

## SPECIAL SECTION

### LIVER TRANSPLANTS FROM DONORS AFTER CARDIAC DEATH

MS GLENDA BALDERSON, PROFESSOR JONATHAN FAWCETT,  
PROFESSOR STEPHEN LYNCH

AUSTRALIA AND NEW ZEALAND LIVER TRANSPLANT REGISTRY

Liver transplantation is the only treatment for end stage liver disease and the results are excellent. However there is a continuing disparity between the number of potential recipients and available donor organs for transplantation. Deaths on the waiting list are consistently near 10%. Surgical techniques such as the use of reduced-size grafts, split liver grafts and living donation have been used, where appropriate, to address this shortage. Another potential source is the use of extended criteria donors and, in particular, organs donated after cardiac death (DCD) which has undergone a renaissance in the past decade.

Early results from the use of DCD grafts were associated with poor outcomes mostly caused by ischaemic injury of the biliary tree leading to long term ischaemic cholangiopathy. The development and application of appropriate guidelines for controlled DCD (age < 50 years, first warm ischaemia time 20-30 minutes and projected cold ischaemia time of approximately six hours) for liver grafts have resulted in more recent reports of improved results comparable with results obtained for grafts donated from beating heart donors (DBD).

The number of DCD donors in Australia has increased steadily since 2005 as shown in Figure 69, however this has not been matched by a similar rise in the number of liver grafts transplanted from this donor source. The first DCD liver graft was transplanted in 2006 and since then 39 DCD liver grafts have been transplanted.

The outcomes of these DCD liver grafts is reported here compared with the outcome of contemporaneous liver grafts from DBD donors.

Figure 69

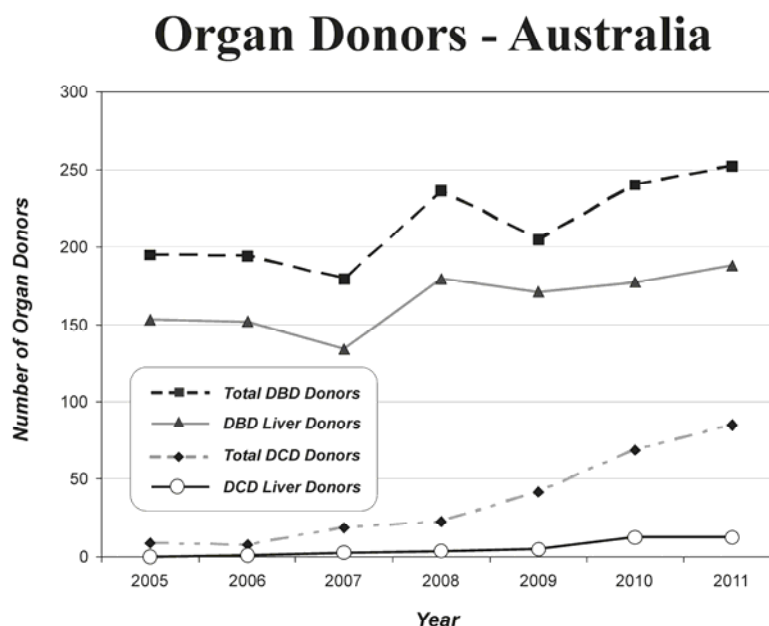


Figure 70 details the characteristics of the deceased donors since 2006 comparing donors after brain death (DBD, n=1249) with donors after cardiac death (DCD, n=39). The DCD donors were significantly younger than the DBD donors ( $p<0.001$ ). DCD donors were more likely to have died from hypoxia/anoxia and road trauma and less likely to have died from a stroke (15% vs 51%).

Figure 70

Donor Characteristics		
	DBD Donors	DCD Donors
Age - mean $\pm$ SD	42.2 $\pm$ 17.6	32.8 $\pm$ 12.2
- median (range)	43.2y (0.6 - 84y)	30.7y (13.7 - 58.2y)
Gender	54% Male	64% Male
Cause of Death		
- Stroke	51%	15%
- Road Trauma	16%	36%
- Other Trauma	11%	4%
- Hypoxia/Anoxia	19%	46%
- Cerebral Tumour	1%	-
- Other	2%	-

Recipient characteristics are outlined in Figure 71. Age at transplant in adult recipients was significantly older in the DCD group ( $p=0.044$ ). One DCD graft was used for a re-transplant, the rest being primary grafts. Only two children have received an organ from a DCD donor, one of whom had been listed urgently after primary non function (PNF) of their first DBD donor graft.

DCD donor grafts were transplanted as reduced-size grafts for the two paediatric recipients. In the DBD group, 14% received a split liver graft and 3% a reduced-size graft. Two patients (3%) with acute liver failure (one adult, one child) received a DCD graft compared with 12% of patients receiving DBD grafts.

Re-transplantation of failed grafts from all causes was similar in both groups. Fourteen patients with PNF who had received a DBD donor graft were all re-transplanted. There were two DCD donor grafts with PNF. One was re-transplanted urgently with a DBD donor graft and the other patient died before a liver graft became available.

Figure 71

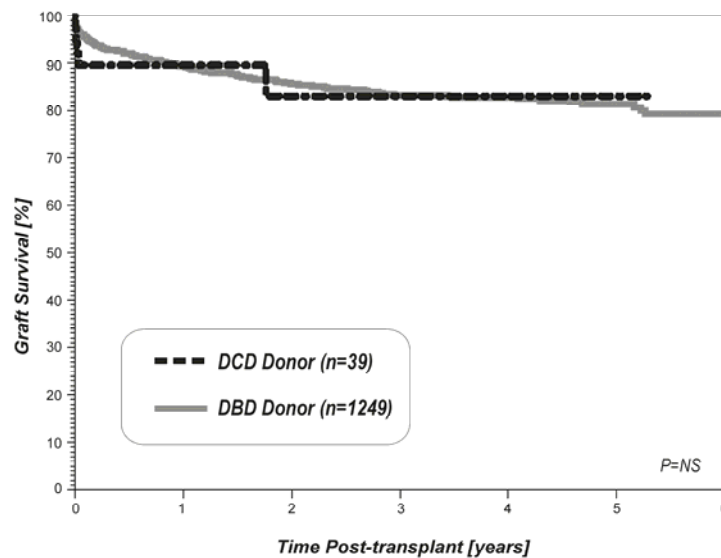
Recipient Characteristics		
	DBD Donor (n=1249)	DCD Donor (n=39)
Age - Adults	n = 1075	n = 37
- Mean $\pm$ SD	50 $\pm$ 16y	53.7 $\pm$ 9.1
- Median (Range)	52.6y (16-69.9y)	55.6 (16.8 - 67.7y)
Age - Children	n= 174	n= 2
- Mean $\pm$ SD	5.1y $\pm$ 4.8y	4.7y, 9.5y
- Median (Range)	2.8y (6w - 15.8y)	
Gender	65% Male	92% Male
Graft Number - 1	92%	97%
- 2	7%	3%
- 3	1%	-
Graft Type - Whole Liver	83%	95%
- Split liver	14%	-
- Reduced graft	3%	5%
Acute Liver Failure	12%	5%
Re-transplantation rate	4%	3%
Primary Non-Function (PNF)	14	2

Both patient and graft survival were excellent and similar in both groups.

Figure 72

	Patient Survival (%)		Graft Survival (%)	
	DBD	DCD	DBD	DCD
1 year	93%	95%	89%	89%
3 year	87%	88%	83%	83%
5 year	85%	88%	81%	83%

Figure 73



Long term morbidity data particularly relating to complications involving the biliary tree will be needed to fully evaluate the outcomes of the grafts transplanted from DCD donors. A pilot project is currently underway but data are not yet available .

Overall, the early results of the use of liver grafts from DCD donors are encouraging. A relatively small number of DCD donors fulfil the guidelines currently applied for the use of liver grafts for transplantation but as confidence grows in the use of these organs in the future, efforts to procure and use them will be increased - by expanding the number of donor hospitals willing to undertake this demanding procedure and transplanting these grafts into a wider range of recipients. This would provide an additional source of donor organs to address the increasing demand for liver transplantation.