By Patricia Ringos Beach, MSN, RN, AOCN, ACHPN, Annette M. Hallett, BSN, RN, and Kim Zaruca, BSN, RN

Organ Donation After Circulatory Death: Vital Partnerships

Interdisciplinary care is needed when a brain-injured patient—and potential organ donor—doesn't meet the criteria for brain death.

Overview: The authors present the case of a woman in her mid-50s who sustained extensive brain injury in an accident but wasn't declared brain dead. The case highlights some of the clinical and ethical considerations of organ donation after circulatory death (also known as non–heart-beating donation and donation after cardiac death). It also illustrates the interdisciplinary teamwork necessary for organ donation in such cases, involving nurses and other clinicians in the ICU, palliative care, and the local organ procurement organization, among others.

Keywords: cardiac death, circulatory death, donation after cardiac death, end-of-life care, ethics, non–heart-beating donation, organ donation, organ donation after circulatory death, organ transplantation, palliative care

We weren't with her as she traveled east on the rural two-lane highway that late spring afternoon, stopped at an intersection, and then proceeded on. We weren't there as a driver traveling south failed to stop at the traffic light. Therefore, we didn't hear the sound of metal crushing metal as the other car slammed into her driver's-side door. Nor did we witness the work of the Life Flight crew as they extricated her, removing the driver's-side door and cutting her still-buckled seat belt, and stabilized her neck, intubated her, administered IV fluids, monitored vital signs, and transported her by helicopter to a level 1 trauma center. That's where we met Sharon Rice, as part of a team that would provide the care she so vitally needed.

Her family told us that Sharon was a vibrant, healthy teacher in her mid-50s who loved to travel. (Names and other identifying details have been changed to protect the family's identity.) In the hours after the accident, Sharon's condition deteriorated. Corneal reflexes were absent; cough and gag reflexes were weak but present. She had no facial reflexes, Babinski's reflexes were present bilaterally, and decerebrate posturing occurred. She didn't open her eyes spontaneously or in response to vocal, tactile, painful, or noxious stimuli.

In accordance with our hospital's policy (and that of the Centers for Medicare and Medicaid Services), a referral to the organ procurement organization (OPO) is made for all heart-beating, ventilator-dependent patients with a brain injury who also have a Glasgow Coma Scale score of 5 or less, indicating severe brain injury; a referral is also made in cases when treatment withdrawal is being considered. In Sharon's case, a score of 3 was documented in the ED when she was chemically sedated. A subsequent neurologic examination yielded a score of 5, and the OPO referral was made within three hours of admission.

Sharon was a potential candidate for organ donation after circulatory death (DCD)—also called non–heart-beating donation and donation after cardiac death. Such patients have severe brain injuries but don't meet the criteria for brain death; their organs can be procured only if circulation stops and death is declared within a brief period after the withdrawal of life-sustaining therapy. A 2006 Institute of Medicine (IOM) report, *Organ Donation: Opportunities for Action*, identifies DCD as one promising way of augmenting organ and tissue donation in the United States.[1] And the need is urgent. In 2008, 27,281 solid-organ transplantations were performed—21,065 from deceased donors and just 848 from DCD—and more than 100,000 people were waiting for a solid-organ transplant.[2] Roughly the same number of people are waiting for a transplant in 2011 (see Figure 1 and Table 1).

A five-year collaborative effort resulted in a DCD policy at our facility, and Sharon was our first case after the policy went into effect in November 2007. Her care involved many specialties—ICU, palliative care, critical care, trauma care, the OPO, and pastoral services among them—and inspired and touched so many, that we decided to write about it as a way of teaching nurses about DCD.

INTENSIVE CARE

Three days after her accident, Sharon remained in the neurosurgical ICU. Her husband, Paul, kept desperate vigil, along with her parents, sister, and sister-in-law, visiting when allowed. Her injuries included subdural and subarachnoid hemorrhages; anoxic brain injury; skull, nasal, and mandibular fractures; lacerations of the external left ear; and contusions along her left side and both upper arms. She was chemically sedated, and when the sedative was discontinued for a brief assessment, corneal reflexes remained absent, and a weak gag reflex and decerebrate posturing remained present. Although intubated and on a ventilator, she was also breathing on her own, at a rate higher than the ventilator setting of 12 breaths per minute. The ventilator was also set to a tidal volume of 550 mL, a fraction of inspired oxygen of 30%, and a positive end-expiratory pressure of 5 cm H_2O.

The team concluded that Sharon had little or no chance of significant recovery. The family learned of

Figure 1. The Number of People Waiting for Solid-Organ Transplants in the United States

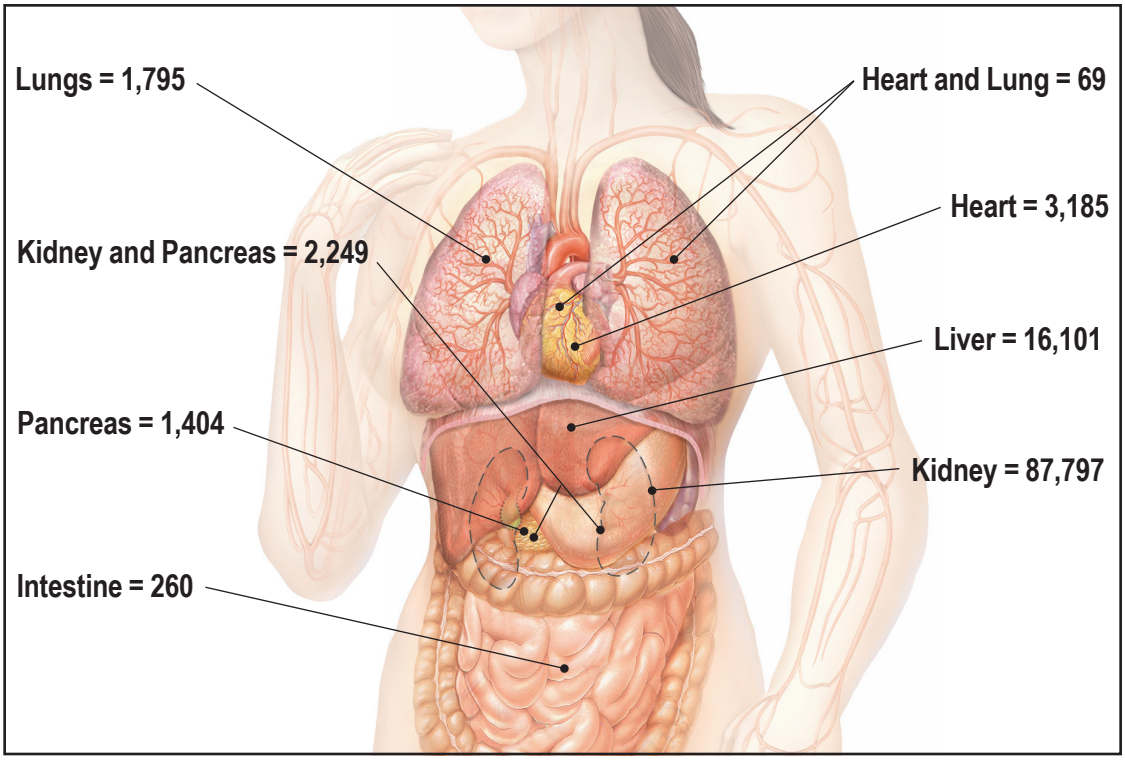

Table 1. The Number of Candidates for Organs on Current U.S. Waiting List

	All Organs	Kidney	Liver	Pancreas	Kidney/ Pancreas	Heart	Lung	Heart/ Lung	Intestine
All Ages[a]	110,206	87,797	16,101	1,404	2,249	3,185	1,795	69	260
Children (≤17 y)	1,779	776	541	58	2	254	90	13	186
Adults (≥18 y)	108,444	87,034	15,564	1,346	2,247	2,931	1,705	56	74

[a] Totals may not equal the sum of adults and children, because patients may be listed with more than one transplant center or waiting for more than one organ.
Source: Human Resources and Services Administration, Organ Procurement and Transplantation Network. http://optn.transplant.hrsa.gov.

this at several meetings, where ICU nurses, the palliative care nurse coordinator, the hospital's pastoral care staff, and clergy from Sharon's church offered support.

ORGAN DONATION AFTER CIRCULATORY DEATH

A palliative care nurse asked Paul: given what the trauma physicians had said, what would be Sharon's wishes for care? Could he help to establish a goal for her care? Paul said that he couldn't imagine Sharon living in a facility, attached to machines. "That wouldn't be Sharon," he said. Paul said that his wife had completed a living will four years earlier, which he'd also signed. In it, she stated that she wouldn't want medical treatment continued if it were determined that she wouldn't recover or was terminally ill. He added that Sharon had already made the decision to help others through organ donation. The physician wrote an order to change Sharon's code status from "full code" to "do not resuscitate, comfort care only." A referral for palliative care was made and the OPO in-house coordinator was informed.

In completing a living will, Sharon was in the minority of Americans. Silveira and colleagues found that 45% of 3,700 people ages 60 years and older who had died between 2000 and 2006 had a living will.[3] (The National Hospice and Palliative Care Organization serves as a clearinghouse for information on advance care planning for all states; see http://caringinfo.org.) Sharon had also, through her driver's license renewal, given "first-person consent" for organ donation—a declaration of the wish to be an organ donor that's an option for residents in most states.[4] (For more on how to register for organ donation, see www.donatelife.net.)

DCD is not a new concept. Before the Harvard Committee's 1968 report established brain-death criteria based on neurologic findings, all deaths were determined based on the cessation of cardiopulmonary function.[5] Today, organs for transplantation may be procured from patients after death has been determined by either neurologic or circulatory criteria.

The 2006 IOM report discusses the importance of distinguishing between deaths determined by neurologic or circulatory criteria, especially when explaining the donation process to a family.[1] The terms *brain death* and *neurologic death* refer to the irreversible cessation of all brain activity, including that of the brain stem. Most organ donation occurs in such cases; a brain-dead patient is maintained in an ICU so that organ function can be optimized until procurement takes place. The terms *cardiac death* and *circulatory death* are used to describe patients who aren't brain dead, and who, after the withdrawal of life-sustaining therapies, are pronounced dead after two to five minutes of a nonperfusing rhythm, when the cessation of circulatory and respiratory function is understood to be irreversible.[6] If such a patient doesn't die within 60 to 90 minutes, she or he is no longer a candidate for donation because the organs will not have been adequately oxygenated. (A 60-minute window is the policy at our facility.) Generally, organs obtained after circulatory death are as viable as those obtained after neurologic death,[1] but usually just the kidneys, liver, and pancreas are procured after circulatory death.[7]

In circumstances where DCD is a possibility, organ donation is discussed only after the decision is made to withdraw life-sustaining interventions.

Among the recommendations in the Society of Critical Care Medicine's position paper on DCD are several that speak to end-of-life care and the manner in which death is determined, including the following[8]:

- Clinicians' primary goal is to care for the dying patient, and interventions that might harm the patient but benefit organ procurement should be avoided.
- Death must be proclaimed according to "objective, standardized, auditable criteria."
- No clinician who participates in organ procurement or transplantation may declare the patient dead.

- Before and after the withdrawal of life-sustaining therapy, patients have the right to analgesics and other palliative measures.

Because Paul raised the possibility of organ donation, the OPO liaison explained the DCD process. Laboratory tests would determine whether Sharon's organs were suitable for donation; if they were, the team would decide which organs and tissues would be recovered, where matching recipients could be found, what the timeline of organ recovery would be, how the withdrawal of life-sustaining measures would occur, and what would happen if Sharon didn't die within 60 minutes.

Her family decided to honor her wishes and attempt to donate her organs. It was agreed that the withdrawal of life-sustaining therapies would begin at 11 PM.

WITHDRAWAL OF LIFE-SUSTAINING MEASURES

Sharon's palliative care nurse acted as the liaison between the team and the family. She assured the family that care would continue before, during, and after the withdrawal of life-sustaining measures, regardless of the outcome. If Sharon didn't die within 60 minutes, she would be transferred to the palliative care unit, which would provide privacy and quiet, unlimited visiting hours, a sleeper bed for the family, and personal attention from a nurse skilled in end-of-life care.

The IOM has published guidelines on the withdrawal of life-sustaining treatments and the independent decision for organ donation.[9] They stipulate that end-of-life care should focus on the patient and family, not the potential for organ donation.

Standardized tools are available for the evaluation of a patient's suitability for DCD. The University of Wisconsin Donation After Cardiac Death Evaluation Tool scores specific clinical factors such as the presence or absence of spontaneous respiration; the score predicts the probability (low, medium, or high) that the patient will breathe on her or his own after extubation. Lewis and colleagues found that the tool predicted death within 60 minutes of extubation 83% of the time.[10] A 2010 study by Yee and colleagues reported that the variables most likely to predict death within 60 minutes of withdrawal of life-sustaining measures were absent corneal and cough reflexes, abnormal or absent motor response, and an oxygenation index higher than 4.2.[11]

The OPO Life Connection of Ohio uses a tool similar to the Wisconsin tool. A critical care physician determines the patient's potential for donation and the likelihood of death within 60 minutes of extubation. The physician may lower the breath rate on the ventilator to determine the patient's respiratory drive and tidal volume. Other factors assessed include whether the patient is on vasopressors, whether there is a cough or gag reflex, and how responsive the patient is to stimuli.

The physician didn't believe Sharon would die within 60 minutes because of her strong respiratory drive and high tidal volume. The family was made aware of this assessment and chose to proceed with DCD, knowing that she would likely be transferred to the palliative care unit. Extubation would take place in a private ICU room adjacent to the operating room (OR), with family members present. If she were to die within 60 minutes of extubation, she would be moved immediately to the OR, where the transplantation team would be waiting.

Our facility's policy on DCD is very clear: it should not interfere with the primary mission of providing necessary medical care to the seriously sick and injured.

HOSPITAL POLICY AND PROCEDURE

Consent for donation of Sharon's organs had been obtained at 2 PM. From that time until 11 PM, when life-sustaining therapies would be withdrawn, the OPO investigated the possibility of "directed donation"—whether one of Sharon's kidneys could be donated to an acquaintance—but this wasn't possible because that person hadn't yet been placed on a waiting list. Organ recovery surgeons were notified, permission to proceed was obtained from the coroner (necessary in all trauma cases), blood and urine samples were sent for testing, the palliative care team was activated, and the OR was notified. The OPO coordinator checked a database to determine potential recipients for Sharon's organs.

Our facility's policy on DCD is very clear: it should not interfere with the primary mission of providing necessary medical care to the seriously sick and injured. It complies with the criteria set forth by the IOM,[9] the Ohio Solid Organ Transplantation Consortium,

and the *Ethical and Religious Directives for Catholic Health Care Services*.[12] The policy covers

- notifying the OPO.
- screening the candidate for appropriateness for donation (through a review of records and discussion with physicians).
- obtaining the family's consent for donation.
- managing the care of the potential donor: testing for organ suitability (serologic screening for hepatitis and HIV, for example) while maintaining hemodynamic support and organ function (which involves continual assessment, fluid administration, and communication between the team and the family).
- communicating among staff, including completing a detailed checklist and comfort-care order.
- performing prerecovery procedures, such as chest X-ray; urinalysis; blood, urine, or sputum culture; biopsy (rarely indicated); bronchoscopy (if the lungs are to be procured); and the final step in the process, extubation. (In some facilities heparin is administered to keep the organs perfused, but this is controversial[1]; our policy is to administer no medications to a living patient for the purpose of preserving organ function.)
- pronouncing death, according to one of the following criteria: five minutes of ventricular fibrillation, five minutes of electrical asystole, or five minutes of pulseless electrical activity.
- caring for the patient in case death doesn't occur within 60 minutes of withdrawal of life-sustaining measures.

A detailed checklist gives all team members a way to make sure policies are adhered to. (For a copy of our policy's checklist, contact coauthor Kim Zaruca at kimberly_zaruca@mhsnr.org.)

A 2010 survey by Fugate and colleagues found great variability in hospital policies on DCD; nearly half of hospitals that have such policies don't define criteria for determining circulatory death.[13] According to a 2010 study by Bernat and colleagues, a period of two to five minutes of a nonperfusing rhythm is adequate because after that time lost circulatory and respiratory function does not reverse.[14] And as the Hospice and Palliative Nurses Association position paper on organ and tissue donation says, "Palliative care professionals should have a role in the care of DCD donors until death has been pronounced to ensure attention to symptom distress and family care."[15] The hospital maintains communication with the OPO, and uses the in-house coordinator as a liaison.

In addition, the in-house coordinator communicates with the OPO staff as they enter data into the United Network for Organ Sharing (UNOS). These data interface with a database of potential organ recipients. Organs are placed in accordance with UNOS standards. Coordination is necessary to determine whether the local transplantation surgeon or a visiting transplantation team will be available for organ recovery. The recipients must also be notified and arrive to their transplantation center for preoperative evaluation and preparation.

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When planning the withdrawal of life-sustaining measures, the ICU, palliative care, pastoral care, and OPO personnel review the plan of care, including current medications, artificial feedings, inotropic medications, and ventilator settings.[16] Preparations should extend to planning what will happen if the patient dies or doesn't die within 60 minutes. The family should be advised of each plan.

In our facility, care for patients at the end of life is facilitated by an order set in the electronic medical record. These aren't standardized orders but can be used by the physician to ensure that the patient's essential needs are met.

For all members of the team, carrying out Sharon's wishes while providing end-of-life care remained the first priority. But as is true in many hospitals, the caregivers in this case had the choice to opt out of Sharon's care for ethical reasons (see *Ethical Considerations of DCD*[1, 6, 17-19]). And while some perioperative nurses at our facility initially voiced discomfort—because the patient coming into the OR is dead, there is no ventilator and no anesthesiologist—we've found that with the goal of saving lives through organ donation, all nurses have been willing to participate in organ procurement.

Sharon and her family were taken to an ICU trauma room, just outside the OR suite. At 10:45, the nurses, a chaplain, three OPO in-house coordinators, a trauma

resident, and the patient's own pastor and his wife gathered. The procedure was again explained thoroughly and time was provided for questions.

At 11:05, Sharon was given 5 mg of morphine and 2 mg of lorazepam. The ventilator was removed at 11:22, while Paul held her hand. Her oxygen saturation level dropped quickly to 60%, and by midnight it was 40%. As her respirations quickened and became slightly labored, the morphine and lorazepam doses were repeated. Comfort was a priority.

After an hour passed, Sharon was still breathing. She no longer met the criteria for organ donation. Sharon and her family were moved to a quiet, private room in the palliative care unit. Hot coffee and warm blankets were given to the family, and a pull-out bed was fitted with sheets and pillows. A dim light from a corner lamp provided a contrast to the glaring lights in the hallway. As Sharon was settled into her new surroundings, a nurse placed a prayer blanket, knitted by volunteers in the palliative care unit, at the foot of the bed to provide a less-sterile feel to the room. The nurses assured Sharon's family that, although organ donation didn't take place, they had indeed followed her wishes, and they could take comfort in that knowledge.

END-OF-LIFE CARE AND PALLIATIVE CARE

Wednesdays are bread-making days in the palliative care unit—a comfort measure for patients and families that began when the unit opened. A volunteer brought

Ethical Considerations of DCD

Some have debated when death really occurs.

The 2006 Institute of Medicine report on organ donation acknowledges that the point at which death can be declared—when circulatory or neurologic function has ceased irreversibly—is not universally agreed upon.[1] The "dead donor rule" has guided practice, dictating that no organs may be procured from a dying patient until that patient has died, and conversely, that no patient may be killed for the procurement of organs. But Truog and Miller discuss the limitations of this rule: "Although everyone agrees that many patients could be resuscitated after an interval of two to five minutes, advocates of this approach to donation say that these patients can be regarded as dead because a decision has been made not to attempt resuscitation." In other words, such patients are "irreversibly" dead only because family, caregivers, and the patients themselves have decided not to attempt resuscitation.[6] Informed consent, they say, ethically justifies DCD.

A 2006 article by Souter and Van Norman discusses that "controlled" DCD—an anticipated death occurring in a hospital, where the patient is ventilated and organ viability can be maintained (as opposed to "uncontrolled" death, which usually occurs outside the hospital)—can shorten ischemic times in heart, liver, and lung transplantation, but it can also present ethical quandaries: performing extubation in an OR, for example, so that the organs may be quickly procured has led some clinicians to "decry the transformation of the OR from a traditional place of healing and hope to a place of death."[17] Souter and Van Norman say that the education of hospital personnel on such issues has been slow. Also, a 2006 study found that some perioperative nurses "did not accept the irreversibility of cardiac death."[18]

When considering the withdrawal of life-sustaining interventions and the potential for organ donation, the team prioritizes care based on the patient's and family's needs and values. When the family's wishes are in conflict with the patient's stated wishes, clinicians should talk sensitively with family members about what would be in the patient's best interest.

The goals of end-of-life care and organ donation can be met in even the most tragic of circumstances. But there's also some controversy about this. Some legal specialists have argued that these two goals can be in conflict in cases involving circulatory death because in some states organ-donor laws supersede do-not-resuscitate orders; for example, a patient can be kept on a ventilator for the purpose of maintaining organ viability.[19] Thus, when a patient with a severe brain injury doesn't meet the criteria for neurologic death, it's important to establish what the patient's wishes are and what can realistically be accomplished.

freshly baked bread to Sharon's room, explaining that it was food for the body and soul. For this family, the baking and sharing of bread symbolized our team's respect for Sharon's life and beliefs and our holistic approach to her care. As the family recalled later, at her funeral, "The act of sharing bread, the act shared by Jesus and his disciples, reminds us of God's enduring love for us in all circumstances."

Clinicians who discuss options for end-of-life care and the withdrawal of medical treatment with family members should always acknowledge that organ donation and palliative care are not mutually exclusive.[20] The World Health Organization has defined palliative care as an approach that in cases of life-threatening illness focuses on "prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems."[21] End-of-life care is an important part of palliative care, and in cases involving DCD the palliative care team includes ICU and OPO personnel. When severe traumatic injury threatens a patient's life, palliative care expertise, especially in communication and symptom management, is essential. This is also true in DCD cases.

On the palliative care unit, Sharon's cervical collar, ventilator, and lower-extremity compression devices were removed. Bruises on her left side changed to a light gray-green. She died two days later, having lived well beyond the 60 minutes allowed for solid-organ procurement. Her family stayed with her. They voiced regret that no one would benefit from her organs; but when she died, her corneas were donated. We were also with Sharon when she died.

Many patients await transplantation. To them, organ donation is a gift. To donors and their family members, it can be a way to make sense of a sudden or an unforeseeable loss of life, one positive outcome of their tragedy they can take pride in. ▼

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Patricia Ringos Beach is patient navigator and clinical nurse specialist at Mercy Cancer Center, Toledo, OH. Annette M. Hallett is palliative care coordinator at Mercy St. Vincent Medical Center in Toledo, where Kim Zaruca is in-house organ procurement coordinator for Life Connection of Ohio. *The authors of this article have disclosed no significant ties, financial or otherwise, to any company that might have an interest in the publication of this educational activity.* *Contact author: Patricia Ringos Beach, pbeach@bex.net.*

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