Effect of High Dose Dexmedetomidine-Ketamine Sedation on Respiratory Function and PVR in Children with Congenital Heart Disease

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Introduction

- Children undergoing cardiac catheterization require anesthesia or sedation.
- The results of cardiac catheterization can be improved by using adequate sedation.
- Accurate measurement of pulmonary vascular resistance (PVR) is required.
- Dexmedetomidine, a selective alpha 2 agonist, has been used in high doses to sedate children without causing respiratory depression.
- Controversy exists regarding the effect of dexmedetomidine on PVR.
- Ketamine, in combination with low dose dexmedetomidine, has been effective in sedating children for catheterization.
- At the University of New Mexico, we use a combination of high dose dexmedetomidine and ketamine to sedate children for cardiac catheterization.

Purpose

- To review the effect of high dose dexmedetomidine-ketamine sedation in children undergoing cardiac catheterization on the following:
  - Spontaneous ventilation
  - Respiratory parameters (pH, pCO2, pO2)
  - Pulmonary vascular resistance

Methods

- Institutional IRB approval
- Retrospective chart review of all children undergoing cardiac catheterization with high dose dexmedetomidine-ketamine sedation at the University of New Mexico over an 18 month period.
- Patients excluded if other anesthetic/sedation used
- Chart review included: age, weight, cardiac defect, purpose of catheterization, preoperative medications, FIO2, respiratory parameters, blood gas measurements, PA pressures, PVR, drug dosages and adequacy of sedation.
- Evaluation of pulmonary function based on arterial blood gas information and respiratory rate.
- Evaluation of PVR based on pulmonary artery pressures and Woods units.

Results

- A total of 17 charts met the requirements for review.
  - Patients ranged in age from 6 weeks to 9 years.
  - The majority of patients were 4 years and under.
  - All sedation done with spontaneous ventilation.
  - pCO2 measurements ranged from 35-56.
  - Average pCO2 value 43.
  - Dexmedetomidine bolus ranged from 0 – 7.3 mcg/kg.
  - Average bolus dose was 2 mcg/kg.
  - Dexmedetomidine infusion ranged from 1.6 – 4.4 mcg/kg/h.
  - Average infusion dose was 2.3 mcg/kg/hr.
  - Ketamine doses ranged from 1.15 – 10 mg/kg.
  - Average Ketamine dose was 3.3 mg/kg.
  - PVR measurements ranged from 1.2 – 4.4 Woods units.
  - 2 of 3 patients with PVR > 2.1 were on Enalapril and had unbalanced AV canal.
  - Both patients responded favorably to either oxygen or NO.
  - There was minimal correlation between higher doses of dexmedetomidine or ketamine and increased PVR.

Discussion

- We report the use of high dose dexmedetomidine with ketamine for children undergoing cardiac catheterization.
  - This technique provides effective sedation and maintains spontaneous ventilation.
  - Doses used showed a wide range of variation. We attribute this to multiple anesthetic providers and lack of protocol standardization.
  - Patients receiving higher doses of Dexmedetomidine required less supplemental ketamine. All doses showed similar results with regard to pulmonary function.
  - There is minimal correlation between PVR and doses of dexmedetomidine + ketamine.
  - Two patients exhibited markedly increased pulmonary vascular resistance.
  - Both of these patients had preexisting pulmonary hypertension.
  - It is unlikely that these measures were related to sedation technique.

Conclusions

- The use of high dose dexmedetomidine-ketamine provides adequate sedation for cardiac catheterization.
- Respiratory function is preserved in the spontaneously breathing patient.
- Observed values of PVR using this sedation technique were in the expected and acceptable range in the majority of cases.
- Further studies with standardization of protocol are required.

References