Commentary: Single-dose cardioplegia: Adjusting the brew

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Protecting the heart from ischemic damage is a critical component of every cardiac surgery. Cases using cardiopulmonary bypass (CPB) with aortic crossclamping disrupt coronary circulation and oxygen supply necessary for aerobic metabolism. Without altering the metabolic demands of the heart, roughly 15 to 20 minutes of ischemia can result in irreversible damage and myocardial dysfunction. The strategy to address this dilemma has been intraoperative reduction of cardiac metabolism via hypothermia and cardioplegic solution, which have successfully extended the safe duration of crossclamp time.

Conventional cardioplegia consists of high-dose potassium to induce diastolic arrest, a buffering agent, and substance to reduce calcium levels. Additional additives including insulin, calcium-channel blockers, and Krebs cycle intermediates have also been used to optimize myocardial metabolism and limit cell damage. Conventional cardioplegia requires redosing every 20 minutes, but alternatives including del Nido (DN) and histidine–tryptophan–ketoglutarate (HTK) solutions have gained popularity as single-dose options. Single-dose DN\(^1\) and HTK\(^2\) have noninferior outcomes compared with conventional cardioplegia and are favored by some because of fewer intraoperative pauses for administration and lower overall CPB and ischemic time.\(^3,4\)

In this issue of the Journal, Suarez-Pierre and colleagues\(^5\) present a continuation of the Lawton group’s work on diazoxide as a myocardial-protective agent. In this porcine study comparing modified St Thomas cardioplegia with the same solution with diazoxide on cardiac function after 2 hours ischemic time on CPB, cardiac output was significantly preserved in the diazoxide group compared with the conventional group. These findings are noteworthy because diazoxide extended the cardioprotective duration of the conventional solution into a range of other single-dose cardioplegias.

Many groups have investigated the role of adenosine triphosphate potassium sensitive channel (K\(_{ATP}\)) openers in ischemic myocardial protection.\(^6\) This study by the Lawton group is an excellent translation of their extensive mechanistic studies involving diazoxide\(^7,8\) into a large animal model that raises additional questions for further study. Although their results imply that diazoxide is effective at prolonging the dosing interval for conventional St Thomas cardioplegia, another useful comparison group would be with other clinically validated single-dose solutions such as DN or HTK. Furthermore, if diazoxide is an effective cardioprotective additive in conventional cardioplegia, what would its effect be with DN or HTK? Ultimately, as this work is considered with previous small clinical studies demonstrating the safety of diazoxide and its efficacy in preserving cardiac output both as a preconditioning agent\(^9\) and additive\(^10\) in conventional blood cardioplegia, larger-scale clinical trials are indicated to investigate its utility in myocardial protection during cardiac surgery.

References


