Continuous Coronary Sinus Perfusion for Recovery of Hearts from Non-Heart-Beating Donors

M. Peltz, S. Brant, M. Cobert, L. West, M. Jessen
Cardiovascular and Thoracic Surgery, University of Texas Southwestern Medical Center, Dallas, TX

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Purpose: DCD donors are not usually considered for heart transplantation. Recent studies suggest that machine perfusion appears promising for improving preservation of donor hearts and increasing the donor pool for cardiac transplantation. The purpose of the current study was to evaluate coronary sinus perfusion preservation of DCD donor hearts in a large animal model of cardiac transplantation.

Methods: 7 canine donor animals were anesthetized and then disconnected from mechanical ventilation. Five minutes after EKG silence, hearts were exposed and flushed with 1 liter University of Wisconsin Machine Perfusion Solution after cross-clamp application. Hearts were subsequently excised and then randomized either to machine perfusion preservation through the coronary sinus at 5°C (n=4) using a prototype perfusion device (LifeCradle, Organ Transport Systems) or conventional cold static storage (n=3) for 4 hours. Oxygen consumption and lactate accumulation were measured continuously in perfused hearts. Hearts were then reimplanted into recipient animals and reperfused for 6 hours.

Results: The time to EKG silence was similar between perfused (35±6 min) and static (42±11 min) storage hearts. Perfused hearts continued to extract oxygen throughout the perfusion interval. Lactate levels in perfused hearts were low. All perfused hearts were able to separate from cardiopulmonary bypass (CPB) at least transiently. 3 of 4 perfused hearts remained off CPB after an initial 1 hour reperfusion period. 1 of 3 static storage hearts was initially able to separate from CPB. By the end of the 6 hour reperfusion period, all static storage hearts required a return to CPB. The total time spent on CPB during the final hour of reperfusion was 11±11 min in the perfused group and 53±7 min in the static group (p<.05). Troponin-t release (9.8±4 vs 11.8±2 ng/mL) and creatine kinase release (11350±8556 vs 22005±7997 IU/L) were lower in perfused hearts but this difference was not significant.

Conclusions: These data suggest that machine perfusion preservation can potentially recover hearts from DCD donors. Coronary sinus machine perfusion preservation appears promising for expanding the donor pool for cardiac transplantation.