Abstract

Maintenance of Human Heart Oxidative Metabolism after 12 Hour Perfusion Preservation

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Purpose: Perfusion preservation with oxygenated preservation solution may extend the storage interval and permit utilization of marginal donor hearts. We previously evaluated a perfusion device (Life-Cradle®, Organ Transport Systems, Inc.) in a large animal model and demonstrated improved post-transplantation ventricular function, reduced apoptosis, and reduced lactate accumulation. We applied the same preservation strategy to rejected hearts from human donors to evaluate device performance in a human model.

Methods and Materials: Human hearts unsuitable for transplantation (n9) were obtained from potential donors throughout our local organ procurement organization. Explanted hearts (n8) were flushed with University of Wisconsin Machine Perfusion Solution, connected to the perfusion device and perfused at 10 mL/100g/min at 5°C for 12 hours with the same solution. One heart underwent conventional static storage for the same interval. Temperature, flow, and pressure were recorded in perfused hearts. After 12 hours of perfusion, Hearts were removed and weighed. Tissue samples were collected, frozen in liquid nitrogen and later analyzed by proton magnetic resonance spectroscopy (MRS). The lactate/alanine ratio was used to evaluate the metabolic state of stored hearts as previously described.

Results: Donor patient’s ages in this study range from 20-67 years. Perfusate temperature was maintained at 62°C. Aortic pressures averaged 162 mmHg. After 12 hour storage, perfused hearts showed no evidence of myocardial edema. Initial heart weights were 42931 g. Final heart weights were 40429 g (pNS). Final LV water content: was 76.80.9%. Oxidative metabolism was preserved in perfused hearts. LV extract lactate/alanine ratios were 0.680.22 for perfused hearts. This ratio was 2.55 in the static storage heart.

Conclusions: Perfusion preservation supported myocardial metabolism over this extended storage interval without myocardial edema formation. These data suggest that perfusion preservation may be an effective strategy to preserve human hearts for long intervals.

The Journal of Heart and Lung Transplantation Abstracts
Volume 28, Number 2S, S126