



Outcomes Following Renal Transplantation After Multiorgan Retrieval Versus Kidney-Only Retrieval in Donation After Cardiac Death Donors

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ABSTRACT

With the increase of donation after cardiac death (DCD) now including procurements for not only kidney but also liver, pancreas, and lung transplantations, we analyze whether multiorgan DCD retrievals have a negative impact on immediate and short-term renal transplant outcomes due to increased length of time of explantation of the kidney from the donor and the associated risks of re-warming. We performed a retrospective study of all DCD donors from 2002 to 2009 at a single unit. Immediate and short-term outcomes between kidney-only versus multiorgan retrieval were compared. Cold ischaemia was significant between the two groups ($P = .04$), but all other variables were nonsignificant. The results show that immediate graft function, rates of acute rejection and graft/recipient survival are comparable when DCD allografts are procured from both multiorgan and kidney-only donors. The comparable outcomes from kidney-only and multiorgan donations in this study may be due to by the highly selective use of donors for multiorgan DCD donation. This selectivity may explain the “better” quality of kidney for these cases in which patients were able to tolerate potentially injurious rewarming.

DONATION after cardiac death (DCD) is the mode of procurement in one third of all renal transplants in the United Kingdom.¹ In recent years, DCD donation has expanded from renal procurement alone to other organs such as liver, lung, and pancreas. During procurement, the kidneys are the last organs to be removed from the donor cadaver and, after multiorgan procurement, the delay in explanting the kidneys can lead to rewarming of the kidneys. This study compares the outcomes of renal transplantation after kidney-only and multiorgan DCD procurements.

MATERIALS

A retrospective study from 2002 to 2009 examined the outcomes of DCD donations performed by the St James University Hospital organ retrieval team. This unit's policy for DCD donation involves identification of potential donors from intensive care units in the region in 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 Once the retrieval team is on site, supportive treatment is withdrawn.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. Retrieval proceeds using the super rapid technique.² Aortic perfusion is performed using University of Wisconsin

solution in multiorgan retrieval and using Marshall's solution in a kidney-only retrieval. Information regarding donor and recipient demographics is in Table 1.

All donors were characterized Maastricht category 3 and immunosuppressive regimes were standard throughout the unit's DCD program. Induction was performed with monoclonal antibody and methylprednisolone, with maintenance immunosuppression consisting of calcineurin inhibitor (tacrolimus) and mycophenolate mofetil.

The outcomes of renal transplants performed from kidney-only and multiorgan DCD donors were compared. Rates of delayed graft function (DGF), primary nonfunction (PNF), biopsy-proven acute rejection (AR), and 1-year graft and patient survivals were studied. Categorical data were compared using the chi-square or Fisher exact test; longitudinal data were compared using a Student *t* test. All tests showed a 5% level of statistical significance.

RESULTS

Sixty-eight DCD donations involved procurement of the kidneys alone and 56 involved multiorgan procurement. Donor or recipient information was not available in all

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Table 1. Donor and Recipient Demographics

Variable	Kidney Only	Multivisceral	P Value
Donor age (yrs)	49.7	36.2	.0001
Donor gender			
Male	46	62	.520
Female	38	36	
Donor cause of death			
CVA	40	48	.139
Trauma	14	26	
Other	30	24	
Donor eGFR (mL/min)	93.7	118.3	.0001
Recipient age (y)	51.0	45.7	.019
Recipient gender			
Male	63	58	.024
Female	21	40	
Recipient dialysis type			
Predialysis	6	1	.105
Peritoneal	27	32	
Haemodialysis	51	65	
Retransplant?			
Yes	3	12	.034
No	81	86	
Mean HLA mismatches	3.3	3.3	.933

Abbreviations: CVA, cerebrovascular accident; eGFR, estimated glomerular filtration rate.

cases. These cases with insufficient information were excluded from further analysis. One hundred eighty-two DCD procured renal allografts were available for full analysis (Table 1). In kidney-only cases, retrieval donors were significantly older and had a lower eGFR. Recipients from this group were more likely to be older males.

Cold ischaemia time was significantly prolonged among the multiorgan donation cohort. All other outcomes were comparable between the two groups (Table 2). There was no significant difference in 1-year graft or recipient survival (Figs 1 and 2).

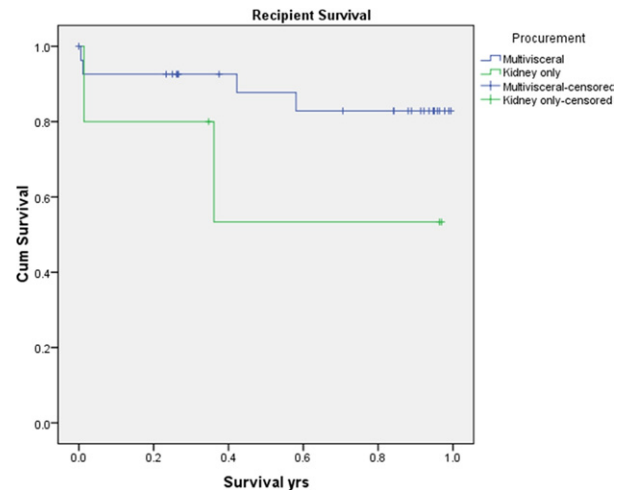
CONCLUSIONS

This study shows that immediate graft function, rates of AR, and graft/recipient survival are comparable when DCD

Table 2. Cold Ischaemia Time and Immediate Graft Outcomes in Kidney-Only and Multiorgan Groups

Variable	Kidney Only	Multiorgan	P Value
Cold ischaemia time	14 hours 55 min	16 hours 11 min	.04
DGF	50%	55%	.56
AR	20%	18%	.81
PNF	5%	6%	.88
1-y graft survival	85%	86%	.79
1-y recipient survival	86%	90%	.52

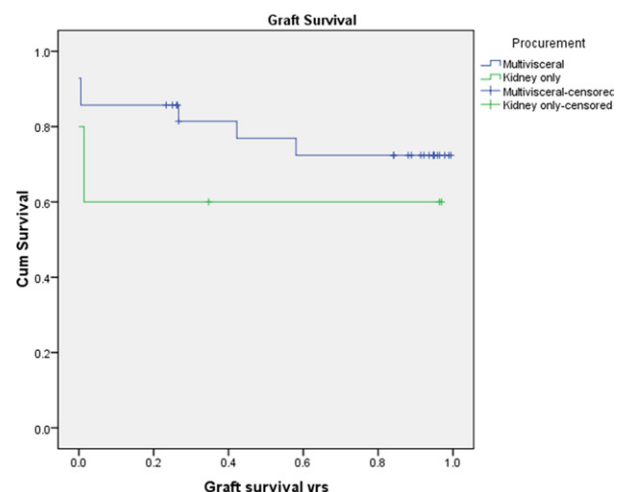
Abbreviations: DGF, delayed graft function; AR, acute rejection; PNF, primary nonfunction.

**Fig 1.** Recipient survival among Kidney-only and multiorgan groups.

allografts are procured from multiorgan and kidney-only donors regardless of donor age, eGFR, and recipient gender and age.

Compared to kidney-only retrieval, multiorgan procurement is a more prolonged surgical procedure which can require rewarming of the kidneys before explantation. This is a further potentially injurious factor that may be detrimental to the outcome of DCD renal transplantation.³⁻⁵ A recent study of brain stem dead donors showed increased rates of delayed graft function among recipients of grafts with prolonged explant times.⁶

The comparable outcomes from kidney-only and multiorgan donations encountered in this study may be due to the highly selective use of donors for multiorgan DCD donation. Grafts such as the liver, lung, and pancreas are exquisitely sensitive to ischemia and mandate that only the most optimal DCD donors are considered for multiorgan

**Fig 2.** Graft survival among kidney-only and multiorgan groups.

procurement. As shown in this study, kidneys from multi-organ retrievals are statistically younger with a higher baseline eGFR. Putatively the kidneys of such donors have considerable physiological reserve and are better able to tolerate rewarming and graft injury. Consequently, they show equivalent characteristics of graft function and survival to those procured from kidney-only donors without rewarming injury.

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