Caudal Clonidine in Day-Care Paediatric Surgery

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Summary

We evaluated the analgesic efficacy, hemodynamic and respiratory safety of clonidine when added to bupivacaine for caudal block. Forty children undergoing inguinal hernia repair were randomly given caudal injection with 0.75 ml.kg⁻¹ of bupivacaine (0.25%) and clonidine 2 µg.kg⁻¹ in Group C or 0.75 ml.kg⁻¹ of bupivacaine (0.25%) alone in Group B after induction of anaesthesia. Postoperatively duration of analgesia, OPS score (observational pain / discomfort scale), Sedation score, heart rate and blood pressure were recorded. Duration of analgesia was significantly longer (p< 0.001) in Group C (10.25 hours) as compared to 4.55 hours in Group B. Bradycardia, hypotension and sedation were not observed in Group C. The addition of clonidine in caudal blocks prolongs postoperative pain relief in children and is a safe alternative to bupivacaine alone in paediatric daycare surgeries.

Key words    Caudal epidural, Clonidine, Bupivacaine

Introduction

Caudal epidural analgesia is one of the most popular regional blocks in paediatric anaesthesia, but its main disadvantage is short duration of action after single injection (4-6 hrs) even with a long acting local anaesthetic.

Prolongation of caudal block using a single shot technique; can be achieved by addition of various adjuvants. Epinephrine was the earliest adjuvant drug used, during second half of 1980’s. Opioids were also used but their use carried risk of respiratory depression¹. Ketamine as an adjuvant has potential for neurotoxic effects if inadvertently injected intrathecally² and neostigmine is accompanied by 30% incidence of vomiting³.

Clonidine, an α₂-adrenergic agonist, produces analgesia without significant respiratory depression. The analgesic action of epidurally administered clonidine is due to stimulation of descending noradrenergic medullospinal pathways inhibiting the release of nociceptive neurotransmitters in the dorsal horn of spinal cord⁴. The analgesic effect of clonidine is more pronounced after neuraxial injection which suggests a spinal site of action and makes this route of administration preferable⁵,⁶.

We designed a prospective randomized double blind study to examine the haemodynamic and respiratory effects of clonidine as an adjunct to bupivacaine caudal epidural analgesia and compare its analgesic efficacy with control group in which only bupivacaine was used, in paediatric day care procedures.

Methods

After informed parental consent, 40 ASA I children between 1-10 years of age weighing 5-20 kg, who were scheduled to undergo inguinal herniotomy as daycare cases were admitted in the study. Children with any contraindication to caudal block or having congenital heart disease were excluded from the study. No premedication was given and all surgeries were performed under general anaesthesia. Inhalational induction was done with oxygen, nitrous oxide and sevoflurane (3 -4%) with manual assistance.
and fresh gas flow of 2-3 litres/minute. After induction of anaesthesia, the children were assigned randomly to receive a caudal epidural injection of either 0.75 ml kg⁻¹ of 0.25% bupivacaine (Group B) or 0.75 ml kg⁻¹ of 0.25% bupivacaine with 2µg kg⁻¹ of clonidine (Group C). Clonidine was loaded in 1 ml syringe so as to keep the volume same in both the groups. Caudal block was performed with 23 gauge hypodermic needle under aseptic conditions in left lateral position and the child was turned supine after the injection of the drug. Mean blood pressure and heart rate were recorded before induction of anaesthesia and every 5 minutes subsequently. An intraoperative increase in heart rate and blood pressure by more than 10% after 15 minutes of caudal injection was defined as insufficient analgesia and treated with intravenous fentanyl 1mcg kg⁻¹.

At the beginning of skin closure, sevoflurane and nitrous oxide were discontinued. When the children were sufficiently awake, PLMA was removed and they were shifted to the recovery room, breathing room air.

After arrival mean blood pressure, heart rate and SpO₂ was documented hourly for 6 hours. Intraoperative or postoperative decrease in mean blood pressure or heart rate more than 30% of the baseline values was defined as severe hypotension or bradycardia respectively. Respiratory depression was defined as a decrease of SpO₂ less than 93% and required supplemental oxygen via mask. Pain assessment in the postoperative period was done by an observer blinded to the therapeutic intervention using OPS score (at 30 minutes, 1 hour and 2 hours) and duration of analgesia. Each variable (crying, facial expression, verbal response, position of torso and motor restlessness) was scored between 0-2 (0: none, 1: moderate, 2: severe), to give a cumulative score of 0-10. If the OPS score was more than 4 in 2 subsequent measurements or if the patient showed obvious signs of pain they were given oral paracetamol 10 mg kg⁻¹. The duration of postoperative analgesia was defined as time between caudal drug injection and the first complaint of pain. Assessment of sedation was done by sedation score at 30 minutes, 1 hour and 4 hours after the operation. Patient sedation score was defined as 1: asleep, not arousable by verbal contact; 2: asleep, arousable by verbal contact; 3: drowsy not sleeping; 4: alert/aware. This helped in identification of respiratory depression. Duration of motor block was assessed by noting the time children began moving their legs. Time of first micturition was also noted. Children were discharged from the daycare ward after 6 hours of arrival. Parents noted the total requirement of additional analgesia in first 24 hours after operation on a form and were contacted telephonically.

Parametric data was analysed using Student’s t test.

**Results**

Mean age, weight, surgical and recovery time were comparable between two groups (mean age of Group B: 3.3 years, mean age of Group C: 3.5 years, mean weight of Group B: 13.5 kg, mean weight of Group C: 14.6 kg, mean surgical time of Group B: 43.8 min, mean surgical time of Group C: 43.8 min, as shown in Table 1). The duration of analgesia and the time for first postoperative analgesic requirement was significantly prolonged in Group C (Table 2 & Fig 1). There was a decrease from base line mean arterial pressure in Group C 5-15 minutes after the injection but it returned to normal in 30 minutes. The mean time for first

| Table 1 Demographic distribution |
|----------------------------------|
| Age(years) | 3.28 ± 1.65 | 3.45 ± 2.06 |
| Weight(kg) | 13.45±6.04  | 14.58±4.40  |
| Duration of surgery(min) | 41 ±13.19  | 43.75±12.23 |

| Table 2 Shows mean values with standard deviation of both groups and respective p-values |
|----------------------------------|
| Intraop MAP(mmHg) | 62.2±11.23 | 62.8±10.07 | 0.86 |
| Postop MAP(mmHg)  | 65.6±9.37  | 70.15±10.09 | 0.15 |
| Intraop HR(bpm)   | 102.35±8.65| 102.3±10.14| 0.99 |
| Postop HR(bpm)    | 95.4±6.8   | 97.05±9.97 | 0.54 |
| Duration of analgesia(hr)| 4.5±0.87 | 10.25±6.03 | 0.00 |
| Mean sedation score | 2.8±0.45 | 2.83±0.47 | 0.84 |
| Mean OPS score     | 4.65±0.25  | 4.55±0.25  | 0.62 |
analgesic requirement in Group C was 10.25 ± 6.03 hours, while it was 4.5 ± 0.87 hours in bupivacaine Group (Table 2 & Fig 1).

The comparison of mean arterial pressure during intraoperative and postoperative period (Fig 2 & 3), between both groups, using Student’s t test, yielded p-values (0.86 for intraoperative MAP and 0.15 for postoperative MAP) which were not significant. The comparison of heart rate during intraoperative and postoperative period, between both groups showed insignificant p-value (p-value for intraoperative heart rate was 0.99 and for postoperative heart rate it was 0.54). With N as 20 in each group with a mean prolongation of analgesia by 5.75 hours in Group C as compared to Group B (Fig 6), the power of study was 94.2% and the p-value less than 0.05 (p < 0.001).

None of the children had urinary retention and the incidence of vomiting was comparable between the groups (Table 1, 2). None of the children had SpO₂ value less than 95%. None of the children had bradycardia. On awakening no motor block was observed in any case in either group. There was no significant difference in either group in the mean postoperative sedation score (Group B was 2.8 ± 0.45 and Group C was 2.83, (Table 2 & Fig 4). The mean OPS score of Group B was 4.65 ± 0.25 and Group C was 4.55 ± 0.25 (Table 2 & Fig 5). The mean time of first micturition in Group B was 4.8 hours and in Group C was 4.7 hours.
Discussion

Our data indicates that for caudal blockade, the addition of clonidine 2 µg.kg\(^{-1}\) with 0.25% bupivacaine significantly prolongs the duration of analgesia (Table 2 & Fig 1). This reduces the need for both intraoperative and postoperative analgesia. These findings confirm with a previous study\(^7\) which reported that 1-2µg of clonidine with bupivacaine increases duration of analgesia in small children undergoing day care hernia repair compared to bupivacaine alone or bupivacaine with epinephrine 5µg.ml\(^{-1}\).

Duration of analgesia in this study is less than that observed in another study\(^8\) where they used combination of ketamine 1 mg.kg\(^{-1}\) and clonidine 1-2 µg.kg\(^{-1}\) of caudal blockade in children.

Our experience with clonidine for caudal blockade is consistent with the results obtained from other studies\(^9\)-\(^11\), where clondine 1-2 µg.kg\(^{-1}\) was added to caudal bupivacaine for supraumbilical, urological or orthopaedic surgeries.

The undesirable side effects of neuraxial clonidine are hypotension and bradycardia. Many studies\(^6,12,13\) in adult patients have reported a decrease in MAP and HR within 15-30 minutes after epidural injection which lasted for 3-4 hrs before returning to baseline. In our study decrease in blood pressure did occur in all patients who were given clonidine with bupivacaine within 5-15 minutes but returned to normal within 30 minutes.

Some studies\(^12,13\) report a marked decrease in heart rate after epidural clonidine while others do not. We did not observe any significant bradycardia in our study.

Dose dependent sedation usually accompanies the use of clonidine for regional anaesthesia\(^6,14\), however with 2µg.kg\(^{-1}\), we did not appreciate any excessive sedation (Fig 2 and 6). All the children were sleeping but arousable and this was appreciated by the parents.

All children could move their legs at the end of 6 hour period and there was no case of retention of urine. Except for 2 patients, there was no case of postoperative vomiting and therefore discharge of no child was delayed.

This study used patients undergoing the same surgical procedure, no premedication and same pattern of induction so as to eliminate any factor that could have interfered with analgesia requirement or haemodynamic variables.

The use of parents to assess pain after discharge till 24 hours may introduce some sort of inconsistency in deciding to medicate the child but it is the parents who know their child best.

The main purpose of our study was to assess the suitability of clonidine and bupivacaine in daycare patients who are to go home the same day. Absence of any side effect like sedation, bradycardia, vomiting and respiratory depression with reduction in the need of analgesic goes in the favor of using clonidine as an adjuvant with local anaesthetic in this set of patients.

We chose dose of 2 µg.kg\(^{-1}\) as compared to 1µg.kg\(^{-1}\) as used in many studies, as this dose provides benefit to the child with no additional risk of side effects.

This combination of 2 µg.kg\(^{-1}\) clonidine with bupivacaine 0.25% is a safe and effective alternative to bupivacaine alone for caudal block in paediatric day care surgeries.

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