Myocardial perfusion characteristics during machine perfusion for heart transplantation

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Background. Optimal parameters for machine perfusion preservation of hearts prior to transplantation have not been determined. We sought to define regional myocardial perfusion characteristics of a machine perfusion device over a range of conditions in a large animal model.

Methods. Dog hearts were connected to a perfusion device (LifeCradle™, Organ Transport Systems, Inc, Frisco, TX) and cold perfused at differing flow rates (1) at initial device startup and (2) over the storage interval. Myocardial perfusion was determined by entrapment of colored microspheres. Myocardial oxygen consumption (MVO₂) was estimated from inflow and outflow oxygen differences. Intra-myocardial lactate was determined by 1H magnetic resonance spectroscopy.

Results. MVO₂ and tissue perfusion increased up to flows of 15 mL/100 g/min, and the ratio of epicardial:endocardial perfusion remained near 1:1. Perfusion at lower flow rates and when low rates were applied during startup resulted in decreased capillary flow and greater non-nutrient flow. Increased tissue perfusion correlated with lower myocardial lactate accumulation but greater edema.

Conclusions. Myocardial perfusion is influenced by flow rates during device startup and during the preservation interval. Relative declines in nutrient flow at low flow rates may reflect greater aortic insufficiency. These factors may need to be considered in clinical transplant protocols using machine perfusion.

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