

Title : ANALGESIA AND VENTILATORY RESPONSE TO CO₂ FOLLOWING EPIDURAL SUFENTANIL IN CHILDREN

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INTRODUCTION : Epidural morphine is effective for treatment of postoperative pain in children (1). However a major side effect of morphine given epidurally is a prolonged depression of the ventilatory control (1), which may be attributed to rostral spread of this water soluble opioid (2). Sufentanil epidural administration has been proposed for postoperative pain relief in adults (3). The aim of this study was to evaluate analgesia and ventilatory response to CO₂ following epidural sufentanil in children.

METHODS : Fifteen children (ASA I or II), aged 7.7±0.9 yr (mean±SEM) (range 4–12 yr), weighing 27.7±3 kg (range 14–47 kg) were studied. They were scheduled for urologic procedures. This study was approved by the Human Investigation Committee and the parental consent was obtained. They were premedicated orally with diazepam (0.33 mg/kg up to 10 mg) one hour before induction. Anesthesia was induced with thiopental (5 mg/kg) and maintained with 60 % N₂O in O₂ and isoflurane (1–1.5 %) administered by a mask. A 20g epidural catheter was placed at L3–L4 interspace. One or two ml of 1 per cent lidocaine with epinephrine 1/200,000 was used to test the position of the catheter. At the end of surgery, inhalation anesthesia was discontinued. One hour after the end of surgery when pain and/or discomfort occurred, 0.75 µg/kg of preservative free sufentanil in 2 ml of saline were injected in the epidural catheter. All the patients stayed in a 30° head-up position. The onset and duration of analgesia and the side effects were assessed in each patient ; in addition in 8 of the 15 children aged 8.6±0.8 yr the maximum tolerance to periosteal pressure was assessed over the distal end of the tibia and of the radius with a calibrated spring-loaded rod, before and 30, 60, 90, 120 and 240 min after epidural sufentanil injection. These same eight children underwent also the following ventilation study. Respiratory rate (RR), minute ventilation (VE) and end-tidal CO₂ tension (PETCO₂) were recorded during room air breathing and CO₂ stimulation with a mask through a pneumotachograph and a Rudolph non-rebreathing valve. PETCO₂ was continuously measured with a calibrated capnograph. Pneumotachograph and capnograph outputs were interfaced to a computer with an analog-to-digital converter. Linear regression equations were computed from VE and PETCO₂ for each CO₂ challenge curve. Respiratory measurements were performed one-half hour before induction of anesthesia, and postoperatively, just before and 30, 60, 120 and 240 min after epidural sufentanil injection. At the same time, plasma sufentanil concentrations were assayed by radio-immunoassay. All values are expressed as mean±SEM ; statistical analysis was performed using ANOVA followed by the use of the t-test for paired data.

RESULTS : The onset of analgesia occurred 3.0±0.3 min after epidural sufentanil injection and its duration was 198±19 min (range 90–240 min). We observed a

significant periosteal analgesia of the tibia at 30, 60, 90 and 120 min and of the radius at 60, 90 and 120 min (figure 1). The side effects were pruritus (3/15), nausea (5/15), urinary retention (1/11) and drowsiness (10/15). Resting RR did not change during the study. Postoperatively Resting VE and slope VE/PETCO₂ decreased significantly during 120 min and PETCO₂ increased during 60 min. Compared with postoperative preepidural value, the slope VE/PETCO₂ decreased significantly after epidural sufentanil during 60 min and increased at 240 min (table I). The plasma sufentanil concentration are summarized in table I.

DISCUSSION : Epidural sufentanil provides rapid and effective analgesia in postoperative children following urologic surgery ; however the clinical usefulness for postoperative analgesia seems low because of its short duration. The two main side effects were drowsiness and decrease of the ventilatory response to CO₂ which may be due to a systemic effect and/or a rostral spread as suggested by the low plasma sufentanil concentration and the rostral spread of periosteal analgesia.

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Table I. Respiratory variables and plasma sufentanil concentrations. Mean±SEM. * p<0.05, ** p<0.01 from preoperative period, † p<0.05 from postoperative period before epidural sufentanil.

	Preoperative Period		Postoperative Period			
	Before epidural sufentanil	30 min	60 min	120 min	240 min	
Resting RR (breaths.min ⁻¹)	22.7±1.4	22.5±1.3	22.2±1.7	20.4±2.1	25.7±2.0	24.0±2.1
Resting VE (l.min ⁻¹)	6.3±0.5	5.6±0.4*	4.2±0.4*	4.2±0.5†	4.6±0.6*	5.4±0.5
Resting PETCO ₂ (mmHg)	37.7±0.7	38.9±1.2*	42.5±1.2*	41.1±1.3†	38.9±1.7	39.2±1.3
Slope VE/PETCO ₂ (l.min ⁻¹ .mmHg ⁻²)	1.66±0.12	1.10±0.13*	0.68±0.10*	0.89±0.11**	1.07±0.07**	1.42±0.08
Plasma sufentanil (ng.ml ⁻¹)	-	-	0.10±0.01	0.04±0.01	0.06±0.01	0.04±0.01

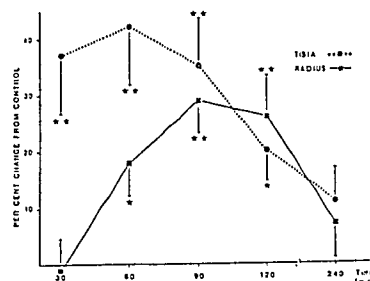


Figure 1. Percent change from control in maximum tolerance to periosteal pressure. Mean±SEM, *p<0.05 **p<0.01 from control.