Review article

Organ donation after cardiocirculatory death in Switzerland: a review

Julius Weiss[a], Franz F. Immer[a]

a Swisstransplant, the Swiss National Foundation for organ donation and transplantation, Bern, Switzerland

Abstract

Transplantation is the treatment of choice for many patients with terminal organ failure. Due to the shortage of donor organs available for transplantation from brain-dead donors, some countries increasingly promote donation after cardiocirculatory death (DCD). In Switzerland, DCD was introduced in 1985 but it was stopped when the national Transplantation Act came into force in 2007. DCD was discontinued because it was unclear whether the procurement of DCD organs was still allowed under the new law. Following the resolution of this issue, the DCD programmes were restarted in some hospitals. This paper aims at providing a brief overview on the historical, legal and medical framework for DCD in Switzerland. Its main objective is to describe some of the peculiarities of DCD in a manner that will be informative to a readership who might be unfamiliar with the actual circumstances in which DCD may take place, and its medical prerequisites. Therefore, the focus of this article lies on giving an account of the typical medical procedure of DCD while not going too far into medical detail.

Key words: DCD, donation after cardiac death, non-heart-beating donation, transplantation.

Introduction

Transplantation is the treatment of choice for many patients with terminal organ failure. In cases where there is an alternative treatment, such as dialysis for chronic renal insufficiency, solid organ transplantation reduces morbidity and mortality, and it improves the patient's quality of life [1, 2]. For patients who suffer from diseases that cause an irreversible loss of organ functionality, and for which no replacement therapy exists, receiving a donor organ is vital. At the current stage of medical research and practice, there is no therapy for patients with end-stage heart, lung or liver failure which is comparable to transplantation in terms of quality of life and survival benefit [3–5]. It is therefore the hope of thousands of waitlisted patients worldwide to get an often life-saving donor organ. Unfortunately, some of these patients' hopes are dashed because in most countries, including Switzerland, there is a shortage of deceased donor organs available for transplantation.

At the present time, organ donation after brain death (DBD) is the most common source of organs for transplantation in Switzerland. As in other countries that are facing a shortage of deceased donor organs, and because not all potential organ donors qualify for DBD, the significance of donation after cardiocirculatory death (DCD) is increasing [7, 8]. However, DCD (which sometimes is also called "donation after cardiac death" or "non-heart-beating donation") is a challenging procedure, and for medical reasons, the number of patients who may qualify for this type of organ donation is limited. In this context, the authors briefly describe the historical background of DCD in Switzerland, then provide a short overview on the legal framework of post mortem organ donation and its provisions for DBD and DCD. Following that, some of the medical requirements for deceased organ donation will be set out, and the peculiarities of the DCD process in comparison with DBD will be highlighted. Finally, the major challenges in DCD as well as its benefits will be discussed.

A brief historical background of DCD in Switzerland

Between 1985 and the coming into force of the national Transplantation Act on 1 July 2007, DCD organ transplants were performed routinely in the Zurich and Geneva University Hospitals [9–11]. When the Transplantation Act came into force, the DCD programmes were stopped because unfortunately, it was unclear whether the procurement of DCD organs was still legal under the new law. Particularly so with regard to the question of the timing of request for consent to organ donation, and whether preparatory medical measures with regard to DCD were allowed or not [7, 10, 11]. Another issue was an apparent inconsistency between the law and the guidelines of the Swiss Academy of Medical Sciences (SAMS). Swisstransplant, the Swiss National Foundation for organ donation and transplantation, therefore formed a working group with the aim of discussing the issues with the representatives of the transplant centres, the SAMS, and the Federal Office of Public Health (FOPH). A legal opinion, commissioned by the FOPH, made clear that DCD was in accordance with the law, and that therefore, the SAMS guidelines ought to be amended [7, 10–12]. Following this, DCD programmes have been resumed in the Zurich and Geneva University Hospitals, and the Cantonal Hospital St. Gallen has started to procure kidneys from DCD donors.

The general legal framework for deceased organ donation

Switzerland has an opt-in organ donation policy, meaning that no one may become an organ donor without prior explicit consent to donation (e.g., in the donor card). If no document of the patient's wish is present, the family or a designated person of trust will be asked to decide according to the patient's known or supposed wish. This decision by the next of kin is legally equivalent to the patient's own decision. In accordance with the Swiss Transplantation Act, post mortem organ donation can only take place if the deceased person has consented to organ donation before death, and if death has been confirmed [13]. The determination of death in the context of organ transplantation is regulated in the medical-ethical guidelines of the SAMS [14]. The guidelines state that death may be due to either (a) an "irreversible cessation of the functions of the brain, including the brainstem", or (b) a "permanent cardiac arrest, which reduces or abolishes the cerebral circulation, until the irreversible cessation of the functions of the brain and brainstem – and thus death – ensues (death after cardiac arrest)" [14].

It must be emphasised that in addition to the legal prerequisites (i.e., consent to donation, confirmation of death), there is another important procedural requirement that must be fulfilled: The medical evaluation whether there is any possibility to save a patient's life must be independent of any consideration if a patient might be a potential organ donor or not. This means that from a medical point of view, it must be definite that the patient's prognosis is hopeless, and thus it is actually impossible to save the patient's life, or futile to continue life-sustaining treatment of the patient hospitalised in the intensive care unit. The fulfilment of this prerequisite is guaranteed by the legal requirement that the processes of intensive care on the one hand, and organ procurement and transplantation on the other hand, must be clearly separated and involve different physicians in order to avoid conflicts of interest [13, 14].

Based on the above-mentioned distinction between the causes of death, deceased organ donation is classified as (a) DBD (donation after brain death), or (b) DCD (donation after cardiocirculatory death). According to the so-called Maastricht classification, DCD can further be categorised as uncontrolled DCD for Maastricht categories I (dead on arrival) and II (unsuccessful resuscitation), and controlled DCD for Maastricht categories III (awaiting cardiac arrest) and IV (cardiac arrest while brain dead) [15].

In Switzerland, uncontrolled DCD after unsuccessful resuscitation for at least 20 minutes (Maastricht categories I and II) takes place rather seldom. Maastricht-category-IV-controlled DCD is also uncommon, as in such cases the patient's medical condition is very unstable due to the fact that cardiac arrest occurred despite the patient being ventilated and under full intensive care treatment. The most frequent cases of DCD by far fall into Maastricht category III. Typically, a patient who might qualify for this category of controlled DCD is hospitalised in the intensive care unit. Due to the patient's hopeless prognosis it is foreseeable that, as a matter of course, she or he will die within a few hours. Since Maastricht category III DCD is most common in Switzerland, the description of the medical procedure below will focus on this type of DCD exclusively.

Some medical requirements for deceased organ donation

As stated before, one of the medical prerequisites for any deceased organ donation is a factual impossibility to save a patient's life. This typically occurs in cases where a patient suffers from a severe and irreversible brain injury. Such a lesion of the brain is often caused by severe cerebral haemorrhage, trauma or a cerebrovascular accident (stroke), which all can result in a permanent severe impairment of neurological function. Patients who are diagnosed with these pathologies, and are mechanically ventilated may qualify for DBD. In clinical practice this means that a patient whose brain is severely injured may be diagnosed brain dead if he or she fulfils the clearly defined criteria of brain death [14]. In such a case, and on the condition that consent for organ donation was given, a patient may become a DBD donor, if there are no medical contraindications to organ donation.

In cases where the criteria of brain death are not met, but the other conditions (consent and medical suitability) are satisfied, a patient may qualify for DCD. Typically, this can be the case in patients whose hopeless prognosis is due to causes that lead to severe and irreversible brain damage, or results from cardiac arrest with failed resuscitation or anoxia. These are pathologies which lead to a situation where the only option is the discontinuation of therapy. Withdrawal of treatment due to hopeless prognosis is not uncommon in intensive care. Previously unpublished data from the Swiss Monitoring of Potential Organ Donors (Swiss-POD) show that slightly more than half of patients who die in an intensive care unit do so after treatment was discontinued. Only a fraction of them, however, medically qualify for organ donation. Whether in fact the prognosis is hopeless or not must be assessed and determined unanimously by all clinicians (specialists) who are in charge of the treatment of the patient. Notably, the decision that further treatment is futile must be taken independently of any considerations whether a patient might qualify for organ donation.

All cases in which post mortem organ donation might be an option have in common that it is clear that the patient has no chance of survival. In any case this means that it is only a question of time until the patient

will inevitably die once life-supporting treatment is discontinued. In other words this means that when mechanical ventilation is stopped, the patient dies as a consequence of the permanent cessation of brain and cardiac (circulatory) functions which are interdependent.

The Maastricht category III DCD procedure

Figure 1 is a schematic representation of the Maastricht category III DCD procedure in comparison with the DBD procedure. It shows that basically, the two processes are very similar as their fundamental elements are the same. The difference between the two procedures is mainly due to the chronological sequence of the elements. It also shows that, in the case of Maastricht III category DCD, the patient who deceased due to cardiac arrest (asystole) subsequently must be declared brain dead before organ procurement. This means that after the permanent circulatory arrest – the cause of the patient's loss of life – with documented mechanical failure and therefore no blood ejection (diagnosed by ultrasound), death is being confirmed according to the brain death criteria (except for the apnoea test which is not applicable) [14]. For that reason a DCD donor fulfils both, the "traditional" definition of death, i.e., permanent cardiac arrest, as well as the neurological definition which is the irreversible cessation of all brain functions.

One peculiarity of DCD process in general lies in the fact that time plays an important role in various aspects. First, it must be highly likely that a patient will die of permanent circulatory arrest within two hours after the discontinuation of therapy. This happens most commonly in patients who suffer from basilar artery thrombosis, or brainstem haemorrhage with a failure of the respiratory centre. Second, if the patient has no donor card or advance directive saying whether he or she wished to be an organ donor or not, the next of kin need to come to a decision concerning organ donation which might take some time. Other, related, issues are the infrastructure resources that must be available for DCD, such as free capacity in the operating room, as well as the availability of hospital staff.

The first point (likeliness of circulatory arrest) is a significant condition because the major limiting factor for DCD is the functional warm ischaemic period which cannot exceed two hours. During this period, the organs lack an adequate blood supply caused by the impairment of circulatory function in the dying process after the discontinuation of life-supporting treatment. The lack of blood supply brings about a deterioration of organ functionality which, after a prolonged time, will result in the non-transplantability of the organs. The warm ischaemic tolerance varies between the organ types; it is shortest for liver and pancreas (30 minutes), one hour for lung, and two hours for kidney. Once these periods have elapsed, the organs cannot be transplanted anymore.

If the permanent circulatory arrest does not occur within less than two hours, the DCD process therefore comes to stop. Provided that the circulatory arrest occurs before the maximum warm ischaemic period is reached, the DCD process reaches the asystolic warm ischaemic period. At its beginning there is a minimal stand-off time of 10 minutes, during which no resuscitation measures are taken (according to the decision to discontinue life-supporting treatment). These 10 minutes of permanent cardiac arrest are diagnosed by transthoracic echocardiogram, and they exclude the possibility of adequate cerebral perfusion [14]. As shown in figure 1, the patient is subsequently being tested whether he or she fulfils the criteria for brain death or not. If the criteria are met in clinical examination, the patient will be declared brain dead, and only then organ procurement may start (given consent to organ donation was obtained).

The second point mentioned above concerns the decision by the next of kin whether they consent to organ donation or not. This consensual decision, based on the known or supposed wish of the deceased person, must be taken as soon as possible. If the patient and/or the next of kin have consented to donation, the next of kin will be provided further information about the DCD procedure. This includes that they will be told that, even though the patient's death usually will occur without major delay after the withdrawal of life-sustaining treatment, the patient may only become an actual donor if she or he will die within the time frame that

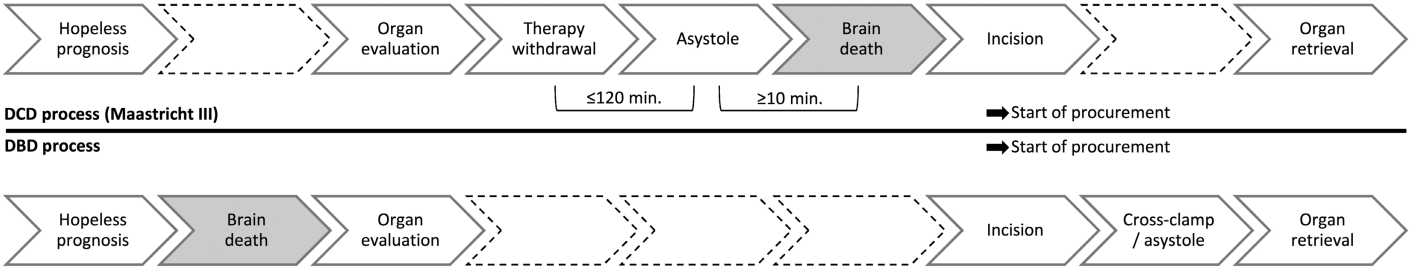

Figure 1: Schematic representation of the Maastricht category III DCD and DBD processes

allows for DCD. The next of kin will be given the opportunity to be onsite when their beloved person passes away, if they wish so. Once circulatory arrest has occurred and brain death has been diagnosed, however, the deceased person must be transferred to the operating room with minimal delay in order to begin with the preparatory measures for organ procurement.

In summary, this shows that DCD is a complex procedure that includes some variables that may hardly be predictable. Therefore, it is a demanding task for the hospital staff involved, and it requires resources, a high degree of coordination and cooperation between all specialists (nurses and physicians in intensive care, surgeons, transplant coordinators). In addition, it is necessary that a transfer of the deceased patient to the operating room can happen promptly. For the next of kin, it is burdensome because in addition to the fact that the patient has a hopeless prognosis, they need to consider organ donation. This situation, however, is likely to be less difficult if the patient's wish had been previously communicated to the next of kin, or documented in an advance directive or the donor card. At any time and in any case, the foremost concern must be the quality of care for the patient who is in the process of dying. This implies that the DCD procedure must not interfere with or compromise palliative care. Especially, this means that it must not extend the patient's agony, and allow death with dignity.

Conclusions

To summarise, there are prerequisites, challenges and opportunities in DCD. The principal consideration, however, must be an optimal care for the patient, irrespective of the question of organ donation. From a medical point of view it is clear that an eventual decision to discontinue life-sustaining treatment has to be made solely on the ground of an established futility of any further therapy. Accordingly, it must be ensured that the decision and its timing is not being influenced by the possibility of organ donation. Also, any measures that need to be taken in connection with organ donation must not further harm the patient. As a consequence, the patient must be provided with the necessary pain relief and treatment like any other patient who is going to pass away in hospital under similar conditions. Accordingly, the standards for end-of-life care in the context of DCD need to be harmonised, and guidelines should be further developed. Some of the major challenges in the DCD process have been pointed out and discussed in the respective section of the paper. Therefore, we would like to conclude by accentuating a few of the benefits of DCD.

First and above all, it should be mentioned that organs procured from DCD donors, and transplanted to patients in need of a donor organ can improve their quality of life significantly, or even be life-saving. However, the outcome of transplantations with organs from DCD donors are not always equivalent to the outcome of transplants with DBD organs. Studies in liver transplantation suggest that recipients of DCD livers are at a higher risk of reduced graft function, and that graft and recipient survival is reduced compared with DBD livers [15–17]. In kidney transplantation, studies have found an increased incidence of delayed graft function in DCD organs. Despite that, the long-term outcome is similar to transplants with kidneys from DBD donors [15, 18–21]. The results achieved with DCD organs in lung transplantation are also encouraging, as there seems to be comparable or even improved outcomes in comparison with transplants from DBD lung donors [22–24].

Another opportunity in DCD is that it offers a possibility to honour a patient's wish to donate his or her organs post mortem. For the next of kin organ donation can be a source of comfort, as the inevitable death and loss of their family member or friend will at least bring some hope to other individuals who are suffering from poor prognosis as well. In view of the fact that organ donation can be life-saving, it is evident that anyone who consents to deceased organ donation acts in a truly altruistic manner which cannot be overestimated.

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Zusammenfassung

Die Transplantation ist für viele Patienten mit terminalem Organversagen die beste Behandlung. Aufgrund des Mangels an Spenderorganen von hirntoten Spendern fördern verschiede Länder Spenden nach kardiozirkulatorischem Tod (DCD). In der Schweiz wurde DCD 1985 eingeführt, aber 2007, als das nationale Transplantationsgesetz in Kraft trat, gestoppt. Grund dafür war, dass unklar war, ob die Beschaffung von DCD-Organen nach dem neuen Gesetz noch erlaubt war. Nach der Lösung dieses Problems wurden die DCD-Programme in einigen Krankenhäusern neu aufgelegt. Dieser Aufsatz gibt einen kurzen Überblick über den historischen, rechtlichen und medizinischen Rahmen für DCD in der Schweiz. Er legt einige Besonderheiten von DCD für eine Leserschaft dar, die nicht mit den Umständen, unter denen DCD stattfindet, oder deren medizinischen Voraussetzungen vertraut ist. Daher konzentriert sich diese Arbeit auf das typische medizinische Verfahren im Fall von DCD, ohne zu sehr in medizinische Details zu gehen.

Résumé

La transplantation est le traitement de choix pour de nombreux patients souffrant d'insuffisance d'organe terminale. En raison de la pénurie d'organes disponibles de donneurs en mort cérébrale, certains pays font une promotion croissante du don après mort circulatoire (DCD). En Suisse, le DCD a été introduit en 1985, mais il a été arrêté lorsque la Loi fédérale sur la transplantation est entrée en vigueur en 2007. La raison en était le manque de clarté sur la légalité de l'explantation d'organes après mort circulatoire sous la nouvelle loi. Suite à la résolution de cette question, les programmes DCD ont été rélancés dans certains hôpitaux. Cet article vise à donner un bref aperçu du cadre historique, juridique et médical pour le DCD en Suisse. Son principal objectif est de décrire quelques-unes des particularités du DCD d'une manière qui sera informative pour le lecteur qui ne serait pas familiarisé avec les circonstances dans lesquelles ce type de don a lieu et avec ses prérequis médicaux. Par conséquent, l'objectif de cet article est de donner un compte rendu de la procédure médicale typique du DCD tout en ne poussant pas trop loin les détails médicaux.

Correspondence
Franz F. Immer, MD
Consultant cardiovascular surgeon FMH
Swisstransplant
Effingerstrasse 1 / Postfach
CH-3011 Bern

franz.immer[at]swisstransplant.org

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