Anesthetic Management of Child with Severe Systemic and Pulmonary Hypertension for Cardiac Catheterization

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Background
Pulmonary hypertension is associated with significant perioperative risk with report of the likelihood of death or need for major resuscitation to be 6% in children under anesthesia for cardiac catheterization.1 Suprasystolic pulmonary hypertension has been found to increase this risk eightfold.2

Case Report
A 12 year old female presented with a blood pressure of 192/139 and evidence of severe pulmonary hypertension on echo (Image I). History was remarkable for VSD (spontaneously closed), syncope at 6 years of age, and general aversion to exercise.

Urgent cardiac catheterization was required for further evaluation and initiation of pulmonary vasodilators. Arterial and central venous access were obtained with local anesthesia and sedation to allow continuous hemodynamic monitoring and vasoactive support. A carefully titrated induction was performed with a propofol and ketamine (Ketofol) 1:1 mg infusion, and the patient was intubated. Ketofol was administered at 100-300 mcg/kg/min. Hemodynamic testing revealed suprasystolic pulmonary hypertension (35 Wood units) with minimal response to O2, iNO and epoprostenol.

She was subsequently extubated and brought to the cardiac ICU. Treprostinil was slowly titrated up as tolerated by her systemic BP and intracavitary LV gradient (Image II). Phenylephrine infusion was required intermittently to maintain her SVR. Atrial septostomy was later performed to relieve right-sided pressure.

Discussion
Our review of the literature did not reveal prior reports of a child with such severe systemic and pulmonary hypertension. This patient was theorized to have severe primary pulmonary hypertension with resultant decrease in cardiac output, leading to increased SVR and systemic hypertension.

Our anesthetic management goals included maintaining high SVR and avoiding further increases in PVR. Based upon her preoperative echocardiogram, suprasystolic RV pressure resulted in displacement of her interventricular septum towards the LV. During anesthetic induction, an acute decrease in SVR or increase in PVR could cause a greater degree of septal displacement. This could lead to obstruction of LV filling, reduced stroke volume, blood pressure and coronary perfusion, worsening of right-sided heart failure and ultimately cardiovascular collapse.

The safety and effectiveness of the ketamine and propofol mixture has been demonstrated in pediatric patients undergoing cardiac catheterization.4 Adult studies have demonstrated that ketamine causes an increase in PVR during spontaneous respiration.5 Studies in children, however, have demonstrated that ketamine does not cause increased PVR while breathing spontaneously under anesthesia.6 One study of children undergoing cardiac catheterization found that propofol significantly decreased MAP, while ketamine increased MAP and had no effect on SVR, PVR or pulmonary mean arterial pressure.7

In the setting of severe systemic and pulmonary hypertension, the hemodynamic effects of propofol and ketamine can counteract each other, potentially providing hemodynamic stability in patients at high risk for cardiovascular collapse

References