

Coronary Flow and Reactivity, but not Arrhythmia Vulnerability, Are Affected by Cardioplegia During Cardiopulmonary Bypass Surgery of Piglets

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Introduction: Cardiopulmonary bypass (CPB) surgery remains associated with significant cardiovascular morbidity in both pediatric and adult patients but the mechanisms are not fully clarified. Abnormalities in coronary flow and function have been suggested to play an important role. A few prior studies suggested protective effects on coronary and myocardial function by short intravenous (i.v.) infusion of cyclosporine A prior to CPB surgery.

Methods: Barrier-bred piglets (10-12 kg, n=20) were subjected to CPB with (n=10) or without (n=10) antegrade administration for 20 minutes of cardioplegic solution. Prior to surgery, half of animals from each group received 10-minute i.v. infusion of 100 mg/kg cyclosporine A. Left anterior descending coronary flow velocity responses to adenosine, serotonin, and atrial pacing, as well as left ventricular function and postsurgical vulnerability to atrial fibrillation (Afib) were assessed by intracoronary Doppler, epicardial echocardiography, and in vivo electrophysiological study, respectively.

Results: Coronary peak flow velocity (cPFV) rose significantly after surgery, especially in cardioplegia group ($p < 0.01$ vs. non-cardioplegia group and pre-surgery). cPFV responses to adenosine, but not to serotonin, tended to decrease ($p = 0.06$) after surgery only in cardioplegia group ($p = 0.06$; $p = 0.8$ in non-cardioplegia group vs pre-surgery). After surgery, cPFV response to atrial pacing was lower in cardioplegia than in non-cardioplegia animals ($p = 0.02$). Neither vulnerability nor duration of induced Afib after surgery differed between groups (Chi-square $p = 0.4$). Cyclosporine had no significant effect on coronary indexes or arrhythmia vulnerability ($p > 0.4$). There was no difference in systolic myocardial function between groups at any timepoint.

Conclusions: Cardioplegia during CPB surgery of piglets was associated with profound abnormalities in coronary vasomotor tone and receptor-related flow regulation, whereas arrhythmia vulnerability appeared to be comparable with that in non-cardioplegia group. In this study, intracoronary pretreatment with cyclosporine had no observable protective effect on coronary circulation or arrhythmia vulnerability after CPB surgery.