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Title:  Myocardial Cytochrome Oxidase Activity Increases with Age and Hypoxemia in Patients with Congenital Heart Disease  

Introduction:  Myocardial protection strategies seen to be beneficial in adults undergoing cardiac surgery have failed to show comparable benefits in neonates and infants. Myocardial tolerance to ischemic injury is influenced by age and cyanosis, though the underlying physiologic mechanism is unclear. We hypothesized that the activity of cytochrome oxidase (COX) within mitochondria changes based on age and oxygen saturation.  

Methods:  Right atrial appendage tissues from patients undergoing first time surgical repair or palliation of congenital heart defects were analyzed for steady state COX kinetics by oxidation of ferrocytochrome C via spectrophotometry. Multiple linear regression analysis was used to assess the effects of age and mean preoperative arterial oxygen saturations (SaO2) on the COX activity.  

Results:  Overall, 31 patients with a median age (interquartile range) of 83 days (8-174) and preoperative oxygen saturation of 99% (85-100%) were enrolled. Multiple linear regression analysis predicted significantly greater COX activity in the myocardial tissue for patients with SaO2 <90% (p = 0.005) and older age (p = 0.013).  

Conclusion:  Myocardial COX activity increased with older age and lower preoperative oxygen saturations. This may have consequences for myocardium during ischemia-reperfusion and suggests that myocardial protection strategies may need to be tailored specifically to a patient’s age and preoperative hypoxia status. Such an approach needs to be explored further, but may help reduce the risk of ischemia-reperfusion injury during congenital cardiac surgery.