Case report

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The Combination of Dexmedetomidine and Bupivacaine for Caudal Anesthesia in Children

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ABSTRACT

Introduction

Caudal anesthesia is one of the most popular, reliable and safe methods of pain relief in children and can provide pain relief for various surgical procedures below the umbilicus.

Material and Methods

Total 52 cases with physical status I and II class of the American Society of Anesthesiologists (ASA), aged 2 to 12 years, who underwent elective surgeries below the umbilicus, such as hernia repair, orchiopexy, hypospadias repair, epispadias, etc.

Results

The duration of caudal analgesia was determined from the moment the caudal epidural was injected till the moment the child first complained of pain or the time when the first postoperative analgesia was required. The average duration of postoperative caudal analgesia in patients of group B was 3.12 ± 0.58, while in patients of group BD this duration was 9.36 ± 0.65 hours.

Conclusion

Our results show that the addition of dexmedetomidine to the local anesthetic for caudal block significantly increases the duration of analgesia and reduces the need for analgesics

Keywords: Dexmedetomidine; Caudal block; Bupivacaine

INTRODUCTION

Caudal anesthesia is one of the most popular, reliable and safe methods of pain relief in children and can provide pain relief for various surgical procedures below the umbilicus. The main disadvantage of the caudal block is the short duration of action after a single injection. Increasing the duration of the caudal block with various adjuvants remains relevant to this day.

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Purpose of our study is to evaluate the efficacy and safety of the caudal use of dexmedetomidine in caudal anesthesia in children.

MATERIAL AND METHODS

The subject of the study was 52 children with physical status I and II class of the American Society of Anesthesiologists (ASA), aged 2 to 12 years, who underwent elective surgeries below the umbilicus, such as hernia repair, orchiopexy, hypospadias repair, epispadias, etc. Standard monitors such as electrocardiogram, pulse oximeter and non-invasive blood pressure (BP) were used.

All children were premedicated with midazolam 0.15 mg/kg and fentany l0.2 microgm/kg before the start of the operation.

The child was brought to the operating unit in a half-asleep state. ASA standard monitoring attached The induction done with I.V. Propofol 2mg/kg and muscle relaxant I.V. atracurium 0.5mg/kg the appropriate size LMA inserted after 3 min of giving atracurium. Anaesthesia was maintained on oxygen, Nitrous oxide and sevoflurane. After checking the air entry and fixation of LMA the child wad turned to left side and proper position was given for caudal block.

Caudal blockade was performed with aseptic and antiseptic precautions. Depending on the drug administered, the patients were divided into two groups: Group B: bupivacaine 2.5 mg / kg + saline 1.0 ml / kg. Group BD: bupivacaine 2.5 mg / kg + 1 µg / kg dexmedetomidine + saline 1.0 ml / kg.

For puncture of the caudal space, we used conventional 19-21G intramuscular needle. Heart rate (HR), BP, ETCo2 and oxygen saturation were recorded before induction and then immediately after caudal anesthesia and every 10 minutes during surgery thereafter. Adequate analgesia was defined as hemodynamic stability, as indicated by the absence of an increase in systolic blood pressure or heart rate of more than 20% compared to baseline. A decrease in mean arterial pressure> 30% was defined as hypotension and was treated with intravenous fluids/ephedrine injections. A decrease in heart rate >30% was considered as bradycardia and was treated with 0.01 mg/kg atropine injection. All patients were followed up for 2 hours in the postoperative ward before returning to the ward. HR, BP, RR were monitored constantly. Post-operative pain was assessed 30 minutes 1, 2, 4, 6, 8, 10, 12, 18 and 24 hours after recovery from anesthesia on the FLACC scale. The duration of pain relief (time from caudal block to the first dose of the required analgesic) was recorded. At the end of the procedure the patient was reversed with neostigmine and atropine and LMA removed.

Postoperative analgesia was prescribed in the form of a paracetamol 10 mg/kg suppository. In the post-operative period, the time of onset of pain and the total number of analgesics administered in 24 hours were recorded in all groups. All observations were recorded and all results were analysed. Statistically, data were presented as mean ± standard deviation. A P value <0.05 was considered a statistically significant difference with the unpaired Student's t test.

DISCUSSION

Caudal epidural analgesia is one of the most popular and commonly performed regional blocks in pediatric anesthesia. It is a reliable and safe technique that can be used with general anesthesia for intra and postoperative analgesia in patients undergoing abdominal and lower limb surgeries.[7]

The main disadvantage of caudal anesthesia is the short duration of action after a single injection of local anesthetic solution. The use of caudal catheters to administer repeated doses or infusions of local anesthetics is not popular because of the risk of infection.

Dexmedetomidine is highly selective α2 adrenoreceptor agonist, the analgesic action of intrathecal or epidural dexmedetomidine results from direct stimulation of preand post-synaptic α2 adrenoreceptors in the dorsal grey matter of spinal cord thereby inhibiting the release of nociceptive neurotransmitters. This effect correlates with the concentration of dexmedetomidine in the cerebrospinal fluid but not that in the plasma.[9,10]

This study was undertaken to assess the efficacy and safety of dexmedetomidine with bupivacaine in pediatric patients undergoing infraumbilical surgeries under caudal analgesia.

We chose a dose of 1 µg/kg of dexmedetomidine in our study as there were similar studies[12] done with clonidine showing that increasing the dose from 1 µg/kg to 2 µg/kg did not enhance the analgesic effect of clonidine but increased the incidence of side effects such as respiratory depression, bradycardia, and hypotension with increasing dose. Data are still insufficient about the effects of different concentrations of dexmedetomidine when used to prolong caudal analgesia. Recently, a study was done by Al-Zaben et al.[13] in which they assessed analgesic efficacy and side effects of two

doses (1 µg/kg and 2 µg/kg) of dexmedetomidine administered along with bupivacaine and concluded that increasing the dose increased side effects such as bradycardia, hypotension, and urinary retention whereas duration of postoperative analgesia was comparable.

Intra and post-operative pulse rate and blood pressure

In children, dexmedetomidine has been used without clinically important respiratory or hemodynamic effects. Although hemodynamic side effects appears to be less pronounced in children than in adults, they may be dose-dependent as reported by Konakci et al.[10] The side effects of neuraxial dexmedetomidine administration include hypotension and bradycardia. The antihypertensive effect results from stimulation of α2 inhibitory neurons in the medullary vasomotor center of the brainstem, which leads to a reduction in norepinephrine turnover and sympathetic outflow from the central nervous system to the peripheral tissues. Bradycardia is caused by an increase in vagal tone resulting from central stimulation of parasympathetic outflow, as well as reduced sympathetic drive. Dexmedetomidine has an 8-fold greater affinity for α2 receptors as compared to clonidine. It is more selective for α2a receptors that are responsible for sedative and analgesic effects of such drugs. Our study confirms the finding of hemodynamic changes as shown by other workers.

DURATION OF ANALGESIA

In children, a mixture of 2.5mg/kg bupivacaine with 1 µg/kg dexmedetomidine has shown to improve the duration and quality of analgesia provided by the caudal block. The mean duration of analgesia in our study was found to be 4.33 ± 0.98 h for the plain bupivacaine group versus 9.88 ± 0.90 h for the dexmedetomidine group.

Parameswari et al.[14] evaluated the efficacy of clonidine added to bupivacaine in prolonging the analgesia produced by caudal bupivacaine in children undergoing subumbilical surgeries and concluded mean duration of analgesia was significantly longer in clonidine group.

Xiang et al.[15] used caudal dexmedetomidine for hernia sac traction and found a significant increase in duration of postoperative analgesia in dexmedetomidine group. Rescue analgesics in the first 12 h postoperative period.

In our study, the dexmedetomidine group required significantly less number of rescue analgesics as compared to plain bupivacaine group. In plain bupivacaine group, all patients required 2 or more than 2 rescue analgesic within 12 h. In dexmedetomidine group, 76% patients required single rescue analgesic and 24% required two rescue analgesic. This is in agreement with a study conducted by Saadawy et al.

POSTOPERATIVE COMPLICATIONS

The incidence of nausea vomiting was higher in children who received plain bupivacaine. Five children in dexmedetomidine group complained of nausea vomiting compared to 10 in plain bupivacaine group. At no time in this study, there was a decrease in RR and fall in SpO_2 requiring oxygen supplementation. The addition of caudal dexmedetomidine 1 µg/kg to bupivacaine 2.5mg/kg prolonged the duration of analgesia in comparison to plain bupivacaine 2.5mg/kg without an increase in adverse effects in children undergoing infraumbilical surgeries.

RESULTS

The duration of caudal analgesia was determined from the moment the anesthetic was injected until the moment the child first complained of pain or the time when the first postoperative analgesia was required. The average duration of postoperative caudal analgesia in patients of group B was 3.12 ± 0.58, while in patients of group BD this duration was 9.36 ± 0.65 hours. This shows that the duration was significantly increased by the addition of dexmedetomidine to bupivacaine (P <0.0001). Patients in group BD required significantly fewer additional analgesics than in group B. In group B, all patients required 2 or more analgesic injections within 24 hours. The mean FLACC pain score was lower in Group BD patients during the first 24 hours postoperatively. The mean FLACC score in group B was 8.76± 1. 38., and in group BD - 5.85± 1.67. The results are comparable and statistically significant (P <0.0001). The addition of caudal dexmedetomidine 1 mcg / kg to bupivacaine increased the duration of analgesia compared to simple bupivacaine 2.5 mg / kg without increasing side effects in children who underwent surgery below the umbilicus.

CONCLUSION

Our results show that the addition of dexmedetomidine to the local anesthetic for

caudal block significantly increases the duration of analgesia and reduces the need for analgesics. More data is also needed on the neurological safety of dexmedetomidine.

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Conflicts of interest: There are no conflicts of interest

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