TITLE: CONTINUOUS EPIDURAL INFUSION OF 1/8% BUPIVACAINE FOR POSTOPERATIVE PAIN RELIEF IN PEDIATRIC UROLOGY PATIENTS

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Introduction: Regional analgesia is frequently used as an adjunct to general anesthesia in pediatric patients to reduce intraoperative anesthetic requirements as well as provide postoperative pain relief. Regional analgesia has been shown to provide better postoperative pain relief with fewer side effects than narcotics administered by conventional methods.[1] Caudal analgesia has been proven safe and effective, but its duration of action usually does not extend beyond the day of operation. Bolus epidural administration of local anesthetics has also been used for postoperative analgesia without untoward effect.[2] In this study, we utilized a continuous epidural infusion of bupivacaine to provide a constant level of analgesia in pediatric urology patients.
Methods: Ten consecutive pediatric patients who underwent ureteroneocystostomy received postoperative analgesia by continuous epidural infusion of 1/8% bupivacaine at an average rate of 0.2 cc/kg/hr for the first two postoperative days. This group was compared with 10 patients of similar age and weight who received single dose caudal analgesia with 1/4% bupivacaine following ureteroneocystostomy
Results: Comparison between the caudal and epidural groups are summarized as follows.

Group	Epidural	Caudal
Number of patients	10	10
Age range	20 mo - 9 yr	20 mo - 9 yr
Weight range	9.7 - 39.4 kg	11.9 - 31.9 kg
# of narcotic doses - 1st two postop days (mean)	0.6*	4.1
# of B&O suppositories used first two postop days (mean)	1.3*	3.1
Average duration of hospitalization (days)	8.7	8.5
Incidence of nausea/vomiting	2/10	1/10
Complications: pulmonary and/or related to regional analgesia	0/10	0/10
Average time to first bowel movement (days)	4.3	4.6

* $p < 0.05$, unpaired two-tailed t test

Discussion: This study demonstrates that continuous epidural analgesia for postoperative pain management is effective and safe. Superior relief of postoperative pain and bladder spasms was provided by the continuous epidural infusion when compared with caudal analgesia as indicated by significantly decreased usage of supplemental narcotics and B&O suppositories in the epidural group. Postoperative gastrointestinal function as well as duration of hospitalization were comparable in both groups. There were no associated pulmonary or technique related complications.
References: 1. Anesthesiology 61:A430, 1984
2. Eur J Anaesthesiol 4:327-335, 1987

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Title: EVALUATION OF BRAIN OXYGENATION DURING CARDIOPULMONARY BYPASS AND TOTAL CIRCULATORY ARREST IN CHILDREN BY NEAR INFRARED SPECTROSCOPY

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Introduction. Adequacy of cerebral oxygenation during cardiopulmonary bypass (CPB) is important for anesthetic and surgical management of pediatric patients. Current CPB management in children presents significant alterations in physiology; there are extremes of temperature, hemodilution, perfusion pressure and blood flow with or without periods of total circulatory arrest. Since the effects of such alterations at the tissue and intracellular level are unknown, our study utilized near infrared spectroscopy (NIRS) to examine the effects on brain oxygenation of hypothermic CPB with and without circulatory arrest. Adequacy of cerebral oxygen delivery was assessed by intraoperatively monitoring changes in levels of cerebral oxygenated hemoglobin (HbO_2). Cerebral intracellular oxygen sufficiency was assessed by monitoring changes in level of cerebral oxidized cytochrome a,a_3 (cytochrome c oxidase), the terminal oxidase of the respiratory chain.
Methods. NIRS was used to measure changes in cerebral Hb, HbO_2, oxidized cytochrome a,a_3 and tissue blood volume (tBV) in 14 neonates and infants during surgical repair of congenital heart defects requiring CPB. Anesthetic management consisted of midazolam 0.1-0.4 mg/kg, fentanyl 25-100 mcgs/kg and pancuronium as required for neuromuscular blockade and controlled ventilation. CPB management consisted of nonpulsatile flow using a membrane oxygenator. CPB prime solution consisted of lactated ringers and packed RBC's needed to maintain a 20% hematocrit. Patients were core cooled via the perfusate during bypass and blood gases, uncorrected for temperature, were used to maintained at a pH of 7.35-7.40 and pCO_2 of 35-40 torr.

A four wavelength near infrared spectrophotometer was used to continuously measure changes in levels of Hb, HbO_2, oxidized cytochrome a,a_3 and tBV in the brain cortex. The non-invasive NIRS technique has been described previously .[1] In our study, a pair of fiberoptic bundles were placed on the forehead of each patient; the first to illuminate the brain and the second to recover reflected photons for spectral analysis.

Patients were grouped according to the absence or presence of circulatory arrest. In non-circulatory arrest patients, NIRS parameters were recorded before CPB (baseline), immediately after start of CPB, at the end of cooling on CPB, at the end of rewarming on CPB and while stable post-CPB. In circulatory arrest patients, an additional measurement was made at the end of circulatory arrest before restarting the CPB pump. Data was analyzed using paired t-testing.
Results. Levels of HbO_2 were significantly decreased at the end of cooling and the end of rewarming in both circulatory arrest and non-circulatory arrest groups when compared to baseline ($p < 0.04$). These changes in HbO_2, however, returned to baseline levels after CPB. Levels of oxidized cytochrome a,a_3 were decreased during CPB in both groups, however maximal change from baseline was 40% greater in the circulatory arrest group. Both groups showed a significant decrease in level of oxidized cytochrome a,a_3 after CPB when compared to baseline ($p < 0.03$). Oxidized cytochrome a,a_3 recovered only 18% of the maximal change from baseline in the non-circulatory arrest group and 27% of maximal change in the circulatory arrest group. Tissue blood volume in both groups decreased during CPB and returned to near baseline levels after CPB.
Conclusions. The ability of NIRS to detect dynamic trends in brain oxygenation revealed that in pediatric patients: 1) Cerebral intracellular oxygenation is significantly decreased during circulatory arrest, suggesting the occurrence of an oxygen debt. 2) In both non-circulatory arrest and circulatory arrest groups, intracellular oxygenation does not return to baseline after CPB. The reduction in intracellular oxygenation is not related to a deficit in O2 availability as cerebral HbO2 returns to baseline after CPB. 3) The level to which intracellular oxygenation recovers immediately after CPB is not influenced by periods of circulatory arrest.
References. 1. Piantadosi C.A., J.Crit. Care 4:308-18;1989