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Initial Experience with Dexmedetomidine for Cardiac Catheterization in Children

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Introduction: Children undergoing cardiac catheterization require deep sedation or general anesthesia. Although there are arguments for both techniques, in reality, when performing invasive cardiac procedures in children, the depth of sedation required to blunt reflexes to painful stimuli and to ensure immobility is close to that of general anesthesia. In order to obtain accurate hemodynamic information, depression of cardiovascular and respiratory function should be avoided. Endotracheal intubation and mechanical ventilation require a depth of anesthesia which will invariably lead to some reduction in myocardial contractility and alteration of respiratory mechanics. Dexmedetomidine is a selective $alpha_2$ adrenergic agonist that has sedative, analgesic and anxiolytic properties. It decreases blood pressure, heart rate and circulating catecholamines in a dose-dependant manner and is not associated with respiratory depression. There are several reports of its use for pediatric sedation. (1-3). We describe our preliminary experience in 20 infants and children undergoing cardiac catheterization.

Methods: The Hospital's Institutional Review Board (IRB) approval was obtained. The sedation technique was as follows. All patients were premedicated with midazolam 0.75 mg/kg PO. Placement of an intravenous line was facilitated by the inhalation of either nitrous oxide or sevoflurane. A loading dose of 1 mcg/kg dexmedetomidine was administered over 10 minutes and followed by an initial continuous infusion of dexmedetomidine at 1 mcg/kg/hr. Nasal canulae were applied which allowed end-tidal CO_2 monitoring and the addition of supplemental oxygen. Patients were allowed to breathe spontaneously. The following parameters were recorded every five minutes; heart rate, non-invasive blood pressure, pulse oximetry, respiratory rate, end-tidal CO_2, bispectral index score (BIS), Skeie (4) sedation score and dexmedetomidine infusion rate. Local anesthetic infiltration of the groin preceded vascular access. An initial arterial blood gas sample was recorded. Patient movement or evidence of inadequate sedation (increased heart rate, blood pressure, respiratory rate or BIS value) were treated with a bolus of propofol (1 mg/kg). The dexmedetomidine infusion rate was titrated to the level of sedation (monitored by sedation score and BIS value) to a maximum of 2 mcg/kg/hr with the aim of maintaining a sedation score of 4 - 5 and a BIS value < 80. Per our standard practice patients were sedated with midazolam (0.1 mg/kg) at the end of the procedure. Time to wakefulness was not recorded.

Results: The study cohort consisted of 20 patients. Age ranged from 3 months to 10 years (mean 2.7 years) and weight from 4.1 to 22.8 kg (mean 14.1 kg). Thirteen patients (65%) had an intervention performed while the remaining seven cases (35%) were diagnostic only. The commonest procedure was coil occlusion of a patent ductus arteriosus (seven patients), other interventions included angioplasty, stent implantation and balloon valvuloplasty. Total time of the procedures ranged from 50 to 202 minutes (mean 104 minutes). BIS values following the loading dose ranged from 31 to 87 (mean 60). Five patients (25%) had some movement on local anesthetic infiltration or groin vessel access; all were given a propofol bolus at this time. This movement was slight and did not necessitate forced restraint or result in difficulty securing vascular access. No patient failed sedation or required conversion to general anesthesia; eight patients were effectively sedated with dexmedetomidine alone, however 12 patients did receive a propofol bolus at some time during the procedure due to movement, increasing BIS value or in anticipation of stimulation. There were no incidences of airway obstruction or respiratory depression that required intervention. In all cases the heart rate and blood pressure remained within 20% of baseline. No patient required treatment for bradycardia or hypotension. The average infusion rate of dexmedetomidine following the loading dose was 1.15 (± 0.29) mcg/kg/hr (range 0.6 – 2.0 mcg/kg/hr).

Discussion: We report our initial experience using dexmedetomidine for diagnostic and interventional catheterization in children. Effective sedation was achieved in all patients with stable hemodynamics and no adverse effects. The average infusion rate was 1.15 mcg/kg/hr which is greater than the dose required for MRI sedation. (2) This is reflective of the more invasive nature of cardiac catheterization. The current price of dexmedetomidine is $57.20 (2 mL, 200 mcg vial) compared to $11.83 for 20 mL (200 mg) for propofol. Further prospective trials are required to determine the optimal dose, efficacy and cost-benefit of dexmedetomidine for sedation of children undergoing cardiac catheterization.

Refs:
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