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COMPARATIVE STUDY OF CAUDAL BUPIVACAINE AND BUPIVACAINE WITH CLONIDINE IN INFRAUMBILICAL SURGERIES IN CHILDREN

Anaesthesiology

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ABSTRACT

Background: Caudal epidural analgesia is one of the most commonly performed regional blocks in paediatric anaesthesia for intra and post-operative analgesia. This study was conducted to know the efficacy and safety of addition of clonidine to bupivacaine in a single shot caudal block in children.

Material & Method: This study was conducted at Govt. medical college,kota and attached hospitals,in 60 children in the age group of 5–10 years coming for various elective infraumbilical surgical procedures. They were divided into two groups of 30 each. Group A received caudal 0.25% bupivacaine (1ml/kg) and group B received caudal 0.25% bupivacaine (1ml/kg) with clonidine (1.5µg/kg). The various parameters studied were hemodynamic changes, duration of analgesia and incidence of side effects.Pain assessment was done at the1st, 2nd, 3rd,4th,8th, 12th and 24thhour after the surgery.

Results: The groups were similar in age, sex and weight. The hemodynamic parameters like heart rate, blood pressure, respiratory rate were also similar between the two groups after administering caudal block. The mean duration of analgesia in group B (433.5±60min) was significantly longer ($p<0.05$) than group A (250.33±41min). The pain score in the two groups were similar up to 2hours after surgery but was higher in group A at the end of 3rd and 4thhour compared with group B. Incidence of vomiting was comparable in both the groups while there was no incidence of bradycardia , hypotension or respiratory depression in both the groups.

Conclusion: This study showed that the addition of clonidine in the dose of 1.5µg/kg to 0.25% bupivacaine (1ml/kg) improved the analgesic duration and efficacy after a single shot caudal block with minimal side effects in children.

KEYWORDS

Caudal, Clonidine, Bupivacaine

INTRODUCTION

The International Association for the Study of Pain defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage"[1]. Pain is a complex constellation of unpleasant sensory, perceptual, and emotional experiences and certain associated autonomic, psychological, emotional, and behavioral responses. In fact, pain experienced by infants and children often goes unrecognized, even neglected, because of the operational definition of pain that requires self-report .[2,3]

Pain management is an essential component of care provided by paediatric anaesthesiologists. For many years, it has been recognized that paediatric patients are more likely to have pain treated less aggressively than their adult counterparts.[4,5,6]. It is important to understand that pain due to surgical procedures not only results in an immediate nociceptive response but also results in changes in the nociceptive activation pathways that lead to hypersensitivity, hyperalgesia, and allodynia.[7]

Regional anaesthetic techniques reduce the overall intra-operative requirement of both inhaled and intravenous anaesthetic agents and allow more rapid return of the conscious pre-operative state while providing effective post-operative pain relief with minimal sedation.[8] Caudal analgesia is one of the most popular regional anaesthetic technique employed in children. It is a relatively simple technique with a predictable level of blockade, and is by far the most common regional technique used in paediatric surgery for lower abdominal, urological, and lower limb operations. Gradual offset usually provides analgesia beyond the duration of surgery, with a smooth recovery period and good postoperative pain control. This benefit is especially important in ambulatory and same-day surgery patients because it reduces analgesic requirements and facilitates early discharge.[9]

Clonidine, an alpha 2-adrenergic agonist, produces analgesia without significant respiratory depression after systemic, epidural, or intrathecal administration. Analgesic effect of clonidine is more pronounced after neuraxial injection, which suggests a spinal site of action and makes this route of administration preferable. The addition of clonidine also prolongs the duration of action of bupivacaine after intrathecal and epidural administration in adults.[10] In children, a mixture of 1 ml/kg 0.25% bupivacaine and l-2 mcg/kg clonidine improves the duration and quality of analgesia provided by caudal block, although results differ widely, ranging from 16.4 hours for 1 mcg/kg to 5.8 and 9.8 hours for 2 mcg/kg.[9]

We designed this prospective randomized double blind study to compare caudal bupivacaine with clonidine and bupivacaine alone with regards to hemodynamic changes, analgesic potency and side effects in children.

MATERIAL AND METHODS

The study was approved by instituitional ethical committee and informed consent was taken by the patient's attendant. This study included 60 children of age group 5-10 years, ASA grade 1& 2, of either sex, coming for various elective infra-umbilical surgical procedures such as herniotomies, circumcision, orchidopexy, perineal surgeries and minor lower extremity procedures. Children with ASA grade 3 and 4, infection at the site of injection, coagulopathy or on anticoagulation drugs, congenital abnormalities of lower spine and meninges, active disease of the CNS, history of allergy to local anaesthetics were excluded from the study.

All these patients underwent a pre-anaesthetic check-up the day before surgery and all the routine and specific investigations were noted. The children were electively kept NBM for 6 hrs. The sample size was determined by power of analysis. The patients were randomly allocated into two groups: Group A and Group B. Randomisation was done by picking random lots from a sealed bag. Twenty minutes before shifting them to the operating room, oral midazolam 0.5 mg/kg was administered as pre-medication to all the children in both the groups. The patients were then shifted into the operating room and connected to monitors; electrocardiogram, non-invasive blood pressure and pulse oximeter, and baseline values were recorded. The children were induced with 50% nitrous oxide, 50% oxygen and 8% sevoflurane. Intravenous access was secured and lactated Ringer's solution was administered as per the calculated fluid requirements. Inj. Fentanyl 2 mcg/kg was given intravenously for analgesia. Airway management was left to the discretion of the attending anaesthesiologist and the children were managed with face mask, laryngeal mask airway or

endotracheal tube, with or without muscle relaxants. After induction, patients were placed in the lateral decubitus position and a single shot caudal block was performed, with aseptic precautions, using a 23 G hypodermic needle, by an anaesthesiologist who was blinded to the drug that was to be administered in the caudal epidural space. The drug was loaded by an anaesthesiologist who did not participate in the study. The patients were randomly divided into 2 groups of 30 each.

Group A received 0.25% of bupivacaine 1 ml/kg.

Group B received 0.25% of bupivacaine 1 ml/kg with clonidine 1.5µg/kg.

The patients were assessed for 24 hours post-operatively. Post-operative assessment was done by another anaesthesiologist in the post-anaesthesia care unit (PACU) who was not aware of the drug administered and by a nurse in the ward who was also blinded. Patients were monitored for heart rate, respiratory rate and blood pressure after administration of caudal block at 0,5,15,30,45,60,120 and 180 minutes and the values were recorded. On arrival to the recovery room, the child was monitored for another 1 hour with spO_2, respiratory rate, NIBP and heart rate every 15 minutes. After that the child was shifted to the ward and monitored thereafter.

Post-operative analgesia is assessed by Paediatric Objective Pain Scale. The assessment was done for a period of 24 hours after caudal block. If the pain score was more than 6 for 2 consecutive intervals of 10 minutes, then supplementary analgesia with rectal Paracetamol (15mg/kg) was given. These assessments were made at 1,2,3,4,8,12 and 24 hours after caudal block.

PAEDIATRIC OBJECTIVE PAIN SCALE

Observations	Criteria	Points
Blood pressure	±10% pre-operative value >20% pre-operative value >30% pre-operative value	0 1 2
Crying	Not crying Crying but responds to tender loving care Crying with no response to tender loving care	0 1 2
Movement	None Restlessness Thrashing	0 1 2
Agitation	Sleep Mild Hysterical	0 1 2
Posture	No special posture Flexing legs and thighs Holding penis or groin	0 1 2

In the post-operative period, patients were also monitored for adverse effects, including respiratory depression, vomiting, hypotension and bradycardia. Respiratory depression was defined as a decrease in the SpO2 of <93% that required administration of supplemental oxygen via face mask or a respiratory rate of < 10 breaths per minute. Bradycardia is defined as the decrease in the heart rate of more than 30% of the baseline value. It was subsequently treated with Inj. Atropine 0.01mg/kg. Hypotension is defined as a decrease in the mean arterial pressure of greater than 30% of the baseline value. It was treated with rapid infusion of IV fluids and if that was unsuccessful, then Inj. Phenylephrine 2-10µg/kg.

Sedation: A 4 point sedation score was used as follows:

4-POINT PATIENT SEDATION SCORE

1	Asleep; not arousable by verbal contact
2	Asleep; arousable by verbal contact
3	Drowsy / not sleeping
4	Awake / alert

Statistical analysis: The results of continuous variables are given as mean ± SD and proportion as percentage. The difference between the two groups was assessed by student's - t test and chi-square test. For all the tests a 'p' value of 0.05 and less was considered for statistical significance.

RESULTS:

The groups were comparable with respect to age and weight {Table1}. Hemodynamic parameters remained stable in both the groups throughout the surgery

Table 1 The age and weight data is presented as mean and standard deviation

Demography	Group A(n=30)	Group B(n=30)	P value
Age (in years)	7.1±1.58	6.86±1.6	0.94
Weight(in kg)	16.3±2.9	15.7±3.4	0.46

Table 2: TYPES OF SURGICAL PROCEDURE

	GroupA	GroupB
Types of surgery	n(%)	n(%)
Circumcision	6(20)	8(26)
Herniotomy	13(43)	14(46)
Orchidopexy	2(7)	2(7)
Anorectal surgeries	5(16)	4(14)
Others	4(14)	2(7)

Table 3: PAIN SCORE AT VARIOUS TIME INTERVALS

Timeinterval (hours)	GroupA n(%)	GroupB n(%)	P*Value	2 Value
1	0	0	-	-
2	0	0	-	-
3	1(3)	0	1	0
4	14(47)	1(3)	<0.01	12.8
8	13(43)	19(63)	0.2	1.6
12	9(30)	9(30)	-	-
24	13(43)	11(33)	0.8	0.06

The distribution of subjects in the two study groups according to pain score. The Paediatric Objective Pain Score was below 6 at the end of first and second hour in both the groups and did not require any analgesia. At the end of third hour, 1(3%) of the patients in group A had a pain score of statistically insignificant ($p > 0.05$).

At the end of fourth hour, 14(47%) of patients in group A had a pain score of significant p value($p < 0.01$). The pain score was 6 in 13(43%) of patients in group A and 19(63%) in group B by the end of eight hour which was not statistically significant. At the end of 12th and 24th hour, group A had 9(30%) and 13(43%) patients with pain score of (0%) and 11(33%) with similar pain score respectively. The differences were found statistically insignificant.

TABLE 4 : DURATION OF ANALGESIA

Duration of analgesia (min)	Group A	Group B
Mean duration ± SD	250.33±41.4	433.5±60.2
Range	180 -355	265–530

$p<0.01$, student's unpaired't' test

The mean duration of analgesia was 250.33 ± 41.4 min in group A with a range of 180 to 355 min. In group B, the mean duration of analgesia was 433.5 ± 60.2 min with a range of 265 to 530 min. The difference in the mean duration of analgesia was statistically highly significant ($p<0.001$) which is shown in table 4.

Table 5: SEDATION SCORE AT VARIOUS TIME INTERVALS

Time interval (hrs) (hours)	GroupA n(%)	GroupB n(%)	p* value	2 value
1	30(100)	30(100)	-	-
2	30(100)	30(100)	-	-
3	30(100)	30(100)	-	-
4	9(30)	29(97)	<0.001	25.9
8	0	14(46)	<0.01	15.7
12	0	2(6)	0.47	0.51
24	0	0	-	-

The distribution of subjects in the two study groups according to sedation score are shown in table 5. The sedation score at the end of first, second and third hour was less than 3 in both the groups and the children were drowsy but responding to verbal commands. At the end of fourth and eight hour 9(30%) and 0(0%) of patients in group A and 29(97%) and 14(46%) of patients in group B respectively had a score of 3, indicating a significant difference in the sedation score between the groups at that time. At the end of 12th and 24th hour, all the patients in group A were awake and alert. In group B 2(6%) had a score of 3 at

the 12th hour and all were awake by the end of 24th hour. There was no significant difference between the two groups at this time.

Table 6 : INCIDENCE OF SIDE EFFECTS

SIDE EFFECTS	GroupA	GroupB
Hypotension	0	0
Bradycardia	0	0
Vomiting	3(9%)	2(6%)
Dural puncture	0	0
Blood vessel puncture	0	0
Respiratory depression	0	0
Pruritis	0	0

The incidence of nausea and vomiting was among 3(9%) children in group A compared to 2(6%) in group B. This was not statistically significant.

DISCUSSION

The past decade has witnessed many advances in the understanding and treatment of pain in children. Caudal epidural blockade is one of the most popular regional block used in paediatric anaesthesia. This reliable and safe technique is used widely for many surgical procedures in combination with general anaesthesia. It allows rapid recovery from anaesthesia with effective post-operative analgesia. Hence, recently several studies have reported caudal use of opioids and other drugs in children to improve postoperative analgesia. Though the use of caudal opioids did prolong the duration of analgesia, it was associated with side-effectslike respiratory depression, pruritis, urinary retention, nausea and vomiting. Hence, other drugs like clonidine have been administered to improve analgesia inthe postoperative period while avoiding the side-effects associated with opioid use.[10] Koul A et al divided 40 children undergoing inguinal hernia repair into 2groups. One group was given caudal injection of 0.75ml/kg of 0.25% bupivacaine alone and the other group was given clonidine 2µg/kg along with 0.75ml/kg of 0.25% bupivacaine. Duration of post-operative analgesia was 4.55 hours in the group receiving only bupivacaine and 10.25 hours in the group receiving bupivacaine with clonidine ($p<0.001$). Bradycardia, hypotension andsedation were not observed in clonidine group [11]. Parameswari A, Dhev Anand M, Vakamudi M. evaluated the efficacy of clonidine added to bupivacaine in prolonging the analgesia produced by caudal bupivacaine in children undergoing sub-umbilical surgery. One hundred children, age one to three years, undergoing sub-umbilical surgery, were prospectivelyrandomized to one of two groups: caudal analgesia with 1 ml/kg of 0.25% bupivacaine in normal saline (Group A) or caudal analgesia with 1 ml/kg of 0.25% bupivacaine with 1 µg/kg of clonidine in normal saline (Group B). Post-operative pain was assessed for 24 hours using the FLACC scale. The mean duration of analgesia was significantly longer in Group B (593.4 ± 423.3 min)than in Group A (288.7 ± 259.1 min); $P < 0.05$. The pain score assessed using FLACC scale was compared between the two groups, and children in Group B had lower pain scores, which was statistically significant. The requirement of rescue medicine was lesser in Group B[12]. Our clinical study entitled 'comparative study of caudal bupivacaine and bupivacaine with clonidine in infra-umbilical surgeries in children' was conducted to compare the effects of addition of clonidine to bupivacaine as a single shot caudal block in children. They were divided into two groups of 30 each.

Group A received caudal bupivacaine 0.25% (1ml/kg). Group B received caudal bupivacaine 0.25% (1ml/kg) with clonidine (1.5µg/kg). The main parameters studied were hemodynamic changes, duration of post-operative analgesia and incidence of side-effects. Both the groups were comparable with respect to age, sex and weight distribution. There was no significant difference between the two groups with respect to haemodynamic parameters like systolic and diastolic blood pressures, heart rate and respiratory rate. The pain score at the end of 1st and 2nd hour was below 6 in both the groups. At the end of the 3rd and 4th hour, 3% and 47% of patients in group A had pain score 6 compared to 0% and 3% in group B respectively, which was significant. At end of 8th, 12th and 24th hour, there was no difference between the groups with regard to pain score. Yash Meghani et al conducted a randomised double blinded study of 60 children of ASA I and II, aged 2-10 years, undergoing elective infra-umbilical surgeries were randomly allocated to group A(n=30) (0.25% plain bupivacaine 1ml/kg + 1 ml Normal Saline) and Group B(n=30) (0.25% plain bupivacaine 1ml/kg + 1µg/kg clonidine + 1 ml Normal Saline). Post operative pain, duration of analgesia, time of first rescue analgesic, total number of rescue analgesic doses, hemodynamic changes, complications and sedation were recorded. The duration of analgesia in the post operative period was more in Group B (9.98±0.86)Hrs as compared to Group A(4.3±1.12)Hrs.100% patients in Group A required two or more than two rescue analgesic within 12 hrs whereas in Group B 83% patients required single rescue analgesic and 17% required two rescue analgesic, respectively. The mean sedation scores were higher in Group B as compared to Group A.[13]

In our study, the mean duration of post-operative analgesia was 250.33 ± 41.4 min in group A and 433.5 ± 60.2 min in group B, thereby reducing the requirement of analgesics in group B in the post-operative period. Jamali and colleagues[14], in a study of children aged 1-7 years undergoing sub-umbilical surgery, found that the mean duration of post-operative analgesia was significantly increased on adding clonidine 1 µg/kg (990 ± 570 min) to plain bupivacaine 0.25%(1 ml/kg) (460 ± 420 min).

The duration of sedation corresponded closely with the duration of analgesia. There was no significant sedation in the post-operative period leading on to respiratory depression and the sedation score was either 2 or more in all the patients at all times. J J Lee et al[15] also found that the duration of sedation was very similar to the respective duration of caudal analgesia in both the groups. None of the children had an SpO_2 value of < 95% or ventilator frequency of less than 16 in the post-operative period.

There was no significant difference in the incidence of nausea and vomiting between the two groups. There was no incidence of hypotension, bradycardia, respiratory depression and vessel or dural puncture in the two groups.

CONCLUSION

The present study demonstrated that caudal administration of bupivacaine 0.25% (1 ml/kg) with clonidine (1.5 µg/kg) resulted in superior analgesia with longer duration of action compared with 0.25% bupivacaine (1 ml/kg) alone, without any significant difference in the hemodynamic parameters and the incidence of side-effects.

REFERENCES

1. International association for study of pain, Subcommittee on Taxonomy. Pain terms : a list with definitions and notes on usage. Pain 1979; 6: 249-252.
2. Anand KJ, Craig KD. New perspectives on the definition of pain. Pain 1996; 67:3-6.Discussion 209-211, 1996.
3. Walco GA, Cassidy RC, Schechter NL. Pain, hurt, and harm. The ethics of pain control in infants and children. N Engl J Med 1994; 331:541-544.
4. Twycross A, Mayfield C, Savory J. Pain management for children with special needs : A neglected area … Paediatr Nurs 1999; 11:43-45.
5. Sahler O, Frager G, Levetown M, et al. Medical education about end-of-life care in the pediatric setting : Principles, challenges, and opportunities. Pediatrics 2000; 105:575-584.
6. Eland JM. Children's communication of pain. Educational Psychology, Iowa City, University of Iowa, 1974.
7. Anand KJ, Hickey PR. Pain and its effects in the human neonate and fetus. N Engl J Med 1987; 317:1321-1329.
8. Markakis DA. Regional anaesthesia in paediatrics. Anesthesiol Clin North America 2000;18(2):355-9.
9. De-Beer DAH, Thomas ML. Caudal additives in children - solutions or problems? Br J Anaesth 2003;90(4):487-98 .
10. Basker S, Singh G, Jacob R. Clonidine in paediatrics - a review. Indian J Anaesth 2009;53(3):270-280.
11. Koul A, Pant D, Sood J. Caudal clonidine in day-care paediatric surgery. Indian J Anaesth 2009;53(4):450-454
12. Parameswari A, Dhev Anand M, Vakamudi M. Efficacy of clonidine as an adjuvant to bupivacaine for caudal analgesia in children undergoing sub-umbilical surgery. Indian J Anaesth 2010;54:458-63
13. Meghani Y, Vakil R et al. A comparative study between caudal bupivacaine and bupivacaine plus clonidine for post operative analgesia in children. Journal of Dental & Medical Sciences 2014;13(5):16-22.
14. Jamali S, Monin S, Begon C, Dubousset A, Ecoffey C. Clonidine in paediatric caudal anaesthesia. Anaesth Analg 1994;78:663-6.
15. Lee JJ, Rubin AP. Comparison of a bupivacaine-clonidine mixture with plain bupivacaine for caudal analgesia in children. Br J Anaesth 1994;72:258-262