrolled the study. Written informed consent obtained from all parents. A single operator (K.E), experienced in pediatric ultrasound-guided regional anesthesia, applied all blocks to patients. Patients were allocated by random number table in caudal or TAP groups: caudal block (C, n: 31), TAP block (T, n: 30).

Patients had received routine midazolam (0.5 mg.kg-1 oral) sedation 1 hour before the anesthesia. Heart rate [HR], non-invasive blood pressure, arterial oxygen saturation and end-tidal carbon dioxide monitoring were used during surgery.

Atropine (15 µg.kg-1) and fentanyl (2 µg.kg-1) were administered in anesthesia induction after obtaining vascular access, mask ventilation was accomplished by using 8% sevoflurane in 50/50% oxygen/nitrogen oxide followed by laryngeal mask airway placement. The rate of inhaled gases during anesthesia maintenance was adjusted as follows: oxygen/nitrogen oxide 50/50% with sevoflurane value of 1-1.5 vol %. The volatile agent concentration was reduced toward the end of surgery for fully awakening the patients at the end of the procedure.

In group C (n:31) patients were placed in left lateral position. Around the sacral hiatus was carefully sterilized with an antiseptic solution. The technique was done with the guidance of a high-resolution ultrasound machine (7.5 MHz Linear prop, Esaote My Lab 30cv, Florence, Italy). A 22 gauge spinal needle was placed in line with and parallel to the transducer (ultrasound beam). The needle shaft was visualized and under the guide of ultrasound was advanced into the sacral hiatus using the longitudinal section. Passage of the needle through the sacral hiatus was observed by the operator. When the operator was satisfied that the needle was in the sacral hiatus, 0,3 mL.kg-1 0,25 % levobupivacaine (Chirocaine, Abbott, Rungis, France) was injected in 60 seconds. All patients were admitted to the recovery room and were quitted when they were fully awake and pain free. Patients were assessed for the quality of pain relief by using Faces Pain Scale – Revised (FPS-R) (figure - 1) at 0., 1., 4., 6., hours of the postoperative period. Possible complications resulting from caudal block were also recorded. Analgesic (paracetamol 15 mg.kg-1 oral) administered when patients scored 5 or more on the pain scale and the analgesic requirement was recorded. Tramadol drop 1-2 mg.kg-1 oral administration was planned as needed for moderate to severe pain which doesn't relieved by paracetamol.

In group T (n:30) patients were placed in supine position. After aseptic preparation of the puncture site, the TAP block was performed using a 22-gauge needle. The probe was placed transversely on the vertical mid-axillary line between the iliac crest and 12th rib. External oblique, internal oblique and transversus abdominis muscles of the anterior abdominal wall were identified. When the neurofascial plane was identified the needle was introduced anteriorly and advanced in-plane. Once the tip of the needle was correctly positioned between the internal oblique and transversus abdominis muscles, and after a negative aspiration test, 0,5 mL.kg-1 of a 0,25 % levobupivacaine solution (Chirocaine, Abbott, Rungis, France) was slowly injected.

2.1. Statistical analysis:

Statistical data were analyzed using Statistical Package for Social Sciences version 15 (SPSS Inc., Chicago, IL, USA). Shapiro Wilks test was used to analyze normality of the distribution of variables. Descriptive statistics were given as mean ± standard deviation or median (min-max) for continuous variables. Group comparisons were performed using the Mann-Whitney U test and t test. Pearson chi-square test or Fisher's Exact test was used to compare categorical data. Categorical data were given as n and %. Statistical significance was accepted at $p<0.05$.

3. Results:

From January through December 2014, 61 patients were enrolled the study. At the end of research, we analyzed

the data of a total of 61 patients (group C: 31, group T: 30) (Table 1).
Patient's demographic information and local anesthetic volume are shown in Table 2. Male to female ratio was similar in each group (P=0.98). Between two groups there were no significant differences at ages and body weight. ASA physical status did not differ significantly between groups.

Table 1. The types of the procedures being performed.

Surgery	Caudal block (n:31)	TAP block (n:30)	Total (n:61)
Inguinal herniorrhaphy	11(%35)	15(%50)	26(%42)
Undescended testis	18(%58)	12(%40)	30(%50)
Hydrocelectomy	2(%7)	3(%10)	5(%8)

Data were expressed as mean ± SD, frequency (n) and percentage (%)

Mean local anesthetic volume at group C was 4,11 0,89 mL and group T was 8,33 4,28 mL. The local anesthetic volume used for TAP block was more than caudal block (p<0,05), (Table 2).

Table 2: Demographic data and local anesthetic volumes.

	Caudal block mean±SD	TAP block mean±SD	p
Age	4,87±3,48	5,88±4,94	0.358
Weight (kg)	20,41±8,97	22,53±20,14	0.597
Local anesthetic volume (mL)	4,11±0.89	8,33±4,28	<0.001

TAP: Transversus abdominis plane. Data were expressed as mean ± SD

When we compared the FPS-R at 0. hour, TAP block was more efficient at postoperative pain than caudal block (p<0,05) (Table 3). FPS-R scores of two groups showed no statistical difference between the groups after first hour of postoperative period.

Table 3: Postoperative FPS-R scores of groups

FPS-R	Caudal block mean±SD	TAP block mean±SD	p
1. hour	2,58±2,21	0,30±0,79	0,000
2. hour	1,58±0,92	1,57±1,87	0,970
4. hour	0,87±1,11	0,60±1,19	0,363
6. hour	0.58±0,62	0,90±1,56	0,295

TAP: Transversus abdominis plane, FPS-R: faces pain scale-revised. Data were expressed as mean ± SD

We recorded the analgesic requirements of all patients (n: 61) and 22% off all patients (n: 14) required analgesic. There were no significant differences between two groups (Table 4).

Table 4: Analgesic requirements of two groups.

Analgesic requirement	Caudal block N (%)	TAP block N (%)	Total N (%)	p
yes	7 (23,3)	7 (22,6)	14 (23)	0,944
no	24 (76,7)	23 (77,4)	47 (77)	

TAP: Transversus abdominis plane. Data were expressed as frequency (n) and percentage (%)

4. Discussion

Pediatric patients need to have adequate pain control following surgery for avoiding neuroendocrine stress response and emergence agitation. Regional anesthesia can be applied by both central and peripheral techniques. Caudal block is very popular regional anesthesia technique without any temporary or permanent sequelae for lower abdominal surgery of children [7]. Besides coagulation disorders and congenital abnormalities limit the application of caudal block, it carries a risk of serious complications such as paraplegia. Alternative regional techniques which produce effective pain relief and have a low risk of morbidity are required. TAP block has been investigating as a safe and effective block for adults [8,9,10]; but; there is limited data in literature comparing the efficacy of TAP block with caudal block in children [11,12,13,14].
We investigated the efficacy and safety of caudal and TAP blocks in postoperative period of lower abdominal surgery in children retrospectively.
In this retrospective study, pain scores in the first hour postoperatively were significantly higher in the caudal group but were equivalent at all subsequent hours. But mean FPS-R scores were not as high as to need treatment in both groups even at first hour. TAP block and caudal block were associated with similar analgesic effects in the early postoperative period following lower abdominal surgery.
Data were collected by blind investigator in the postoperative period. Only 23 % patients in per groups needed analgesic and single dose of paracetamol 15 mg.kg-1 oral was enough for pain relief and any patient needed opioid agent. There were no adverse effects related to analgesic drug. TAP block is indicated for all kind of lower abdominal surgery including appendectomy, hernia repair [15]. In our study in caudal group, three of seven patients who needed postoperative analgesic administration had undergone inguinal herniography and other four patients had orchiopexy. In TAP group, one of seven patients who needed postoperative analgesic administration had undergone inguinal herniography and other 6 patients had orchiopexy procedure. This finding concluded us TAP

block may not sufficient in orchiopexy procedure. Limitations of this study are small sample size, only early postoperative period observation, not studied in a specific surgery. Further studies should be conducted comparing TAPB with other regional anesthesia techniques for specific pediatric surgeries.

We standardized midazolam premedication in order to control its effects in day-stay pain assessment. Adjunct medicines can be added for improving the quality or quantity of block or decreasing side effect frequency [16,17]. We used only % 0.25 levobupivakain 0.5 ml.kg-1 for both types of blocks in this investigation in order to compare them without adjunct medicine effects.

Briskin et al [11] recommended TAPB instead of caudal block, with its superior safety profile and wider applicability as a preferred postoperative analgesia method for ureteral reimplantation in children. Bryskin et al [11] stated that the caudal block comprises visceral block as much as motor and sensorial block unlike TAP block which doesn't provide visceral anesthesia adequately. If visceral pain is an important component of postoperative pain, TAP block must be supported with other analgesic modalities.

We didn't use opioids for avoiding opioid side effects such as respiratory depression or increased sedation since our patients are discharged approximately 6 hours after the surgery. Bryskin et al. [11] found low frequency of emesis in the TAPB group which reflects the lower cumulative opioid dose in that group.

We prefer ultrasound guidance because it is more time-consuming, and ensures us the needle is placed correctly, local anesthetic spread around the nerves and no other structures are injured. In our study all procedures were performed by the same operator for avoiding personal differences of block timing. Total block time covered surgery period and early postoperative period in both groups.

TAP block requires large volumes of local anesthetic as in our study to anaesthetize multiple small abdominal wall nerves. High doses of local anesthetic should be avoided for not to cause systemic toxicity. We didn't observe any complication of our regional technics in both groups.

In conclusion Ultrasound-assisted TAP block and caudal block are simple, safe and effective analgesic methods in early period of postoperative pain management in lower abdominal pediatric surgery.

Conflict of interest: The authors declare that they have no conflict of interest.

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