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Research Article

Fentanyl, dexmedetomidine, dexamethasone as adjuvant to local anesthetics in caudal analgesia in pediatrics: A comparative study

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KEYWORDS

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Abstract *Background:* Caudal analgesia is a good, reliable and easy method to provide intraoperative and postoperative analgesia in the infraumbilical surgery in pediatrics. Many additives were used in combination with local anesthetics in caudal block to prolong the postoperative analgesia (fentanyl, dexmedetomidine and dexamethasone).

Aim of the study: This study aimed to compare the intraoperative hemodynamics, postoperative analgesia, postoperative sedation and postoperative side effects of fentanyl, dexmedetomidine and dexamethasone as adjuvant to bupivacaine in caudal analgesia in pediatrics.

Methods: 120 pediatric patients (3–10 years old) scheduled for lower abdominal surgeries under general anesthesia allocated to 4 groups. Group I (control), in this group the patients received 0.5 ml of a equal mixture of bupivacaine 0.25% and lidocaine 1% diluted in saline (in a dose of 0.5 ml/kg) caudally. In Group II (fentanyl group), the patients received the same mixture of Group I + fentanyl (1 μg/kg) caudally. In Group III (dexmedetomidine group), the patients received the same mixture of Group I + dexmedetomidine (1 μg/kg) caudally. In Group IV (dexamethasone group), the patients received the same mixture of Group I + dexamethasone (0.1 mg/kg) caudally.

Results: The demographics and hemodynamics were comparable among the studied groups. The dexmedetomidine group and dexamethasone group were less in pain score, prolong the duration of analgesia and less in number of patients required analgesia compared to control and fentanyl groups. More sedation was present in the fentanyl and dexmedetomidine groups. The fentanyl group showed significant increase in the adverse effect incidence.

Conclusion: Both caudal dexmedetomidine and caudal dexamethasone added to local anesthetics are good alternatives in prolongation of postoperative analgesia compared to caudal local anesthetic alone or added to caudal fentanyl. Also they showed less side effects compared to caudal fentanyl.

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1. Introduction

Caudal analgesia is a good, reliable and easy method to provide intraoperative and postoperative analgesia in the infraumbilical surgery in pediatrics. But the single shot caudal analgesia is short in duration so the use of catheter injection may be used to prolong the analgesia time but it is associated with infection [1,2].

Many additives were used in combination with local anesthetics in caudal block to prolong the postoperative analgesia [3].

Fentanyl has been widely used as analgesic adjuvant to epidural analgesia and it acts on substantia gelatinosa on the dorsal horn of spinal cord by blocking fibers carrying nociceptive impulses both pre- and postsynaptically. But it has undesirable side effects as respiratory depression, itching and vomiting [4,5].

Dexmedetomidine is α_2 adrenergic receptor agonist which has sedative and analgesic effects. When it is combined with local anesthetics caudally, it prolongs the postoperative analgesia [6,7].

Administration of dexamethasone in the epidural space can reduce postoperative pain and analgesic requirements [8,9].

2. Aim of the study

This study aimed to compare the intraoperative hemodynamics, postoperative analgesia, postoperative sedation and postoperative side effects of fentanyl, dexmedetomidine and dexamethasone as adjuvant to local anesthetics in caudal analgesia in pediatrics.

3. Patients and methods

This study was approved by the local Clinical Research Ethics Committee of Menoufiya hospital and written informed consent was obtained from the parents of patients before the surgery. 120 boys with the American Society of Anesthesiologists (ASA) physical status I–II, aged 3–10 years scheduled for lower abdominal surgeries were included in this study.

Clinical examination and routine investigation were done to all the patients.

The exclusion criteria included the following: patients with contraindication to caudal anesthesia, cardiovascular diseases, drug allergy, and clotting disorders, or those whose families did not approve inclusion in the study.

In the operating room, the standard monitors including pulse oximetry, ECG, noninvasive blood pressure were present. 22-gauge cannula was inserted into an available peripheral vein.

All patients underwent general anesthesia that was conducted by the face mask sevoflurane and endotracheal intubation was facilitated by atracurium 0.5 mg/kg and controlled ventilation till regular spontaneous ventilation was achieved. The patients tilted on the side (lateral position) and caudal anesthesia was performed under complete aseptic condition by using loss of resistance technique. The correct caudal needle placement is identified by injecting 3 mL of saline rapidly through the caudal needle while palpating the skin overlying the sacrum. If no midline swelling was detected, the needle is probably correctly positioned. In contrast if no midline swelling was detected during saline injection, the needle was incorrectly positioned and redirected again. Then the patients were enrolled randomly by sealed envelope into 4 groups (30 patients for each) and the anesthesiologist was blinded for each solution.

Group I (control group), in this group the patients received 0.5 ml/kg of a equal mixture of bupivacaine 0.25% and lidocaine 1% diluted in saline caudally.
Group II (fentanyl group), in this group the patients received the same mixture of Group I + fentanyl (1 μg/kg) caudally.
Group III (dexmedetomidine group), in this group the patients received the same mixture of Group I + dexmedetomidine (1 μg/kg) caudally.
Group IV (dexamethasone group), in this group the patients received the same mixture of Group I + dexamethasone (0.1 mg/kg) caudally.

After 15 min from the caudal block, the surgical procedure started and the block considered failed if the heart rate (HR) or mean arterial blood pressure (MAP) was 15% from the base line. The block failed patient excluded from the study and i.v. fentanyl (1 μg/kg) was given to provide the analgesia.

After the completion of the surgery, the volatile anesthesia disconnected and patients were extubated when adequate spontaneous ventilation was established. Patients were be transferred to recovery room and then to the surgical ward.

The demographic data (age, weight, ASA status, type of operation and duration of surgery) were recorded.

The following parameters were assessed: the intraoperative and postoperative heart rate (HR) and mean arterial blood pressure (MAP) at base line, after induction, after caudal block and every 15 min for 3 h from the start of operation in the operative room.

In the postoperative anesthesia care unit (PACU), the modified objective pain score (MOPS) [10] was assessed at 30 min, 1, 2, 3, 6 and 12 h in the surgical ward.

The MOPS consists of 5 parameters: crying (0 = none, 1 = consolable, 2 = non consolable), movements (0 = none, 1 = restless, 2 = thrashing), agitation (0 = asleep or calm, 1 = mild, 2 = hysterical), posture (0 = normal, 1 = flexed, 2 = holds injury site), verbal (0 = asleep or not complaint, 1 = complaint but cannot localized, 2 = complaint but can localize).

If the (MOPS) ≥ 4, the patient was given supplementary paracetamol i.v. injection in a dose of 15 mg/kg as analgesia. The first time to require analgesia was calculated (the time from caudal block to the first time to paracetamol injection), and also the number of patients require analgesia in the first 12 h postoperative was calculated.

Ramsay sedation score was assessed at the time of the pain (1 = anxiety and completely awake, 2 = completely awake, 3 = awake but drowsy, 4 = asleep but responsive to verbal commands, 5 = asleep but responsive to tactile stimulus, and 6 = asleep and not responsive to any stimulus) [11].

The adverse effects in PACU also were assessed: hypotension (decrease in basal mean arterial blood pressure by 20%) treated with i.v. fluid and incremental dose of ephedrine 5 mg/kg, bradycardia (defined by decrease in basal heart rate by 20%) treated by i.v. atropine .01–.02 mg/kg), respiratory