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The effect of caudal levobupivacaine and morphine combination in pediatric lower extremity orthopedic surgery

Pediyatrik alt ekstremite ortopedik cerrahisinde kaudal levobupivakain ve morfin kombinasyonunun etkileri

Sertöz N[1] Çağıran E[1] Ayanoğlu H Ö[2]

[1]Ege Üniversitesi Tıp Fakültesi, Anesteziyoloji ve Reanimasyon Anabilim Dalı, İzmir, Türkiye
[2]Marmara Üniversitesi Tıp Fakültesi, Eğitim ve Araştırma Hastanesi, Anesteziyoloji ve Reanimasyon Anabilim Dalı, İstanbul, Türkiye

Summary

Introduction: In this study, we evaluated the peroperative and postoperative effects of caudal levobupivacaine and IV or caudal morphine retrospectively.

Materials and Methods: We retrospectively evaluated the records of healthy 40 children aged between 2-12 years, who had osteotomy for lower extremity under general anesthesia and caudal blockade. The solution injected was 0.5ml.kg^{1} volume of 0.25% levobupivacaine including 20µg.kg^{-1}morphine (Group I) or only 0.25% levobupivacaine with IV morphine added at a dose of 0.1 mg.kg^{-1} (Group II). We compared the groups in terms of peroperative hemodynamic changes and postoperative analgesia.

Results: No significant differences were found in terms of age, height, weight and duration of surgery. We did not observed any peroperative or postoperative hemodynamic changes needing intervention for any patients ($p>0.05$). The mean time to the first analgesic need was 644±160 min. for Group I and 542.3±98 min. for Group II ($p<0.05$). None of the patients had side effects such as motor blockade, nausea, vomiting and pruritus.

Conclusion: Among pediatric patients who underwent lower extremity surgery, morphine added caudally to levobupivacaine provided a longer duration of analgesia without leading to clinically significant hemodynamic changes and side effects when compared to IV doses of morphine added to levobupivacaine.

Key Words: Caudal analgesia, morphine, levobupivacaine.

Özet

Amaç: *Bu çalışmada pediyatrik ortopedide, alt ekstremite girişimlerinde kaudal levobupivakaine eklenen IV veya kaudal morfin kombinasyonunun peroperatif ve postoperatif etkilerini retrospektif olarak değerlendirmeyi amaçladık.*

Gereç ve Yöntem: *Alt ekstremite osteotomisi geçiren genel anestezi sonrası kaudal analjezi uygulanan 2-12 yaş arası 40 hastanın anestezi takip formları incelendi. Kaudal analjezi için 0.5 ml.kg %0.25 levobupivakaine 20µg.kg morfin eklenen hastalar(Grup I) ile yine kaudal olarak verilen 0.5 ml.kg % 0.25 levobupivakine IV 0.1 mg.kg morfin eklenen hastaların (Grup II) peroperatif hemodinamik ve postoperatif analjezi etkileri karşılaştırıldı.*

Bulgular: *Guruplar arasında yaş, boy, ağırlık, ameliyat süreleri açısından anlamlı bir farklılık bulunmamıştır. Peroperatif ve postoperatif hemodinamik değişiklikler açısından gruplar arasında fark saptanmadı. İlk analjezik gereksinim süresi Grup I için 644± 160 dk, Grup II için 542± 98 dk bulundu. ($p<0.05$) Hiçbir hastada motor blokaj, bulantı-kusma, kaşıntı gibi yan etkiler saptanmadı.*

Sonuç: *Alt ekstremite cerrahisi uygulanan pediyatrik hastalarda kaudal levobupivakaine eklenen morfinin, kaudal levobupivakine eklenen IV morfine göre hemodinamik değişikliklere ve yan etkilere neden olmaksızın daha uzun süre analjezi sağladığı saptanmıştır.*

Anahtar Sözcükler: *Kaudal analjezi, morfin, levobupivakain.*

Yazışma Adresi: Nezih SERTÖZ

Ege Üniversitesi Tıp Fakültesi, Anesteziyoloji ve Reanimasyon Anabilim Dalı, İzmir, Türkiye

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Introduction

Caudal epidural anesthesia is one of the most frequently used anesthetic techniques as it is a reliable and efficient anesthetic method in pediatric patients.

Caudal blockade has such advantages as decreasing intraoperative anesthetic need, hastening recovery, achieving effective postoperative analgesia and shortening the hospital stay when it is combined with general anesthesia in lower abdominal, urogenital and lower limb surgery, especially in children (1).

Long acting local anesthetic using levobupivacaine at a concentration of 0.25% and at a dose of 0.5 – 1 $ml.kg^{-1}$ in order to prolong postoperative analgesia in caudal blockade results in duration of analgesia of about 4 to 6 hours in the postoperative period (2).

In a caudal blockade, it is also possible to further prolong the analgesic period with optimal morphine doses added to local anesthetics as well as decreasing the side effects of the opioids (*i.e.*, respiratory depression, nausea and vomiting, itching, urinary retention) (3).

The current study aimed to compare the effects of caudal levobupivacaine–morphine combination and intravenous morphine added to caudal levobupivacaine on peroperative hemodynamics and postoperative analgesia in pediatric patients undergoing a relatively painful procedure such as an osteotomy in lower limb orthopedic surgery.

Materials and Methods

In the present study we retrospectively reviewed medical records of 40 patients aged between two and twelve years who underwent lower limb surgery under caudal blockade in the orthopedic operation room and who were physically healthy at the time of the operation. Per oral midazolam at a dose of 0.75 $mg.kg^{-1}$ had been given 45 minutes before the operation for the purpose of premedication.

In the operation room, following standard monitoring (ECG, SpO2, NIBP) the patients were given a 50% O_2/N_2O mixture, induction with 4-6% sevoflurane applied and then IV line was placed. From the records, we obtained data that all the patients were intubated after being giving of atropine at a dose of 10$\mu g.kg^{-1}$, fentanyl at a dose of 2 $\mu g.kg^{-1}$ and rocuronium at a dose of 0.6 $mg.kg^{-1}$ by intravenous route. During anesthetic maintenance, sevoflurane at end-tidal concentration of 2%, 50% of O_2/N_2O mixture and rocuronium at a dose of 0.15 $mg.kg^{-1}$ was used when required.

Recordings of heart rate (HR), mean arterial pressure (MAP), peripheral oxygen saturation (SpO_2) at intervals of 5 minutes during the operation were available.

A total of 40 patients were divided into two groups of 20.

Group I (K_{L+M}): A single epidural dose of the drug mixture consisted of 0.25% levobupivacaine at a dose of 0.5 $ml.kg^{-1}$ and morphine at a dose of 20 $\mu g.kg^{-1}$ was administered. Group II (K_L+ IV M): 0.25% levobupivacaine at a dose of 0.5 $ml.kg^{-1}$ was administered into the epidural space and morphine was administered by IV route at a dose of 0.1$mg.kg^{-1}$.

Following the operation HR, MAP, SPO2, respiratory rate, pain level by the objective pain scale (OPS and **Table-1)**, and sedation levels by the Ramsey's sedation scale (Table-2) were recorded four times during the first postoperative hour and then once in an hour during the consequent 5 hours. Total analgesic need during the 24 hour period and the time of the first analgesic dose were recorded. The duration of analgesia was considered as the time between the application of caudal blockade and the time of the first analgesic administration.

Table-1. Objective pain scale.

SCORE	0	1	2
SYSTOLIC BLOOD PRESSURE	increase < 20% of preoperative blood pressure	increase 20-30% of preoperative blood pressure	increase >30% of preoperative blood pressure
CRYING	not crying	responds to age appropriate nurturing (tender loving care)	does not respond to nurturing
MOVEMENTS	no movements relaxed	restless moving about in bed constantly	thrashing (moving wildly)
AGITATION	asleep or calm	can be comforted to lessen the agitation (mild)	cannot be comforted (hysterical)
PAIN	states no pain	cannot localize	localizes pain

Table-2. Ramsay sedation scale (RSS)(14).

1.	Patient is anxious and agitated or restless, or both
2.	Patient is co-operative, oriented and tranquil
3.	Patient responds to commands only
4.	Patient exhibits brisk response to light glabellar tap or loud auditory stimulus
5.	Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus
6.	Patient exhibits no response

Additionally, possible side effects such as respiratory depression, motor blockage, hypotension, bradycardia, nausea and vomiting, itching, and urinary retention were found in the recorded data.

Parametric data (age, sex, weight, length, duration of the operation, time to first analgesic requirement, and values of OPS and Ramsey's sedation scale) were analyzed by the Student's t test and peroperative and postoperative variables (HR, MAP, OPS, Ramsey) between the (K_{L+M}) and (K_L+IV M) groups were analyzed by 2-factor variance analysis with one factor being repeated. For each variable, the Student's t test was used in the control of the significance difference between the groups. The statistical significance level was considered to be 0.05. Cross tables were made for sex ratios in the groups and chi-square analysis was performed. SPSS software v.16.0 was used for statistical analysis.

Results

Patient characteristics were similar (P > 0.05) (Table-3).

Duration of the operation was found to be similar in both groups, whereas the time to the first analgesic requirement was longer in Group I [caudal (levobupivacaine+ morphine)] than in Group 2 (caudal levobupivacaine +IV morphine) (p < 0.05).

Table-3. Patient demographic data.

	Group1 (K_{L+M})	Group 2 (K_L+IV M)	p
Age (Year)	5.9 ± 3.3	4.5 ± 3.0	0,172
Sex (M/F)	10/10	9/11	
Weight (Kg)	15 ± 7.4	20 ± 10	0,122
Duration of Operatin (Min)	112 ± 32	109 ± 47	0,786
Time to First Analgesic Requirements (Min)	644 ± 160.3	542.3 ± 98	0.02

Although there was no difference between the groups in terms of hemodynamic variables (HR, MAP) (p > 0.05), changes in time from baseline values were found to be significant in both groups (p< 0.05).

Postoperative respiratory rates, SpO_2 values and end-tidal CO_2 values were similar both in and between the groups (p > 0.05).

Additional necessary doses of fentanyl and sevoflurane due to hemodynamic changes in the groups were similar (p > 0.05). No motor blockade occurred in any patient in either group.

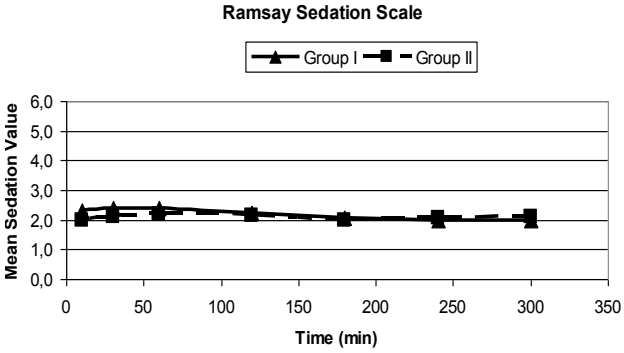
When Ramsey's sedation scores were evaluated in both groups, the sedation level of one patient in the Group I and 3 patients in the Group II were considered to be agitated whereas the sedation level of one patient in the Group I during the first hour of postoperative monitoring was found to be 5, that is to say the patient was opening his eyes with only painful stimuli. No statistically significant difference, however, was found between the groups in sedation levels (p > 0.05) (Figure-1).

When both groups were compared for mean scores of pain scale during the period to the first analgesic use, no statistically significant difference, was found between the groups (p > 0.05) (Figure-2). In terms of OPS scores, one patient in Group I and two patients in Group II showed OPS>5 (p>0.05) a difference.

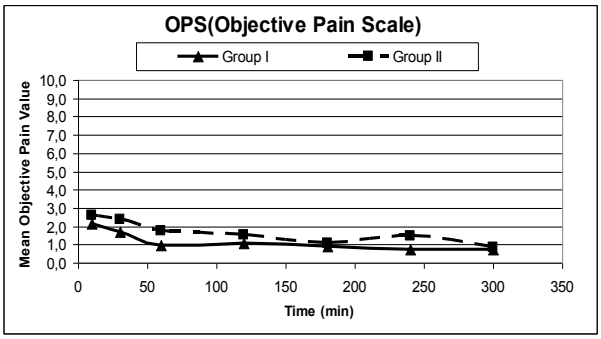
In regard to additional analgesic need during the postoperative period, one patient in the Group I and six patients in Group II received additional analgesia (p > 0.05).

In terms of side effects, only nausea and vomiting were observed in three patients in Group I and Group II (p > 0.05). Other side effects such as respiratory depression, itching, urinary retention, hypotension, bradycardia, and motor blockade were not observed.

Graphic-1. Ramsey Sedation Scale (RSS)(14).



Graphic-2. Objective pain scale (OPS) (13).



Discussion

Caudal blockade is applied in order to decrease analgesic need under general anesthesia and to provide postoperative analgesia in orthopedic operations in the lower limbs of pediatric patients (1).

Using local anesthetics at high doses in caudal blockage increases the incidence of side effects without increasing therapeutic efficacy (4).

In addition, concentration of the local anesthetics used is also important. In a study by Wolf et al., the authors found shorter duration of motor blockade and analgesia in the 0.125% bupivacaine group than in the 0.25% bupivacaine group (4).

Ivani G et al. found that in caudal applications, at a volume of 1mlkg^{-1}, motor blockade disappeared faster in the 0.125% bupivacaine group, whereas duration of postoperative analgesia was longer in the 0.25% bupivacaine group (5).

Results of the studies on different concentrations of local anesthetics such as bupivacaine, levobupivacaine, and ropivacaine have shown that as concentrations of the local anesthetics decreased, the duration of motor blockage and the duration of analgesia were shortened (6).

The optimum concentration of local anesthetics was found to be 0.25% and the volume of the local anesthetics to vary between 0.5 and 1 ml.kg^{-1} depending on the surgical site (4,7).

In the current study, 0.25% concentration of levobupivacaine was used at volume of 0.5 ml.kg^{-1} Studies have shown that adding morphine to local anesthetics in caudal blockade decreases the requirement of local anesthetics as well as their side effects while increasing the quality and the duration of analgesia (8-10).

Wolf et al. added 50 µg.kg^{-1} of morphine in pediatric urogenital surgical patients and found side effects (nausea, vomiting) in 40% of the patients (9).

In another study in which three doses of morphine (33, 67 and 100 µg.kg^{-1}) with lidocaine were used for postoperative analgesia in lower abdominal surgical procedures, Krane et al. observed side effects more frequently at doses of 67 and 100 µg although all three doses maintained effective analgesia (11).

Mayhew et al. administered low doses of caudal morphine at doses of 30µg.kg^{-1} and 40µg.kg^{-1} for purposes of postoperative analgesia and observed similar incidence of side effects (12).

As in all of the studies above, high doses of morphine achieve analgesia of a longer duration but increase incidence of side effects. In this study it was observed that adding morphine at a dose of 20µg.kg^{-1} to the caudal local anesthetics maintained effective analgesia and fewer side effects than in other studies. Furthermore, no motor blockage occurred in any patient during the postoperative period as a consequence of using lower amounts of local anesthetics.

Postoperative pain was evaluated by an objective pain scale considering the age group of the patients (13). Scores of the objective pain scale were lower in the group of caudal morphine than in the IV morphine group whereas the scores of Ramsey's sedation scale (14) were higher in the caudal morphine group than in the IV morphine group. In summary, our patients receiving caudal morphine had better postoperative and longer duration of analgesia than in the IV morphine group. The severe sedation observed in one patient in the caudal morphine group shows that morphine dose per kilogram of body weight needs to be limited to obese patients.

Conclusion

Morphine in a 20µg.kg^{-1} dose added to 0.5 ml.kg^{-1} of 0.25% levobupivacaine used in caudal blockade of pediatric patients undergoing orthopedic lower limb operations provides longer duration of analgesia without leading to clinically significant hemodynamic changes and without causing a significant side effect when compared to IV doses of the same drug.

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