Pre-Operative Preparation and Induction for the Newborn with Congenital Aortic Stenosis: A Lesson in Careful Management

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Introduction
While sharing the same risks and the same anesthetic goals, there are significant limitations in treating congenital aortic stenosis compared to acquired aortic stenosis. While reductions in preload can be particularly detrimental to any patient with aortic stenosis, a prolonged NPO status in an infant with congenital aortic stenosis can be especially difficult to manage. Proper communication and planning following unexpected changes in a busy hospital can help mitigate these difficulties.

Case
A full-term infant was born at our institution without event. At his first visit to his pediatrician, he was noted to have a very harsh systolic murmur. An electrocardiogram did not reveal any abnormalities. However, an echocardiogram revealed severe aortic stenosis with a peak gradient of 76 mmHg.

At 19 days, it was decided to attempt a balloon valvuloplasty in the catheterization laboratory to reduce the gradient across the aortic valve. He came in to the hospital for the procedure that day. As there was no intravenous access present, a mask induction was planned. His pre-induction blood pressure of 75/40 mmHg was very close to measured blood pressures at his clinic visits prior to the procedure. Shortly after induction with sevoflurane and oxygen, while intravenous access was being obtained, systolic blood pressure fell to the high thirties. Intravenous access was readily secured and he was resuscitated with further boluses of albumin, calcium, and epinephrine to support blood pressure. Once hemodynamic stability was restored, anesthesia was maintained with varying amounts of fentanyl and sevoflurane, with an end tidal concentration not greater than 0.7%.

Hypotension continued beyond the induction period. Other indicators of decreased perfusion such as diminished end tidal carbon dioxide and diminished capillary refill were also observed. Blood pressure was initially measured non-invasively on the right upper extremity. Confirmatory measurements were gained when the femoral artery was accessed by the interventional cardiologist.

Discussion
Currently, the smallest available prosthetic aortic valve is 17 mm, so infants with congenital aortic stenosis undergo either repeated balloon valvuloplasties or aortic valvotomy for those who fail more conservative therapy. Percutaneous balloon valvotomy is as effective as surgical valvotomy in this group (Gatzoulis, 1995) and is the preferred option in most centers.

As in acquired aortic stenosis, compensatory left ventricular hypertrophy results in impaired diastolic function with a rise in left ventricular end-diastolic pressure. Changes in left ventricular preload associated with induction of anesthesia may reduce stroke volume and impair sub-endocardial perfusion, further worsening myocardial function. Prompt restoration of coronary perfusion pressure and LV preload is necessary to avert a rapid decline in cardiac output leading to cardiac arrest.

Current guidelines suggest that infants remain NPO no more than four hours for breast milk or two hours for clear liquids. In this case, the patient was kept NPO for greater than 10 hours due to schedule changes. The prolonged NPO period contributed to severe hemodynamic instability during induction and a prolonged post-procedural ICU stay.

Proper communication of changes in scheduling, particularly for pediatric patients who may be vulnerable to the effects of dehydration, is important to prevent untoward complications.

References