

Donation after Cardiac Death: An End of Life Option for Patients and Families

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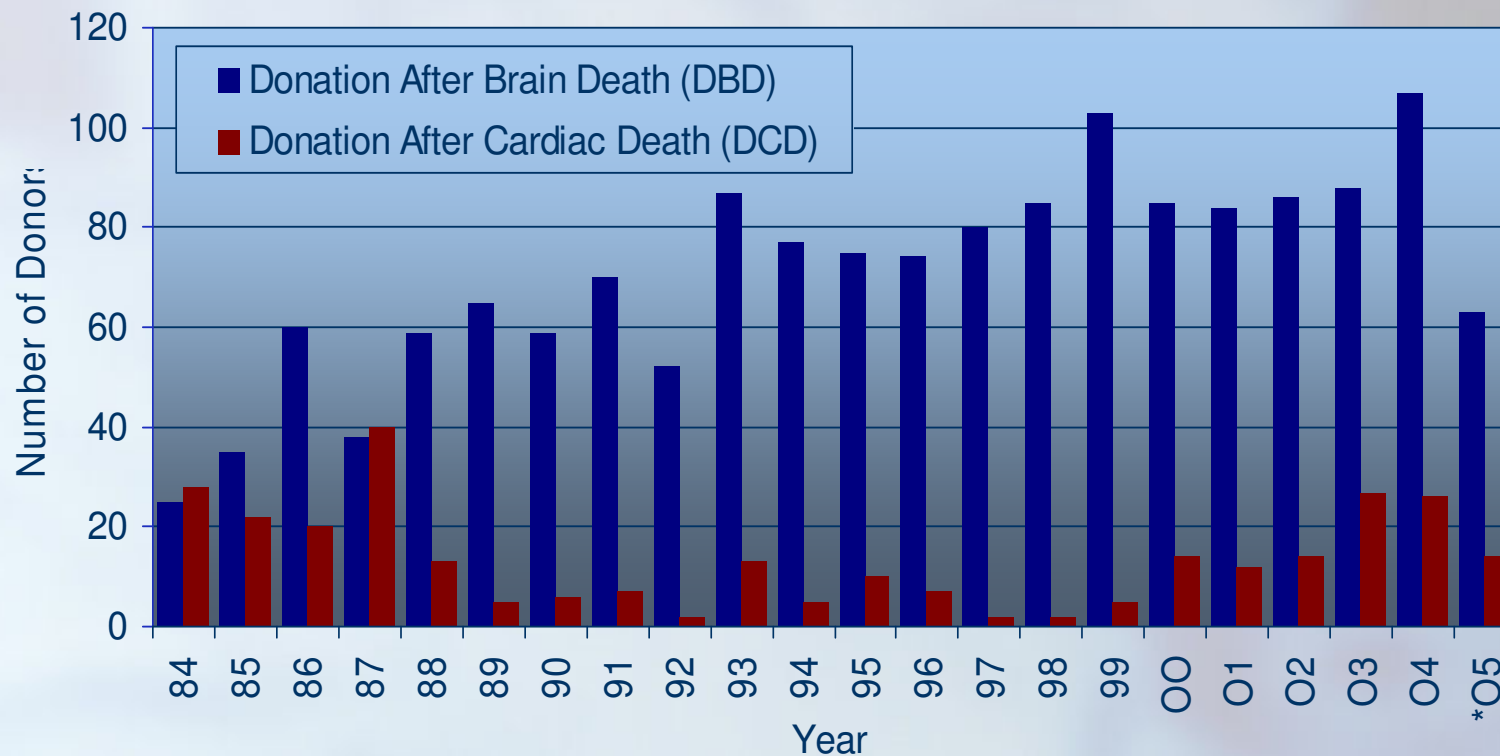
Department of Surgery

Division of Transplantation





Donation After Brain and Cardiac Death: University of Wisconsin Experience

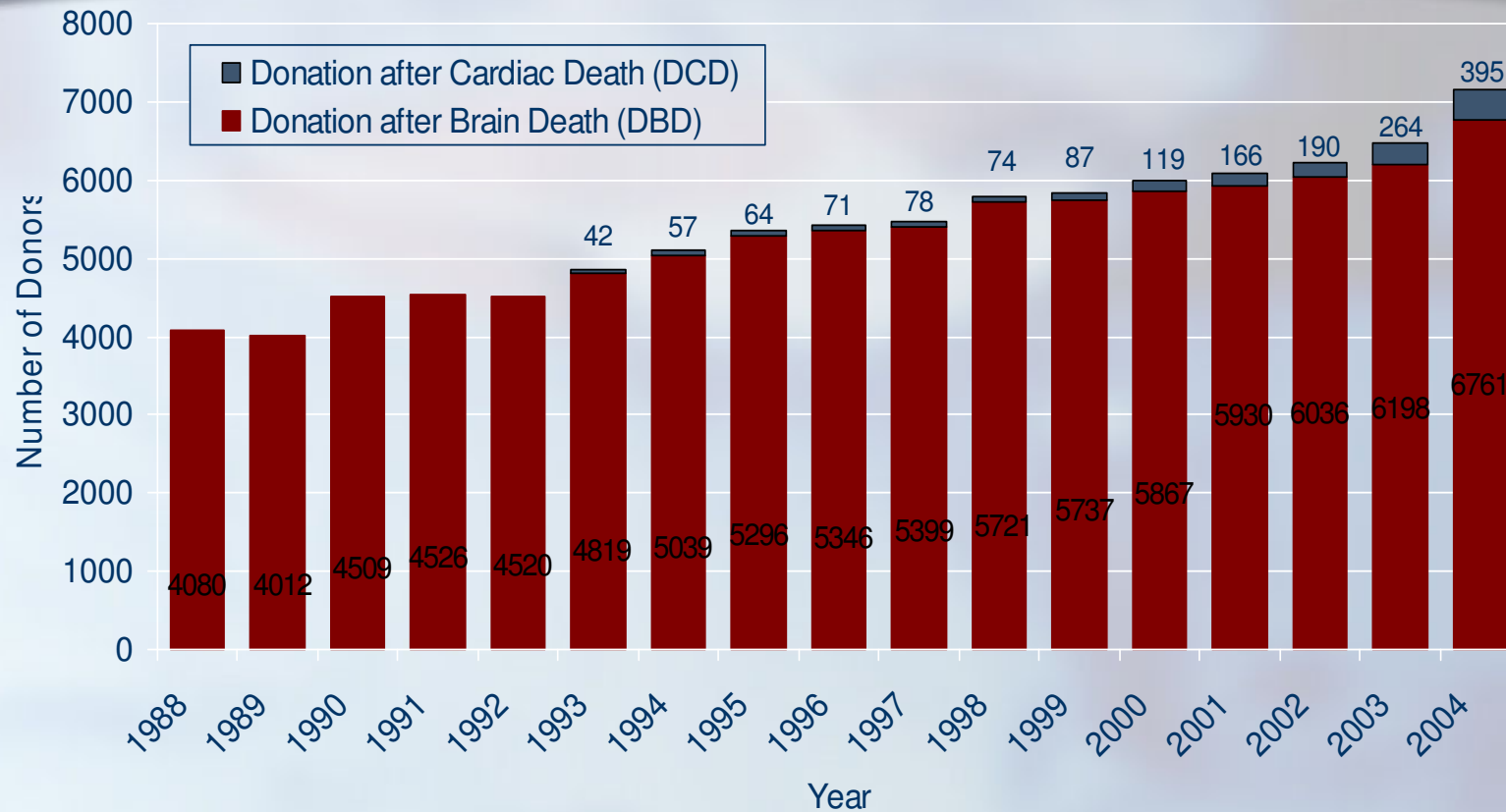


* As of 8-9-05



Deceased Organ Donors

DCD and DBD



UNOS data through 12/31/04



OPO Performance 2003-2004

DCD Donors

	2003	2004
OPO's without DCD donors	27	16
OPO's with at least 1 DCD donor	32	42
OPO's with > 5 DCD donors	12	20
Total number of DCD donors	264(4.1%)	395(5.5%)





Organ Transplant Breakthrough Collaborative Goals

Organs Transplanted per Donor

Standard Criteria Donors:	4.3
DCD Donors:	2.75
ECD Donors:	2.5
Total:	3.75

At Least 10% of Donors Are DCD





OPO Performance 2004

DCD Donors

■ Gift of Life	47(12.1%)	■ Finger Lakes	11(20.8%)
■ NEOB	38(19.5%)	■ TRC	10(9.9%)
■ Gift of Hope	36(12.1%)	■ Mid America	8(7.1%)
■ Life Center	33(19.0%)	■ LOPA	8(5.0%)
■ Midwest	28(18.2%)	■ Carolina	7(5.1%)
■ UW	27(20.3%)	■ Golden State	7(15.2%)
■ Lifquest	18(16.7%)	■ One Legacy	7(2.0%)
■ Michigan	14(5.1%)	■ Iowa	6(15.4%)
■ Core	14(9.3%)	■ New Jersey	6(3.85)
■ Washington	12(10.0%)	■ New York	6(2.3%)



Impact of DCD upon DBD

- 16 DSAs accounting for 80% of DCD donation in 2004 increased DCD, SCD, and ECD donor recovery from 2003 to 2004:
 - 49.3% increase for DCD
 - 9.4% increase for SCD
 - 3.8% increase for ECD
 - Donation rate increased from 50% to 53.9%
- In 2004, non-DCD recovery positively associated with DCD recovery among the 59 DSAs.





Who are the Candidates?

- Patients with severe neurological injury
 - Intracranial hemorrhage, stroke, anoxia, trauma
- Patients without neurological injury
 - Degenerative neuromuscular diseases
 - End-stage cardiopulmonary diseases
- Do not meet the criteria for brain death
- No chance for survival off the ventilator
- Family and physician elect to withdraw support





Development of the University of Wisconsin Donation After Cardiac Death Evaluation Tool

Lewis J, Peltier J, Nelson H, et al.

Progress in Transplantation 2003;13:265-73





UW Donation After Cardiac Death (DCD) Evaluation Tool

Criteria	Assigned Points	Pt. Score
<i>Spontaneous Respirations after 10 min.</i>	-	
Rate >12	1	
Rate <12	3	
TV >200 cc	1	
TV <200 cc	3	
NIF > 20	1	
NIF <20	3	
<i>No Spontaneous Respirations</i>	9	
<i>BMI</i>		
< 25	1	
25-29	2	
> 30	3	
<i>Vasopressors</i>		
No Vasopressors	1	
Single Vasopressor	2	
Multiple Vasopressors	3	
<i>Patient Age</i>		
0-30	1	
31-50	2	
51 +	3	
<i>Intubation</i>		
Endotracheal tube	3	
Tracheostomy	1	
<i>Oxygenation After 10 minutes</i>		
O2 Sat >90%	1	
O2 Sat 80-89%	2	
O2 Sat <79%	3	
Final Score		
Date of Extubation	Time of Extubation	
Date of Expiration	Time of Expiration	
Total Time		

Scoring

- 8-12 High Risk for continuing to breath after extubation
- 13-18 Moderate risk for continuing to breath after extubation
- 19-24 Low risk for continuing to breath after extubation



DCD Tool Accuracy 2003-2004

Score Driven

Proceed

53/56 (94.6%)

Rule-out

22/27 (81.5%)





Where Will Withdrawal of Support Occur?

- Operating Room
 - Family in attendance
 - Family not in attendance
- Intensive Care Unit





Who Will Declare Death?

- **Physicians**

- Primary physician, intensivist, on-call physician, resident, anesthesiologist

- **Nurses**





Medications and Pre-Withdrawal Procedures

- **Pre-Withdrawal Isolation/Cannulation**
 - Local anesthesia
 - Femoral artery and vein
- **Medications**
 - Heparin, Regitine
 - Analgesia

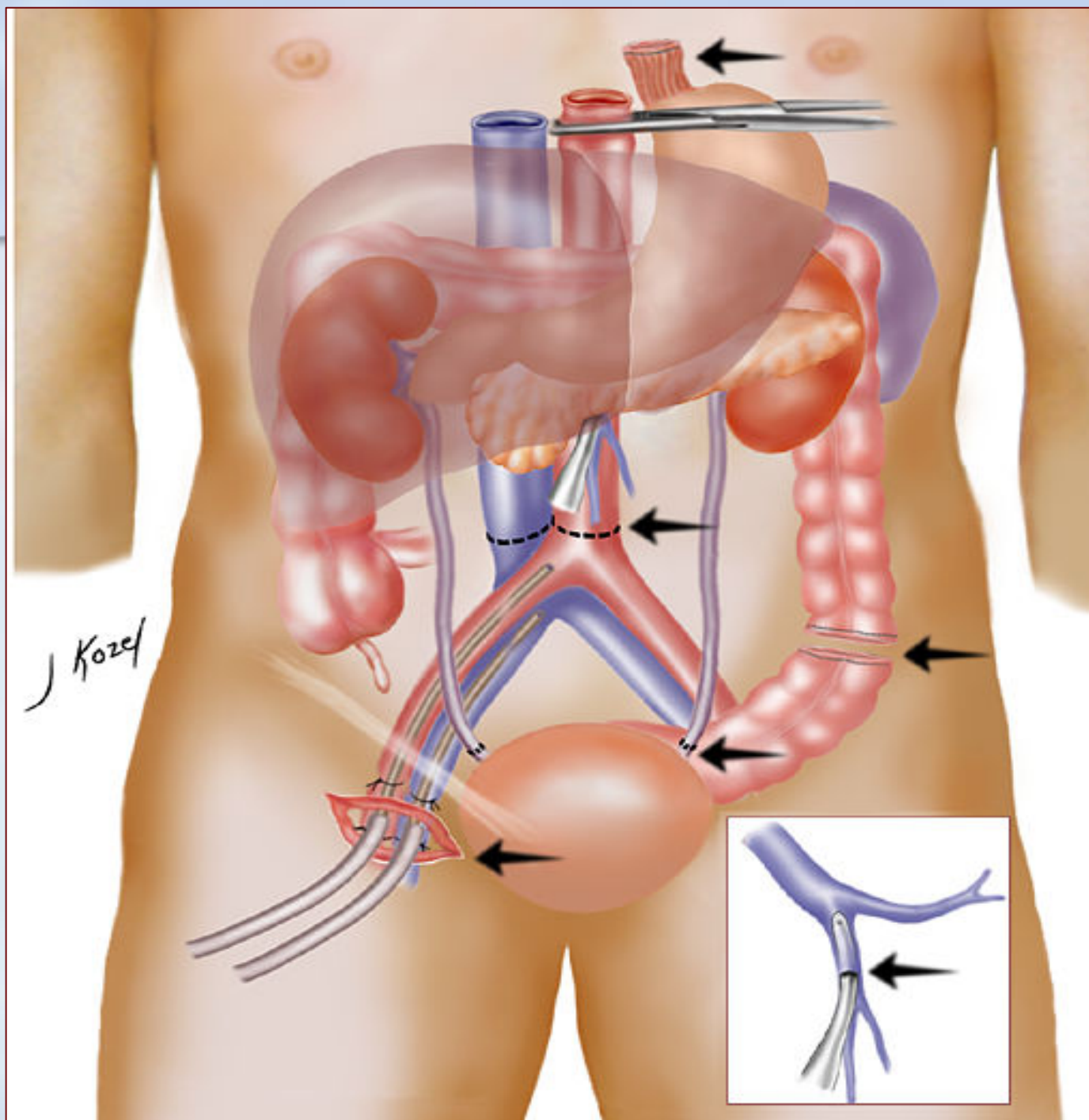




What Happens if the Patient Does Not Expire?

- Occurs in approximately 5-10% of cases
- Pre-donation discussion with family, physicians and nurses
- Patient transferred to pre-determined unit
- Treating team remains responsible for patient care





Donation After Cardiac Death: The University of Wisconsin Experience with Renal Transplantation



**Cooper JT, Chin L, Krieger NR, et. Al
American Journal of Transplantation 4: 1490-1494, 2004**



DCD Renal Transplantation

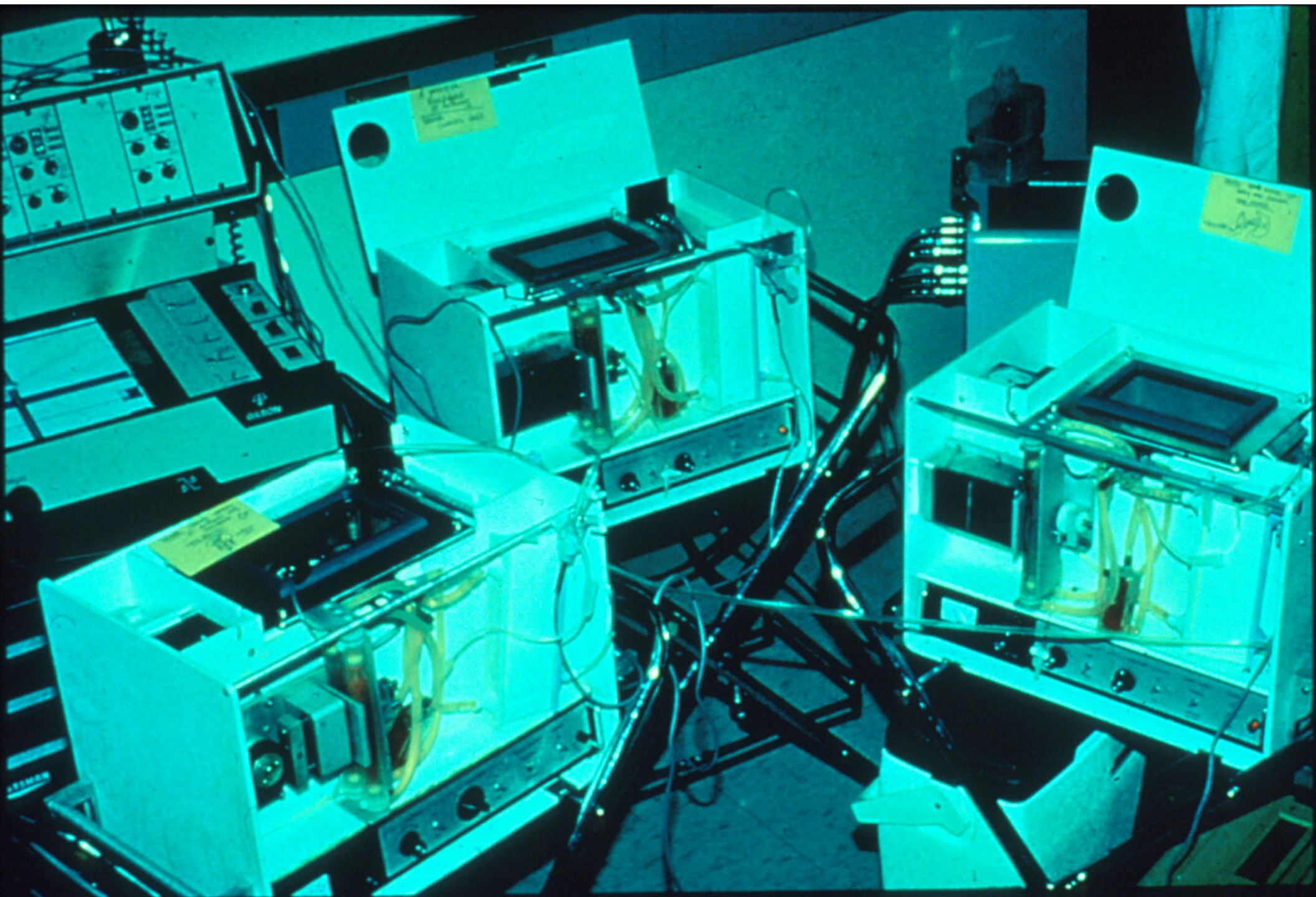
January 1984 – July 2000

1,471 Renal Transplants

382 DCD

1,089 DBD







DCD Renal Transplantation

Graft Function

	DCD	DBD	P-value
Delayed Graft Function	27.5%	21.3%	0.01
Primary nonfunction	1.1%	0.8%	0.34
Discharge creatinine (mg/dL)	1.9	1.7	0.001



DCD Renal Transplantation

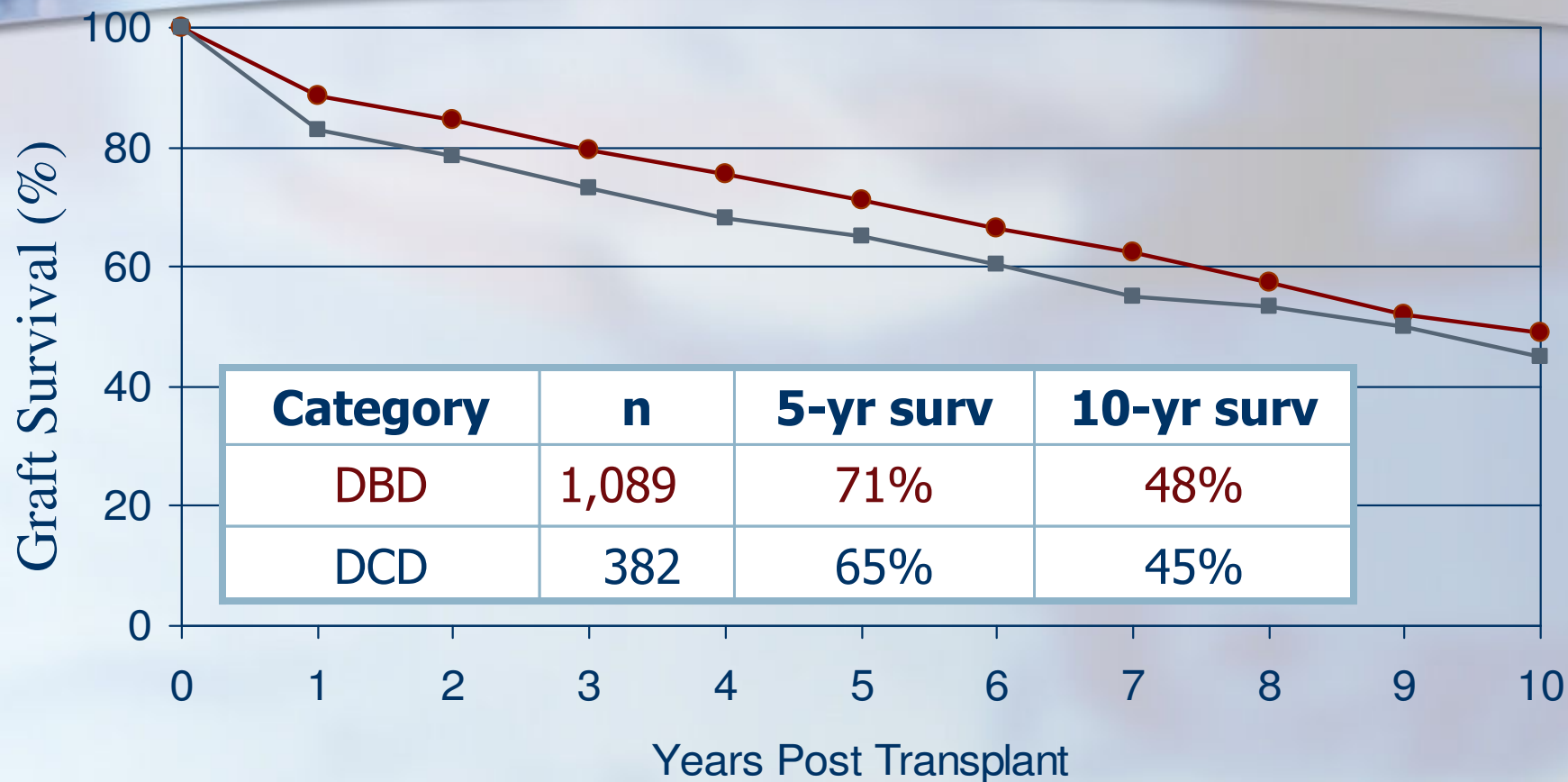
Complications

1/94-7/00

Complication	DCD	DBD	P-value
Rejection (%)	44.1	45.4	0.76
Ureteral (%)	5.9	9.3	0.50
Lymphocele (%)	8.8	9.1	0.90
Renal artery (%)	4.4	6.8	0.38

DCD Renal Transplantation

Graft Survival



$p=0.054$



Renal Transplantation Performed Using Non-Heart-Beating Donors: Going Back to the Future

Rudich SM, Kaplan B, Magee JC, et al.
Transplantation 2002; 74(12): 1715-1720

	CAD HB Donors	NHB Donors	Living Donors
N	97,990	708	34,531
Cold ischemic time (hr)	21.7	24.6	1.5
DGF (%)	23.3	42.4	5.5
Graft loss first month			
PNF (%)	7.5	18.4	2.5
Acute rejection (%)	21.7	13.2	14.3
Thrombosis (%)	16.0	10.5	16.8
6 yr PS (%)	77.8	80.9	88.8
6 yr GS* (%)	72.5	73.2	81.2



**Death censored*



Relative Rate of Graft Failure of DCD vs. non-DCD Kidney Transplants, 2000-2004

DCD Type	N	RR*	CI	p-value
Non-DCD	35,290	1.00	Ref	Ref
DCD	1,258	1.05	0.91,1.22	0.48

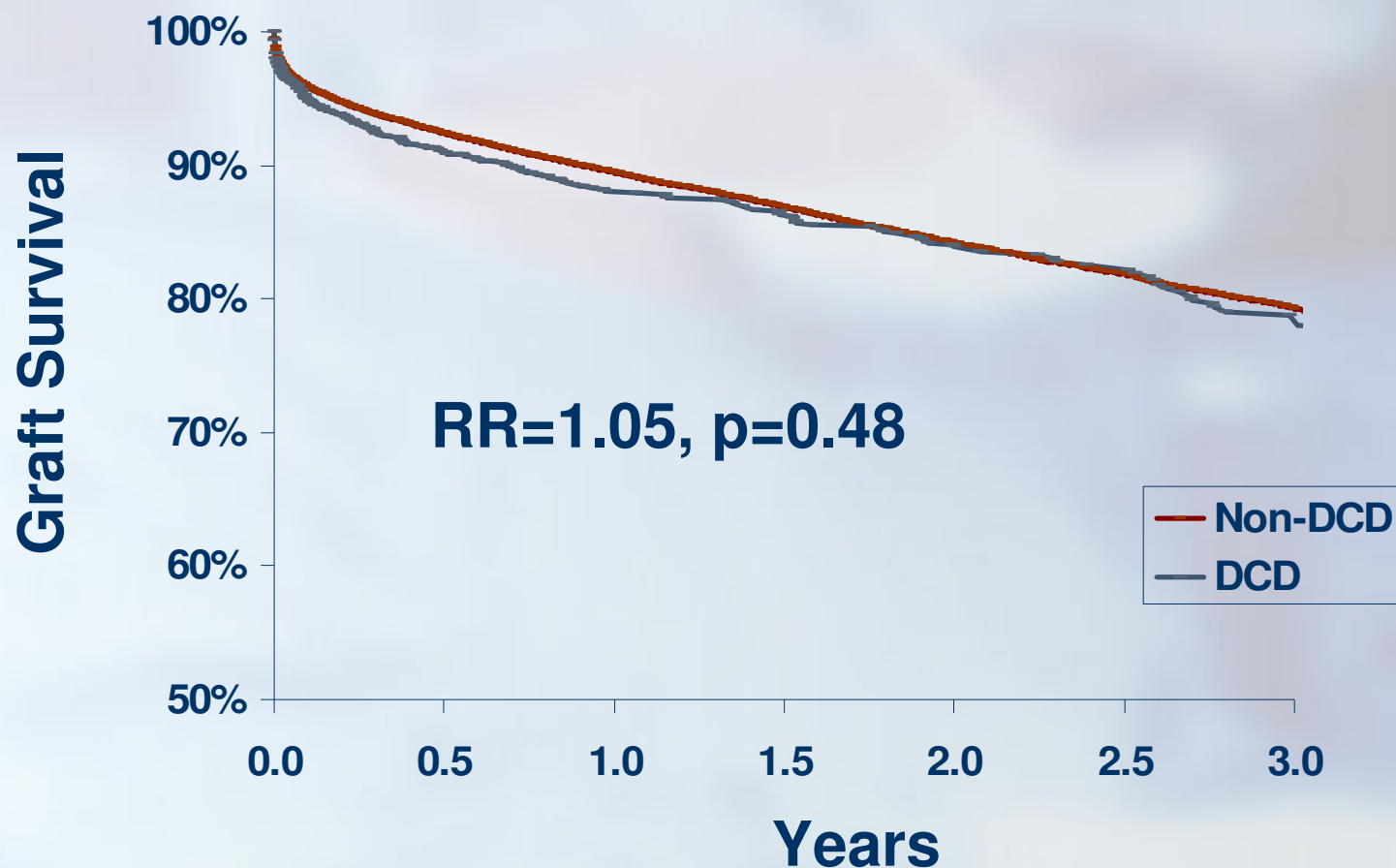
*Adjusted for recipient age, sex, race, PRA, ESRD cause, years of ESRD, HLA mismatch, year of transplant, previous transplant, transfusions and donor age, sex, race, hypertension, diabetes, cause of death, creatinine, cold ischemia time.

SRTR





Adjusted* Graft Survival for DCD vs. non-DCD Kidney Transplants, 2000-2004



SRTR

*Adjusted for recipient age, sex, race, PRA, ESRD cause, years of ESRD, HLA mismatch, year of transplant, previous transplant, transfusions and donor age, sex, race, hypertension, diabetes, cause of death, creatinine, cold ischemia time

Simultaneous Pancreas-Kidney (SPK)

Transplantation from DCD Donors

Annals of Surgery, in press 2005





SPK DCD Donation

Donor Characteristics

1/1/93-7/31/02

	DCD (n=31)	DBD (n=455)
Age (yr)	31.8	30.8
Gender (M:F)	1.6:1	1.5:1
Glucose (mg/dL)	169.5	191.6
Creatinine (mg/dL)	0.93	1.0
Warm ischemic time (min)	15.3	0.0*
Cold ischemic time (hr)		
Pancreas	15.9	15.7
Kidney	17.4	17.2



SPK DCD Donation

	DCD(n=31)	DBD(n=455)
Delayed graft function	25.8%	5.3%
Serum creatinine (mg/dL)		
Day 7	2.6±2.3	1.8±1.8*
Discharge	1.6±.8	1.4±.5**
Discharge Serum Glucose(mg%)	102±32	100±32
6-mo. Serum Glucose(mg%)	92±15	98±41
6-mo. HbA1c	5.5±.8	5.5±1.0



* $p=.001$

** $p=.03$



SPK DCD Transplantation

Postoperative Complications

Complication	DCD(n=31)	DBD(n=455)
Enteric conversion	33%	17%*
Enzyme leaks	3%	12%
Pancreatitis	16%	14%
UTI	65%	49%**
Ureteral strictures	6%	5%
Abdominal infections	3%	10%



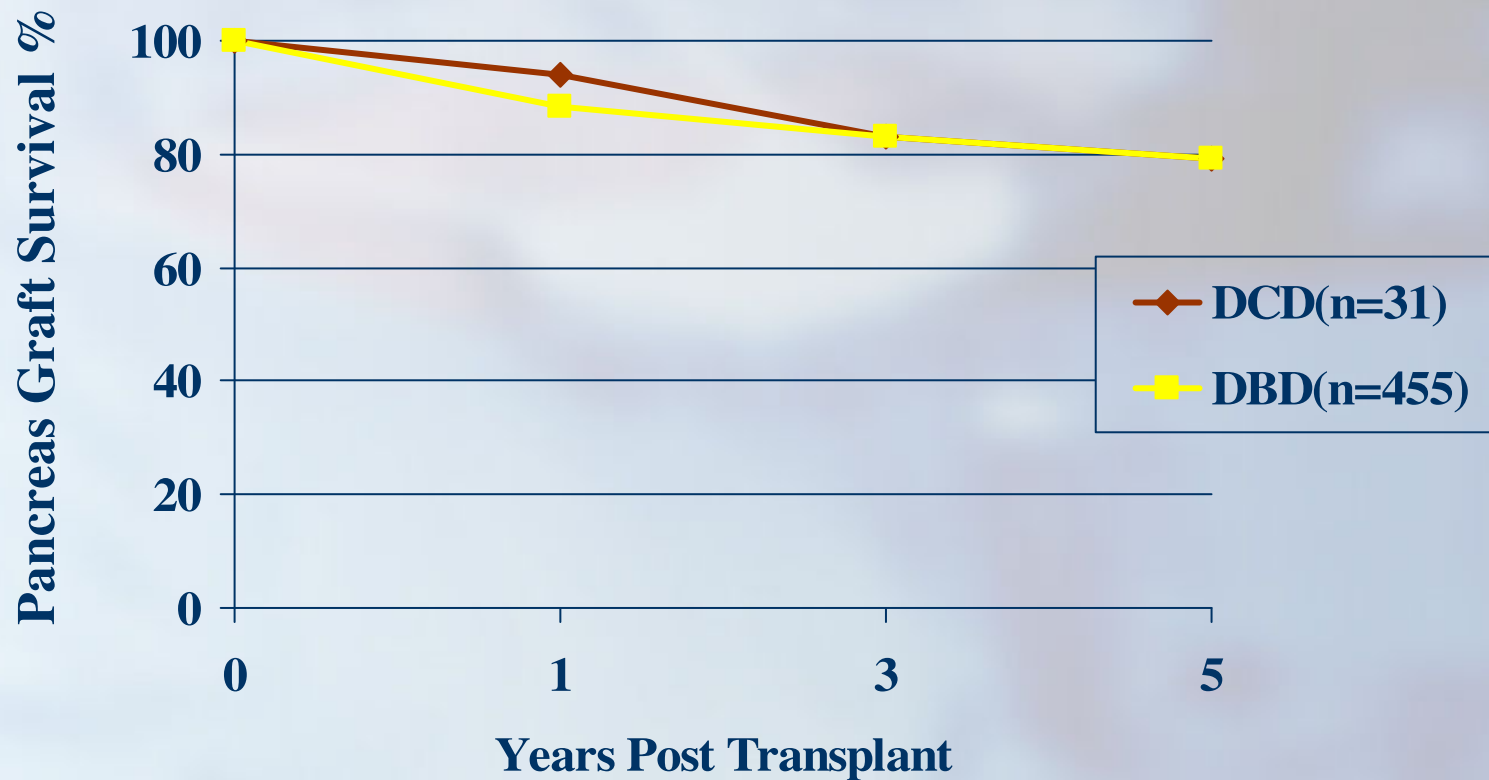
* $p=.02$

** $p=.01$



Pancreas Graft Survival

SPK DCD Transplantation

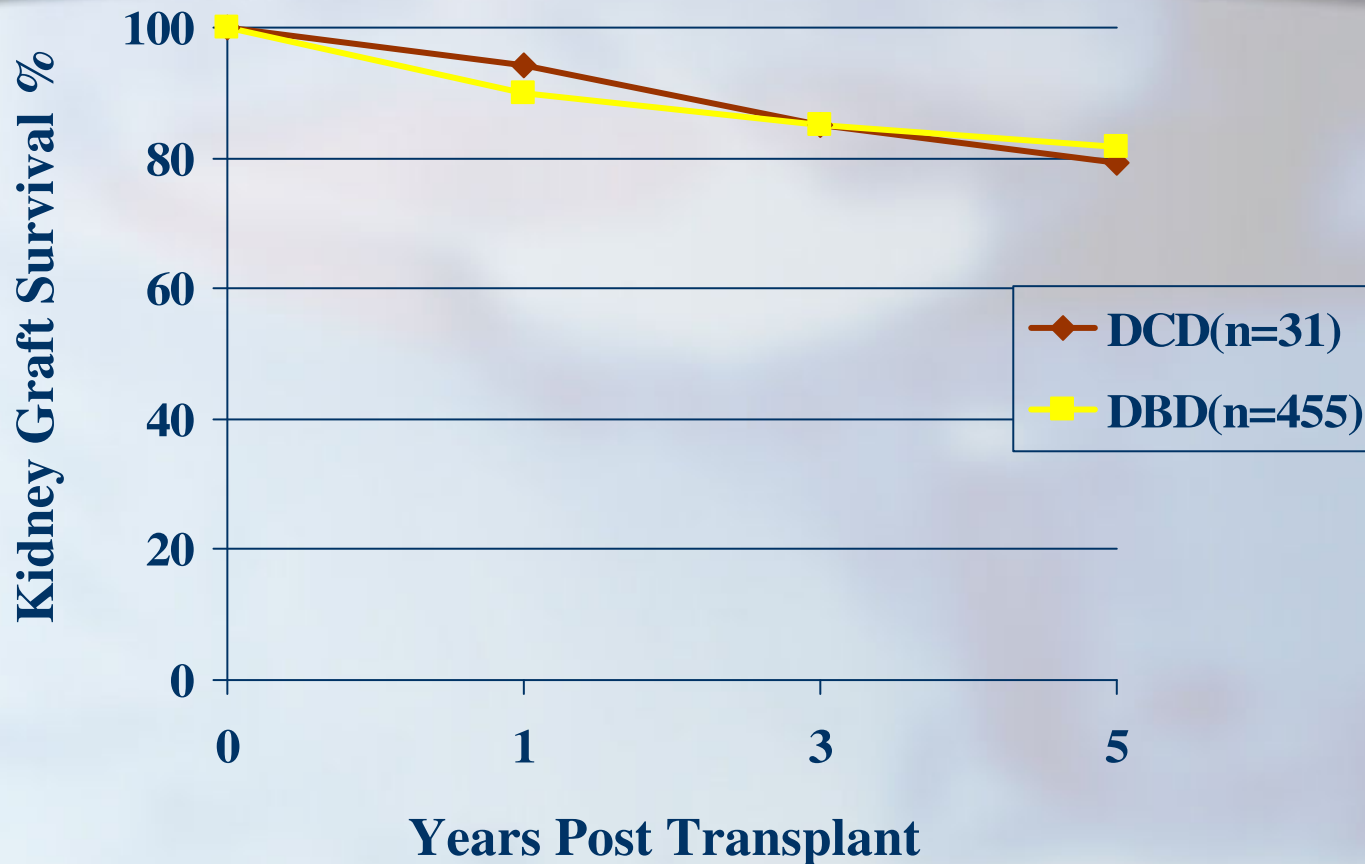


P= .5648



Kidney Graft Survival

SPK DCD Transplantation



P=.6549

Donation After Cardiac Death: The University of Wisconsin Experience with Liver Transplantation

Annals of Surgery, in press 2005





DCD Liver Transplantation

Study Period

(1/1/93 – 7/31/02)

930 Organ donors

81 (8.7%) DCD

849 (91.3%) DBD

47 Multi-organ

1 Pancreas
only

33 Kidney
only

553 (65.1%)
Liver transplants

36 (76.5%) Liver transplants

11 (23.4%) Livers not used





DCD Liver Transplantation

Donor Characteristics

	DCD (n=36)	DBD (n=553)
Age(yr)	35.1±14.9	33.4±16.6
Gender(M:F)	3.5:1	1.5:1*
Vasopressors,n(%)	12(33.3)	425(76.9)**
Warm ischemic time (min)	17.8	0.0**
Cold ischemic time (hr)	8.2	8.3



* $p=0.05$

** $p=0.0001$



DCD Liver Transplantation

Operative Time, Blood Products, and Length of Stay

	DCD(n=36)	DBD(n=553)
Operative time(hr)	8.6± 2.1	8.1± 2.2
Blood Products(u)		
PRBC	18.6± 12.4	14.9± 16.2*
FFP	43.0± 26.2	31.6± 23.6*
Platelets	27.7± 4.1	20.5± 20.8*
Length of stay	26.1± 41.4	22.3± 18.1*



DCD Liver Transplantation

Postoperative Laboratory Values

	Postoperative Day			
	1		3	
	DCD	DBD	DCD	DBD
AST (u/L)	1034±838*	736±1114	202±226	258±453
ALT (u/L)	688±522*	542±522	442±339	562±339
LDH (u/L)	871±715*	783±715	305±129	352±129
GGT (u/L)	158±112*	124±141	236±214*	179±191
ALP (u/L)	117±69	121±99	138±60	131±85
PT/INR (sec)	14.4±1.1 / 1.4±.21	15.3±2.4 / 1.4±.25	13.0±1.3 / 1.2±.12	13.8±3.3 / 1.2±.18

* $p < .001$





DCD Liver Transplantation

Postoperative Laboratory Values

	Postoperative Day 7		Discharge	
	DCD	DBD	DCD	DBD
AST (u/L)	53±32	96±310	46±40	37±34
ALT (u/L)	202±120	272±121	132±68	122±68
LDH (u/L)	251±79	272±79	201±56	192±56
GGT (u/L)	325±161*	276±225	447±380*	251±229
ALP (u/L)	156±63*	143±81	261±236*	119±131
PT/INR (sec)	13.3±1.4 / 1.2±.18	13.3±1.9 / 1.2±.21	12.9±1.7 / 1.14±.15	12.6±1.7 / 1.1±.34

* $p<0.001$



DCD Liver Transplantation Complications

Complication	DCD (n=36) n (%)	DBD (n=535) n (%)
Hepatic artery		
Thrombosis (HAT)	2 (5.5)	64 (11.8)
Stenosis (HAS)	6 (16.6)	30 (5.4)*
Portal vein		
Thrombosis (PVT)	1 (2.8)	18 (3.3)
Stenosis (PVS)	1 (2.8)	11 (2.0)
Primary nonfunction (PNF)	2 (5.5)	7 (1.3)
Hepatic abscess/biloma	6 (16.6)	46 (8.3)**
Ischemic-type biliary stricture (ITBS)	5 (13.8)	44 (8.0)

**p=0.001, **p=0.04.*



DCD Liver Transplantation

Etiology of Graft Loss

Etiology	n
Death with function	7
Death with poor function	3
Primary non-function	2
Hepatic artery thrombosis	2
Biliary strictures	2
Intrahepatic sepsis	1
Vanishing bile duct syndrome	1
Total	18



DCD Liver Transplantation

Retransplantation

	DCD (n=36) n (%)	DBD (n=553) n (%)
Retransplantation	7(19.4)	24(7.1)*
Indications(n)		
Primary-Non Function(PNF)	2	
Hepatic artery thrombosis(HAT)	1	
Celiac artery stenosis/bilomas	1	
Intrahepatic sepsis	1	
Vanishing bile duct syndrome(VBDS)	1	

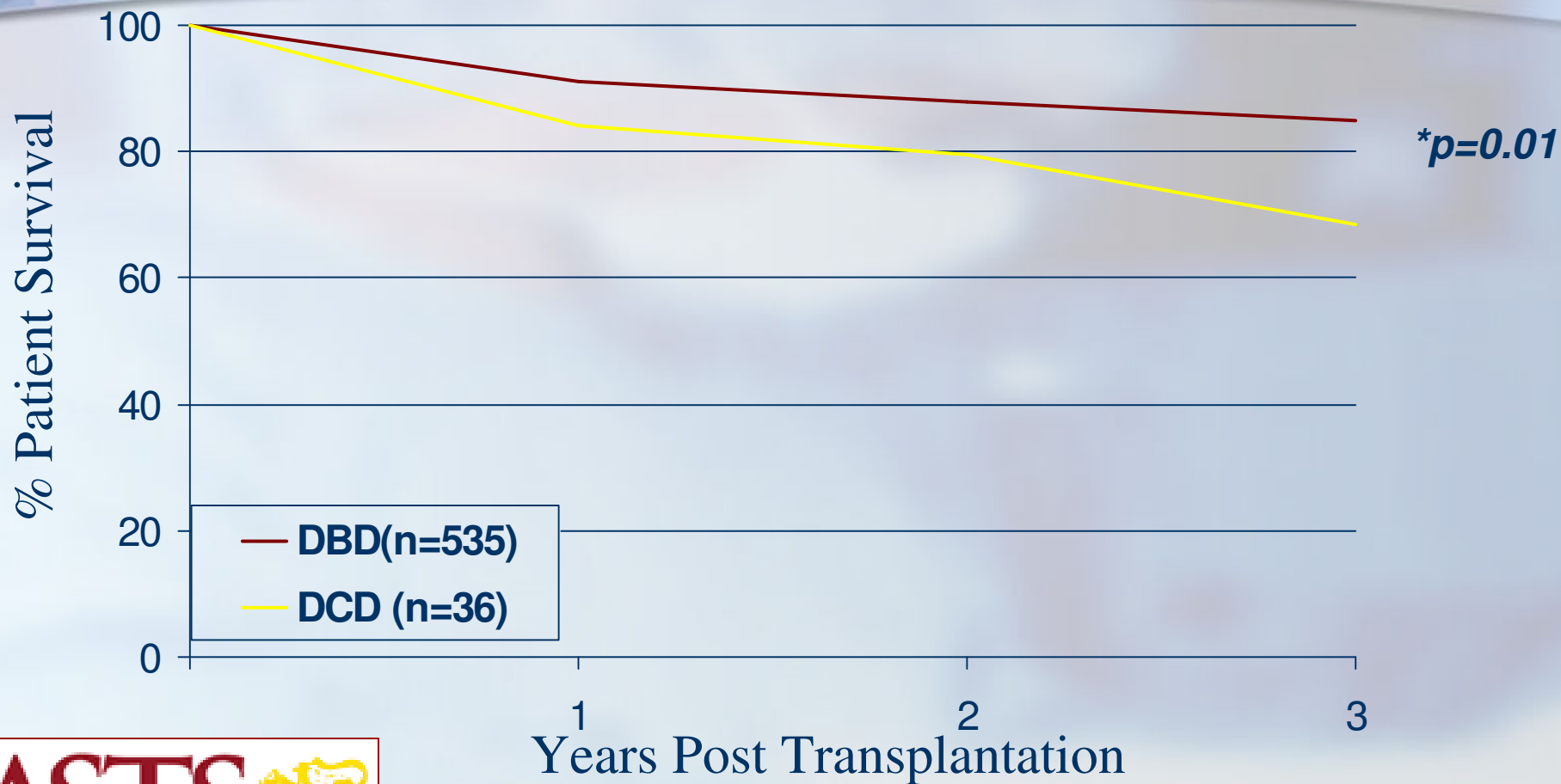


**p<0.01*



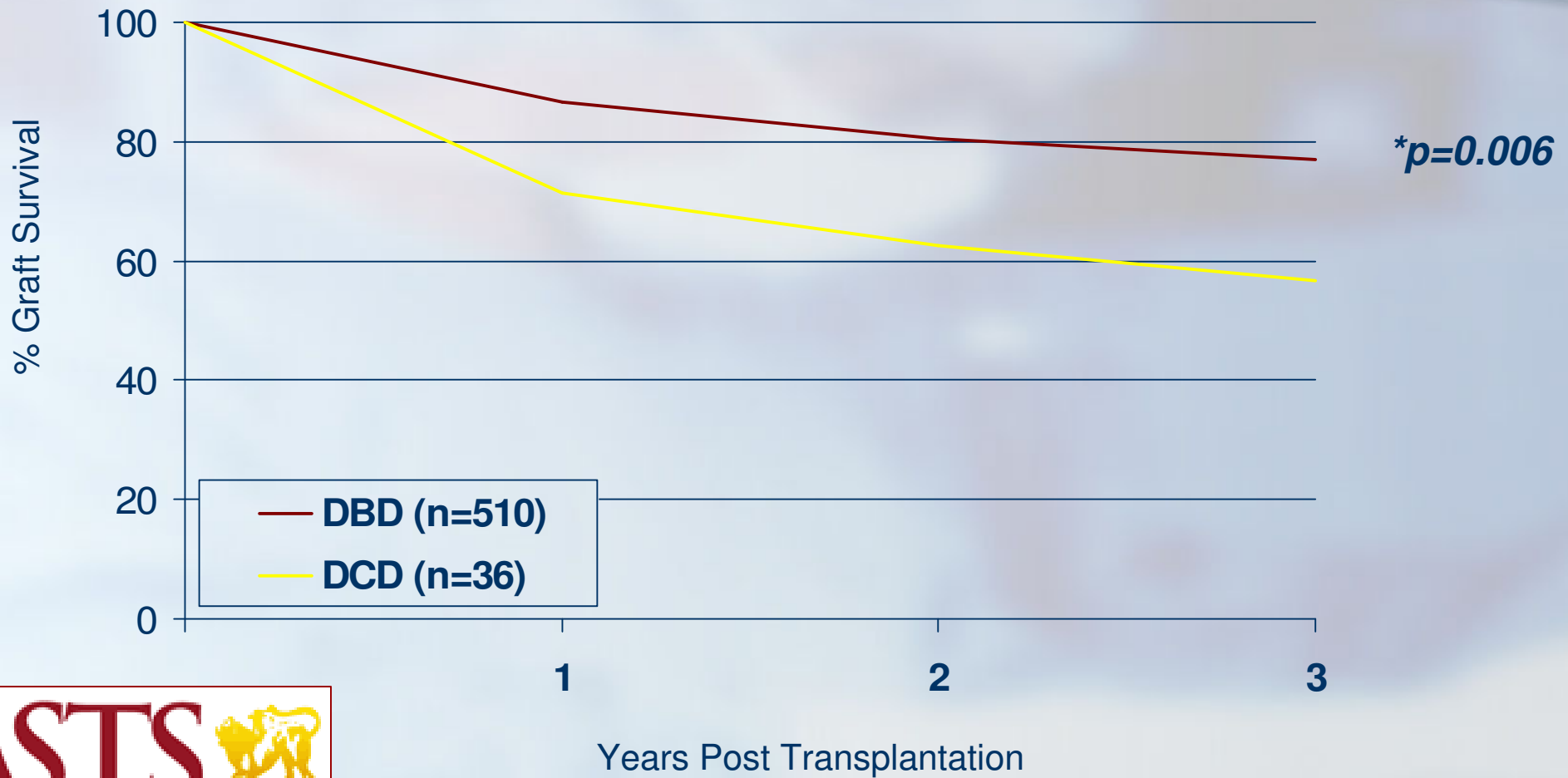
Patient Survival After Liver Transplantation

DCD vs. DBD



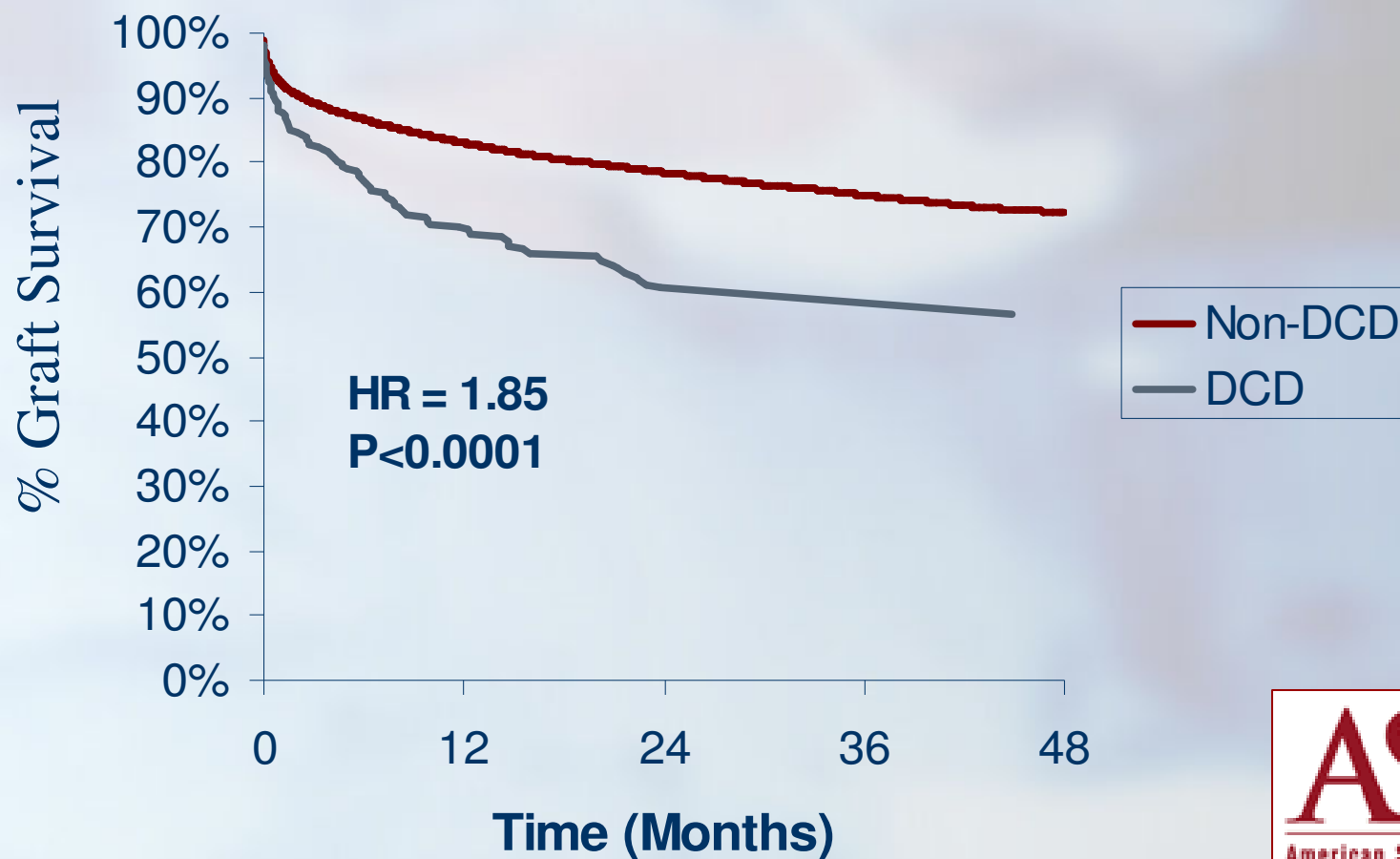
Allograft Survival After Liver Transplantation

DCD vs. DBD



Adjusted Graft Survival

(1/1/2000 - 10/31/2003)





Patient Survival, Graft Survival and ITBS after DCD Liver Transplantation Age < 40 vs. Age > 40

- | | |
|--------------------------------|--------------------------------|
| ■ 3 Year Patient Survival < 40 | ■ 3 Year Patient Survival > 40 |
| ■ 80 % | ■ 55% |
| ■ 3 Year Graft Survival < 40 | ■ 3 Year Graft Survival > 40 |
| ■ 65% | ■ 45% |
| ■ 3 Year ITBS rate < 40 | ■ 3 Year ITBS rate > 40 |
| ■ 7% | ■ 32% |



Recommendations Regarding DCD Donor Liver Transplantation

- Foley DP et al, Annals of Surgery 2005(in press)
 - Donor age < 50
 - Warm ischemic time(WIT) < 30 min
 - Cold ischemic time(CIT) < 8 preferably < 6 hours
 - Avoid Retransplantation and technically difficult cases
 - Careful surveillance for hepatic artery stenosis and biliary complications





Donation After Cardiac Death

Lung

University of Wisconsin

- 18 lung transplants
 - 8 single
 - 5 double





Number of Transplants from DCD Donors University of Wisconsin

<u>Type of Transplant</u>	<u>Number of Transplants</u>
Kidney (1984)	537
Liver (1993)	59
Pancreas (1993)	49
Lung (1993)	18
8 single, 5 double	
<u>Total Transplants</u>	663*



** As of 8/9/05*

ORGAN DONATION AFTER CARDIAC DEATH

SAVING MORE LIVES

