



**University of
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Institute for Biomedical Ethics and Medical History

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Donation after Cardiac Death



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Overview

- Organ donation – general considerations
- The specifics of donation after cardiac death (DCD)
- Ethical challenges of DCD
- Communicating about DCD – a study
- Conclusion



Organ donation – general considerations



Some historical and conceptual remarks

- The **first transplantations** with organs of deceased persons (1950s) were de facto “donations after cardiac death”, without being called so.
- The first transplantation after **brain death** is said to have been carried out in 1965 in Belgium (Detry et al. 2012).
- The term “**Non-Heart-Beating Donation**” (NHBD) was first used when introducing the Maastricht categorization of DCD in the early 1990s (Veatch 2010; Detry et al. 2012).
- Later, NHBD was mostly replaced by the term “**Donation after Cardiac Death**” (DCD) in order to indicate that death precedes donation (Bernat et al. 2006).
- Today it is argued that the term “**Donation after Circulatory Determination of Death**” (DCDD) should be used, because “(...) death determination is based on the cessation of circulatory and respiratory, not cardiac, functions” (Bernat et al. 2010, 2010b).

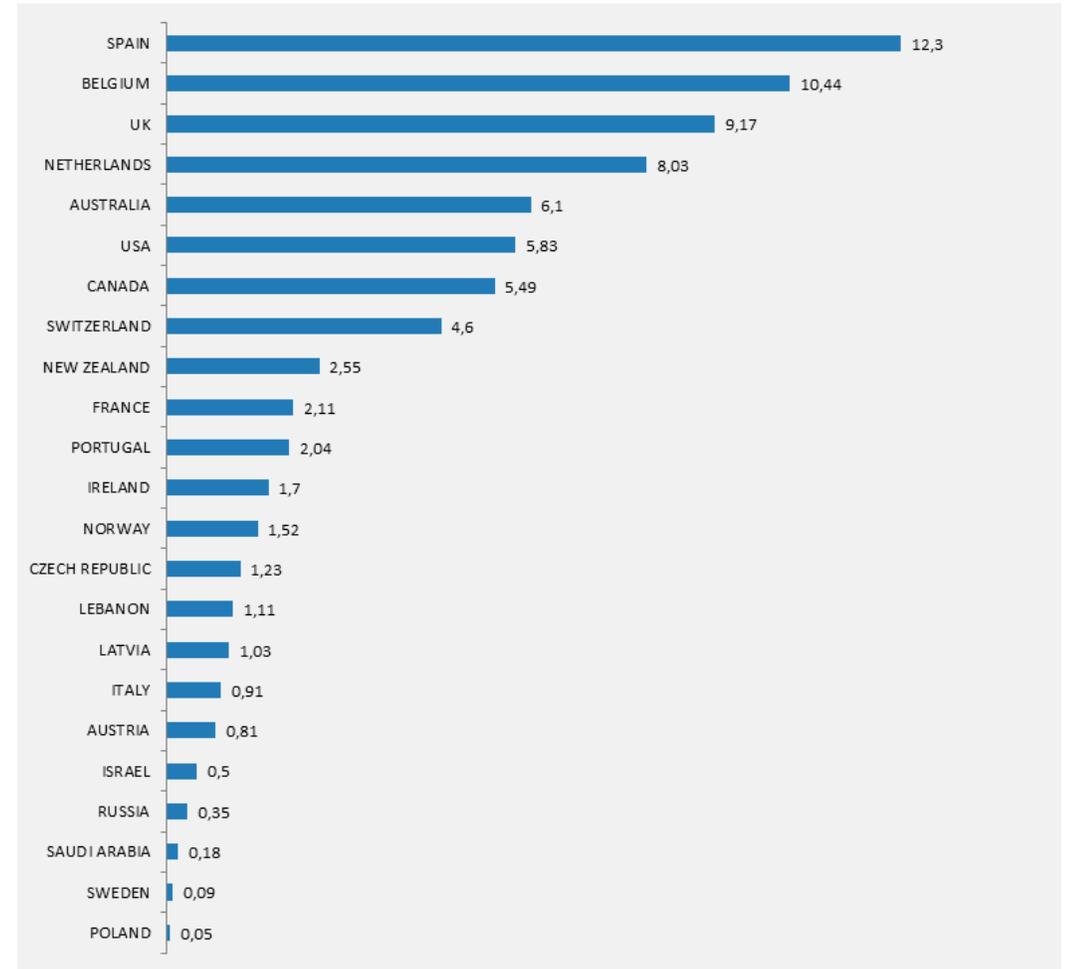


Facts and numbers

- Mostly **kidneys** are obtained with DCD, because these organs tolerate ischemia better.
- In recent years, DCD **liver** donations have gained in importance.
- Today (in rare cases) **lungs, pancreas** and **heart** are also obtained by DCD.

Chart: data of 2017 in DCD donations per million inhabitant (source: irodat.org):

- Spain: 26% DCD
- Belgium: 31% DCD
- Switzerland: 27% DCD
- Czech Republic: 5% DCD





Topics of the ethical debate in transplantation

Topics in the debate	DBD	DCD
Death criterion: Are donors really «dead»?	XXX	X(X)
Allocation: Who should get organs?	XXX	XX
Are donors «harmed» (preparatory measures)?	XX	XXX
Living donation: coercion, donor market etc.?	N/A	N/A
Donation in special cases (e.g. death penalty, euthanasia)?	N/A	XX
Consent models: opt-in or opt-out?	XX	(X)
How to deal with close relatives (communication etc.)?	XX	(X)



Conceptual clarification regarding “death”

One need to distinguish between:

- **Definition of death:** This concerns the philosophical-metaphysical discussion of the concept, nature, essence or definition of death.
- **Death criterion:** This concerns the philosophical-biological discussion about the definition of death criteria, i.e. facts whose existence is tantamount to the death of a human being.
- **Determination of death:** This concerns the biomedical discussion on determining clearly ascertainable empirical characteristics of death that fit the respective death criterion as well as the development of the necessary test procedures.

Important: (human) «death» is not a purely biological phenomenon.



The specifics of donation after cardiac death (DCD)



Types of DCD (refined classification)

In 1995, four DCD categories were proposed. This so-called **Maastricht classification** was supplemented with a fifth category in 2000 (Sanchez-Fructuoso et al. 2000), although this can also be considered a subcategory of category 2.

The most relevant distinction for the ethical analysis concerns the one between **controlled** and **uncontrolled** DCD.

Kat.	Description	Type
M1	Dead on arrival	Uncontrolled
M2	Unsuccessful resuscitation	Uncontrolled
M3	Circulatory collapse after therapy stop	Controlled
M4	Circulatory collapse in brain dead donors	Uncontrolled / (controlled)
M5	Circulatory collapse after euthanasia	Controlled



Processes (2)

Type of donation	Period 1	Period 2	Period 3	Period 4	Period 5
DBD	Therapy of catastrophic brain injury	Discussion situation with relatives	Discussing about organ donation (may involve additional tests)		Explantation
Controlled DCD	Therapy of catastrophic event	Discussion about organ donation	Wait for circulatory collapse	No touch period	Explantation
Uncontrolled DCD	No medical intervention	Reanimation	No touch period	Organ preservation, discussing about organ donation	Explantation



Preparatory measures

Measure	Explanation	Timing
Anticoagulation	Heparine to improve O ₂ -supply	May happen before death declaration
Cardiac massage	In uDCD possible (mechanical)	May happen before death declaration
Donor checks	Checking donor specifications	May happen before death declaration
ECMO	Partial or whole body	After declaration of death
Monitoring	General supervision of patient	Intention change
Organizational issues	May include measures to preserve organs (waiting for explantation team)	May happen before death declaration
Perfusion tube	Organ flush for cooling	Usually after declaration of death
Vasoactive medication	To improve O ₂ -supply of organs	May happen before death declaration
Ventilation	Standard in DBD, uDCD possible	Part of therapy, intention change



Determination of death in DCD

Almost all countries that perform DCD seem to **legally distinguish** between a brain death criterion and a cardiovascular criterion – in the latter, the irreversible breakdown of circulatory function and respiration is considered the characteristic of death.

All procedures for determining death in DCD always include **measurement of circulatory function** as the first step:

- AAP: absent arterial pulse (Doppler)
- ACO: absent cardiac output (echocardiogram)
- AHB/AHS: absent heart beat (auscultation)
- AS: asystole (electrocardiogram)
- BP: blood pressure (arterial line tracing)

The determination of death **may include neurological elements**, but only very few countries (Switzerland, Austria) perform a brain death diagnosis also in the case of DCD.



No-touch period and brain death

Most countries have a “no touch” period of **5 minutes** in case of DCD, which is compatible with the (few studies) available on the time needed until brain cells die when no oxygen is available to them.

However, there is some tension with studies regarding **autoresuscitation** (next slide).

Study	Timing (no O ₂)	Explanation
Stiegler et al. 2012	2-10 min	EEG in pigs disappears after 72 sec the latest. Brain stem reflexes not discernible after 5 minutes, reanimation failed in all cases
Posner 2007	~4 min	Brain cells in hippocampus and cerebellum die
Browne 2010	4-6 min	Cortex is irreversibly damaged
Hacke 2007	5-8 min	Most brain cells die
Bernat 2007	20-30 min	Necrosis in the brain is actually discernible



Irreversibility of “death” (1)

Two points are discussed regarding “irreversibility” of death in the case of DCD;

- 1) **Concept of irreversibility:** What exactly does “irreversible” mean in the context of DCD? Finally, at the time when the patient is still alive, a decision is made (especially in the case of cDCD) not to continue with certain medical measures or to apply them again.
- 2) **Possibility of autoresuscitation** (spontaneous return of the circulatory function): Is there evidence that autoresuscitation is possible within the framework of the current DCD protocols or can this be ruled out at the time of the diagnosis of death?

The first issue concerns mainly a conceptual point (see later slides), whereas the second issue concerns an empirical point.



Irreversibility of “death” (2)

Several cases of **autoresuscitation** (AR) have been observed. However, most published studies have a rather low quality level. The probability of AR seems to vary greatly based on the reason of injury/death – the closer the situation resembles controlled DCD, the less problematic is AR (but this also means that AR may be a problem for uDCD).

Timing (table): Time between therapy stop and AR

Study	# Pat.	Timing	Outcome
Adhiyaman et al. 2007	38	23 <10 min 5 >10 min	All patients had AR; 45% with good neurological recovery, one person died
Hornby et al. 2010	32	Seconds until 33 min.	8 patients with full recovery, 1 with neurological damage, 15 persons died
Joffe 2007	12	3 until >10 min	5 patients survived
Shet et al. 2012	73	No AR	Systematic check for AR in case of controlled DCD



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Ethical challenges of DCD



Framework for analysis

When using the standard “principlism” (Beauchamp & Childress) approach for assessing ethical issues of DCD, the following can be said:

- **Respect for autonomy:** Persons must make an informed decision whether they want to become a DCD donor or not.
→ **Is DCD in a relevant sense different from DBD?**
- **Nonmaleficence:** DCD donors should not be harmed by the procedure.
→ **Can DCD be more harmful than DBD?**
- **Beneficence:** Care for the relevant involved people (also relatives) must be provided.
→ **Does DCD affect interaction with relatives differently compared to DBD?**
- **Justice:** Quality differences of DCD versus DBD organs should be taken into account in organ allocation (could be an issue in case of livers).

In the following, we will not discuss the fourth aspect.



Topics discussed in the literature

Results of a literature analysis on ethical aspects of DCD (2008-2017; from Christen & Gloor 2018):

- The topic of the **preparatory measures** and the **death criterion** for DCD are most prominently represented in the literature.
- Frequent mention is also made of the **special timing issues** of DCD in contrast to DBD - in particular with regard to the question whether the relatives of a donor are aware of those issues.
- Finally, special topics are also discussed such as DCD in **children** or in the case of **euthanasia**, the influence of DCD on the DBD donor numbers and indications that certain transplantation centers could be resistance to DCD.



Preparatory measures

There is an intensive ethical debate in the literature about the **admissibility** of preparatory measures to distinguish them from organ-preserving measures, and on the question of who may give **consent** (e.g. Bastami et al. 2012; Childress 2008; Christensen and Michel 2012; Downie et al. 2008; Haase et al. 2016; Manara et al. 2012; Richards and Rogers 2007; Sparrow 2012; Verheijde and Rady 2010).

The issue of preparatory measures is more sensitive in the case of **uncontrolled DCD**, as there is a bigger need to protect organs from ischemia. Furthermore, means are used that are also relevant in intensive medicine (“transition problem”).

Some preparatory measures, particularly employed in uDCD, have the **potential to violate the principle of nonmaleficence**. A potential donor should be informed about these procedures in order to make an informed decision.



The “transition problem” in uncontrolled DCD

In uncontrolled DCD, a **transition from the focus of resuscitation to organ protection** takes place. This transition of intentions is accompanied by the fact that organ-preserving measures such as ECMO, cardiac massage or hypothermia are also used for resuscitation (Doig and Zygun 2008; Chen et al. 2008; Schneider et al. 2009).

One therefore **needs to decide** when to use these procedures for the purpose of survival or for organ conservation (Harrington 2009; Ortega Deballon 2009). Kirkpatrick et al. (2010) point out that this triage may be susceptible to social bias.

This could furthermore lead to the scenario that the **chances of survival** of a person that suffers cardiac arrest are dependent on whether they are located in the catchment area of a transplant center with uDCD or in the catchment area of a center that researches new resuscitation techniques.



The irreversibility problem

The occurrence of death in DCD is “decision-based”: the decision to discontinue therapy (cDCD) or to discontinue resuscitation (uDCD).

- Some authors consider the determination of a circulatory collapse not an irreversible death criterion (Machado and Korein 2009). It should count as a **death prognosis**, not a death diagnosis (Truog and Miller 2010). They also criticize that – since no neurological determination of death (NDD) takes place – death criterion and death diagnosis are not aligned (Joffe et al. 2011).
- Other authors reply that such decisions are **common practice** in intensive care (Bernat 2010a, 2010b); in particular, if patients have given a “do not resuscitate” order (Sheth et al. 2012). They also reply that an NDD would not be necessary since the declaration of death happens after the “no touch period”.



The time pressure problem

Due to ischemia, **timing issues are more relevant in DCD compared to DBD**, although controlled and uncontrolled DCD differ in that respect:

- **Controlled DCD** are “planned” and relatives are informed in advance on the procedures. In particular, they have time to decide about donation in case no will of the person is available. But the problem remains that only little time is available for relatives between declaration of death and explantation to “say goodbye” to the deceased person.
- **Uncontrolled DCD** is unplanned and there is in particular not much time for relative to make a donation decision (if one is needed). They may furthermore not be aware of the “transition problem”. However, data indicate that relatives have less problems to accept death in case of uDCD.

There are hardly any studies on the question of whether the relatives of DCD donors actually see a problem here. However, it should be noted that the particular temporal structure of DCD has a potential to reduce care obligations to relatives.



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Communicating about DCD



Study setup (Christen & Gloor 2018)

The aim of the study was to obtain data on **information practice on DCD**. We used the IRODat website and other online sources to identify the email contact addresses of 123 organ procurement organizations (OPO) worldwide (countries and States of the USA).

All OPOs have been contacted and asked to complete an **online survey**. Data collection lasted from October 2015 to April 2016. They received two reminder e-mails. The survey consisted of 18 questions (the number of questions displayed depended on the answers given).

We also analyzed 56 **OPO websites** at two different time points (2015 and 2017) on the way they inform about DCD.



Results

The website analysis shows that only **8 of the 56 websites** provide specific information or a link to DCD and **15 mention DCD** as a possible form of transplantation without offering more information – 33 did not (among them 10 of DCD countries). In 6 cases we found a conflict between the data of the survey (it was stated that one informs about DCD) and those of the website (the information claimed was not found); these contradictions have not been resolved upon request.

36 questionnaires were analyzed (29%). The vast majority (22 out of 25) of respondents from countries practicing DCD consider it **important to inform potential donors**, families and authorized persons about the differences between DCD and DBD. For 11 respondents, the reason for this is that there are relevant differences between DBDs and DCDDs; 8 believe that despite a lack of relevant differences, information should be provided; 3 others state other reasons.

The study indicated a gap between the intention to inform and the actual information practice for persons who want to inform themselves to become a donor.



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Conclusion



The “duty to inform”

There is sufficient indication that **DCD differs from DBD in relevant ways**, in particular if uncontrolled DCD is practiced.

From an ethical point of view, there is an obligation to provide information on these differences based on the principle of **respect for autonomy** and the assumption that people who are willing to donate have the right to know about controversies that concern DCD.

People should be given the opportunity to decide whether they only accept donation after brain death, only donation after cardiac death or both options to donate.



Communication needs

Specifically, the information should include the following points:

- **Concerning the principle of nonmaleficence:** Potential donors should be informed about possible preparatory measures and organ-preserving measures in the case of DCD and the fact that the procedure for determining death differs from DBD. In addition, the difference between controlled and uncontrolled DCD shall be clarified.
- **Concerning the principle of beneficence:** Potential donors should be aware of the differences between DBD and DCD with regard to time sequences and the corresponding consequences for the relatives.

How exactly these points can be communicated effectively is a separate issue. Evidence exists that, even in a clinical setting, relatives have difficulties to identify the differences between DBD and DCD (Bastami et al. 2012).



A suggestion regarding determining death

One way to address the communication problem is that transplantation medicine use a **uniform death criterion** and **standardized procedures for determining death** (see also Christen et al. 2015).

This means that death determination in DCD should include elements of brain death diagnostics, as this is the case in Switzerland (SAMW 2017).

This facilitates communication regarding the specifics of DCD: The person can be sure, that her death in the context of an organ donation is determined uniformly and possible questions of a violation of the principle of nonmaleficence with regard to organ-preserving measures and irreversibility are no longer specific to DCD.



References

References cited in this presentation are contained in the following publication:

Markus Christen & Martina Gloor (2018): Ethische Relevanz und faktische Mängel in der Kommunikation von Spezifika der Organspende nach Kreislaufstillstand. *Ethik in der Medizin* 30: 343–361

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