

Meeting Report

Report of a National Conference on Donation after Cardiac Death

J.L. Bernat, A.M. D'Alessandro, F.K. Port, T.P. Bleck, S.O. Heard, J. Medina, S.H. Rosenbaum, M.A. DeVita, R.S. Gaston, R.M. Merion, M.L. Barr, W.H. Marks, H. Nathan, K. O'Connor, D.L. Rudow, A.B. Leichtman, P. Schwab, N.L. Ascher, R.A. Metzger, V. Mc Bride, W. Graham, D. Wagner, J. Warren and F.L. Delmonico*

*Corresponding author: F.L. Delmonico, The Organ Procurement and Transplantation Network and the United Network for Organ Sharing, francis_delmonico@neob.org

A national conference on organ donation after cardiac death (DCD) was convened to expand the practice of DCD in the continuum of quality end-of-life care.

This national conference affirmed the ethical propriety of DCD as not violating the dead donor rule. Further, by new developments not previously reported, the conference resolved controversy regarding the period of circulatory cessation that determines death and allows administration of pre-recovery pharmacologic agents, it established conditions of DCD eligibility, it presented current data regarding the successful transplantation of organs from DCD, it proposed a new framework of data reporting regarding ischemic events, it made specific recommendations to agencies and organizations to remove barriers to DCD, it brought guidance regarding organ allocation and the process of informed consent and it set an action plan to address media issues. When a consensual decision is made to withdraw life support by the attending physician and patient or by the attending physician and a family member or surrogate (particularly in an intensive care unit), a routine opportunity for DCD should be available to honor the deceased donor's wishes in every donor service area (DSA) of the United States.

Key words: Deceased organ donation

Received 25 July 2005, revised and accepted for publication 24 October 2005

A national conference on organ donation after cardiac death (DCD) was convened in Philadelphia on April 7 and 8, 2005, to address the increasing experience of DCD and to affirm the ethical propriety of transplanting organs from such donors. Participants represented the broad spectrum of the medical community, including neuroscientists,

critical care professionals and distinguished bioethicists (Appendix 1).

Six work groups were assembled to address specific DCD issues and fulfill the conference objectives: (i) determining death by a cardiopulmonary criterion, (ii) assessing medical criteria that predict DCD candidacy following the withdrawal of life support, (iii) reviewing protocols for successful DCD organ recovery and subsequent transplantation, (iv) initiating DCD in donation service areas (DSAs), (v) discussing the allocation of DCD organs for transplantation and (vi) examining perceptions of DCD held by the media and the public.

Work Group 1: Determining Death by a Cardiopulmonary Criterion

A prospective organ donor's death may be determined by either cardiopulmonary (DCD) or neurologic criteria (donation after brain death [DBD]) (1). The term *donation after cardiac death (DCD)* clearly indicates that death precedes donation. Death determination in the DCD patient mandates the use of a cardiopulmonary criterion to prove the absence of circulation. The cardiopulmonary criterion may be used when the donor does not fulfill brain death criteria. The ethical axiom of organ donation necessitates adherence to the dead donor rule: the retrieval of organs for transplantation should not cause the death of a donor (2).

In clinical situations that fulfill either brain death criteria or the circulatory criterion of death, the diagnosis of death requires the determination of both *cessation of functions* and *irreversibility* (1).

Cessation of functions is recognized by an appropriate clinical examination that reveals the absence of responsiveness, heart sounds, pulse and respiratory effort. In applying the circulatory criterion of death in non-DCD circumstances, clinical examination alone may be sufficient to determine cessation of circulatory and respiratory functions. However, the urgent time constraints of DCD may require more definitive proof of cessation of these functions by the use of confirmatory tests. Confirmatory tests (e.g. intra-arterial monitoring or Doppler study) should be performed in accordance with the hospital protocol to assure the family and the hospital professional staff that the patient is dead.

The 1997 Institute of Medicine (IOM) report suggested that “accepted medical detection standards include electrocardiographic changes consistent with absent heart function by electronic monitoring and zero pulse pressure as determined by monitoring through an arterial catheter” (3). Conference participants concluded that electrocardiographic (ECG) silence is not required for the determination of death, because the criterion for determining death is the absence of circulation. However, if ECG silence is determined, it may be used as a confirmatory test for absent circulation because ECG silence is sufficient to show absence of circulation.

Irreversibility is recognized by persistent cessation of function during an appropriate period of observation. Based on a cardiopulmonary criterion, DCD donor death occurs when respiration and circulation have ceased and cardiopulmonary function *will not resume spontaneously*. This meaning of “irreversibility” also has been called the “permanent” cessation of respiration and circulation. If data show that autoresuscitation (spontaneous resumption of circulation) cannot occur and if there is no attempt at artificial resuscitation, it can be concluded that respiration and circulation have ceased permanently.

In clinical situations in which death is expected, once respiration and circulation cease (irrespective of electrical cardiac activity), the period of observation necessary to determine that circulation will not recur spontaneously (autoresuscitation) may be only a few minutes. Current data on autoresuscitation indicate that the relevant event is cessation of circulation, not cessation of electrical activity. When life-sustaining therapy is withdrawn, based on the limited data available (presented by Michael Devita and not included in this report), spontaneous circulation does not return after 2 min of cessation of circulation.

Clarifying the period of circulatory cessation observed to determine death

An Organ Procurement Organization (OPO) survey conducted for the DCD conference determined that 92% (47) of all OPOs use a 5-min interval from asystole to the declaration of death, consistent with the IOM recommendations. Nevertheless, three OPOs use an interval of 2 min and one OPO uses an interval of 4 min.

The Society of Critical Care Medicine (SCCM) concluded that “at least 2 minutes of observation is required, and more than 5 minutes is not recommended” (4).

The IOM and SCCM recommendations were expert judgments (3–5). Subsequent studies have not been conducted to provide a statistically valid basis for determining the minimum duration of observation for ruling out the possibility of autoresuscitation. Until additional data are available, the time intervals used by physicians to observe the absence of circulation and thereby certify death may vary. Confer-

ence participants supported the wording of the SCCM that for DCD “at least 2 minutes of observation is required, and more than 5 minutes is not recommended” (4). When death is declared following these considerations, no further time is required before recovery events may be initiated.

Appropriate agencies of the Department of Health and Human Services should fund observational studies on the frequency of autoresuscitation in DCD patients and other patients dying after withdrawal of life-sustaining therapy. However, the cardiopulmonary criterion of death (irreversible cessation of circulatory and respiratory function) applies to all patients who lose circulation, regardless of organ donor status.

Work Group 2: Assessing Medical Criteria to Predict DCD Candidacy Following the Withdrawal of Life Support

Evidence-based clinical judgment should be used to assess whether cardiac death will likely occur within a period of 2 h after the withdrawal of life support and thus allow successful DCD. The University of Wisconsin has developed an algorithm for the assessment of the potential DCD donor. A score is computed based on the patient’s age, body mass index, O₂ saturation, method of intubation (endotracheal vs. tracheostomy), level of spontaneous respiration and requirement for vasopressors, all of which indicate the likelihood of death within 1 h after extubation (6) (Table 1). UNOS has also developed criteria that can be helpful in identifying potential DCD candidates (Table 2).

DCD in the continuum of end-of-life care

Quality end-of-life care for a potential organ donor (as with any individual whose treatment is being withdrawn) is the absolute priority of care and must not be compromised by the donation process. The decision to withdraw or withhold life-sustaining treatment should be made with the patient or family surrogate before the discussion of organ donation begins. This decision to withdraw or withhold treatment should be made on its own merit, with the patient’s physician having established the futility of any further treatment, and not for the purpose of organ donation. Sedatives and opioids should be administered in the customary manner for all end-of-life care and should be used to treat patient’s discomfort and/or the appearance of discomfort.

Conditions of DCD eligibility

Potential candidates for DCD include patients whose life-sustaining treatment is under consideration for withdrawal and who will likely die soon after the withdrawal/refusal of this treatment. Conditions that may lead to consideration of DCD eligibility include irreversible brain injury, end-stage musculoskeletal disease and high spinal cord injury. In the intensive care unit, this clinical scenario has been referred to as controlled DCD (vs. uncontrolled DCD, which

Table 1: The University of Wisconsin criteria for predicting asystole following withdrawal of life support (evaluation tool for donation after death)

Criteria	Assigned points	Patient score
Spontaneous respirations after 10 min		
Rate > 12	1	
Rate < 12	3	
TV > 200 cc	1	
TV < 200 cc	3	
NIF > 20	1	
NIF < 20	3	
No spontaneous respirations	9	
Body mass index		
< 25	1	
25–29	2	
> 30	3	
Vasopressors		
No vasopressors	1	
Single vasopressor	2	
Multiple vasopressors	3	
Patient age		
0–30	1	
31–50	2	
51+	3	
Intubation		
Endotracheal tube	3	
Tracheostomy	1	
Oxygenation after 10 min		
O ₂ saturation > 90%	1	
O ₂ saturation 80–89%	2	
O ₂ saturation < 79%	3	
Final score		
Date of extubation time of extubation		
Date of expiration time of expiration		
Total time		

TV = tidal volume; NIF = negative inspiratory force.

Scoring

8–12 = High risk for continuing to breathe after extubation.

13–18 = Moderate risk for continuing to breathe after extubation.

19–24 = Low risk for continuing to breathe after extubation.

occurs when patients unexpectedly suffer cardiac arrest from which they do not survive). The time limit to cardiac death following the withdrawal of treatment may be up to 2 h and still enable DCD organ recovery. In cases involving a medical examiner or coroner, either should be notified of the decision to withdraw support as early as possible.

Work Group 3: Protocols of DCD Organ Recovery and Successful Transplantation

This work group addressed the administration of agents that can minimize the ischemia-reperfusion injury experienced after transplantation. The current acceptable limits of warm and cold ischemic time for each organ transplanted as a result of DCD were also reviewed.

Pre-recovery administration of pharmacologic agents

An emerging body of subclinical/molecular evidence supports the use of pre-procurement treatments for their preserving effect on the vascular endothelium of the transplanted organ (7). The administration of pharmacologic agents may minimize ischemia/reperfusion injury and improve organ function after DCD transplantation.

The administration of heparin at the time of withdrawal of life-sustaining treatment is the current standard of care and a key component of the best practice. The long-term survival of the transplanted organ may be at risk if thrombi impede circulation to the organ after reperfusion. The omission of heparin could negatively affect organ recovery and hinder the distribution of recovered organs (as most centers require the use of heparin in DCD). The use of heparin is considered controversial on the basis of theoretic concerns that it may hasten the death of the donor. Nevertheless, there is no evidence that heparin causes sufficient bleeding after withdrawal of treatment and thus, causes death. The cause of demise is the withdrawal of life support, which leads to loss of circulation and respiration (not the administration of heparin).

Table 2: UNOS criteria for identifying potential DCD patients

Apnea	LVAD	PEEP \geq 10 and SaO ₂ \leq 92%	Norepinephrine, epinephrine or phenylephrine \geq 0.2 μ g/kg/min	IABP 1:1 OR dobutamine or dopamine \geq 10 μ g/kg/min and CI \leq 2.2 L/min/m ²
RR < 8	RVAD	FiO ₂ \geq 0.5 and SaO ₂ \leq 92%	Dopamine \geq 15 μ g/kg/min	IABP 1:1 and CI \leq 1.5L/min/m ²
RR > 30 during trial off mechanical ventilation	V-A ECMO	V-V ECMO		
	Pacemaker with unassisted rhythm < 30			

RR = respiratory rate; LVAD = left ventricular assist device; RVAD = right ventricular assist device; V-A ECMO = venoarterial extracorporeal membrane oxygenation; PEEP = positive end-expiratory pressure; SaO₂ = arterial oxygen saturation; FiO₂ = fraction of inspired oxygen; V-V ECMO = venovenous extracorporeal membrane oxygenation; IABP = intra-aortic balloon pump; CI = cardiac index.

The appropriate timing for administration of anticoagulants and vasodilators during the DCD process is unresolved. Flushing organs with anticoagulants/vasodilators after procurement may be as effective as pre-procurement administration. Thrombolytics may be of value after the declaration of death, but few data are available to answer this question. Vasodilators such as phentolamine (Regitine); antioxidants such as steroids, vitamin E, *N*-acetylcysteine and agents such as mannitol may be administered as per local protocol.

Some DCD protocols employ premortem cannulation of large arteries and veins (before the cessation of circulation occurs) to facilitate rapid postmortem infusion of organ-preservation solutions. Individual institutions may approve this type of intervention (vessel cannulation) for use after circulation ceases and death is pronounced. As recommended by the IOM, informed consent of the patient or family is necessary for any premortem intervention (3,5).

Warm ischemic time: controlled

The interval of time between extubation (as the definitive withdrawal of treatment) until the initiation of cold perfusion is the most commonly used definition of warm ischemic time (WIT); however, WIT definitions still vary among centers recovering DCD organs. A more descriptive definition of what occurs after withdrawal of treatment is necessary. It was proposed that WIT be defined as having two phases:

Withdrawal phase (Phase I): the time interval from withdrawal of ventilatory support to cardiopulmonary cessation (this phase includes extubation at the time of discontinuation of life support).

Acirculatory phase (Phase II): the time interval from cessation of circulation to the initiation of cold perfusion. This phase includes the waiting period from the absence of circulation to the declaration of death (typically 2–5 min). Thus, the declaration of death occurs at the end of this phase.

Conference participants recommended that the Organ Procurement Transplant Network (OPTN) modify its data submission requirements to differentiate Phase I from Phase II. Data that should be collected minute-by-minute during these two phases include systolic, diastolic and mean arterial blood pressure; O₂ saturation and urine output. Collection of data in this fashion will allow analysis to delineate the duration and effect of hypoperfusion after withdrawal of life support (but prior to declaration of cardiac death). Prior to the availability of this newly collected data, a retrospective study that merges current known hemodynamic data from OPOs with Scientific Registry of Transplant Recipients (SRTR) data regarding corresponding recipient outcomes was recommended.

Table 3: Desirable warm ischemia times (WIT) and cold ischemia times (CIT) for transplantation of DCD organs

	Kidney	Liver (Donors < 60)	Pancreas
WIT	1 h	30 min	1 h
CIT	<24 h if possible	<8 h	< 18 h

Acceptable duration of WIT for the successful transplantation of organs

Published reports (utilizing the definition of WIT as the interval of time between extubation until the initiation of cold perfusion) suggest that the WIT should not exceed 30 min for successful liver transplantation and 60 min for kidney and pancreas transplantations (Table 3) (8). These generally accepted guidelines assume that the mean arterial pressure has fallen to <60 mmHg within minutes after withdrawal of treatment. For livers, WIT > 30 min may increase the risk of post-transplant biliary stricture (8).

Cold ischemia time

Cold ischemic time (CIT) extends from the initiation of cold preservation of the recovered organs to restoration of warm circulation after transplantation. The reasonable limits of WIT and CIT have yet to be established by precise data. There is variability by accepting surgeon/center and by donor and recipient characteristics. Intuitively, shorter CIT and WIT are better. For kidney transplantation, the CIT should be <24 h; for pancreas transplantation, <18 h and for liver transplantation, <8 h (Table 3). The interval needed for liver allograft vessel anastomoses (after the liver is removed from cold storage) until reperfusion of blood is established (the anastomosis time) is an additional period of WIT.

Because there is a paucity of data allowing a proper decision regarding the acceptance of organs with variable CITs and WITs, information should be obtained to characterize the influence of these variables. For example, current evidence suggests that lungs may have better tolerance to long warm and cold ischemia times than other donor organs (9).

Cold storage solutions and pulsatile perfusion

The pulsatile preservation of DCD kidneys remains controversial, necessitating the development of controlled trials. Data presented by the SRTR suggest that there is no benefit of pulsatile preservation in preventing delayed graft function (DGF) of DCD kidneys (Table 4). If true, this would be an important finding, as DGF appears to have a negative influence on survival (Table 5). Nevertheless, pulsatile preservation may hold value by demonstrating the perfusion characteristics of the kidney, which brings security in accepting it for transplantation.

For cold storage, the optimal preservation solution (University of Wisconsin, UW, or Histidine-Tryptophan-Ketoglutarate, HTK and others) has yet to be established and only recently added to the SRTR database.

Table 4: Percent and adjusted odds of delayed graft function (DGF) by donation after cardiac death (DCD) and pumping type, 2000–2004

DCD and pumping type	Percentage of DGF	OR ¹	P
NonDCD, not pumped	23.9	1.00	Ref
NonDCD, pumped	17.0	0.54	<0.0001
DCD, not pumped	42.3	2.52	<0.0001 ²
DCD, pumped	40.2	2.04	<0.0001 ²

¹Adjusted for recipient age, sex, race, preformed antibodies, cause of end-stage renal disease, years of end-stage renal disease, HLA mismatch, year of transplant, previous transplant, and transfusions and donor age, sex, race, hypertension, diabetes, cause of death, creatinine level and cold ischemia time.

²p = 0.15 for comparison among DCD only.
Data from Scientific Registry of Transplant Recipients.

The technical aspects of organ recovery from DCD donors were presented during the conference but are not summarized here. The retrieval of thoracic organs, which requires reintubation of the DCD donor following the declaration of death, was addressed at a special thoracic session, held in May 12, 2005, and devoted to the recovery of lungs from DCD.

Thoracic subcommittee report

Once death occurs, it is important to reintubate and ventilate the lungs before surgical excision. The vena cava should be vented preferentially in the abdomen or via a femoral or vena caval cannula, not in the thoracic cavity. As in all cases of abdominal and thoracic recoveries, the surgical teams should discuss the conduct of the surgical procedure. Since aspiration is a frequent problem in potential lung donors (possibly exacerbated in the DCD situation), a nasogastric tube should be placed in all potential DCD lung donors. Likewise, bronchoscopy is necessary prior to withdrawal of support and extubation to adequately assess suitability for DCD lung donation.

Limited anecdotal evidence in humans supports the feasibility of cardiac transplantation following DCD, including the first successful heart transplant. Ongoing research involving optimization of the reperfusion technique may

enhance immediate functional recovery. Based on the growing numbers of successful non-cardiac solid organ retrievals following DCD, and the ongoing shortage of cardiac donors, especially in the pediatric arena, protocols to develop and optimize heart transplantation following DCD for pediatric and adult recipients are anticipated.

Work Group 4: Initiating and Increasing DCD in Donation Service Areas

DCD requires an integration of the best practices from “three estates” of the medical community: the donor hospital, the OPO and the transplant center. Data from an OPO survey suggest a variety of impediments to DCD, including a concern about negative public perception, the absence of an OPO or donor hospital policy on DCD and the lack of transplant center surgeon support to recover DCD organs. The objectives of this work group were to address barriers so that DCD could be initiated in DSAs where DCD recovery does not occur currently and expand it where DCD recovery are relatively low. The 20 DSAs (of 58 CMS designated service areas) that accomplished more than five donations after cardiac death in 2004 are listed in Table 6.

Specific actions proposed to agencies and organizations are listed below:

- AOPO
 - Establish a DCD mentorship program in its technical assistance program (TAP).
 - Add a DCD component to OPO accreditation standards.
- ACOT: HHS Secretary’s Advisory Committee on Organ Transplantation
 - Support studies assessing the frequency of autoreuscitation in DCD patients and other patients dying after withdrawal of life-sustaining therapy.
 - Recommend that the OPTN modify data submission standards to capture Phase I and Phase II data with a minute-by-minute collection of data to measure systolic and diastolic blood pressure, O₂ saturation and urine output.

Table 5: Summary of adjusted kidney graft survival results by donor type and delayed graft function (DGF)

Donor type	N	Percentage of DGF	One-year survival %			Three-year survival%		
			No DGF (%)	DGF (%)	Overall (%)	No DGF (%)	DGF (%)	Overall (%)
SCD	29862	21	93	80	90	84	68	80
ECD (no DCD)	5424	33	88	72	83	77	58	71
DCD (no ECD)	1120	40	93	83	89	87	69	80
DCD + ECD	136	55	85	76	81	85	55	70

SCD = standard criteria donors; ECD = expanded criteria donors; DCD = donation after cardiac death. Adjusted for recipient age, sex, race, preformed antibodies, end-stage renal disease, years of end-stage renal disease, HLA mismatch, year of transplant, previous transplant, transfusions and donor sex, race, diabetes and cold ischemia time. Data from Scientific Registry of Transplant Recipients.

Table 6: Organ procurement organizations (n = 20) that accomplished more than five donations after cardiac death in 2004

	Number	Percent
Gift of Life	47	12
NEOB	38	19
Gift of Hope	36	12
Life Center NW	33	19
Midwest	28	18
UW	27	20
LifeQuest	18	17
Michigan	14	5
CORE	14	9
WRTC	12	10
NYFL	11	21
TRC MD	10	10
Louisiana	8	5
MTA	8	7
OneLegacy	7	2
Carolina	7	5
Golden State	7	15
NYODN	6	2
NJTO	6	4
Iowa	6	15

Source: AOPO Annual Survey.

- Provide guidance on issues of informed consent.
- OPTN/UNOS
 - Revise transplant center and OPO membership criteria to require DCD protocols.
 - Establish organ-specific subcommittees on DCD to address organ-specific suitability criteria and allocation policies.
 - Conduct financial analysis of the long-term impact of DCD organ use on transplant centers.
 - Use regional meetings as a venue for DCD discussion and education.
- NATCO
 - Expand DCD in all NATCO education programs.
- ASTS/AST
 - Establish a joint committee to increase DCD recovery and utilization.
- JCAHO
 - Revise accreditation standards to require hospitals to implement DCD protocols.
 - Provide an annual DCD report that includes regional profiles, new developments and trends and outcomes.
- CMS
 - Revise regulations governing donation, utilization and reimbursement to reflect the unique characteristics of DCD procurement and transplantation.

The impact of DCD on the occurrence of donation after brain death organ recovery and transplantation

The Netherlands experienced a 21% decrease in DBD (159 to 126) during a recent 5-year period, during which there was a 129% increase in DCD (41 to 94) (9). In contrast, the United States has increased its total number of DBD

while accelerating DCD organ recovery. Sixteen U.S. DSAs, accounting for 80% of the DCD in 2004, demonstrated a 49.3% increase in DCD while increasing the number of standard criteria donors (SCDs) by 9.4% and expanded criteria donors (ECDs) by 3.8%. Thus, the experience of the Netherlands has not been observed in the United States. The evolving DCD practice is expected to result in an absolute increase of organ donors, i.e. in addition to DBD.

Work Group 5: Allocation of DCD Organs for Transplantation

Strategies for DCD organ allocation were considered to provide equitable access for DCD organs while sustaining incentives for DCD recovery. The economic impact of DCD on a transplant center's interest in accepting DCD organs was also addressed, noting that the rate of DGF is almost doubled for DCD kidneys (40.1%), compared with non-DCD SCD kidneys (21.2%). The yield of organs from DCD is clearly less than that for SCD, but slightly better than that achieved by ECD.

Among kidney transplants from deceased donors who did not meet the ECD definition, overall adjusted 1- and 3-year allograft survivals were 90% and 80% for SCD and 89% and 80% for DCD recipients, respectively (Table 5). Among transplants from donors who met the ECD definition, overall 1- and 3-year adjusted allograft survivals were 83% and 71% for ECD transplants and 81% and 70% for DCD/ECD kidneys, respectively (Table 5).

The SRTR analysis of OPTN outcome data provided important references for the working group's consideration of allocation (Figure 1 and Table 5). Given current donor and candidate acceptance criteria, allograft survival for similar subgroups (with or without ECD status, with or without DGF) of DCD and DBD kidneys were found to be comparable.

Allocation issues: kidney

The OPOs are not required to include DCD kidneys in the "payback" process, in exchange for receipt of a zero-antigen mismatched kidney by a transplant center in the OPO's DSA. The DCD kidneys are allocated to zero-antigen mismatched patients locally, and then they are allocated by local, regional and national distribution. The allocation policy should hasten the process (organ placement) by which OPOs obtain transplant center acceptance for a DCD organ. To counter the disincentive to recover DCD, the work group participants recommended that DCD not be used in calculating outcomes for OPTN or CMS reports of center performance.

With current data showing equivalency in graft and patient survivals of DCD and DBD primary kidney transplants despite higher DGF rates in DCD organs (Table 5), conference

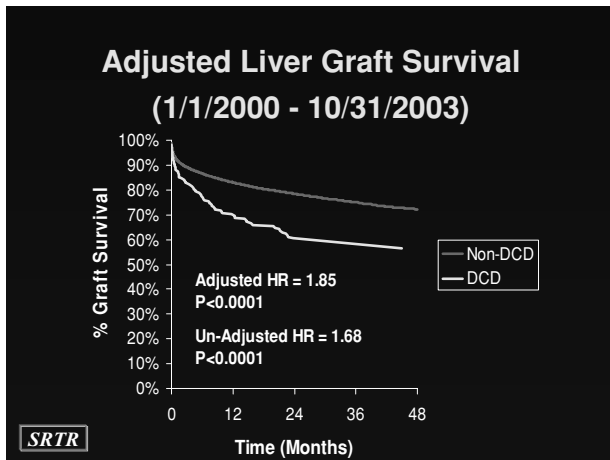


Figure 1: Adjusted liver graft survival (1/1/2000–10/31/2003).

participants were reluctant to recommend changes in the current DCD allocation policy.

Finding recovery surgeons

If there is no local center available to recover DCD organs, the OPTN computer match run should be followed regionally. The accepting regional program must be willing to procure to receive the DCD organs. For DCD kidney-only donors, the regional center could recover and retain one kidney for its patient. The other kidney is offered locally to a willing center. If there is no accepting local center, then the second kidney will be offered through the UNOS Organ Center according to the OPTN computer match program.

Allocation issues: liver

Work Group 5 participants recommended that the OPTN require centers to list candidates who are willing to accept DCD liver offers. Given the higher risk of graft failure for DCD livers compared with SCD livers (Figure 1), candidates should be counseled regarding the risk of DCD organ acceptance, with informed consent obtained at the time of listing (see below). The effect of DCD on outcomes (OR = 1.85) may influence recipient selection. The hazard ratio of death following transplantation exceeds the risk of death while waiting on the list for candidates at certain MELD scores (10).

The work group participants recommended that DCD donor liver placement follow the current allocation algorithm, with distribution stratified by local recovery and allocation followed by regional offers. Parallel (backup) offers should be made to expedite placement.

Allocation issues: pancreas

Successful pancreas transplantation has been reported from DCD at the University of Wisconsin (8). The work group participants recommended that the current OPTN pancreas allocation algorithm be followed, with local DSA

priority given to combined kidney/pancreas candidates or pancreas-alone candidates who have been listed as willing to accept a DCD pancreas.

Recipient informed consent

The work group participants considered the information that should be shared with a potential transplant recipient of a DCD organ to achieve informed consent. This aspect of the deliberations was controversial. Some of the participants recommended full disclosure of the donor circumstances of death, because the outcome, especially for DCD liver allograft recipients (Figure 1), might be less than that achieved by transplantation of DBD organs.

The process of informed consent should be done in phases, with the current characteristics of the deceased donor pool discussed at the outset of a patient listing. This initial consent discussion should include the transplantation of organs from donors with varying degrees of risk of failure compared with an ideal donor. Final consent should be obtained at the time of the proposed transplantation, when the physicians have a more precise assessment of the risks associated with undergoing a DCD (or ECD) transplant versus the risk of waiting for the next available donor (considering the candidate's severity of disease and mortality risk at the time of the offer).

Work Group 6: The Media, Public Perceptions and DCD

The work group participants were asked to assemble comprehensive information for different audiences—the transplant community, other professional disciplines and the press and the general public—and disseminate this conference report in an informative but not promotional manner. The expansion of policies related to DCD reflects advances in the practice of medicine. Families who want their loved ones to be an organ and tissue donor should no longer be excluded from the opportunity of donation nor should they have to bear the responsibility of raising the DCD option to the medical care team.

The public message to be conveyed about DCD is listed below:

- DCD honors donor wishes in the continuum of quality end-of-life care.
- DCD can provide comfort and support to donor families.
- DCD saves lives.

Conclusion

The National Conference on DCD affirmed DCD as an ethically acceptable practice of end-of-life care, capable of increasing the number of deceased-donor organs available for successful transplantation.

Organization and Agency Representation

Conference participants represented the American Medical Association (AMA), the Society of Critical Care Medicine (SCCM), the American Association of Critical Care Nurses (AACN), the American Society of Anesthesiologists (ASA), the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO), the American Society of Transplant Surgeons (ASTS), the American Society of Transplantation (AST), the Association of Organ Procurement Organizations (AOPO), the Scientific Registry of Transplant Recipients (SRTR), Eurotransplant, the North American Transplant Coordinators Organization (NATCO), the National Association of Medical Examiners (NAME), the United Network for Organ Sharing (UNOS) contractor of the Organ Procurement Transplant Network (OPTN), the Division of Transplantation of the Department of Health and Human Services (DOT), Centers for Medicare and Medicaid Services (CMS), the National Kidney Foundation (NKF), and the World Health Organization (WHO).

Acknowledgments

This national conference was sponsored by the UNOS Foundation, the American Society of Transplant Surgeons, the Division of Transplantation, HRSA; the Gift of Life Foundation, Barr Laboratories, Inc., the American Society of Transplantation and the National Kidney Foundation. We express our appreciation to Kim Johnson, Lin McGaw and John Rosendale, MS, of UNOS for their administrative and data support. We also acknowledge with appreciation the following individuals for their comments and editing of the manuscript drafts: Michael Abecassis, MD; Patricia Adams, MD; James DuBois, PhD; Lisa Florence, MD; Sandy Feng, MD; Michael Graham, MD; William Harmon, MD; Jeffrey Kahn, PhD; Gauke Kootstra, MD; Stephen Rayhill, MD; Jorge Reyes, MD; Robert Sade, MD; Sam Shemie, MD and Sally Webb, MD.

Finally, we wish to acknowledge our gratitude to the following staff of the SRTR for responding to the data requests: Dawn Zinsser, MS; Valarie Ashby, MS; Joshua McGown, MS; Laura Christensen, MS; Nathan Goodrich, MS and Sarah Miller.

References

1. Guidelines for the determination of death. Report of the medical consultants on the diagnosis of death to the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research. *JAMA* 1981; 246: 2184–2186.
2. Robertson J. The dead donor rule. *Hastings Cent Rep* 1999; 29 (6): 6–14.
3. Institute of Medicine, National Academy of Sciences. Non-heart-beating organ transplantation: Medical and ethical issues in procurement. Washington, DC: National Academy Press, 1997.
4. Ethics Committee, American College of Critical Care Medicine; Society of Critical Care Medicine. Recommendations for non heart beating organ donation. A position paper by the Ethics Committee, American College of Critical Care Medicine, Society of Critical Care Medicine. *Crit Care Med* 2001; 29: 1826–1831.

5. Institute of Medicine, National Academy of Sciences. Non-heart-beating organ transplantation: Practice and protocols. Washington, DC: National Academy Press, 2000.
6. Lewis J, Peltier J, Nelson H et al. Development of the University of Wisconsin donation after cardiac death evaluation tool. *Prog Transplant* 2003; 13: 265–273.
7. Polyak MM, Arrington BO, Kapur S, Stubenbord WT, Kinkhabwala M. Donor treatment with phentolamine mesylate improves machine preservation dynamics and early renal allograft function. *Transplantation* 2000; 69: 184–186.
8. D'Alessandro AM, Fernandez LA, Chin LT et al. Donation after cardiac death: The University of Wisconsin experience. *Ann Transplant* 2004; 9: 68–71.
9. Cohen B, Smits JM, Haase B, Persijn G, Vanrenterghem Y, Frei U. Expanding the donor pool to increase renal transplantation. *Nephrol Dial Transplant* 2005; 20: 34–41.
10. The Report of the New York State Department of Health Commission on Expanded Criteria Organs for Liver Transplantation. *Liver Transplantation* 2005; 11: 1184–1192.

Appendix 1

Group 1

James Bernat, MD: Leader, Dartmouth-Hitchcock Medical Center

Tom Bleck, MD: Leader, University of Virginia

Stephen Ashwal, MD, Loma Linda University School of Medicine

Alexander Capron, LLB, World Health Organization

Lisa Day, RN, PhD, UCSF School of Nursing

Michael DeVita, MD, University of Pittsburgh Medical Center

Michael Diringer, MD, Washington University

James DuBois, PhD, DSc, Center for Health Care Ethics, St. Louis University

Richard Fine, MD, University Hospital of SUNY

John Haas, PhD, STL, The National Catholic Bioethics Center

Jeffrey Kahn, PhD, MPH, Fairview University Medical Center

Gauke Kootstra, MD, PhD, University Hospital Maastricht

Peggy Kosherzenko, Public Ledger Building

Jerry Menikoff, JD, MD, Kansas University Medical Center

Chuck Mowll, Joint Commission on the Accreditation of Healthcare Organizations

John Robertson, JD, LLD, University of Texas at Austin Law School

Patricia Talone, RSM, PhD, Catholic Health Association

Leslie Whetstone, ABD, PhD, Duquesne University

Report of a National Conference on Donation after Cardiac Death

Micheal A. Williams, MD, Johns Hopkins University

Linda Wright, University Health Network

Group 2

Stephen Heard, MD: Leader, UMass Medical Center

Stanley Rosenbaum, MD: Leader, Yale University School of Medicine

Justine Medina, RN, MS: Leader, American Association of Critical-Care Nurses

Peter Abt, MD, Strong Memorial Hospital

Maggie Allee, RN, JD, Oregon Health Science University Hospital

Richard Brill, MD, Cincinnati Children's Hospital Medical Center

Barbara Daly, RN, PhD, University Hospital, Cleveland

Constance Donovan, RN, MPH, St. John's Emergency Trauma Center

John Edwards, RN, BSN, Gift of Life Donor Program

Barry Friedman, RN, Children's Medical Center of Dallas

Bill Hanson, MD, University of Pennsylvania School of Medicine

Rick Hasz, MFS, Gift of Life Donor Program

Nancy Knudsen, MD, Duke University Medical Center

Tracy Koogler, MD, University of Chicago

Susan Mandell, MD, University Hospital UCHSC

Joe Nespral, Texas Organ Sharing Alliance

Susan Palmer, MD, Oregon Anesthesiology Group, PC

Tim Pruett, MD, UVA Health Sciences Center

Gail Van Norman, MD, University of Washington

Sally Webb, MD, Medical University of South Carolina

Ken Wood, DO, University of Wisconsin Hospital

Christine Zawistowski, LeBonheur Children's Medical Center

Group 3

Tony D'Alessandro, MD: Leader, University of Wisconsin Hospital

Bob Gaston, MD: Leader, University of Alabama at Birmingham

Michael Abecassis, MD, Northwestern Memorial Hospital

Jeff Crippin, MD, Washington University School of Medicine

American Journal of Transplantation 2006; 6: 281–291

Viken Douzdjian, MD, Legacy Transplant Services

James Eason, MD, Ochsner Transplant Center

Sandy Feng, MD, PhD, University of California San Francisco Medical Center

Rich Freeman, MD, New England Medical Center

Mitch Henry, MD, Ohio State University Hospital

Martin Jendrisak, MD, Barnes-Jewish Hospital

Lynt Johnson, Georgetown University Medical Center

Alan Langnas, DO, Nebraska Medical Center

Cosme Manzarbeitia, MD, Albert Einstein Medical Center

Lori Markham, RN, Midwest Transplant Network

Bob Merion, MD, University of Michigan Medical Center

Jeff Punch, MD, University of Michigan Medical Center

Stephen Rayhill, MD, Oregon Health Sciences University

Jorge Reyes, MD, University of Washington Medical Center

Kerri Robertson, MD, Duke University Medical Center

Harvey Solomon, MD, St. Louis University Hospital

Lewis Teperman, MD, NYU School of Medicine

Francis Wright, MD, Texas Transplant Institute

Hasan Yersiz, UCLA Medical Center

Thoracic Group

Mark Barr, MD: Leader, USC and Children's Hospital of LA

Abbas Ardehali, MD, UCLA Medical Center

Mark Boucek, MD, The Children's Hospital

Tony D'Alessandro, MD, University of Wisconsin Hospital

Duane Davis, MD, Duke University Medical Center

Francis Delmonico, MD, Massachusetts General Hospital

Niloo Edwards, MD, University of Wisconsin Hospital

Tom Egan, MD, UNC Hospitals

Ed Garrity, MD, Loyola University Medical Center

Val Jeevanandam, MD, University of Chicago Medical Center

Bernat et al.

Shaf Keshavjee, MD, Toronto General Hospital

Robert Love, MD, University of Wisconsin Hospital and Clinics

Michael Mulligan, MD, University of Washington Medical Center

Alec Patterson, MD, Barnes-Jewish Hospital

Andrew Pierre, MD, Toronto General Hospital

Alberto Pochettino, MD, The Hospital of the University of Pennsylvania

W. Steves Ring, MD, University Hospital – St. Paul

Arun Singhal, MD, Temple University Hospital

J. David Vega, MD, Emory University Hospital

Group 4

Howard Nathan: Leader, Gift of Life Donor Program

William H. Marks, MD, PhD: Leader, Swedish Medical Center

Kevin O'Connor: Leader, New England Organ Bank

Dianne LaPointe Rudow, ANP: Leader, Columbia Presbyterian Medical Center

Charles Alexander, Transplant Resource Center of Maryland

Lori Brigham, Washington Regional Transplant Consortium

Esther Marie Carmichael, CMS

Danielle Cornell, LifeQuest Organ Recovery Services

Susan McVey Dillon, Donor Family Representative

Lynn Driver, Indiana OPO

Carlos Esquivel, MD, PhD, Stanford University Medical Center

Gwen George, Gift of Life Donor Program

Rob Kochik, New York Organ Donor Network

Dianne LaPointe Rudow, ANP, Columbia Presbyterian Medical Center

Barbara LeTourneau, MD, MBA, Regions Hospital

Tom Mone, OneLegacy

Helen Nelson, RN, BSN, University of Wisconsin Hospital and Clinics

Friedrich Port, MD, University Renal Research and Education Association

David Powner, MD, University of Texas Houston Medical School

David Shaffer, MD, Vanderbilt University Medical Center

Paul Schwab, MA, MPA, Association of Organ Procurement Organizations

Nancy Senst, RN, BSN, CPTC, LifeSource

Michael Shapiro, MD, Hackensack University Medical Center

Alison Smith, RN, BSN, Gift of Hope

Katherine Turrisi, MSN, Medical University of South Carolina Transplant Center

Group 5

Bob Metzger, MD: Leader, Florida Hospital Medical Center

Nancy Ascher, MD, PhD: Leader, University of California

Patty Adams, MD, Wake Forest University School of Medicine

Juan Arenas, MD, Henry Ford Hospital

James Bowman III, MD, CMS

Jim Burdick, MD, HRSA Division of Transplantation

Bernard Cohen, PhD, Eurotransplant International Foundation

Diane Corning, RN, BSN, MPS, JD, CMS

Connie Davis, MD, University of Washington Medical Center

Dale Distant, MD, SUNY HSC at Brooklyn University Hospital

Lisa Florence, MD, Swedish Medical Center

Suzie Fredenberg-Cross, Tennessee Donor Services

Stuart Greenstein, MD, Montefiore Medical Center

Bill Harmon, MD, Children's Hospital

Doug Heiney, UNOS

Alan Leichtman, MD, University of Michigan Medical Center

Ginny McBride, RN, MPH, HRSA Division of Transplantation

Dinesh Ranjan, MD, University of Kentucky Medical Center

Mark Schnitzler, PhD, Center for Outcomes Research (via phone)

Cindy Sommers, Esq., UNOS

Group 6

Walter Graham, JD: Leader, The United Network for Organ Sharing

Report of a National Conference on Donation after Cardiac Death

Jim Warren: Leader, Transplant Communications, Inc.

Michael Graham, MD, The National Association of Medical Examiners

Dennis Wagner, Leader MPA, HRSA Division of Transplantation

Bill Lawrence, The United Network for Organ Sharing

Terri Tye, Joint Commission on the Accreditation of Healthcare Organizations

Joe Roth, The Association of Organ Procurement Organizations

Dolph Chianchiano, The National Kidney Foundation

Debbie May Johnson