Sequential Transplant of Paired Kidneys Following Donation After Cardiac Death: Impact of Longer Cold Ischemia Time on the Second Kidney on Graft and Patient Outcome

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ABSTRACT

The United Kingdom has no national sharing scheme for kidneys received from donation after cardiac death (DCD). Therefore, both kidneys retrieved by a transplant team are implanted at a single unit, often sequentially. This study analyzes the impact of a prolonged cold ischaemia time on the second transplanted kidney and the effects on short-term and long-term outcomes in all our DCD renal implants from 2002 to 2009. Cold ischaemia time was significantly longer with the second kidney ($P = .04$) as was delayed graft function ($P = .02$). Acute rejection was increased in the first transplanted kidney ($P < .001$). Five-year patient survival was comparable between groups, but 5-year graft survival was higher in the second transplanted group ($P = .04$). The results confirm that, provided recipient centers are willing to accept higher initial rates of delayed graft function, it is acceptable to transplant DCD grafts sequentially without jeopardizing long-term graft or recipient outcome.

GRAFTS OBTAINED from donors after cardiac death (DCD) are inherently exposed to variable periods of potentially injurious warm ischemia. This, in combination with a period of cold ischemia, leads to increased rates of delayed graft function (DGF) and primary nonfunction (PNF) among DCD recipients. The United Kingdom has no national system for kidney sharing from DCD donors and DCD kidneys are often transplanted sequentially at recipient centers. Hence, relative to the first kidney, the second of the pair has an extended cold ischemia time (CIT). Prolonged CIT is known to increase rates of DGF[1] and may also reduce graft survival rates.[2-5] This study clarifies the impact of prolonged CIT in second kidneys in a series of sequential DCD transplants from a single center.

METHODS

A retrospective study of all DCD renal transplants between 2002 and 2009 at a single center was performed. This unit's policy for DCD donation involves identification of potential donors from intensive care units in the region in patients for whom further treatment has been deemed futile. These patients are reviewed by the regional transplant coordinators and consent for organ donation is obtained. Once the retrieval team is on site, supportive treatment is withdrawn. This unit's policy is to wait a maximum of 90 minutes for asystole to occur. When asystole occurs there is a stand-off period of 10 minutes before commencement of retrieval. Aortic perfusion is performed using University of Wisconsin solution in multiorgan retrieval and using Marshall's solution in a kidney-only retrieval.

All donors were characterized Maastricht category 3. Immunosuppressive regimes were consistent throughout the DCD program with monoclonal antibody and methylprednisolone at induction and tacrolimus and mycophenolate mofetil as maintenance.

Kidneys obtained from the same donor were compared according to the order they were transplanted (first versus second). Rates of DGF, PNF, biopsy proven acute rejection (AR), and graft and patient survivals were compared. Categorical data were compared using chi-squared or Fisher exact tests; paired longitudinal data were compared using a paired Student t test. All tests showed a 5% level of statistical significance.

RESULTS

In the 7-year study period, 201 kidneys from DCD donors were transplanted. Six paired kidneys were transplanted concurrently and 21 were either imported from outside our retrieval zone, implanted as dual grafts, en bloc

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Table 1. Donor and Patient Demographics

Variable	1st Kidney	2nd Kidney	P Value
Donor age (yrs)	42.5	42.5	1
Donor gender			
Male	54	54	1
Female	36	36	
Donor cause of death:			
Cerebrovascular accident	42	42	1
Trauma	21	21	
Other	27	27	
Recipient Age (y)	47.7	49.6	.385
Recipient gender			
Male	61	59	.752
Female	29	31	
Retransplant?			
Yes	7	9	.500
No	83	81	
Mean HLA mismatches	3.3	3.3	.901

grafts, or not used because of damage or poor perfusion. The remaining 84 paired kidneys were transplanted sequentially and were included in the analysis (Tables 1 and 2). First transplanted kidneys had significantly shorter CIT compared to second transplanted grafts. The groups had comparable implantation warm ischemia times. PNF rates were comparable between first and second transplanted kidneys. Rates of DGF were highest among the grafts transplanted second. Rates of AR were highest among the first transplanted kidneys. Five-year recipient survival (92% versus 90%; chi-square = 0.07; $P = .3$) was comparable regardless of the order of transplantation (Fig 1). Graft (74% versus 89%; chi-square = 0.06; $P = .04$) survival rates were higher among the cohort of second kidneys (Fig 2).

CONCLUSIONS

Concurrent with the findings of previous studies,[2,4,5] sequential transplantation of paired kidneys from DCD donors results in higher rates of DGF in kidneys transplanted second, however, this does not appear to be deleterious to long-term graft or recipient survivals. Surprisingly, kidneys transplanted first had higher rates of AR despite a decreased incidence of DGF. This may be due to the numbers of patients involved in this study, and significance may not have been a factor with larger

Table 2. Donor Variables and Graft Outcomes

Variable	1st Kidney	2nd Kidney	P Value
Cold ischaemia time	13 h 41 min	17 h 45 min	.04
Warm ischaemia time	32 min	32 min	.07
DGF	47%	62%	.02
AR	22%	12%	<.001
PNF	1%	3%	.08

Abbreviations: DGF, delayed graft function; AR, acute rejection; PNF, primary nonfunction.

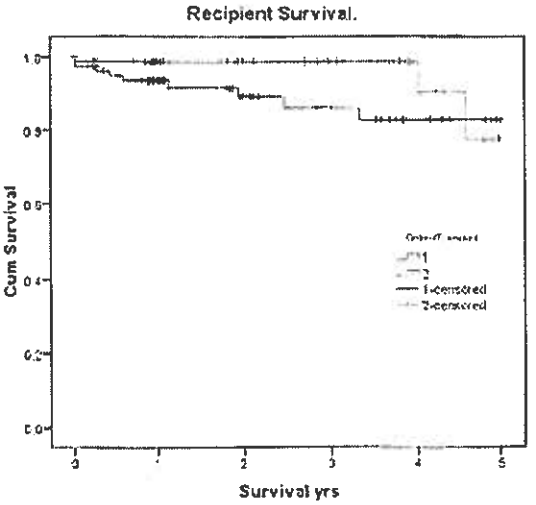

Fig 1. Recipient survival between recipients of first and second kidneys.

numbers of patients. Alternatively, there may be a protective process in DCD donors of DGF on the incidence of AR.

This study confirms that it is acceptable to transplant DCD grafts sequentially without jeopardizing long-term graft or recipient outcomes, provided recipient centers are willing to accept higher initial rates of DGF.

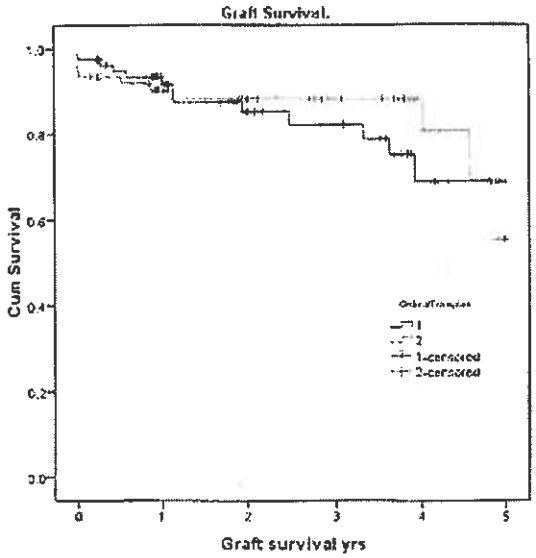

Fig 2. Graft survival between recipients of first and second kidneys.

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