On the illegitimacy of Donation after Cardiac Death

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"Nobody would seriously argue that the condition of a patient, two minutes post arrest, who is unable on his own to return to normal rhythm, is ipso facto dead [1]."

A seemingly innocuous method to expand the donor pool has progressively infiltrated the medical community with little fanfare. In fact, it is not a new technique but was the progenitor for cadaveric transplants prior to the acceptance of whole brain death (WBD) in the late 1960s. Originally named Non-Heart-Beating Organ Donation, currently deemed Donation after Cardiac Death (DCD), it is an organ procurement method in which death is declared using the cardio-respiratory criterion rather than the neurologic criterion. After death is declared using the cardio-respiratory standard, a variable wait time elapses (usually 2-5 minutes in the USA) following which organs are recovered.

The question that arises is: are these donors really dead after 2-5 minutes of cardiac arrest, zero pulse pressure, apnoea, and unresponsivity, or are they in a dying process? I will argue that that DCD is clinically problematic and conceptually inconsistent for three principal reasons.

First, auto-resuscitation has not been sufficiently studied to confidently declare that it will not occur after 65 seconds of asystole. Even if it could be established, however, the ordinary understanding of irreversible loss of function is not satisfied when auto-resuscitation does not occur or when an individual proscribes an intervention.

Second, DCD focuses on a criterion of death that claims cessation of the organism as a whole can be determined by the loss of cardio-respiratory function only, independently of brain status. Third, DCD conflates a prognosis of death with a diagnosis of death such that imminently dying patients are treated as if they were dead, thus violating the dead donor rule; a normative rule in transplantation, which stipulates that persons are not killed, for or by, the removal of their organs.

I. Transplantation and the DDR

Robert Truog has argued prolifically to abandon the DDR in favour of removing organs from patients who are in a persistent vegetative state (PVS) or from similarly neurologically devastated patients who he claims are beyond harm and/or from those who can explicitly give consent for organ removal such as the imminently dying. He argues that respect for autonomy and nonmaleficence should guide normative rules for donation rather than relying on the concept of whole brain death (WBD), which does not satisfy the DRR given its inherent incoherence [1].

Notwithstanding Truog's often compelling arguments, especially with regard to the problems with WBD, the transplantation community is sensitive to public perception and has repeatedly refused to abandon the DDR despite the fact that it would surely expand the donor pool. In 1994 the American Medical Association’s (AMA) Council on Ethical and Judicial Affairs recommended making an exception to the DDR in the case of anencephalic infants. The UNOS Ethics Committee immediately rejected their recommendation despite the fact that some members viewed such infants as appropriate candidates for donation.

While some UNOS members agreed with the AMA that such infants could be used as organ sources, they unanimously rejected violating the DDR, which would sanction killing for their organs. Those who advocated using anencephalics as organ donors argued that such infants should be reclassified as dead using an ontological definition of death as fulfilled by a higher brain death criterion, thereby safeguarding the fundamental tenet of organ transplantation. Ultimately the AMA Council rescinded its position after much criticism. The general consensus is that removing vital organs prior to death is regarded as homicide even with consent and even when a patient is beyond harm. Thus organ donation remains faithful to the DDR despite a vocal minority opinion. I will conclude therefore that DCD equivocates the line between a dying patient and a corpse and as such violates the current rules that direct organ transplantation.

II. The Maastricht Categories

The 1st International Workshop on DCD was held in Maastricht, the Netherlands, March 30 and 31 1993, in which the four categories of DCD donors were classified, now known as the Maastricht Categories. Maastricht Categories I and II are uncontrolled and refer to those patients pronounced dead on arrival (I) or to patients who have failed successful resuscitation (II). Maastricht Categories III and IV refer to controlled DCD, which refer to patients awaiting cardiac arrest after a planned withdrawal of life sustaining treatment (III) or patients who suffer cardiac arrest while awaiting WBD protocol or after a WBD diagnosis but prior to transfer to the operating theatre (IV). In light of manageability and scope, this article is concerned with evaluating category III. Currently, uncontrolled DCD is infrequently practiced due in part to the logistical drawbacks in procuring functional organs from unexpected deaths, but also because it raises additional moral questions such as when, in the resuscitation process, does the goal switch from treating the patient to preparing him as a potential donor. Of note, controlled DCD bases its legitimacy not only on the fact that cardio-respiratory function is said to be irreversible when the patient will not auto-resuscitate, but also because the patient or family has refused further intervention. This cannot be said of the uncontrolled donor. Moreover, uncontrolled DCD raises additional clinical concerns given the possibility of the Lazarus Phenomenon in which the patient experiences return of spontaneous circulation (ROSC) after a declaration of death using the cardio-respiratory criterion.

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III. Auto-Resuscitation and DCD

Auto-resuscitation, sometimes referred to as the Lazarus Phenomenon, occurs when a patient’s heart spontaneously regains pump function and effectively generates circulation after a period of circulatory arrest. The issue of auto-resuscitation is pertinent to DCD since procuring organs during the time frame in which a patient could auto-resuscitate would mean that neither a strong nor a weak irreversibility criterion had been fulfilled, thus procurement would be tantamount to murder. Auto-resuscitation could theoretically occur in both controlled and uncontrolled DCD donors though it is more likely to occur in the latter.

Despite repeated calls for data regarding auto-resuscitation, no large-scale studies have been designed to address this issue. Only one 2004 study by Wijdicks and Diringer has undertaken the incidence of auto-resuscitation prospectively though the authors admit that their small sample could not be the final arbiter on the issue [3].

Wijdicks and Diringer report twelve patients undergoing withdrawal of mechanical ventilation who had cardiac function monitored via electrocardiogram (ECG). The patients had moderate to severe neurologic injuries, with a Glasgow Coma Scale (GCS) score between 3 and 4. The patients were monitored with an ECG for at least 10 minutes post-cardiac arrest and three patients had arterial catheters in place. Two recordings showed a burst of 5-20 heartbeats 6 minutes after asystole but the arterial catheters in place in those patients did not register circulation, indicating that the cardiac activity was not strong enough to generate circulation. Four other patients demonstrated broad, undefined complexes at 5, 7, 9, and 10 minutes after asystole but did not show a recognizable rhythm. The authors note that though this cardiac activity was disorganized, their observations are in conflict with the Institute of Medicine (IOM) recommendations that call for “at least five minutes of asystole by electrocardiographic and arterial pressure monitoring.”

To briefly summarize, the current data on auto-resuscitation do not establish how long an interval is required to exclude the phenomenon. Thus, it is impossible to make a determination as to whether a 2, 5, or 10 minute no-touch period is adequate at this time. However, auto-resuscitation is not the crux of the issue because the inability to auto-resuscitate does not make an individual dead. Rather, the inability to auto-resuscitate prognosticates death but it is not death itself, for even if it is proven that auto-resuscitation will not occur after a specific number of seconds of asystole, that has only satisfied the weakest construal of irreversibility.

Using a weak construal of irreversibility that declares death on the inability to auto-resuscitate is problematic since many people may suffer an injury from which they cannot auto-resuscitate, though they could be successfully resuscitated with an intervention. Adopting such an approach to irreversibility would mean that the many patients who suffer a cardiac arrest each year who are successfully resuscitated were dead but subsequently resurrected. This seems counter-intuitive at best as such patients were not dead but clearly in a reversible dying process.

IV. Manual Resuscitation and DCD

We must now turn to the prospect of manual resuscitation to support the claim that some DCD donors are not yet dead at organ procurement if they could be successfully resuscitated with an intervention. Successful resuscitation must be regarded as a moving target, that is, the ability to resuscitate an individual varies greatly depending on the circumstances and the co-morbidities in place. If circulation is restored within a variable few minutes, brain function may be recovered, but how much functional recovery can be regained without neurologic sequelae is contingent on a number of different “fate” factors including: arrest time, resuscitation time, time interval between collapse to CPR, core temperature, age, and sex, and baseline neurologic status [4-7].

In addition to restoration of blood flow through numerous techniques, temperature regulation has proven critical in cardiopulmonary and cerebral resuscitation. Exactly how many minutes the brain can sustain complete global ischaemia and still be resuscitable remains debatable. The literature indicates a potential range anywhere between 5, 7, and 11 minutes for acceptable neurologic outcome depending on the types of resuscitative mechanisms utilized.

The currently accepted maximal period of time of normothermic no-flow that is consistently reversible to complete recovery of neuronal function is less than 5 minutes. The 5 minute limit is being challenged by observation that occasional animals or humans recover after 10 minutes of arrest time [4].

This 5-10 minute time frame may be much longer, however, considering some animal studies, which have shown promising results with induced hypothermia. Recent studies have shown complete neurologic recovery in dogs and cats after 16-60 minutes of complete cerebral ischaemia [8-12].

Since neurons require an uninterrupted supply of oxygen and glucose to maintain brain metabolism, mild to moderate hypothermia can improve cerebral outcome by facilitating a “metabolic ice box” for the brain. That is, hypothermia offers a neuro-protective effect by cooling the core body temperature to induce a clinical state similar to suspended animation or torpor, whereby neuronal metabolic consumption is suppressed. By lowering oxygen consumption needs, the brain struggles less to obtain its normal requirements and therefore less damage ensues. Induced hypothermia is also thought to be beneficial in reducing other co-morbidities associated with ischaemia and reperfusion including cardiovascular and haemodynamic disturbances, hyperthermia, and coagulopathy. Accordingly, the recent literature indicates “The 5 minute limit for neuronal survival from normothermic arrest has been extended to 11 minutes with the use of a combination treatment regime [4].”

The scientific data are clear that between 2 to 5 minutes following circulatory arrest, successful cardiopulmonary and cerebral resuscitation is technically possible. Given the diverse population of patients undergoing DCD we cannot make a sweeping generalization that all DCD patients could be successfully resuscitated. It is clear, however, that modern resuscitation techniques are capable of successfully resuscitating patients following much longer downtimes than previously experienced; therefore far longer than 2-5 minutes must elapse before successful resuscitation can be foreclosed.

We have thus reviewed the scientific data showing that the phenomenon of auto-resuscitation remains a possibility. There are no convincing data showing that it cannot or will not occur after 2-5 minutes of asystole, ventricular fibrillation (VF), or electromechanical dissociation (EMD). Also, we have presented data indicating that successful manual resuscitation certainly remains a possibility in this 2-5 minute interim as well. The term “successful” resuscitation must again be qualified. If a DCD donor could be resuscitated to exhibit any brain function that would preclude a diagnosis of WBD (pupillary constriction, or any other rudimentary brain stem activity), then it cannot be claimed that the donor has met the criterion for death as outlined in the Uniform Determination of Death Act.
According to the statute, circulation and respiration can only be discounted in the presence of whole brain death. Therefore, if a DCD donor were resuscitated in whom circulation and respiration could be restored, the patient could only be declared dead on neurologic criteria. It is quite possible however, considering the data presented, that brain function could be restored in the 2-5 minute interval following cessation of circulation. Brain physiology has consistently demonstrated that the brain does not die instantly upon circulatory arrest and some parts, particularly the brain stem, are quite hardy and can withstand prolonged periods of anoxia.

Using the statutory definition of death, it does not matter whether brain function is restored to a marginal state or to a fully functional state; in other words, the quality of neurologic recovery is not important. If a WBD protocol is not fulfilled then death cannot be declared in the presence of circulation and respiration, even if such functions are supported by artifice. Following this argument then, many DCD donors would be able to be resuscitated to some degree of brain function after 2-5 minutes of asystole, EMD, or VF after a declaration of death using the cardio-respiratory criterion and therefore are in a reversible dying process and not yet irreversibly dead.

VI. Heart Dead VS. Brain Dead

Having attended to the issue of irreversibility we must now turn to the last conceptual issue pertaining to DCD, that is whether the cardio-respiratory criterion can be used as a legitimate criterion of death independently of the neurologic criterion. Advocates of DCD argue that the process is licit because it uses the cardio-respiratory criterion promulgated by the UDDA. They maintain that the UDDA allows either criterion to be fulfilled, not both, to declare death [15]. The UDDA does in fact state that death may be declared when either criterion is met; thus, DCD is in accordance with the way the statute is written; death can be declared using the cardio-respiratory criterion without also ensuring that the WBD criterion is fulfilled [16]. However, if we accept a literal interpretation of the UDDA we are offered two disjunctive criteria to ascertain when death has occurred with no explanation of how they are related to one another. This raises several complex problems.

Robert Veatch identifies the crux of the issue when he notes that if a cardiac arrest can be called irreversible at two minutes then death does not require that brain functions must cease [17]. Death can be declared in the presence of continued respiration and circulation provided the whole brain is dead whereas death may not be declared in the presence of continued brain function regardless of circulation and respiration. This reflects the notion that all death is brain death. If the
heart and lungs are not prerequisites for life, and there cessation are not necessary to declare death, as the President’s Commission claimed, a criterion that is not necessary for life or death cannot logically be used independently of the brain to declare death. Yet this is precisely what DCD requires. As stated in the New England Journal of Medicine, “It is clear that a person is not dead unless his brain is dead. The time honoured criteria of the stoppage of the heartbeat and circulation are indicative of death only when they persist long enough for the brain to die.” [18] But dying takes time.

All things being equal, when a patient irreversibly loses cardio-respiratory function he will become WBD, such that irreversible absence of either criterion instantiates the definition of death. The problem is that DCD prevents all things from becoming equal [1]. Using the cardio-respiratory criterion it is possible that the whole brain is not yet dead, which is morally and legally unacceptable.

Using cardio-respiratory criteria to declare death has not been problematic outside of DCD because WBD naturally occurs as a result of cardio-respiratory failure. The brain does not die instantaneously, however; thus DCD intervenes during the process and removes organs often before the brain has had time to completely die. If the brain is not dead, or the critical parts thereof depending on whether one espouses a traditional or ontological view, the patient cannot be dead. The President’s Commission has been clear that all death is brain death. Michael DeVita argues that the two criteria endorsed by the UDDA are complementary in that both need not be fulfilled to declare death. He argues “Most brains cease to function before the heart stops, usually when the blood pressure gets very low, about 50 or so (normal is usually about 120 or so.)” [19] DeVita continues, “In addition, when circulation stops, brain function always stops within 12 seconds except in a very few specific situations which are impossible during non-heart-beating organ donation.” [19]

It is difficult to accept the conclusion that the whole brain is dead simply because brain function stops at 12 seconds. Joanne Lynn argues that no one would suggest that two minutes of anoxia indicates that the brain has irreversibly ceased to function [20]. The brain may have stopped functioning, yet a non-functional brain is not a dead brain. As Lynn further notes, not only is there inadequate evidence pointing to global loss of brain function on the basis of cessation of circulation, but, the available evidence shows that it must be longer than a two-minute duration. This is especially relevant when one considers the neurologically intact DCD patient rather than a patient who retains some ventilatory drive but has extensive brain destruction.

Given the clinical data reviewed, it is arbitrary to select a number of minutes to precisely determine when death has occurred in all cases [21]. There is no clear consensus regarding how much time must elapse after cardio-respiratory functions have failed to declare death and begin organ procurement [22]. Whether 2, 5, or 10 minutes have elapsed after cessation of circulation and respiration, irreversibility has likely not been established since resuscitation to a conscious state is theoretically possible. This does not become “ethically insignificant” simply because of a moral choice; a decision to forgo treatment does not ensure death at that moment, simply ensures that death will inevitably occur.

Ultimately, it does not matter if cardio-respiratory functions are irreversible; what matters in the definition of death is whether brain function is irreversible. Until the brain is irreversibly dead the patient cannot be said to be dead. At 2, 5, and perhaps even 10 minutes of circulatory arrest that DCD requires, it is clear the brain is not yet dead according to the traditional WBD argument.

Organ transplantation is a vital field that can often save or dramatically improve the quality of human life. It can only continue if the public supports it and if the public is confident that the normative rules and guidelines that have been implemented are upheld. At this juncture, DCD is likely an unknown procedure to the general population and it may continue without incident. There is the also possibility, however, that these conceptual issues will eventually be addressed in a public forum. If society concludes, as I have argued, that some donation after Cardiac Death patients are not yet dead at the moment of organ recovery, the field of transplantation may suffer reprisals that could cripple or endanger its viability. In order to safeguard against this possibility, DCD ought to be suspended until these issues are judiciously resolved.

References