DCD Liver Transplant: The OPO Perspective

19

Danielle Balbis and Heather Markuson

Introduction

The process of organ donation is multifaceted, and one of the many complexities is donation after circulatory death, or DCD. Organ donation following *brain death (also known as neurologic death)* is a more straightforward process, as organs are recovered for transplant from patients who have been declared brain dead. However, for DCD, organs are recovered for transplant from patients who have been declared dead by cardiopulmonary criteria following the removal of life-sustaining measures and a 2–5-minute waiting period. The majority of these patients have experienced a devastating neurologic insult, have not deteriorated to brain death, and have little to no chance for a meaningful recovery. Together with the physician(s), the family elects to withdraw life-sustaining therapies. The Organ Procurement Organization (OPO) offers organ, tissue, and eye donation options to the family if the patient had not already registered his/her donation wishes. After authorization and obtaining a past medical and social history, routine testing is completed and clinical information is gathered before organ offers to transplant programs can be made. The liver is among the more commonly recovered organ for transplant from DCD donors. This chapter will review the pertinent details surrounding DCD from an OPO standpoint. At LifeQuest, the OPO that serves northern Florida, we have been providing DCD donation options for families continuously since 1993 [1]. Table 19.1 below illustrates this 26-year DCD history from 1993 through 2019. LifeQuest has facilitated the recovery of 449 DCD donors, which resulted in 285 livers transplanted. Additionally, 592 kidneys, 30 lungs, 11 pancreases, and 1 heart were transplanted, totaling 919 organs from these 449 generous DCD donors.

D. Balbis (✉) · H. Markuson
LifeQuest Organ Recovery Services, Gainesville, FL, USA
e-mail: danielle.balbis@lifequest.ufl.edu

K. P. Croome et al. (eds.), *Donation after Circulatory Death (DCD) Liver Transplantation*, https://doi.org/10.1007/978-3-030-46470-7_19

Table 19.1 LifeQuest organ recovery services DCD data

Year	DCD cases	Kidneys	Liver	Lungs	Pancreas	Heart
1993	1	2	0	0	0	0
1994	3	6	0	0	0	0
1995	2	4	0	0	0	0
1996	4	6	2	0	0	0
1997	4	4	2	0	0	0
1998	5	6	3	0	0	0
1999	6	9	3	0	0	0
2000	11	11	4	0	0	0
2001	11	14	6	0	0	0
2002	13	18	9	0	1	0
2003	12	17	9	0	1	0
2004	18	21	12	0	2	0
2005	25	24	23	0	1	0
2006	22	31	17	0	1	0
2007	43	57	29	0	1	0
2008	27	36	17	2	0	0
2009	17	20	10	0	1	0
2010	25	38	17	4	2	0
2011	21	33	14	2	0	0
2012	14	19	13	0	0	0
2013	26	26	17	0	0	0
2014	27	31	18	0	0	0
2015	28	39	16	10	0	0
2016	21	31	12	6	0	0
2017	19	25	9	4	0	0
2018	18	27	9	2	0	0
2019	26	37	14	0	1	1
Totals	**449**	**592**	**285**	**30**	**11**	**1**

Hospital Service

To assure timely notification of patients who may have life-sustaining therapies removed for the purpose of death, the OPO must provide all partner hospitals with routine education regarding the identification and referral of these patients. The OPO must assist the hospital with developing policies that require the timely referral of patients whose families may elect to terminate life-sustaining measures. Timeliness of the referral is of utmost importance for these cases. Often when a critical care physician speaks with the family about the poor prognosis and the option of removing life-prolonging treatments, families that elect to do so typically want it done quickly. Whenever possible, the referral to the OPO should be made prior to the physician's conversation with the family, so that the OPO can determine if the patient could potentially donate and be available to speak with them immediately following their decision to end life-sustaining measures on behalf of their loved one. If the referral is made after the family agrees to remove life support, the family is then put on hold until the OPO can arrive to perform a DCD assessment and speak with them about donation options. This not only delays the withdrawal process, but it also delays the organ donation process if the family authorizes it.

Early referral is the key to a successful DCD program for OPOs, as well as better service to families and transplant programs.

Even though it is required by the Centers for Medicare and Medicaid Services' (CMS) Conditions of Participation for hospitals [2] to refer every imminent and actual death, referral variances still occur. The OPO must serve the hospital by rounding on staff and maintaining frequent visibility, providing in-services, assisting with organ donation policies and protocols, and following up promptly with key contacts in the hospital whenever there is a variance. Examples of variances can include late referrals, missed referrals, pre-approaches (mentioning organ donation to the family too early in the process), and *extubation prior to calling the OPO*. All of these can cause the loss of an organ donor, but it is the latter that is the most frequent reason for losing a potential DCD donor for many OPOs. For example, some families will make a decision to withdraw life support on their own and proactively speak with the critical care team to have their loved one removed from life-sustaining measures. When this occurs and the physician agrees, sometimes the patient is removed from the ventilator hastily and only then is the referral made to the OPO. In this scenario, it is too late to offer organ donation options, and the donation opportunity is lost.

Organ procurement organizations must provide the appropriate resources to provide excellent hospital services and assure the referral of all potential DCDs in a timely manner in every hospital in the OPO's service area that has ventilated patients. Without the referral, there can be no organ donor, and consequentially, no liver or any other organ, for transplant.

Referral Response

When the referral of a potential DCD donor is made by the hospital to the OPO, a prompt response is crucial. OPO personnel must arrive on site to the hospital expeditiously in order to perform a DCD assessment before speaking with the family. The reasoning behind an assessment prior to speaking with the family is that the OPO can offer the legal next of kin/family an appropriate option for organ donation. Most patients who are referred to as potential DCD donors do not meet the requirements to become organ donors due to medical suitability and/or the time constraint associated with the period it takes the patient to expire following removal of life-sustaining therapies. Generally, for a DCD liver donor with no medical criteria rule out, the patient must die within 30 minutes after removal of life-sustaining measures in order to be a suitable liver donor. These 30 minutes are critical and provide the transplant programs valuable information about whether the liver will be suitable to transplant into their patient. At times during these 30-minute windows, the patient experiences a prolonged episode of hypotension or oxygen desaturation, which can lead to the liver not being viable for transplant. Other times, the patient dies very quickly, which is the optimal scenario for a transplant program to be able to provide a quality liver for their recipient. While it can be challenging to predict how long it will take a patient to die after life support is withdrawn, it is imperative for the OPO

to attempt to have a reasonable deduction based on clinical information gathered and, frankly, OPO experience. The University of Wisconsin and other OPOs have developed DCD assessment tools [3] that they find useful in improving accuracy when attempting to determine how long it will take a patient to expire once life-sustaining treatments are removed. Other OPOs do not take this consideration into account but rather pursue every potential DCD donor for whom authorization is obtained.

A thorough DCD assessment will include a review of the patient's current clinical status, past medical and social history, body mass index (BMI), hemodynamic status, Glascow coma score (GCS), and ventilator settings [4]. One component when reviewing the patient's past medical and surgical history is to identify any medical conditions or surgical procedures of the chest or abdomen that could have resulted in potential adhesions. This is of particular importance in the DCD liver assessment so that the OPO can provide the transplant programs with information that there may be challenges during an expeditious abdominal recovery. The size of the potential donor including height, weight, BMI, and abdominal girth are critical pieces of information for liver transplant programs, as they are attempting to match donor livers with the most appropriate recipient on their waiting list. Additionally, donors with higher BMIs, coupled with large abdominal girths, will often present recovery challenges for the abdominal team.

There is particular focus on the patient's hemodynamic status especially as it pertains to vasoactive medications. It is important to assess the potential donor's dependence on vasoactive medications to maintain hemodynamic stability, as this provides one important piece of information regarding how long the patient may sustain a state of hypotension and/or how long it may take the patient to die after removing such medications. Another area of specific focus is assessing the patient's respiratory drive. Some might argue this is the single largest determining factor. OPOs will assess the patient's native respiratory drive, if it exists, above the set mechanical rate. If possible, a negative inspiratory force (NIF) measurement is taken. A NIF > 30 indicates a patient has an adequate ability to ventilate themselves following extubation. When the NIF is <30, the patient is not generating enough strength in the diaphragm to create the negative pressure gradient necessary for adequate ventilation. Additionally, patients who require high ventilator support such as those with an $FiO_2 > 70\%$ or Peep >10 cmH_2O to maintain oxygenation provide valuable information on the determination of the respiratory status following extubation.

Not all patients who meet DCD criteria present with the traditional severe neurologic injury and ventilator dependence. There are other types of patients with injuries, both new and old, who may still meet the criteria for DCD donation. Patients with high spinal cord injuries who are dependent on a ventilator may meet DCD criteria even though they are considered neurologically intact. It is their life dependence on the ventilator for respiratory support that makes them a potential DCD candidate. If the ventilator is removed, there is a high likelihood the patient could not maintain their respiratory function and would expire in the time frame for DCD donation. Patients with end-stage Lou Gehrig's disease (ALS), for example, may be considered for potential DCD donation due to the progression of the disease and their dependence on the ventilator for respiratory support [5]. When evaluating for

potential DCD donation, the OPO coordinator must look at the patient's reliance on pharmacological (vasopressor) and/or mechanical (ventilator or other) support to determine the probability that if these measures are removed, would death occur in the timeframe to allow organ donation? Some examples of non-ventilator mechanical support could include extracorporeal membrane oxygenation (ECMO), intra-aortic balloon pump, left ventricular or assist device (LVAD), or diaphragmatic pacer wires.

Neurologically intact patients, like those with high spinal cord injuries, present a particular challenge with regard to authorization. In many of these cases, the patients are determined to be mentally capable of making medical decisions for themselves, including those related to end-of -life. In those instances and in the absence of a donor directive, the OPO will approach the patient for authorization for organ donation. It is not with great frequency that OPO staff speak with an awake patient about organ donation options, but it does happen and OPOs must be prepared for it. OPO's excellence in communication with the hospital staff, transplant centers, donor families, and the patient/potential donor is pertinent in ensuring a seamless and successful donation experience for everyone.

A thorough DCD assessment during the referral response phase is imperative so that the OPO can provide the family with the most accurate information possible to facilitate their making the best decision for them and their loved one. It is equally as important for the OPO to gather this information to determine whether patients would *not* be eligible DCD candidates so that information can be shared with the family as well. A timely referral made by the hospital and an expeditious referral response by the OPO is paramount to set up the donation conversation with the family the best way possible. The conversation about the option of termination of life-sustaining measures should take place independently from the conversation about organ donation options [6]. Bringing up both options within the same conversation may appear to the family that they are making a decision to withdraw life-sustaining measures for the purpose of organ donation, which should never be the case. Families should make the decision to end life-sustaining therapies because the patient has little to no chance of having a meaningful recovery. Only after the decision has been made, should the family be offered the option of organ donation following death, as these are two separate end-of-life decisions.

The Donation Conversation

There are two methods for organ donation authorization for a potential organ donor when the patient's legal next of kin is available by phone or in person. One way is by requesting organ donation with the legal next of kin if the patient had not already made their donation decision. The other is to honor the donation decision the donor already made during their lifetime when they joined the state/national registry. After a referral is made to the OPO, the OPO first responder will check the electronic donor registry to determine if the potential organ donor declared his/her donation decision by joining the registry. If the name of the patient who was referred by the hospital

appears on the registry, it is confirmed by driver's license number, date of birth, and/or other methods to ensure that this is the correct person. It is important for the OPO staff to check whether any details are provided on the registry. Some people want to donate everything, and others want to donate only particular organs or tissues. When someone has registered their decision to be an organ donor upon their death, it is often called first-person authorization or donor designation. Once this information is acquired, it is shared with the family/legal next of kin. With donation after *brain death*, first-person authorization is straightforward in that the patient is already deceased and the donor designation is activated. For DCD, the patient will not be deceased until after life-sustaining therapies are removed and the physician declares death by cardio-pulmonary measures. Therefore, the conversation the OPO has with the family regarding first-person authorization is worded very carefully so that the family understands that the donation decision has already been made and that no organs will be recovered for transplant before death is pronounced and a 2–5-minute waiting period is upheld [7]. Most OPOs favor honoring first-person authorization with DCD donors, but it can be challenging to work out the details of *the process* with the families. One example is when families choose to be present with their loved one when life-sustaining measures are removed, comfort measures are given, and death is declared by the physician or his/her designee. OPO staff must maintain excellent communication with all involved so that the donor's wishes can be honored, the family's requests can be respected, the ICU staff and the declaring physician can work through their desired order of events for their dying patient, the operating room is kept informed, and the transplant program personnel are continually updated.

What may be even more challenging is when the family of the registered donor opposes donation, despite the donor's recorded wishes. Each OPO must develop its own protocols for handling these types of cases. This can certainly be challenging in donation after brain death cases as well, but once again, that is a more straightforward situation because the donor is already deceased. It is more delicate with DCD, because the timing of the donation conversation between the family and the OPO occurs while the patient is still alive. The first-person authorization is activated upon the death of the individual, and when the family plans to surround their loved one's bedside during the declaration of death phase and beyond, the challenge can become insurmountable. The only consistent practice among OPOs for this scenario is that most OPOs handle these on a case-by-case basis, rather than attempt to draw up a standard protocol in an attempt to fit all scenarios of first-person authorization with family opposition.

It is beneficial for OPOs to proactively work closely with each hospital's legal services department, risk management, and ethics committee to develop a position statement in support of first-person authorization regardless of legal next of kin or family opposition. This eliminates any discord between the OPO and the hospital during these encounters and puts everybody on the path of honoring the donor's wishes with a strong attempt to respect the family's needs. Fortunately, most families support their loved one's end-of-life wishes and the authorization process goes smoothly. Whether it is the donor who made the decision during their lifetime to join the registry or it is the family who authorizes organ donation on behalf of their loved one, DCD requires many thorough conversations with the family regarding

the step-by-step process, especially when the family chooses to stay with their loved one during the declaration of death phase. These thorough conversations can set up a compassionate death experience for the donor and their family.

Medical Management of the DCD Liver Donor

Following authorization, the OPO will begin to coordinate with the medical care team to ensure the patient is properly medically managed so that the liver is offered to the transplant program(s) with the best organ function possible in order to lead to the best outcome possible for the recipient. Medical management of the *brain-dead* donor is directed by the OPO coordinator, but in the case of a DCD donor, medical management remains in control of the critical care medicine team in the unit. OPOs do not have authority to write orders for clinical management on a patient who is still alive. Proactive meetings with the critical care medical teams within the OPO's service area hospitals to discuss donor management goals is crucial prior to a DCD case so that expectations are met when a DCD donor case arises. Widely accepted donor management goals for adult donors include keeping the patient normothermic, the mean arterial pressure (MAP) between 60 and 110, the electrolytes within normal limits, the urine output at 1–3 cc/kg/hr., and ventilator settings that maximize oxygenation saturation and pulmonary function while keeping the pH normal [4]. The OPO and critical care medicine team must work seamlessly together, but ultimately, the critical care physician is in charge of the patient's end-of-life care, the comfort measures that are provided during the withdrawal of life-sustaining therapies phase, and the legal declaration of death.

Most OPOs avoid requesting any invasive procedures, such as bedside liver biopsies, but those that do obtain permission from the legal next of kin/family. Bedside, liver biopsies can provide important information about micro- and/or macrosteatosis to liver transplant physicians and surgeons, but it is not common practice for DCD donors. Non-invasive tests that are needed are ordered by the critical care physician. Some examples include laboratory tests (e.g., liver function test, prothrombin time, partial thromboplastin time), radiologic studies, and ultrasounds. Prophylactic antibiotic coverage is also standard on all DCD donors, as well as any medications needed to maintain perfusion of the organs during the evaluation and allocation process. In addition to the standard required deceased donor information, the United Network for Organ Sharing, or UNOS, has a minimum requirement for OPOs in order to present a donor liver offer [8] as outlined in the Table 19.2.

Table 19.2 UNOS policy 2.11.B required information for deceased liver donors

The host OPO must provide all the following additional information for all deceased donor liver offers: **1**. Human leukocyte antigen (HLA) typing if requested by the transplant hospital, including A, B, Bw4, Bw6, C, DR, DR51, DR52, DR53, DQA1, DQB1, and DPB1 antigens in the timeframe specified by the transplant program **2**. Other laboratory tests within 12 hours of the offer: **a**. Alanine aminotransferase/asparate aminotransferase (ALT/AST) **b**. Alkaline phosphatase **c**. Total and direct bilirubin **d**. International normalized ration (INR) or Prothrombin (PT) if INR is not available **e.** Partial thromboplastin time (PTT) **3**. Pre-procurement biopsy results, if performed **4**. Pre-procurement CT imaging results, if performed.

DCD Liver Allocation

At the time of writing this book chapter, liver allocation in the United States has never been more contentious. The outcome of this long-standing debate is that OPOs are required to allocate livers from adult deceased donors to the most urgent recipient candidates in need within a radius of 500 nautical miles from the donor hospital. After that, DCD donor livers are allocated to recipient candidates with a MELD or PELD of 15 or higher within a 150 nautical-mile radius of the donor hospital, then a 250 nautical-mile radius, then 500 nautical miles, and so forth with some differences when the donor is under the age of 18 in order to ensure pediatric candidates awaiting a liver transplant have increased priority when pediatric donor organs become available. The United Network for Organ Sharing (UNOS) is responsible for the management of the organ procurement and transplant network. A significant component of this responsibility is to ensure the programming is accurate according to the most recent liver allocation policy that is approved. The goal of liver allocation, and that of any organ allocation, is to attempt to ensure the most equitable means of allocating these precious gifts of life to those in need. If there were an abundance of livers for transplant, there would be few, if any, allocation issues, but because livers remain a scarce resource, it is unlikely that a consensus on policy related to their allocation would ever be reached. OPOs will continue to follow the order of the list and will need to answer to UNOS for any variances related to liver allocation policy.

When making a DCD liver offer to a transplant program, it is essential for OPOs to present the complete donor picture in order for the liver transplant program physician or surgeon to make an informed decision about the donor liver suitability for his/her recipient. It is especially important to share the radiological interpretation of any imaging studies completed on the DCD donor, but also to share the actual images for the transplant programs to view themselves. Specifically with older DCD donors, viewing the actual images can assist liver transplant program personnel to look for any vascular changes in the donor that may impede the recovery. This can include things such as atherosclerosis in the abdominal aorta or abdominal aortic aneurysms.

Part of the evaluation for all organ donors is serologic and nucleic acid testing for diseases such as hepatitis B (HBV), hepatitis C (HCV), human immunodeficiency virus (HIV), syphilis, cytomegalovirus, Epstein-Barr virus, emerging pathogens, and toxoplasmosis. Until recently, donors who tested positive for HCV were highly unlikely to become DCD liver donors. Even with the availability of treatment for HCV, many transplant programs will not accept DCD liver donors who test positive for HCV. OPOs must stay well informed regarding which transplant programs will accept DCD/HCV positive liver offers and determine what the age limits are on this potential donor pool. With an increase in the number of transplants from HCV positive donors to HCV negative recipients, the age limit for DCD transplants for donors who test positive may change and should be part of the routine communication between OPOs and transplant center partners. For donors who test positive for HIV, it was previously mandated by UNOS policy that only the liver and kidneys can be

allocated; however, in February 2020 that has been amended to include all organs [8]. The DCD donation age cutoff for HIV-positive donors is 50 years old, but like HCV, the OPOs must stay in frequent contact with regional and non-regional transplant programs to determine if that age limit has increased for some programs.

Communicating the donor's known behavioral risk factors is also crucial when offering a DCD liver to a transplant program. Some donors have known risk factors that could produce an increased risk of disease transmission at the time of transplant. When a potential liver donor is deemed to be an increased risk using the current Public Health Safety PHS guidelines [9], the transplant centers are notified and prior to transplant must get permission from the recipients to agree to the transplantation of a PHS increased risk donor liver.

In addition to providing the standard organ suitability information such as laboratory test results, imaging, and donor medical and behavioral history, the OPO must provide additional information about the patient's neurologic status for a DCD liver organ offer. In the brain-dead donor liver offer, there is no mention of neurologic status because there is no need. Providing the liver transplant programs the neurologic condition of the organ donor, as well as respiratory and hemodynamic status, will help the transplant programs determine if they have confidence that there is a suitable liver for their patient and that they will expend the resources needed (transportation, surgeon, transplant personnel, etc.) to recover that donor liver on behalf of their patient.

DCD Liver Recovery

Once DCD liver allocation is complete and there is a transplant program that has committed to traveling to the donor hospital to recover the liver, an operating room (OR) time is agreed upon by the OPO and the liver transplant program. The OPO must carefully coordinate the location of the removal of life-sustaining therapies with the attending physician and critical care staff and coordinate the logistics of getting to the OR in time to prepare the body for incision and rapid recovery of the liver following death declaration and the associated mandatory waiting period. Communication is among the most important components of the coordinator's job when it comes to DCD donors. If the family would like to be present during the withdrawal of life support measures and declaration of death, the goal is to locate an area in close proximity or in the OR. OPO staff do not engage in conversation with the declaring physician about details associated with the removal of life-sustaining therapies, comfort measures, or the declaration of death process. If asked, the OPO responds with "please do what you would normally do for any patient who is being removed from medical intervention and ventilator support for the purpose of death." The practice of withdrawing life-sustaining equipment and providing comfort measures should be no different whether the patient is an organ donor or not.

Prior to the termination of life-prolonging measures, the OPO will coordinate a huddle with the declaring physician, ICU staff, OR staff, and on-site transplant

program personnel, to go over the plan for after the patient expires and what everyone's role is in the DCD process. This is of particular importance for all cases but especially when the family is going to be present for the withdrawal and it is occurring outside of the operating room suite. Some of the topics discussed during this huddle are transportation of the donor to the OR suite, transfer of the organ donor to the OR table, the rapid skin preparation for the organ recovery, the plan if the patient does not die in the time it takes to become an organ donor, and a review of the individual hospital's policy on the DCD donor procedure, including the waiting period and the hospital-specific OR time out verification process. In hospitals where DCD donors are not commonplace, a walk-through of the transportation route from the withdrawal location to the OR suite should be considered prior to withdrawal to ensure that there are no obstacles that may slow down the transportation time to the OR once the donor sustains cardiac death.

It is our experience in our OPO service area that families, when present during the withdrawal process, are not always aware of when their loved one has been pronounced dead after the removal of life-sustaining measures. Often, the declaring physician is respectfully quiet when he/she is providing comfort measures and auscultating for heart sounds. Families are grieving the loss of their loved one, hoping there is no suffering, and often the critical care physician will declare death in a very quiet manner. It is for this reason that our OPO will communicate with the family about placing a hand upon their hand when death has been declared. The OPO coordinator will notify the family that within a few minutes from that point, the OPO will need to take the patient to the operating room. Communicating this to the family several times before the withdrawal process will help the process go smoother when the time comes. It is important that the OPO does not rush the family or appear hurried when transporting the donor to the operating room. Making the experience peaceful and respectful for the donor and family is essential. Good communication with the unit staff, the family, the OR staff, and the transplant programs is what makes for a successful, efficient DCD liver donor recovery. Transplant program personnel should never be in the room when the critical care attending physician is removing life-sustaining therapies, providing comfort measures, and declaring death. This eliminates the appearance of, or actual, conflicts of interest by keeping the end–of-life care and the death of the patient entirely separate from organ recovery.

After the physician declares circulatory death, the OPO will alert the family when it's time to take the patient to the operating room. There is a 2–5-minute waiting period that is maintained in order to assess the potential for auto resuscitation. Generally, 1 minute of that waiting period is spent with the family saying their goodbyes and the remaining minutes are used to transport the patient to the operating room. Once in the operating room, the donor is prepped and draped as promptly as possible. During this time, the declaring physician is monitoring the donor for auto-resuscitation. Once the waiting time is complete, the physician confirms there is no auto-resuscitation, and the transplant program personnel can enter the room and begin the organ recovery.

It is important to mention that every hospital has its own unique way of carrying out the DCD donor process. For instance some hospitals will have a 2-minute waiting period and others will have a 5-minute waiting period before the incision can take place. Some hospitals will allow families into the operating room so that the withdrawal of life-sustaining therapies, administration of comfort measures, and declaration of circulatory death can be provided without the need to transport the patient during the 2–5-minute waiting period. Other hospitals will not allow families in the operating room so the DCD process occurs similar to what is described above. It is not uncommon for families to say their goodbyes and leave the hospital after the authorization of organ donation. When this occurs, most OPOs will choose to carry out the entire DCD process in the operating room and call the family with an update after the procedure has taken place.

Following the waiting period and the preparation of the organ donor, the transplant program will begin the operation of rapidly recovering the liver for transplant with the goal of keeping the warm ischemic time to a minimum. The OPO staff must assist the transplant programs in the operating room to ensure an efficient DCD process. The transplant surgeon will provide a visual inspection of the liver, which offers an early report to the OPO on the likelihood the liver will be recovered and transplanted. If there is any question about the liver, a biopsy may be taken and sent to pathology for a frozen section. The results of the frozen section will be available to the transplant team before their departure from the operating room. When there is a question about whether or not the liver will be used by the transplant program recovering the liver, the OPO will often have a backup in place with another transplant program. This would be the time to alert that backup transplant program about what information has been gathered thus far. Once the liver is flushed and taken out of the body, it is brought to the back table for another inspection, as well as packaging and labeling. It is at this time that the primary transplant program will make a decision on whether or not they will be accepting the liver for transplant for their patient. If they choose to decline it, the liver is offered to the backup program. On occasion, a liver transplant program may request biopsy waivers. Some OPOs practice a firm stance on declining biopsy waivers due to financial reimbursement reasons related to expenses incurred pursuing the case. Others will liberally grant biopsy waivers, especially to transplant programs that have a proven track record of transplanting livers more than discarding them. Most OPOs will entertain biopsy waivers for donor livers on a case-by-case basis.

Donor Family Follow-Up

Donor family follow-up post organ recovery is an important part of the donation process not only to update the donor family on the recovery outcome, but also to ensure continued support through their grieving process. The follow-up begins during the authorization process when many OPOs provide the family a booklet on

what to expect in the following weeks after their loved one's death. This booklet contains information about the donation process, what to expect at the funeral home, obtaining death certificates, grief counseling, local community support groups, and other valuable information for navigating the upcoming weeks and months. During the many conversations with the family that follow authorization, the OPO coordinator also goes over the aftercare that the family can expect from the OPO. If during this conversation the family elects not to receive communication from the OPO regarding the donation process or potentially from future recipients, that is documented in the donor's record and it is honored. Once the recovery process is completed, the OPO coordinator will contact the family via phone to give them the outcome and what organs were able to be recovered for transplant. If the family elected not to be present for the withdrawal, the time of death is provided to the family during this conversation. A follow-up letter is sent from the clinical coordinator or family advocate within the first 2–4 weeks of the donation providing the family with information about the recipients. To protect privacy this is typically limited to non-identifying information provided by the transplant center.

OPO Finances

OPOs must never let finances affect decision-making regarding the pursuit of DCD donors or liver-only donors. Even if an OPO will not receive cost reimbursement that meets the expense of a single donor, that donor must still be pursued. Every donation opportunity must be pursued until there are no more patients on the nation's organ transplant waiting list. Some organ donors yield more organs than others and therefore more organ acquisition charges from OPOs to transplant centers, but it is not a single donor that drives an OPO's financial health, rather the accumulation of all expenses, revenues, and cost reimbursement. This is thought through every year during the budgeting cycle. Some years OPOs might need to make adjustments if the number of single organ donors or DCD donors is on the rise. It is better to make these adjustments in the organ acquisition charge than to attempt to make individual donor decisions based on finances. That said, there are a significant number of patients being withdrawn from life-sustaining measures in hospitals throughout the country. Most of those patients do not meet criteria for DCD donation. Pursuing donation options with every patient for whom life-sustaining therapies are being removed, may be an irresponsible use of staffing resources, family time, hospital personnel time, and yes, expenses. For example, many of these patients are over the age of 80, some have cancer, or other medical rule out criteria. OPOs experienced in DCD donation will get very proficient at determining suitability of DCD donors. Having ample staff to be able to respond to the appropriate DCD referrals and perform thorough DCD assessments to determine medical suitability is crucial for a successful DCD program. Keeping abreast of transplant programs that accept DCD livers from older donors, donors with multiple co-morbidities, hepatitis C, etc., is fundamental. When OPOs engage in the pursuit of every potential organ donor regardless of yield, the finances will work themselves out.

After Action Review

Recovering organs from DCD donors can be challenging for both the OPO and the transplant program, and problem prevention can be learned through experience and through after-action review. OPOs should take the responsibility of coordinating communication with their local transplant programs to discuss every organ donor case, especially DCDs. LifeQuest and the Mayo Clinic Florida have been partners since 1998. In 2005, LifeQuest created the after-action review committee which meets once per week by conference call to discuss every donor that occurred in the LifeQuest service area. The e-mail invitation for this conference call is sent to hundreds of people within the three local transplant centers and LifeQuest. In the beginning, many people joined the call to discuss what went well and what could be improved during each of the donor cases. Over the years we have experienced a decrease in the number of participants on the after-action review call and attribute this to problem prevention due to frequent communication for 14 years. As liver allocation algorithms change in the next couple of years and livers are shared on a broader geographic scale, OPOs will be challenged to maintain this type of frequent communication. The donation service area (DSA) will be redefined or eliminated altogether. OPOs will need a further reach in order to maintain relationships with multiple liver transplant programs so that DCD donations can continue as seamlessly as when OPOs were working with only a small number of regular transplant program personnel. New technology such as liver perfusion machines could also change DCD practices. Perhaps more transplant programs will be inclined to accept DCD livers or marginal livers. Nevertheless, after-action review will be just as important, but the method may need to change.

Summary

Donation after circulatory death is on the rise (see Table 19.3). OPOs must continue to keep hospitals informed of this rising trend and continue to educate hospital personnel on the identification and early referral of potential DCD donors. Likewise, OPOs will need to continue to build upon their already-existing palliative and critical care physician relationships to make certain DCD organ donors are medically managed in a way that optimizes organ function while maintaining excellent end-of-life care. OPOs will need to analyze their trends to be sure staffing models keep up with the increase in referrals and actual donors to ensure that no donation opportunity is lost. Public education to encourage citizens to join the organ donor registry will continue to be a priority. OPOs should add DCD education to their community education repertoire, as there still remains a need for education for this type of organ donation. Finally, OPOs will need to carefully monitor the liver allocation changes, technology, and innovation related to DCD liver donation and transplantation. While DCD is increasing, it still remains the greatest opportunity to increase the liver donor pool in the United States.

Table 19.3 DCD donors in the US 1993–May 2019

Year	DCD donors
Total to date	19,214
Jan–May 31, 2019	1039
2018	2132
2017	1883
2016	1684
2015	1494
2014	1292
2013	1207
2012	1107
2011	1057
2010	943
2009	920
2008	849
2007	791
2006	642
2005	564
2004	393
2003	270
2002	190
2001	167
2000	118
1999	87
1998	75
1997	78
1996	70
1995	64
1994	57
1993	41

References

1. Reiner MA, Cornell D, Howard RJ. Development of a successful non-heart-beating organ donation program. Prog Transplant. 2003;13:225–30.
2. CMS.gov. Conditions of participation for hospitals. https://www.cms.gov/Regulations-and-Guidance/Legislation/CFCsAndCoPs/Hospitals.html.
3. Lewis J, et al. Development of the University of Wisconsin donation after cardiac death evaluation tool. Prog Transplant. 2003;13(4):265–73.
4. Malinoski DJ, Daly MC, Patel MS, Oley-Graybill C, Foster CE III, Salim A. Achieving donor management goals before deceased donor procurement is associated with more organs transplanted per donor. J Trauma. 2011;71(4):990–5, discussion 996
5. Shahed T, et al. Organ donation after cardiac death in amyotropic lateral sclerosis. Ann Neurol. 2012;71(2):154–6.
6. Institute of Medicine, National Academy of Sciences. Non-heart-beating organ transplantation: practice and protocols. Washington, D.C.: National Academy Press; 2000.
7. Bernat JL, D'Alessandro AM, Port FK, Bleck TP, Heard SO, Medina J, Rosenbaum SH, Devita MA, Gaston RS, Merion RM, Barr ML, Marks WH, Nathan H, O'connor K, Rudow

DL, Leichtman AB, Schwab P, Ascher NL, Metzger RA, Mc Bride V, Graham W, Wagner D, Warren J, Delmonico FL. Report of a National Conference on donation after cardiac death. Am J Transplant. 2006;6:281.
8. Organ Procurement and Transplant Network policies, updated 05/24/2019, https://optn.transplant.hrsa.gov/governance/policies.
9. U.S. Public Health Service Guidelines for reducing human immunodeficiency virus, hepatitis B virus, and hepatitis C virus transmission through organ transplantation, Centers for Disease Control and Prevention. MMWR Recomm Rep. 1994; 43(RR-8): 1–17.

Further Reading

Bernat JL, et al. Circulatory death determination in uncontrolled organ donors: a panel viewpoint. Ann Emerg Med. 2014;63(1):89–90.

Grewal HP, et al. Liver transplantation using controlled donation after cardiac death donors: an analysis of a large single-center experience. Liver Transplant. 2009;15:1028–35.

Howard RJ, Cornell D. Ethical Issues in Organ Procurement and Transplantation, Bioethics - Medical, Ethical and Legal Perspectives, Peter A. Clark, IntechOpen, DOI: 10.5772/64922. Available from: https://www.intechopen.com/books/bioethics-medical-ethical-and-legalperspectives/ethical-issues-in-organ-procurement-and-transplantation.

Mathur AK, et al. Donation after cardiac death liver transplantation: predictors of outcome. Am J Transplant. 2010;10:2512–9.

Seem DL, Lee I, Umscheid CA, Kuehnert MJ. PHS guideline for reducing human immunodeficiency virus, hepatitis B virus and hepatitis C virus transmission through organ transplantation. Public Health Reports. 2013;128:247–344.

Sheehy E, Conrad SL, Brigham LE, Luskin R, Eakin M, Schkade L, Hunsicker L. Estimating the number of potential organ donors in the United States. N Engl J Med. 2003;349:667–74.

Taner CB, Bulatao IG, Willingham DL, Perry DK, Sibulesky L, Pungpapong S, Aranda-Michel J, Keaveny AP, Kramer DJ, Nguyen JH. Events in procurement as risk factors for ischemic cholangiopathy in liver transplantation using donation after cardiac death donors. Liver Transpl. 2012;18:101–12.