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Original Contribution

The effects of caudal or intravenous dexmedetomidine on postoperative analgesia produced by caudal bupivacaine in children: a randomized controlled double-blinded study☆,☆☆

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Abstract

Study Objectives: The aim of this study was to compare the effects of caudal and intravenous (IV) dexmedetomidine (1 μg/kg) on postoperative analgesia after caudal bupivacaine in pediatric patients undergoing lower abdominal and perineal surgeries.

Design: A randomized controlled double-blind study.

Setting: University-affiliated teaching hospital.

Patients: Seventy-five American Society of Anesthesiologists I children, aged 1 to 6 years.

Intervention: Patients were randomly allocated to 3 groups. All patients received 1 mL/kg caudal 0.25% bupivacaine. In addition, those in group B (n = 25) received 10-mL IV saline, those in group B-D_{cau} (n = 25) received 1 μg/kg caudal dexmedetomidine and 10-mL IV saline, and those in group B-D_{IV} (n = 25) received 1 μg/kg IV dexmedetomidine in 10-mL saline.

Measurements: Intraoperative mean blood pressure, heart rate, peripheral oxygen saturation, end-tidal sevoflurane, and bispectral index as well as postoperative pain and behavior scores and time to first analgesia were assessed.

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Main results: Group B-D_{cau} had a significantly longer time to first rescue analgesia than groups B-D_{IV} and B, with mean (SD) values of 14.4 (7.5), 9.18 (2.7), and 6.6 (2.5) hours, respectively ($P < .05$). Fewer patients in group B-D_{cau} (n = 16) required rescue analgesia during the first 24 hours postoperatively compared to group B (n = 24) and group B-D_{IV} (n = 20) ($P < .05$).

Groups B-D_{cau} and B-D_{IV} had lower pain and behavior scores than Group B. Eight patients Group B had agitation compared to 2 in Group B-D_{IV} and 0 in Group B-D_{cau}. Four patients in Group B-D_{IV} developed bradycardia and hypotension during surgery.

Conclusions: Compared to IV administration, caudal administration of dexmedetomidine during caudal bupivacaine anesthesia provided prolonged postoperative analgesia and a greater analgesic sparing effect without significant side effects. This suggests a greater role of neuraxial compared to that of peripheral α-2 adrenoceptors in pain processing.
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1. Introduction

Dexmedetomidine is a potent selective α-2 adrenergic agonist. It has sedative, hypnotic, and analgesic properties and was found to have hypnotic and analgesic sparing effects [1,2].

The use of α-2 adrenergic agonists as adjuvant drugs in pediatric anesthesia has become increasingly popular in recent years, particularly to prolong the duration of caudal analgesia. Intravenous (IV) and caudal coadministration of α-2 adrenergic agonists are both used for this purpose [3,4]. To date, comparison between caudal and IV routes of coadministration of these agents has been carried out only for clonidine and has shown equal or better analgesic efficacy for the caudal route without associated hemodynamic instability [5,6].

Both IV and caudal administration of adjuvant dexmedetomidine have been associated with prolonged postoperative analgesia in children undergoing lower abdominal surgeries [4,7–10]. However, direct comparison between these 2 routes of dexmedetomidine administration in terms of analgesic efficacy and side effects is still necessary to determine the better route.

The aim of this randomized controlled double-blind study was to compare the effects of caudal and IV dexmedetomidine as adjuvants to bupivacaine caudal block for postoperative analgesia in pediatric patients undergoing lower abdominal and perineal surgeries.

2. Materials and methods

2.1. Setting, ethical considerations, and patients

This study was conducted at the University of Jordan Hospital, Amman, Jordan, between May 2014 and January 2015. It was approved by the hospital's institutional review board (no. IRB L/2014/35, Chairperson Prof A. Al-Oweidi, April 2014), and informed consent was obtained from the parents of all of the patients in accordance to the World Medical Association Declaration of Helsinki (section B). Seventy-five consecutive children aged 1 to 6 years, American Society of Anesthesiologists I, who were scheduled for elective lower abdominal and perineal surgeries, including hernia repair, hydrocele excision, circumcision, hypospadias repair, and orchidopexy were included in the study. Caudal anesthesia is routinely used in our hospital for these types of surgeries to provide both intraoperative and postoperative analgesia. All patients were eligible for inclusion in the study unless the parents declined or the patient had contraindications to caudal block or to the study drugs, including history of bleeding tendency, infection at the site of block, and preexisting neurologic or spinal disease. Patients with mental or developmental delay were also excluded due to the potential effect on postoperative pain assessment. No premedication was given to any of the patients.

2.2. Study protocol and measurements

Mothers were asked to accompany their children to the operating room to keep them calm. Monitors for heart rate (HR), mean blood pressure (MBP), pulse oximetry (SpO_2), end-tidal CO_2, and pediatric bispectral index (BIS) (Cardiocap II; Datex Ohmeda, Helsinki, Finland) were attached to each patient. After taking baseline readings, anesthesia was induced with 8% sevoflurane in 100% oxygen via facemask, followed by placement of a laryngeal mask airway. Anesthesia was maintained with sevoflurane in a 50% oxygen/air mixture. A 22-G peripheral IV line was placed, and infusion of normal saline, 5 to 10 mL/kg per hour, was started. The sevoflurane concentration was adjusted to maintain a BIS score of 40 to 60.

For study purposes, monitor readings were recorded before performing the caudal block and every 10 minutes thereafter until the end of surgery. The total additional fentanyl requirement during the operation and the end-tidal sevoflurane concentration required for the target BIS score were also recorded.

The children were allocated randomly to the 3 groups using a computer-generated randomization list (Fig. 1).

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