PROJECT SUMMARY/ ABSTRACT: URBAN PROJECT

Despite continued expansion in the use of donor hearts following brain death, there remains an unacceptable shortfall in the supply of suitable donor hearts compared to the demand from increasing recipient numbers on transplant waitlists. Donation after circulatory-determined death (DCD) is emerging as an alternative pathway to traditional donation after brain death. DCD heart transplantation has been made possible by technological developments of reanimation and preservation. In donation after brain death donors, artificial ventilatory and hemodynamic (blood flow) support is used to keep organs in a fully functional state before transplantation. In DCD donors, an absence of respiratory and circulatory function deprives the organs of oxygen for a variable period of time before organ recovery, which increases the challenges in maintaining viability.

The current reanimation technique used once the heart ceases function is to take the heart out of the donor body (ex-situ) and connect it to a heart and lung machine. A recently developed alternative is to restore circulation inside the donor body (in-situ) by connecting the circulation of the donor to the heart and lung machine. This technique of inside the body heart reanimation, in contrast to outside of the body reanimation, has an added benefit of increasing the quality of other donor organs (liver, kidneys) and allows for an assessment of heart function prior to transplantation in a more natural environment. An undesirable effect of this technique, attributed to the use of fully oxygenated blood, causes structural damage to the heart and compromises function. We hypothesize that using an advanced cardioprotective solution during initial perfusion would minimize damage to the myocardium.

Our long-term objective is to develop an optimal technique for inside of the body reanimation and preservation of organs in donation after circulatory determined death. Our specific aims are to demonstrate improved heart function and decreased myocardial structural damage in organs initially perfused with cardioprotective solution in comparison to organs reanimated with fully oxygenated blood. To achieve our aims, we will use a novel porcine model of low-oxygen circulatory arrest. We will assess the function (via echocardiography and hemodynamic measurements), and structural damage via special blood and tissue analysis) in donor organs perfused inside of the body with standard technique using fully oxygenated blood. These will be compared to the results of 5 organs perfused initially with cardioprotective solution.

We anticipate that successful translation of our technique into clinical practice could increase the heart transplantation activity in our region by 20% by improving availability of donor organs. Expanding the donor pool would also increase the accessibility of organs to ethnic and racial minorities in our region as well as nationally.