Importance of Organ Preservation Solution Composition in Reducing Myocardial Edema during Machine Perfusion for Heart Transplantation

M.L. Cobert, M. Peltz, L.M. West, and M.E. Jessen

ABSTRACT

Objective. Machine perfusion preservation has been used experimentally to extend the storage interval of donor hearts. We previously demonstrated that machine perfusion with glucose-supplemented Celsior preservation solution led to superior reperfusion function but resulted in increased myocardial edema compared with conventional static preservation. We hypothesized that other solutions that contain an oncotic agent, such as University of Wisconsin Machine Perfusion Solution (UWMPS), might reduce graft edema development while maintaining myocardial oxidative metabolism during long-term storage.

Methods. Canine hearts were stored and perfused in a perfusion preservation device (LifeCradle; Organ Transport Systems) after cardioplegic arrest and donor cardiectomy. Hearts were perfused either with glucose-supplemented Celsior (which lacks an oncotic agent) or UWMPS (which contains hydroxyethyl starch) at 5°C in the perfusion device over 10 hours. Oxygen consumption (MVO2), lactate accumulation, regional flow distribution, and myocardial water content were measured.

Results. Hearts in both groups continued to extract oxygen over the entire perfusion interval. Lactate accumulation was minimal in both groups. Both solutions delivered perfusate evenly to all regions of myocardium. Heart weight increase (Celsior 31.3± 4.3%, UWMPS -3.3± 1.9%) and final myocardial water content (Celsior 80.2± 1.3%, UWMPS 75.9± 0.3%) were higher in the Celsior group (P < .005).

Conclusions. Donor hearts can be supported by a perfusion device over relatively extended storage intervals. These organs continue to undergo oxidative metabolism with little lactate accumulation. An oncotic agent appears to be important in limiting increases in myocardial water content. UWMPS appears to be superior for perfusion preservation of myocardium by reducing edema development during storage.