HEART FAILURE AND TRANSPLANTATION

Journal Watch

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REVIEW:

Functional assessment and transplantation of the donor heart after circulatory death.

Messer SJ, Axell RG, Colah S, White PA, Ryan M, Page AA, Parizkova B, Valchanov K, White CW, Freed DH, Ashley E, Dunning J, Goddard M, Parameshwar J, Watson CJ, Krieg T, Ali A, Tsui S, Large SR.
J Heart Lung Transplant 2016;35 (12):1443–1452

Despite an increasing demand for organs, the number of heart transplants performed globally has plateaued in recent years chiefly due to limitation in the supply of donor organs. Efforts to expand the donor pool have been attempted for several decades. They include use of marginal organs or hearts from older donors. In recent years, non-cardiac organs from donors after circulatory death have been increasingly used with outcomes comparable to organs from donors after brain death (1). Although the first heart transplant was performed following donation after circulatory death (DCD), this technique was abandoned due to concerns about the effect of warm ischemic time on graft function and inability to assess heart function following circulatory death. Recently two pioneering groups from the UK and Australia have made significant advances in this field facilitated by the availability of ex vivo perfusion technique using the Organ Care System (OCS). Both groups have relied on protocols using Maastricht 3 DCD donors in which cardiac arrest is awaited after withdrawal of life support in donors who are not brain dead. The groups however have utilized different approaches for harvesting. The Australian group led by Dhital (2) utilizes direct procurement and perfusion (DPP) using the OCS. Cardioplegia is administered to the DCD heart within the donor before removal and instrumentation upon the OCS. Assessment is by means of arterial and venous lactate trends, hemodynamic pressures and visual inspection. The British group (3) has opted for normothermic regional perfusion (NRP) in which arch vessels are clamped off to exclude cerebral blood flow in order to avoid a Cushing response. Aortic and right atrial cannulas are inserted, and the donor heart re-perfused on a circulatory pump. The donor trachea is reintubated, and the donor ventilated. Cold cardioplegia is given before removing the heart and instrumenting upon the OCS.

A potential advantage of NRP is the ability to assess graft function prior to and after harvest. In this paper, the British group reports on their early experience with functional assessment and transplantation of donor hearts after circulatory death. In a feasibility phase in 4 donors, pulmonary artery catheter (PAC) was placed following restoration of circulation for hemodynamic assessment, pressure volume loops were recorded, troponin determined and echocardiogram performed to assess graft function. Following harvest the graft was placed on the OCS to allow transport. The OCS system was then modified to allow

measurement of pressure volume loops under loading and unloading conditions prior to histological examination. The authors were able to infer that two donor hearts in the feasibility group would have been unsuitable for transplant based on low cardiac output, high filling pressures, low dP/dt and abnormal ventriculoarterial coupling and these hearts were associated with either ischemia on histology or high troponin. This allowed determination for acceptability criteria for the clinical study in which functional assessment of the donor heart included preserved cardiac index and normal filling pressures by pulmonary artery catheter and ejection fraction by echocardiography. Using these criteria, 9 DCD hearts were transplanted with 100% survival and only 2 patients requiring transient mechanical support (one patient requiring IABP for one day and one patient requiring ECMO for 7 days and IABP for 9 days). Interestingly lactate levels were measured on OCS support, but there was no correlation between the lactate profile and hemodynamic assessment. Furthermore, the authors report that 50% of the hearts would have been rejected if lactate was the sole criteria used. NRP also allowed earlier restoration of coronary circulation compared to current experience with DPP. Functional assessment prior to harvest also potentially avoids expense and waste of an OCS module on a DCD heart which may not meet criteria for functional viability. In this study of a limited number of DCD donors, NRP was associated with excellent survival and a low rate of primary graft dysfunction, allowing the technique to increase transplant activity by 45% in the program. Despite these early promising results, NRP is currently limited to a few countries due to ethical concerns relating to restoration of heart function within the donor. The promising advances in DCD heart donation from these two groups will allow significant expansion of the donor pool in coming years and will no doubt spurn further discussion regarding the ethical considerations surrounding this mode of death.

ADDITIONAL ARTICLES OF INTEREST:

1. Messer S, Large S: Resuscitating heart transplantation: the donation after circulatory determined death donor. Eur J Cardiothorac Surg 2016;49:1-4.

2. Dhital KK, Iyer A, Connellan M, et al.: Adult heart transplantation with distant procurement and ex-vivo preservation of donor hearts after circulatory death: a case series. Lancet 2015;385:2585-91.