Section: Anesthesiology

Research

CAUDAL BUPIVACAINE-NEOSTIGMINE FOR PERIOPERATIVE ANALGESIA IN PEDIATRIC PATIENTS UNDERGOING INFRA-UMBILICAL SURGERIES

Received : 05/12/2022
Received in revised form : 05/01/2023
Accepted : 17/01/2023

Keywords:
Caudal bupivacaine, neostigmine, perioperative analgesia, infra-umbilical surgeries.

Corresponding Author:
Dr. P Satheesh,
Email: satheeshberry@gmail.com
ORCID: 0000-0001-7652-1927

DOI: 10.47009/jamp.2023.5.1.118

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (1); 572-575

C.C Pramoth[1], P Satheesh[2], P Satheesh[2]

[1]Assistant Professor, Department of Anesthesiology, Govt Theni Medical College, Tamilnadu, India
[2]Senior Resident, Department of Anesthesiology, Govt Medical College-Ramanathapuram, Tamilnadu, India

Abstract

Background: In pediatric patients, perioperative pain is a major issue for anesthesiologists. Because presurgical caudal analgesia reduces the stress response to anesthesia and surgery, we used neostigmine combined with bupivacaine to extend the duration of a single caudal block. The purpose of this research was to examine the effectiveness of caudal bupivacaine with or without neostigmine in children having infraumbilical surgery for perioperative analgesia. **Materials and Methods:** A prospective, randomised, double-blind trial was conducted on 45 patients with ASA physical status I or II of either sex, ranging in age from two to ten years. After induction of general anaesthesia, patients scheduled for elective infra-umbilical surgical operations were randomly assigned to one of three groups of 15 patients each to receive caudal injections of either 1ml/kg 0.25 percentage bupivacaine hydrochloride or 2mcg or 5mcg/kg neostigmine. **Result:** All children were hemodynamically stable during and after surgery. The caudal bupivacaine/neostigmine combination produced much better analgesia than bupivacaine alone. Recovery to the first rescue analgesia was 6.05±2.04 h, 11.5±3.42 h, and 16.86± 4.92 h, respectively, in the bupivacaine alone, bupivacaine neostigmine 2mcg/kg, and bupivacaine neostigmine 5mcg/kg groups ($p<0.05$). Additionally, patients receiving pure bupivacaine required more Paracetamol than those receiving bupivacaine/neostigmine to sustain sufficient analgesia in the first 24 post-operative hours. **Conclusion:** Co-administration of caudal neostigmine with bupivacaine greatly prolongs the duration of post-operative analgesia while decreasing the requirement for supplemental analgesics.

INTRODUCTION

Pain stimulates metabolic, neuroendocrine, and cardiorespiratory responses, all of which have a detrimental effect on morbidity and mortality, i.e. the surgical result. Despite widespread recognition of the critical need for appropriate analgesia in adults, it has usually been a secondary priority in paediatric pain. Fortunately, current research has fundamentally altered our approach to juvenile pain.[1]

The caudal blockade is the most often utilized regional anaesthetic method in pediatric patients. Recent research has shown that preoperative caudal analgesia mitigates the stress response associated with anesthesia and surgery and reduces post-operative opioid usage.[2] Bupivacaine is the most often used local anaesthetic in caudal anesthesia for intraoperative and post-operative analgesia during perineal and lower abdominal procedures.[1,2] A single "Kiddie caudal" injection with bupivacaine alone has a limited duration of action (4–8 hours), and catheter insertion into the extradural space increases the risk of infection and tends to delay early mobility.[3-5]

Attempts to resolve these issues Numerous medications, including epinephrine, morphine, clonidine, ketamine, midazolam, tramadol, fentanyl, butorphanol, and neostigmine, have been used in combination with caudal bupivacaine to enhance and prolong analgesia.[3,6-11] Each of the drugs discussed above has certain drawbacks, for example, caudal morphine may cause delayed respiratory depression. Clonidine and midazolam taken caudally have been linked to persistent sedation.[12] Caudal ketamine has been connected with

ISSN (O): 2687-5365; ISSN (P): 2753-6556

behavioural adverse effects 16, and caudal tramadol and neostigmine have been associated with an increased incidence of post-operative nausea and vomiting.[8]

Neostigmine has previously been used in conjunction with local anaesthetics to provide caudal analgesia in juvenile patients having genitourinary/urological surgery. Not much research has been done on its usage in paediatric lower abdominal procedures so far. Thus, the purpose of this double-blind, prospective, randomised, controlled trial was to examine the efficacy of caudal neostigmine (2mcg/kg or 5mcg/kg) vs bupivacaine on perioperative analgesia and related adverse events in paediatric patients having lower abdominal surgery.[13]

MATERIALS AND METHODS

An informed written parental permission was acquired after receiving clearance from the Institute's ethical committee. This research included 45 children aged 2 to 10 years who had ASA physical status I or II of either sex, had a body weight of less than 20% of their target weight and had lower abdominal procedures lasting 1 to 2 hours.

The exclusion criteria were; patients with a history of hypersensitivity reaction to any of the study medications, bleeding diathesis and preexisting neurological or spinal diseases.

A peripheral line was established with 50 percentage N2O in oxygen and sevoflurane administered via a mask. Each kid received 0.01 mg/kg of intravenous atropine. To assist endotracheal intubation, sodium pentathol 4-6 mg/kg was used to establish general anaesthesia, followed by succinylcholine 1.5 mg/kg. On Ayre's T piece or Pediatric Bain's circuit, the anaesthesia was maintained with 60 percentage N2O in oxygen, 0.5-1.5 percentage sevoflurane, and intravenous vecuronium bromide as a non-depolarizing muscular relaxant. No intravenous sedation or analgesia was given to any children throughout the procedure, and sevoflurane was regulated to keep heart rates below 20% of their pre-induction values.

The caudal block was conducted under sterile circumstances with the patient in the left lateral position using a 23-gauge, short bevelled needle. Patients were randomly allocated to one of the three groups using a computer-generated database of random numbers.

Group I: The patient received 1 ml/kg of 0.25% caudal bupivacaine alone.

Group II: The patient got 1 ml/kg caudal bupivacaine 0.25 percentage in conjunction with 2mcg/kg neostigmine.

Group III: Patients got 1 ml/kg caudal bupivacaine 0.25 percentage in conjunction with 5mcg/kg neostigmine.

After 15 minutes of caudal injection, surgery was permitted to commence. Heart rate, arterial pressure, and SpO2 were measured at baseline (before induction), during induction (before the caudal block), and after the caudal block, and then every ten minutes until the procedure was completed. After the procedure was completed, the time interval between the cessation of anaesthetic and spontaneous eye-opening was also recorded (recovery time).

When the kid regained consciousness in the recovery room, the investigator, who was unconscious of the caudal analgesic therapy, documented ventilator frequency, arterial blood pressure, and heart rate at 2, 4, 6, 12, and 24 hours postoperatively. The "Modified Objective Pain Score (MOPS)" was used to measure post-operative pain, and rescue analgesia in the form of oral Paracetamol (20mg/kg) was administered when the score exceeded 4. [Table 1]. Additionally, adverse effects/complications were reported.

Statistical Analysis

The duration and degree of analgesia, complications, and requirement for rescue analgesia were all compared between the two groups. The resulting data were statistically examined using analysis of variance (ANOVA) and the students 't-test. Statistical significance was defined as a 'p-value of 0.05.

RESULTS

All 3 groups were evaluated regarding patient attributes (age, sex, weight, ASA class, duration of surgery and recovery times [Table 2].

Table 1: Modified Objective Pain Score (MOPS)

	Score 0	Score 1	Score 2
Crying	None	Consolable	Not consolable
Movement	None	Restless	Thrashing
Agitation	Asleep/Calm	Mild	Hysterical
Posture	Normal	Flexed	Holds injury site
Verbal	Asleep/No complaints	Complaint but cannot localized	Complaint and can localize

Table 2: Patients attributes

	I	II	III
Age (years)	5.12	5.42	5.28
Sex (M;F)	21; 9	22; 8	20; 10
Weight (Kg) ± SD	16±4.59	15.9±4.24	16.6±5.42
ASA (Class I; II)	11;19	12;18	10;18

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Duration of surgery (minutes) ±SD	50±15	53±12	48±10
Recovery Time (minutes) ± SD	5.5±1.3	6.0±1.0	5.7±1.5

The three groups also had equivalent intraoperative hemodynamic characteristics (heart rate, blood pressure, and oxygen saturation). During surgery, none of the children needed therapy for hypotension or bradycardia. All children were awake and breathing room air when moving to the recovery room.

Caudal injection of bupivacaine with neostigmine produced greater analgesia than the bupivacaine alone group. Recovery periods to the first analgesic were 5.05 2.04 hr, 11.053.42 hr, and 16.864.2 hr, respectively, in the groups receiving bupivacaine alone, bupivacaine with 2mcg neostigmine, and bupivacaine with 5mcg neostigmine [Figure 1].

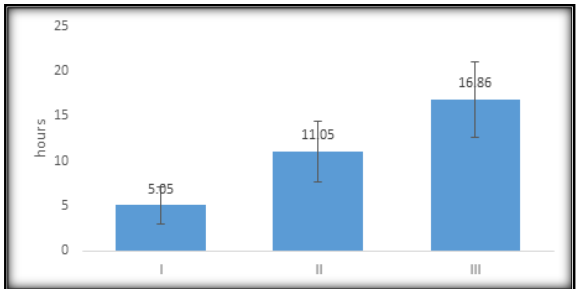

Figure 1: Duration of analgesia

Additionally, patients receiving pure bupivacaine required more Paracetamol than those receiving bupivacaine/neostigmine to sustain sufficient analgesia in the first 24 post-operative hours.

Two patients in the caudal bupivacaine 5mcg neostigmine groups had nausea/vomiting in the recovery room (group III). This change was statistically significant between the groups receiving plain bupivacaine and those receiving bupivacaine 5mcg neostigmine (p=0.05). Post-operative vomiting was neither severe nor persistent and was well controlled with a single intravenous dose of Ondansetron 0.1 mg/kg.

DISCUSSION

Caudal epidural anaesthesia is often used in pediatric therapy to relieve post-operative pain. Caudal block has gained widespread popularity because of its technological simplicity, dependability, safety, and quick performance in large cohorts of newborns and children. Although the single-shot caudal block is often utilized, it may have a brief duration of effect.[1-3]

In this investigation, patients in all three groups were equivalent in terms of age, gender (M; F), and weight (P>0.05). To prolong the duration of analgesia, we employed two doses of neostigmine (2mcg/kg and 5mcg/kg) in conjunction with bupivacaine.[14] The current research established that caudal neostigmine 5mcg/kg in conjunction with 0.25 percentage caudal bupivacaine significantly prolongs post-operative analgesia and decreases the requirement for rescue analgesia in children having lower abdominal surgery.

Numerous studies have employed caudal epidural neostigmine with or without local anaesthetics to prolong the duration of analgesia in paediatric patients. In children, a single caudal injection of 1mcg/kg neostigmine in combination with bupivacaine had no benefit over bupivacaine alone in terms of post-operative pain management.[15] In a prior trial, caudal neostigmine 2mcg/kg diluted in normal saline (1 ml/kg) gave equivalent post-operative analgesia to caudal bupivacaine alone, and co-administration of the two medications was related to prolonged post-operative analgesia and decreased need for supplementary analgesia.[16] In light of the aforementioned two investigations, we compared neostigmine 2mcg/kg and 5mcg/kg to bupivacaine and discovered that both dosages considerably increased the duration of post-operative analgesia and decreased the requirement for rescue analgesia.[13]

A prior dosage response trial with intrathecal neostigmine at doses ranging from 6.25 to 50mcg revealed a reasonably high incidence of nausea (33–67 percentage) and vomiting (17-50 percentage). Neostigmine caudal epidural injection in paediatric patients previously showed considerable post-operative nausea and vomiting at a dosage of 2mcg/kg, however, subsequent research found no increase in adverse effects with co-administration of neostigmine up to 4mcg/kg. Vomiting occurred in the recovery room of two patients receiving caudal bupivacaine 0.25 percentage with 5mcg/kg neostigmine in our trial.[18,19]

Limitation of the study

1. The study group was small and limited to one type of surgical procedure.
2. Because no follow-up research of patients was conducted in this investigation, any long-term adverse effects could not be documented.
3. Our study has not studied a dose-dependent analgesic effect of caudal neostigmine

CONCLUSION

The present study demonstrated that caudal neostigmine 5mcg/kg in combination with 0.25% caudal bupivacaine markedly prolonged post-operative analgesia associated with a side effect of nausea and vomiting and reduce the need for rescue analgesia in children undergoing lower abdominal surgeries.

REFERENCES

1. Khahil SN, Hanna F, Farag A, Govindaraj R, Vije H, Kee S. Chuang AZ. Presurgical caudal block attenuates stress

ISSN (O): 2687-5365; ISSN (P): 2753-6556

response in children. Middle East J Anaesthesiol. 2005;18 (2): 391-400.
2. Kay B. Caudal block for post-operative pain relief in children. Anaesthesia 1974; 29(5): 610 -1.
3. Cook B, Grubb DJ, Aldridge LA, Doyle E. Comparison of the effects of adrenaline, clonidine and ketamine on the duration of caudal analgesia produced by bupivacaine in children. Br J Anaesth 1995; 75(6): 698 - 701.
4. Naguib M, Sharif AMY, Seraj M, El Gammal M, Dawlatly AA. Ketamine for caudal analgesia in children: 559 - 564.
5. Murat I, Delleur MM, Esteve C, Egu JF, Rayanud P, Saint - Maurice C. Continuous extradural anaesthesia in children. Br J Anaesth 1987; 69: 1441 - 1450.
6. Wolf AR, Hughes D, Wade A, et al Post-operative analgesia after paediatric orchidopexy: evaluation of a bupivacaine-morphine mixture. Br. J. Anaesth 1990;64 (4): 430 – 5.
7. Nishina K, Mikawa K. Clonidine in Pediatric anaesthesia. Curr opin Anesthesiol 2002; 15 (3): 309 - 16.
8. Kumar P, Rudra A, Pan AK, Acharya A. Caudal additives in Pediatrics: A comparison among midazolam, ketamine and neostigmine co-administered with bupivacaine. Br J Anaesth 2006;96 (3): 401 - 2.
9. Gunduz M, Ozcengiz D, Ozbek H, Isik G. A comparison of a single dose of caudal tramadol, tramadol plus bupivacaine and bupivacaine administration for post-operative analgesia in children. Paediatr Anaesth 2001; 11(3): 323-6.
10. Constant I, Gall O, Gouyet L, Chauvin M and Murat I. Addition of clonidine or fentanyl to local anaesthetics prolongs the duration of surgical analgesia after single-shot caudal block in children. Br J Anaesth 1998; 80(3): 294 - 8.
11. Vinita Singh, Ashish Kanaujia, G. P Singh: Efficacy of caudal butorphanol. Indian J Pediatr 2006; 73 (2): 147 – 50.
12. Memis D, Turan A, Karamanlioglui B, et al. Caudal neostigmine for postoperative analgesia in pediatric surgery. Paediatr Anaesth. 2003; 13(4): 324 - 8.
13. Krane EJ. Delayed respiratory depression in a child after caudal epidural morphine. Anesth Analg. 1988; 67(1): 79 - 82.
14. Semple D, Findlow D, Aldridge LM, Doyle E. The optimal dose of ketamine for caudal epidural blockade in children. Anaesthesia. 1996; 51(12): 1170-2.
15. Batra YK, Arya VK, Mahajan R, Chari P: Dose-response study of caudal neostigmine for post-operative analgesia in pediatric patients undergoing genitourinary surgery. Pediatr Anaesth. 2003; 13 (6): 515 - 21.
16. Markakis DA. Regional anaesthesia in paediatrics. Anesthesiol Clin North Am. 2000; 18(2): 355 – 81.
17. Abdulatif M, El-Sanabary M. Caudal neostigmine, bupivacaine, and their combination for post-operative pain management after hypospadias surgery in children. Anesth Analg 2002; 95(5): 1215 – 8.
18. Liu SS, Hodgson PS, Moore JM, et al. Dose-response effects of spinal neostigmine added to bupivacaine spinal anaesthesia in volunteers. Anesthesiology 1999; 90(3):710 - 7.

ISSN (O): 2687-5365; ISSN (P): 2753-6556