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Effect of dexamethasone in combination with caudal analgesia on postoperative pain control in day-case paediatric orchiopexy

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Key points

- I.V. dexamethasone 0.5 mg kg^{-1} after induction of anaesthesia provided better postoperative analgesia than placebo after paediatric orchiopexy.
- Requirements for rescue analgesia in post-anaesthetic care unit were lower and time to request postoperative analgesia were longer after i.v. dexamethasone.
- The incidence of adverse effects was low.
- Postoperative pain is an important problem that may be undertreated in the paediatric population, especially in children undergoing day-case surgery.

Background. Dexamethasone has a powerful anti-inflammatory action and has demonstrated reduced morbidity after surgery. The aim of this study was to examine the effects of a single i.v. dose of dexamethasone in combination with caudal block on postoperative analgesia in children.

Methods. Seventy-seven children (aged 1–5 yr) undergoing day-case orchiopexy were included in this prospective, randomized, double-blinded study at a single university hospital. After inhalation induction of general anaesthesia, children received either dexamethasone 0.5 mg kg^{-1} (maximum 10 mg) (n=39) or the same volume of saline (n=38) i.v. A caudal anaesthetic block was then performed using 1.5 ml kg^{-1} of ropivacaine 0.15% in all patients. After surgery, rescue analgesic consumption, pain scores, and adverse effects were evaluated for 24 h.

Results. Significantly, fewer patients in the dexamethasone group required fentanyl for rescue analgesia (7.9% *vs* 38.5%) in the post-anaesthetic care unit or acetaminophen (23.7% *vs* 64.1%) after discharge compared with the control group. The time to first administration of oral acetaminophen was significantly longer in the dexamethasone group (646 *vs* 430 min). Postoperative pain scores were lower in the dexamethasone group and the incidence of adverse effects was similar in both groups.

Conclusions. Intravenous dexamethasone 0.5 mg kg^{-1} in combination with a caudal block augmented the intensity and duration of postoperative analgesia without adverse effects in children undergoing day-case paediatric orchiopexy.
Trial registration: ClinicalTrials.gov. The number of registration: NCT01041378.

Keywords: anaesthesia, caudal; anaesthesia recovery period; analgesia, postoperative; dexamethasone; surgery, day case; surgery, urological, paediatric; orchiopexy

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A caudal block is a popular reliable and safe technique for paediatric pain management after infraumbilical surgical procedures. However, in a significant proportion of patients, despite good initial analgesia from a caudal blockade with local anaesthetic, moderate or severe pain develops as the block resolves.[1 2] The addition of various drugs such as opioids, ketamine, clonidine, or dexmedetomidine to local anaesthetics has been used to improve or prolong caudal analgesia, but their use has been limited by unacceptable adverse effects in children undergoing day-case surgery.[3–7]

Dexamethasone, a corticosteroid with strong anti-inflammatory effects, provides postoperative analgesia and has shown improvement in morbidity such as nausea, vomiting, fever, and delayed oral intake in children.[8 9] However, there are no few data in children undergoing urological procedures.

Therefore, we performed this prospective randomized double-blind study to examine the effects of single intraoperative dexamethasone combined with a caudal block on recovery in children undergoing day-case orchiopexy.

Methods

The IRB of our institution approved this study, and parental consent was obtained for each case. Eighty ASA status I unpremedicated children, aged 1 to 5 yr (≤20 kg) and undergoing day-case unilateral orchiopexy, were enrolled in this prospective, randomized, and double-blind study. Patients were excluded from the study if they had a contraindication for caudal block including a hypersensitivity to any local anaesthetics, bleeding diathesis, infections at the puncture

sites, or pre-existing neurological disease. Each patient was randomly assigned to one of the two groups by following a computer-generated randomization table. On the day of the pre-anaesthetic visit, parents were taught to perform their role in the study and the use of visual analogue pain scores (VAS, 0='no pain' and 10='the worst imaginable pain') after discharge.

Standard monitoring was conducted and anaesthesia was induced with of sevoflurane 8% in oxygen by an anaesthetist who was unaware of the group allocation. After i.v. access was secured, tracheal intubation was performed after the administration of 0.5 mg kg^{-1} of atracurium and mechanically controlled ventilation was used to maintain end-tidal carbon dioxide at 35 (SD 5) mm Hg. Then, children received either dexamethasone 0.5 mg kg^{-1} (maximum 10 mg) (dexamethasone sodium phosphate 5 mg ml^{-1}, Yuhan Co., Seoul, Korea) or the same volume of saline i.v. (n=40 in each group). All study drugs were given by an anaesthesia nurse who did not participate in subsequent management.

After induction of anaesthesia, caudal block was performed using a 5 cm short bevelled 22 G caudal needle after measuring the optimal angle with ultrasonography (LOGIQe, GE Healthcare, Wauwatosa, WI, USA) in the lateral decubitus position.[10] After identifying the space using the loss of resistance technique with saline, children received 1.5 ml kg^{-1} ropivacaine 0.15% (maximum volume, 20 ml) freshly prepared.

Surgery was allowed to begin 10 min after performing the block. The same urologist performed all surgical procedures. End-tidal sevoflurane concentration was adjusted according to clinical signs (arterial pressure or heart rate within 20% of baseline). After emergence from anaesthesia, patients were managed by an observer blinded to group allocation in the post-anaesthetic care unit (PACU). Postoperative pain was assessed at the end of surgery, 30, 60, 120, and 180 min after surgery using the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS, 0–10)[11] and Faces Legs Activity Cry Consolability tool (FLACC, 0–10).[12] I.V. fentanyl 0.5 μg kg^{-1} was administered as rescue analgesia if two coupled observations separated by a 5 min waiting period yielded both CHEOPS and FLACC $\geq$5. Motor block was assessed with a modified Bromage[13] score (0, no motor block; 1, able to move legs; 2, unable to move legs). Postoperative sedation was evaluated using the eight-point modified Ramsay Sedation Scale.[14]

Discharge criteria included clear consciousness, stability of vital signs, ability to tolerate oral fluids and void, age-appropriate level of ambulation, and absence of side-effects. Analgesia after discharge was provided with oral acetaminophen (100 mg in 5 ml). The time to first supplemental oral acetaminophen demand (first acetaminophen time) was defined as the time from the end of surgery to the first registration of a VAS (0–10) $\geq$5 by parent's observation.[15] Twenty-four hours after surgery, reports of delayed side-effects and demands for rescue acetaminophen from the child were gathered from parents via a telephone interview. The interviewer, who was blinded to the treatment group, documented these data with the medical records. A questionnaire was also supplied to assess the parent's satisfaction on a four-point Likert scale (1, excellent; 2, good; 3, fair; 4, poor). This scale has been validated to score patients' satisfaction with anaesthetic technique and postoperative pain relief.[16]

Sample size calculation was based on our previous data,[17] in which we found that mean (SD) to first analgesia in children who received caudal analgesia for orchiopexy using 1.5 ml kg^{-1} ropivacaine 0.15% was 554.5 (114.6) min after surgery. We calculated that 36 patients in each group would be required to show a 20% difference in this time (α=0.05, β=0.1). A total of 80 patients were enrolled for potential protocol omissions. Data distribution was assessed for normality using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Differences between the groups were analysed using Student's t-test, Mann–Whitney rank sum test, χ^2 test, and Fisher's exact test when appropriate. A repeated-measured analysis of variance with the Bonferroni correction was performed to test for inter-group difference in changes of the arterial pressure, heart rate, and pain scores measured at the designated time points. A P-value of $<$0.05 was considered significant.

Results

Eighty patients were recruited to the study but three patients were excluded because of intraoperative administration of fentanyl or midazolam, so data from 77 patients were analysed. There were no significant differences between the two groups with regard to their age, weight, height, duration of surgery, and intraoperative fluid administration (Table 1). There was no failure of caudal block in any patient.

The incidence of rescue fentanyl in the PACU and rescue oral acetaminophen after discharge was significantly lower in children who received dexamethasone compared with those who received saline (Table 2). Eleven of the 39 in the control group and three of the 38 in the dexamethasone group received both fentanyl rescue in PACU and oral acetaminophen after discharge. The time to first oral acetaminophen administration was significantly longer in the dexamethasone group compared with the control group. Pain scores using CHEOPS and FLACC assessed at the PACU

Table 1 Mean (range) or mean (SD) patient data and intraoperative characteristics. There was no difference in variables between the groups

	Control group (n=39)	Dexamethasone group (n=38)
Age (months)	21.8 (12–68)	20.0 (13–57)
Weight (kg)	12.1 (2.7)	11.9 (2.8)
Height (cm)	84.8 (12.1)	83.8 (12.4)
Duration of surgery (min)	38.2 (13.2)	38.1 (12.7)
Fluid administered (ml)	114.5 (54.2)	103.5 (39.2)