Organ Donation following the circulatory determination of death (DCD): An audit of donation and outcomes following renal transplantation

Abstract

J O'Rourke, JA Zimmermann, W Shields, D McLaughlin, P Cunningham, C Magee, DP Hickey
Beaumont Hospital, Beaumont, Dublin 9

Abstract

Organ Donation following the Circulatory determination of Death was introduced in Beaumont Hospital during 2011. The Intensive Care Society of Ireland formally endorsed a national DCD clinical practice guideline in 2012. This retrospective audit covers a 2-year period during which eleven patients were considered suitable for DCD and where consent was obtained. Nine patients died within the ninety-minute period following the withdrawal of life sustaining therapies and subsequently donated organs (82%). Eighteen kidneys were recovered and seventeen patients received renal transplants - one patient received a nephron-dosing dual renal transplant. Lungs were recovered on two occasions and one patient received a lung transplant. Heart valves were recovered on one occasion. To date sixteen of seventeen recipient patients have functioning renal transplants (94%). In conclusion, this model of deceased donation has proven acceptable to families, nursing and medical staff and the outcomes reported are consistent with international best practice.

Introduction

Donation after the Circulatory Determination of Death, Donation after Circulatory Death and Non Heart Beating Organ Donation (DCD, DCD, NHBD) are synonymous terms. They refer to the process whereby organs for transplantation are recovered from persons whose death has been diagnosed on the basis of cardio-respiratory criteria. This is distinct from Donation after Brainstem Death (DBD). Potential DCD donors may be divided into five categories. Category I patients are pronounced dead on arrival to hospital. Categories II and V are patients in whom resuscitation has been attempted, but are pronounced dead following either out-of-hospital cardiac arrest (category II), or in-hospital cardiac arrest (category V). Category III patients have devastating neurological injury, withdrawal of life-sustaining therapies (MILT) is anticipated and end of life care planned. Category IV are patients who suffer cardiac arrest during or after brainstem testing. In these patients BSD testing may prove impossible due to haemodynamic instability or impending cardiovascular collapse.

DCD is necessary for a number of reasons; Ireland has had an extremely successful transplantation program, however organ donation rates fluctuate. Within the Council of European Countries, the Republic of Ireland’s organ donation rates moved from 6th in 2004 to 22nd in 2010 (13 organ donors per million population – ppm). Though rates improved markedly in 2011 (20 ppm), a comparison with Spanish figures (34 ppm) places this improvement in context. DCD is necessary because BSD is being diagnosed less frequently. Road deaths have decreased by greater than 50% within the past 18 years, a statistic known to correlate closely with organ donation rates. This has led to a perceived decreased in the number of organs available for transplantation, which has had an impact on waiting times for organs, a recruitment issue. The introduction of DCD would address these issues by providing an additional organ donor group.

The most important reason that DCD is necessary is that patients who have expressed a wish to become an organ donor due to illness can now be considered for DCD. This occurs if neurological death cannot be confirmed, although, following WLT they may rapidly progress to cardiac arrest and consequent BSD. When death is diagnosed by cardio-respiratory criteria there is still an opportunity to donate organs. The lack of a widely accepted clinical practice guideline dedicated to DCD has heretofore precluded this possibility and denied these patients and families their wish to donate. The DCD practice guideline upon which these results are based, has been reviewed extensively and approved by learned groups both locally and nationally. The reintroduction of DCD with significant restrictions is an important step nationally. DCD accounted for 42% of cadaveric organs donated in the United Kingdom during 2012.

Some caution the development of DCD will further decrease the number of patients who donate organs after BSD. Most significantly, the group of patients who are waiting for an organ to occur, i.e., some clinicians use a DCD pathway to avoid BSD testing? This is known as substitution. Although a legitimate concern, it appears unfounded. BSD donor numbers have decreased in several countries in the years before many DCD programs were introduced. It would be a disservice to transplantation to discontinue life-sustaining therapies early and submit a patient to DCD where extra time would see BSD criteria fulfilled. Although long-term renal outcomes are equivalent, the incidence of delayed renal graft function is increased with DCD, although long-term renal outcomes are equivalent, the incidence of delayed renal function is increased with DCD. Although these outcomes are increased with DCD, while the evidence suggests that lungs function equally well following DCD, heart transplantation, although reported in the literature and historically, is rare. Finally, the number of organs retrieved following BSD is greater than following DCD (3.6 vs 2.1 and 3.3 vs 2.5).

The objectives of this paper are to present the organ donor data and to detail the disease processes that led to these patients being considered for DCD. Early and intermediate results of the transplant recipients are presented.

Methods

This retrospective analysis is based on chart reviews, electronic notes, radiological imaging and test results. The anonymised data presented are regarded as audit and service evaluation rather than research and, following consultation, ethics approval was not deemed necessary. Patients came from two level 3 intensive care units in two hospitals. Beaumont hospital is one of two national neurological tertiary referral centres. The data from eleven potential organ donor patients and seventeen renal transplant recipients were reviewed and simple descriptive statistics compiled.

Results

Donors

Eleven patients (M:F = 8:3) completed the DCD protocol (Table 1). Two patients were in Maastricht category IV. Brainstem testing could not be performed in one patient because the patient was in a state of cardiovascular collapse. Milligram rather than microgram quantities of isotopes were required to maintain a systolic blood pressure of 70 mmHg. While BSD had been diagnosed in the second patient, cardiac arrest ensued despite aggressive resuscitation. Both patients subsequently donated organs. Nine patients were in Maastricht category III. Two of these nine patients did not die within the ninety minute period following the withdrawal of life sustaining therapies and subsequently donated organs (82%).

Recipient

Each organ for transplant was biopsied and placed on the hypothermic machine perfusion (HMP) circuit to determine flow and resistance indices. Each of the eighteen kidneys were transplanted into seventeen patients (M:F = 11:6) (Table 2). One patient had a nephron-dosing transplant, i.e. both donor kidneys were transplanted into a single recipient.
Transplantation was unsuccessful in one patient, biopsy data suggested a recurrence of the patients primary condition focal asemtal glomerulosclerosis. The patient did not respond to plasmapheresis and a transplant nephrectomy was performed. A second patient had prolonged delayed graft dysfunction (DGF), while biopsy data and nuclear imaging studies were satisfactory, doppler studies demonstrated renal arterial stenosis. This patients renal function deteriorated rapidly and creatinine levels increased to 800 micromoles liter-1. Five patients had immediate graft function and did not require post-transplant dialysis. The other ten patients required 32 post-transplant dialysis sessions in total, before all were free from dialysis. This equates to a DGF rate of 70%. As expected, creatinine levels continued to decrease following hospital discharge to a plateau value between 70 and 90 days post transplantation.

Discussion

This case series of eleven contains two patients in the Maastricht IV category. In the patient who did not arrest, BSD could not be ruled out because the patient exhibited movements on stimulation and an EEG suggestive of severe NIE. These patients spent four, six and six days respectively in hospital undergoing neurological evaluation before therapies were redirected to end of life care. The other six patients within the Maastricht III category suffered traumatic brain injury (TBI) or subarachnoid haemorrhage (SAH), but did not progress to brain death. Radiological imaging of each patient was consistent with devastating injury. Two patients had herniation of brain tissue through a craniotomy. Two patients had fixed and dilated pupils for more than 48 hours. Again each patient was observed for a significant period following the injury: three patients for three days, one patient for four days, one patient for twelve days and one patient for fourteen days. Families require time with their loved ones, and while some may be supportive of organ donation, requesting additional time to determine if BSD will occur may be untenable. Families may wish for some degree of certainty in terminal events such as the timing of withdrawal of life supporting therapies.

Although our data demonstrate that outcomes from recipients are very good, we observed a significant incidence of DGF. DGF is defined as the need for dialysis within the first seven days post transplantation. Though the rate of DGF in the current study is high, the occurrence of DGF does not adversely affect the longer-term viability of these kidneys. An average of 2 post transplant dialysis treatments per patient was required, and length of hospital stay increased by 4 days. Recent guidelines from the UK suggest that renal transplant outcomes are satisfactory when the warm ischaemic time (WIT) is increased to 120 minutes and up to 240 minutes in specific conditions. Traditionally, an allowable WIT should be no more than 30 minutes for liver and pancreas retrieval and 60 minutes for lungs. The lungs are unique in their ability to withstand the deleterious effects of the WIT as oxygenation is accomplished by local gaseous diffusion.

DGF has not yet realised its full potential; the WIT is unlikely to change, but ischemia reperfusion injury may be reduced by minimising the cold ischaemic time. While transplant surgeons are reassured by the direct observation of the perfused organ in-vivo as occurs in donation after BSD, this opportunity is invariably lost in DCO. Other assessments have become available, such as macroscopic appearance, biopsy data and flow and resistance measurements on RMP can provide crucial information. Biochemical markers have been identified which correlate with adverse clinical outcomes and primary non-function in hepatic transplantation. By using these markers, inferior hepatic grafts may be discarded early. A number of normothermic ex-vivo oxygenation machines are undergoing trials at present, these afford the opportunity to observe urine production in kidneys, bile production in livers and to observe a restarted DCD heart. Ex-vivo normothermic lung perfusion is widely practised and supported by considerable evidence.

The General Medical Council (UK) state in their publication; Treatment and care towards the end of life - Guidance for doctors (2010) that “if a patient is close to death and their views cannot be determined you should be prepared to explore with those close to them whether they had expressed any views about organ or tissue donation”, and that “organ donation should be considered a part of end of life care and the possibility always considered.”

Careful planning will ensure the successful implementation of DCD in any hospital. The presence of a locally accepted policy governing the process, a period of staff education and a clear path of audit and governance are essential. In our hospital DCD has been incorporated into ongoing education, after event reviews allow staff the opportunity to voice their concerns. In this case have been the retrospective nature, small size and short follow-up period. In conclusion we present this case series of eleven organ donor patients, and of eighteen transplant recipients thanks to the generosity of these patients.

Correspondence: J O’Rourke
Department of Anaesthesia and Intensive Care Medicine, Beaumont Hospital, Beaumont, Dublin 9
Email: jandeands@gmail.com

References
10. Summers DM, Counter C, Johnson RJ, Murphy PG, Neuberger JM, Bradley JA. Is the increase in DCO donors in the United Kingdom contributing to a decline in DBD donors? Transplantation 2010; 90: 1506-1510

Organ Donation following the circulatory determination of death (DCD): An audit of donation and outcomes following DCD


