

## Myocardial Oxidative Stress in Infants Undergoing Cardiac Surgery

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**Introduction:** Cardiac surgery for congenital heart disease often necessitates a period of global myocardial ischemia during cardiopulmonary bypass and cardioplegic arrest, followed by reperfusion after aortic cross-clamp removal. In experimental models, myocardial ischemia-reperfusion is associated with significant oxidative stress and ventricular dysfunction. Myocardial dysfunction after congenital heart disease surgery is an important cause of morbidity and mortality in infants, a cohort known to have immature antioxidant defenses. The aim of this study was to directly measure myocardial oxidant stress in infants with congenital heart disease undergoing surgical repair.

**Methods:** A prospective observational study was conducted in infants (less than 1-year old), who were scheduled for elective surgical repair of a ventricular septal defect (VSD) or tetralogy of Fallot (TOF). Demographics, preoperative variables, postoperative complications (including extracorporeal membrane oxygenation, cardiac arrest, and death) and hospital course were recorded. Intraoperative blood samples were taken directly from the coronary sinus before initiation of cardiopulmonary bypass (baseline, or control) and at 1, 3, 5, and 10 minutes after aortic cross-clamp removal. Samples were processed and analyzed for oxidative stress using commercially available assay kits for thiobarbituric acid reactive substances (TBARS), protein carbonyl, 8-isoprostane, and total antioxidant capacity. For each subject, raw data were normalized to the pre-bypass baseline sample and expressed as fold of control. Change from baseline at each time point was analyzed by one sample t-test with Bonferroni correction for multiple comparisons.

**Results:** Sixteen patients (8 males, mean age 4.7 months) were enrolled in the study; 10 subjects underwent TOF repair and 6 underwent VSD closure. There were no major postoperative complications in the cohort, and all patients survived to hospital discharge. Median hospital length of stay was 6 days (interquartile range 5-7 days). Compared to baseline, there was an immediate, significant increase in all myocardial oxidative stress markers that persisted for 10 minutes following cross-clamp removal. In addition, there was a small decrease in total antioxidant capacity compared to baseline, but this change was not statistically significant.

**Conclusions:** Infant cardiac surgery is associated with a rapid, robust and time-dependent increase in myocardial oxidant stress that can be measured in the coronary sinus *in vivo*. Future studies with larger enrollment are required to assess any association between myocardial oxidative stress and early postoperative outcomes, as well as any potential impact of pre-existing cyanosis on oxidant stress response to cardiac surgery.