Organ Transplantation after Cardiac Death

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The American Organ Crisis

Despite the recent surge in healthcare technologies and medical practice innovation, increasing rates of organ donation to meet the need for solid organ transplants remains one of the largest unsolved problems in the American health industry. The United Network for Organ Sharing (UNOS) lists the current number of candidates on the transplant wait list at 120,000,22 with that number steadily increasing each day. Unfortunately, the number of American donors is nowhere near the number of potential recipients, as a low 40% of Americans consent to organ donation after death.[21] As a result, only 28,000 transplants are performed annually,23 and an average of 21 people die each day due to not receiving a vital organ.[4] America's potential supply of viable organs shrinks even further when considering the overall weaker physical health of Americans; those who want to donate are more likely to have unhealthy organs due to the prevalence of obesity and other health issues.[7] As researchers struggle to grow organs and tissues in vitro to increase America's viable organ supply, hospitals must look towards other means of procuring donations. One potential resource is a small percentage of Americans who no longer need their organs: those who have suffered from cardiac death.

First, a distinction must be drawn between the medical definitions of "brain death" and "cardiac death." Candidates for both include patients with severe neurological injury (from stroke, trauma, anoxia, hemorrhaging), degenerative neuromuscular diseases, or end-stage cardiopulmonary diseases.[2] Although both outcomes stem from severe brain injury, cardiac death does not meet the clinical standards for brain death. The concept of brain death evolved between 1902 and 1950. After brain death was defined, the organs used during transplantation could be more freshly harvested from brain dead organ donors. This led to overall more successful organ transplantations were overall more successful.[10] Organ transplantation and brain death are now inextricably linked, and a diagnosis of brain death is used in the status quo to determine the appropriateness of organ transplantation for dead hospital patients. There are a variety of tests a physician can administer in order to diagnose brain death: brain stem reflex assessments, apnea tests, and coma appraisals that determine if a patient has truly passed.[14] Examples of tests include searching for an absence of gag reflex, corneal reflex and cough reflex. Other tests look for high body temperature or lack of spontaneous respiratory effort. The time of brain death is marked as a patient's legal time of death, and then donation after brain death (DBD) can occur.

In contrast, cardiac death, or non-heart-beating death, occurs when a patient cannot be legally declared dead due to lingering neurological activity, yet the patient has no chance of recovery. In this case, a physician must determine that the patient would die without life support, and the patient's family must subsequently choose to end life support.[24] Only then is donation after cardiac death (DCD) discussed with the patient's family. A referral is made to an Organ Procurement Organization (OPO), which then determines the patient's eligibility to be an organ donor. If a patient is suitably eligible to donate and the patient's family gives consent, the patient is removed from life support and the donation process can begin.[25] Although DCD could theoretically be as viable as DBD in determining a patient's eligibility for donation after serious brain injury, many hospitals do not accept DCD organs as readily as DBD organs. This piece will now delve into the reasons why the American medical community has been wary of accepting DCD.

Surgical Benefits

The main surgical benefit behind DCD is that the patient's body, through use of a ventilator, is still alive. One organ donor can save up to eight lives through donating 2 kidneys, the heart, 2 lung lobes, the liver, the small bowel, and the pancreas.[28] In order to provide a patient with healthy organs, organ removal

must occur as quickly as possible to prevent the deprivation of oxygenated blood to the organs. Therefore, donated organs are most viable if transplanted soon after a patient's death, but can be chilled in a preservation solution for a number of hours before becoming too damaged for transplant. The possible storage times range from less than 6 hours for a heart or lungs, less than 12 hours for a pancreas or liver, and less than 30 hours for a kidney.[26] After deciding to go through with DCD, there are several hours to prepare for surgery without having to worry about the organs expiring, as the body is still alive while on ventilation. This removes the time crunch usually involved in quickly bringing in a transplant team and conducting the surgery for a DBD.

Aside from relaxing time constraints on organ preservation, DCD affects various preparatory processes that occur before donation. The National Protocol for Donation and Cardiac Death explains how the treatment for potential DCD donors differs from the treatment for those who are removed from ventilation without donation. Differences include delaying the withdrawal of ventilation to allow for the organ donation team to organize, taking blood samples from the patient to match organs to potential recipients, moving in a surgical team, and transferring the patient to a more suitable hospital space for the surgery. This process can take up to twelve hours, as it includes ample medical testing and information collection as well as organizing psychological support for the family.[13] The extended process of DCD ensures that paperwork and organ matching can be done before the surgery, as opposed to the two being done concurrently.

Implications for the American Donor Pool

A 2011 study examined 1137 recipients of DCD donor organs over 28 years and found comparable patient and graft survival rates between DCD and DBD transplant recipients for the kidney, pancreas, and lung after 1, 3, and 10 years.[1] Although there was a slightly higher risk of complication for DCD recipients, particularly for those who received livers,16 this study successfully demonstrated that kidney, pancreas, liver, and lung allografts from DCD donors were viable options for those on the waiting list. Currently, around 5% of donated organs in America come from DCD. Of the 2.2 million people who die each year from cardiac death, only 2% of them end up donating organs.[3] In comparison, DBD contributes to roughly 92% of deceased organ donors in America,[6] indicating that a similarly significant donor pool could be gathered from DCD if the practice became more widespread. Estimates show that more than 20,000 patients who die from cardiac death each year may be eligible to donate, potentially doubling the number of available DCD donors.[27]

Unfortunately, DCD was not considered a viable option for donation until recently, and therefore there are some systemic problems that the medical community must solve. First, DCD is not practiced widely enough to warrant the existence of a standard protocol. An OPO survey conducted in 2005 found that 92% of OPOs used a 5-minute interval from asystole to the declaration of death, consistent with recommendations from the Institute of Medicine. However, some OPOs used 4-minute or 2-minute intervals to determine death, presenting a wildly imprecise three-minute range used by American OPOs as a "standard" DCD protocol.[2] There are additional problems with hospital transparency; in approximately 5% to 10% of cases, a patient may not expire within two hours of being taken off of life support,[2] making their organs ineligible for donation. The National Protocol for Donation and Cardiac Death mentions that most patients die within 10 to 20 minutes but may take longer than two hours.[13] It is unclear if families are made aware that there is a one in ten chance of a failed donation attempt. This means if a patient is assumed to be brain dead but fails some of the tests that check for brain death confirmation before organ donation, the patient is no longer classified as dead and needs additional medical attention. This stops the donation process. Families are re-consulted about patient outcomes and the patient is administered CPR and additional life support. In this situation, families are often alarmed that the patient's original state of cardiac death was misdiagnosed, further tarnishing DCD's reputation in the public eye. Ultimately, consent to donate in all situations relies on a favorable public opinion of the donation process, and the fear surrounding muddy definitions of cardiac death has led to many hospitals refusing to carry out the procedure.

Ethical Concerns

Within the medical community, the efficacy of cardiac death definitions and the dead donor rule (DDR) has come into question, particularly as America's organ shortage leads to an increased focus on donation after cardiac death. There are some clear ethical benefits to donation after cardiac death: DCD increases the donor pool, saving the lives of people on the transplant waiting list, and allows providers to fulfill the wishes of patients who wished to donate but would not be eligible for donation under brain-death criteria.[18] Unfortunately, despite these benefits, the majority of debate on donation after cardiac death has been on its ethical concerns.

Both brain death and cardiac death have been codified in the Uniform Determination of Death Act (UDDA) since 1981: "An individual who has sustained either (1) irreversible cessation of circulatory and respiratory functions, or (2) irreversible cessation of all functions of the entire brain, including the brain stem, is dead."[12] When combined with the DDR of organ transplantation, which states that vital organs can only be taken from those who are dead,20 removing organs from a brain dead donor with a "living" body becomes legally and ethically acceptable.[15] Theoretically, these rules and regulations are in place to assuage the fears a patient's family may have. Unfortunately, cardiac death is comprised of an even looser set of criteria than brain death, and many of the problems with brain death are present in cardiac death but at a greater degree. To start, many physicians disagree on whether a patient with some noncritical brain stem function can safely be declared dead. Even in the case of brain death, where there are 14 listed criteria that doctors can use to assess patients and an established recommendation of two examinations plus confirmatory testing with electroencephalography, which measures electrical activity in the brain. Standard protocol is rarely followed. A 2008 study from Pediatrics found that out of 277 brain-dead children in California, only one child received the recommended set of diagnostic tests.[17] This same issue can easily be applied to cardiac death. The criteria for DCD are often up to the discretion of each individual hospital due to the lack of consensus across the medical community. Unsurprisingly, one of the largest concerns with the concept of cardiac death is the fear that a patient is declared dead without a thorough attempt at saving his or her life. Patients worry that a physician may be so determined to help those that need organ donations, that they could unintentionally pressure a family to go through with DCD. Public concerns were raised in a 2006 case when a transplant surgeon allegedly administered fatal doses of morphine and lorazepam to a potential donor in order to hasten death.[19] There is a paradox inherent in the field of transplantation: the need for a dead donor with a living body. Transplant surgeons are hyperaware of this issue; certain laws exist that rely heavily on semantics to distinguish between biological life and death.

In a 2011 paper, Robert Sade uncovers the rhetorical device within the DDR: the UDDA asks for an "irreversible" cessation of heart function, but if a physician has no intention of reviving a patient then the cessation of heart function is inherently irreversible.[15] Along the same vein of thought, Don Marquis speaks on the reversibility of death in "Are DCD Donors Dead?" He notices, "If the transplanted heart functions in the recipient, then it was not dead when it was still in the donor. If the donor's heart was not dead, then the donor should not have been pronounced dead on the basis of cardiac death." Ultimately, he determines that DCD donors cannot be proven dead due to the inherent breaking of the dead donor rule upon the transplant surgery. He concludes that DCD should either be declared unethical due to violating the dead donor rule, or the dead donor rule must be fudged in some way to qualify a patient as rightfully dead.[11] Clearly, even within the medical community there is ongoing debate about the ethics and potential liabilities behind allowing for donation after cardiac death.

This unclear definition of cardiac death is often the hardest part of the process for families to comprehend. Greater public education about DCD is needed, but considering that organ donation itself is a relatively new topic for the American public, the future in which all patients know about DCD and its nuances seems far off. Even brain death, which is defined far more concretely than cardiac death, is a difficult concept for patients and their families to grasp. According to Arthur Caplan of the NYU Langone Medical Center, "the term 'life support' exacerbates the

[lack of understanding about brain death] because those who are brain dead do not have a life to sustain."[9] In the words of Nailah Winkfield, whose child was declared brain dead on life support, "I would probably need for my child's heart to stop to show me that she was dead. Her heart is still beating, so there's still life there."[20] Emergency medicine physician and bioethicist Aasim Padela clarifies this sentiment while speaking about brain death: "When you see someone who is in the hospital and has no cerebral function, that, I think is easier to accept as a situation where physicians may procure organs with consent."[18] But in the case of cardiac death, when patient still appears to have brain function such as temperature control or water and electrolyte balance, it becomes much more difficult to understand where the line between life and cardiac death lies.

Both the public and physicians appear uncertain about the placement of this life and cardiac death. A 2008 study "Survey of Pediatricians' Opinions on Donation After Cardiac Death: Are the Donors Dead?" shows that after being given a description of a hospitalized potential DCD donor, most pediatrician respondents were not confident in answering whether the patient was dead and eligible to donate organs.[8] From the evidence available that discusses concerns with DCD, it is no wonder that the practice is not widespread in America.

Weighing Outcomes

The 2005 case of Children's Hospital in Boston gives a perfect summary of the challenges facing the normalization of DCD. The hospital gathered 17 doctors, lawyers, and health care professionals as part of a panel to debate the costs and benefits of allowing DCD, but were unable to come to a consensus even after two years of discussion. Supporters felt that the practice was legal and followed families' wishes, but opponents worried that end-of-life care for critically ill patients could be compromised.[17] There was a national conference about DCD in 2005 to address its ethical propriety. This debate has yet to come to a close, more than a decade later.

However, America has been making a slow shift towards accepting donation after cardiac death. The Institute of Medicine strongly endorsed DCD in order to increase the donor pool, and since 2007, The Joint Commission has required all hospitals to have DCD protocol for inpatients if they have the available facilities.[18] That being said, fully fleshed-out DCD policies have yet to be fully implemented across a significant number of hospitals. Without a doubt, a more widespread practice of donation after cardiac death would improve America's organ shortage, but first the current practice of donation after cardiac death must undergo further refinement. Without clarifying the conditions surrounding cardiac death to both physicians and the public, donation after cardiac death will remain on the ethical fence in the public eye. Luckily, America has the medical resources and technology to make donation after cardiac death safe, widespread, and beneficial to those on the waiting list. With greater education for patients and among medical providers, DCD will be on the way to gaining public trust and saving countless lives over the coming years.

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