Tensions between end-of-life care and organ donation in controlled donation after circulatory death: ICU healthcare professionals experiences

Matthieu Le Dorze, Romain Barthélémy, Olivier Lesieur, Gérard Audibert, Marie Ange Azais, Dorothée Carpentier, Charles Cerf, Gaëlle Cheisson, Renaud Chouquer, Vincent Degos, et al.

BMC Medical Ethics

RESEARCH

Open Access

Tensions between end-of-life care and organ donation in controlled donation after circulatory death: ICU healthcare professionals experiences

Matthieu Le Dorze[1,2,3*], Romain Barthélémy[1,2], Olivier Lesieur[4], Gérard Audibert[5], Marie-Ange Azais[6], Dorothée Carpentier[7], Charles Cerf[8], Gaëlle Cheisson[9], Renaud Chouquer[10], Vincent Degos[11,12,13], Marion Fresco[14], Fabien Lambiotte[15], Emmanuelle Mercier[16], Jérôme Morel[17], Laurent Muller[18,19], Erika Parmentier-Decrucq[20], Sébastien Prin[21], Armine Rouhani[22], France Roussin[1,2], Jean-Christophe Venhard[23], Mathieu Willig[24], Catherine Vernay[10], Benjamin Chousterman[1,2], Nancy Kentish-Barnes[25] and the CARE-M3 Research Group

Abstract

Background The development of controlled donation after circulatory death (cDCD) is both important and challenging. The tension between end-of-life care and organ donation raises significant ethical issues for healthcare professionals in the intensive care unit (ICU). The aim of this prospective, multicenter, observational study is to better understand ICU physicians' and nurses' experiences with cDCD.

Methods In 32 ICUs in France, ICU physicians and nurses were invited to complete a questionnaire after the death of end-of-life ICU patients identified as potential cDCD donors who had either experienced the withdrawal of life-sustaining therapies alone or with planned organ donation (OD(-) and OD(+) groups). The primary objective was to assess their anxiety (State Anxiety Inventory STAI Y-A) following the death of a potential cDCD donor. Secondary objectives were to explore potential tensions experienced between end-of-life care and organ donation.

Results Two hundred six ICU healthcare professionals (79 physicians and 127 nurses) were included in the course of 79 potential cDCD donor situations. STAI Y-A did not differ between the OD(-) and OD(+) groups for either physicians or nurses (STAI Y-A were 34 (27–38) in OD(-) vs. 32 (27–40) in OD(+), $p=0.911$, for physicians and 32 (25–37) in OD(-) vs. 39 (26–37) in OD(+), $p=0.875$, for nurses). The possibility of organ donation was a factor influencing the WLST decision for nurses only, and a factor influencing the WLST implementation for both nurses and physicians. cDCD experience is perceived positively by ICU healthcare professionals overall.

Conclusions cDCD does not increase anxiety in ICU healthcare professionals compared to other situations of WLST. WLST and cDCD procedures could further be improved by supporting professionals in making their intentions clear between end-of-life support and the success of organ donation, and when needed, by enhancing communication between ICU physician and nurses.

Trial registration This research was registered in ClinicalTrials.gov (Identifier: NCT05041023, September 10, 2021).

*Correspondence:
Matthieu Le Dorze
matthieu.ledorze@aphp.fr
Full list of author information is available at the end of the article

Keywords Organ donation, Controlled donation after circulatory death, End-of-life care, Withdrawal of life sustaining therapies, Intensive Care Units

Background

Controlled donation after circulatory death (cDCD) is one of the ways to increase the transplant supply [1–3]. cDCD refers to organ donation from patients whose death is defined by circulatory criteria after the planned withdrawal of life-sustaining therapies (WLST) [1]. The number of potential cDCD donors is increasing, as more and more patients die in intensive care units (ICUs) after a decision to withdraw LST [4]. Moreover, the results of transplants using grafts from cDCD donors coupled with the use of normothermic regional perfusion appear to be very promising [5–7].

However, the development of cDCD is challenging. In addition to logistical and technical issues, ethical issues related to the WLST may represent an important barrier to its development [3, 8–11]. ICU healthcare professionals may feel uncomfortable with the overlap between end-of-life care and the possibility of organ donation in cDCD. Our previous results have shown that this tension between end-of-life care and organ donation may occur during the three stages of the process: the decision-making process leading to the WLST, the period between this decision and its actual implementation, and the dying and death process [11].

Therefore, the development of cDCD requires the support and the involvement of ICU healthcare professionals and a shared understanding of the trade-offs between end-of-life care and organ donation in the ICU. Developing knowledge about the experiences of ICU healthcare professionals is crucial to improve the quality of the process, but remains understudied [12–21]. We conducted a prospective multicenter observational study to better understand ICU physicians' and nurses' experiences of cDCD.

Methods

The study was designed by a multidisciplinary research team that included ICU physicians involved in organ donation (MLD, RB, OL, BC), a professional of organ procurement organization (OPO) (FR), and a sociologist involved in ICU end-of-life research (NKB).

Participants and design of the stud

The study was a prospective multicenter observational study conducted in 32 centers involved in cDCD donation in France. Organ donation from cDCD donors has been implemented in France since 2015 according to a unique national protocol with the systematic use of abdominal normothermic regional perfusion [22].

ICU healthcare professionals had to complete a questionnaire after the death of end-of-life ICU patients identified as potential cDCD donors that experienced either WLST alone or with planned organ donation. The appropriate institutional review board approved this study (CPP Ile de France XI n°SI 20.01698.044845-MS01).

ICU healthcare professionals included physicians and nurses. A potential cDCD donors was defined as an end-of-life ICU patient for whom a decision to withdraw LST has been made, who had been identified as a potential cDCD donor by the OPO team, and for whom the possibility of organ donation has been addressed with relatives.

Two different situations were defined: 1- Group OD (-): potential cDCD donors for whom the implementation of the WLST began after organ donation had already been ruled out for one or more of the following reasons: medical unsuitability, patient's expressed intent not to donate or relatives' refusal, legal issues, logistical issues, hemodynamic instability); 2- Group OD(+): potential cDCD donors for whom the implementation of the WLST began with organ donation still under consideration.

For each cDCD donor, one ICU senior physician and one or two ICU nurses directly involved in the patient's care were included. Priority was given to those caring for the patient at the time to withdraw LST. Participation was voluntary and free of charge. Each ICU healthcare professional completed anonymously a self-evaluation questionnaire within 72 h of the death of the potential cDCD donor. The questionnaire was developed for this study based on the results of our preliminary qualitative study [11] (Suppemental Material). The questionnaire included the State-Trait Anxiety Inventory (STAI) and twenty-six additional questions. The State Trait Inventory Anxiety is a 40-item, self-administered questionnaire consisting of two subscales. The STAI Y-A measures state anxiety, which reflects the anxiety caused by a situation and felt at the time of the assessment. The STAI Y-B measures trait anxiety, which reflects the anxiety usually felt by the individual. Each scale has 20 items rated from 1 to 4. Total scores range from 20 to 80. Scores range from 20 to 80. Five levels with 10-point differences are described [23, 24]. The additional questions were based on the results of the preliminary study conducted by the same research team [11]. Demographic data of potential cDCD donors and of ICU healthcare professionals were collected.

Objectives

The primary objective was to assess the anxiety of ICU healthcare professionals after the death of a potential cDCD donor. The primary endpoint was the difference of STAI Y-A in WLST-OD(-) and WLST-OD(+).

The secondary objectives were to explore the potential tensions experienced between end-of-life care and organ donation. We explored ICU healthcare professionals' perceptions of care during the three stages of the process, i.e. during the decision-making process leading to the WLST, during the period between this decision and its actual implementation, and during the dying and death process. We explored the experiences of ICU professionals with the overall situation and of cDCD in general.

Statistical analysis

Continuous variables are reported as medians with their interquartile ranges [25th–75th percentiles] and categorical variables are reported as numbers (percentages). The difference between groups were tested using Wilcoxon's test for continuous variables and Fisher's exact test for categorical variables. A sample size of 206 caregivers was calculated to detect a difference of more than 10 points on the STAI Y-A scale between the two groups. This difference was chosen based on the 5 levels described, which differ by 10 points. The statistical analysis was performed using R statistical software version 4.3.1 (R Core Team 2023, R Foundation for Statistical Computing, Vienna, Austria, https://www.R-project.org). A *p* value lower than 0.05 was considered statistically significant.

Results

Potential cDCD donors and ICU healthcare professionals included

A total of 206 ICU healthcare professionals (79 physicians and 127 nurses) were included in the course of 79 potential cDCD donor situations (Fig. 1).

Demographic characteristics of potential cDCD donors are shown in Supplementary Table 1. The end-of-life wishes of potential cDCD donors were known in 45/79 (57%) of cases (89% by relatives testimony, 7% by advanced directives, 4% by health care surrogate (i.e. the person designated by the patient in accordance with the regulations and consulted to ascertain his/her wishes if he/she is unable to express them). The organ donation wishes of potential cDCD donors were known in 51/79 (65%) of cases (86% by relatives testimony, 6% by advanced directives, 8% by health care surrogate). In the OD(+) group, 5/55 potential cDCD donors did not become utilized cDCD donors (1 due to circulatory death declared > 180 min after the WLST, 4 due to excessive warm ischemia time related to normothermic regional perfusion dysfunction or hypoperfusion, 1 due to no organ retrieval).

Demographic characteristics of ICU healthcare professionals are displayed in Table 1. Of these, 57/206 (28%) knew someone who had died in an ICU, 22/206 (11%) knew someone who had donated their organs and 35/206 (17%) knew someone who had been transplanted. Regarding their personal opinions on organ donation, 183/206 (89%) said they were organ donors (of which 77%

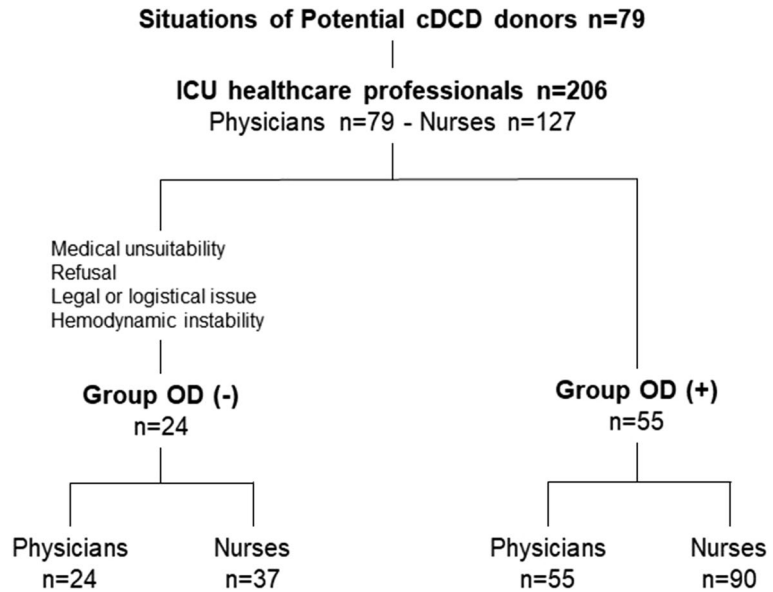

Fig. 1 Situations of potential cDCD donors and ICU Healthcare Professionals included. cDCD: controlled donation after circulatory death, WLST: withdrawal of life sustaining therapies, OD(-): WLST after OD had already been excluded, OD(+): WLST while OD is still under consideration

Table 1 Demographic characteristics of ICU Healthcare Professionals (n = 206)

	Physician *n* = 79	Nurses *n* = 127
Age		
30	7 (9%)	49 39%)
30–39	45 (57%)	43 34%)
40–49	16 (20%)	21 17%)
50	11 (14%)	13 (10%)
Gender, male	49 (62%)	29 (23%)
Years in ICU		
5	44 (55%)	61 48%)
≥ 5	35 (45%)	66 (52%)
Years in ICU with a cDCD program		
5	59 (74%)	90 71%)
≥ 5	20 (26%)	37 (31%)
Number of WLST decision experiences		
10	5 (6%)	92 (72%)
≥ 10	74 (94%)	35 (28%)
Number of previous cDCD experiences		
5	36 (46%)	107 (84%)
≥ 5	43 (54%)	20 (16%)

ICU Intensive Care Units, *cDCD* Controlled Donation after Circulatory Death, *WLST* Withdrawal of Life Sustaining Therapies

have told their relatives), whereas 8/206 (4%) were not, and 14/206 (7%) had no opinion.

Anxiety in ICU healthcare professionals

STAI Y-A were not different between OD(-) and the OD(+) groups (Fig. 2 and Table 2) either for physicians or for nurses (STAI Y-A were 34 (27—38) in OD(-) vs. 32 (27–40) in OD(+), $p = 0.911$, for physicians and 32 (25–37) in OD(-) vs. 39 (26–37) in OD(+), $p = 0.875$, for nurses). Overall, most of the physicians and the nurses have a low or very low state of anxiety respectively during the evaluated situation (83% and 95% respectively).

Experiences of ICU professionals during the three stages of the procedure

Table 3 shows the main findings regarding the experiences of ICU healthcare professionals during the three stages of the process, i.e. during the WLST decision-making process, during the period between this decision and its actual implementation, and during the dying and death process.

Regarding the WLST decision-making process, the possibility of organ donation was a factor influencing the decision for nurses only. Among those who most influenced the WLST decision, the OPO team was mentioned

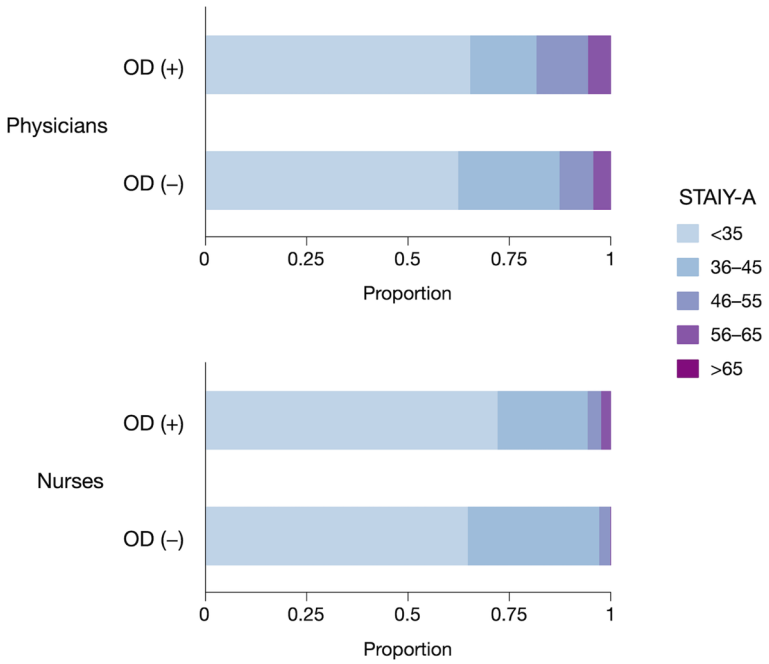

Fig. 2 State-Anxiety (STAI Y-A) of ICU Healthcare Professionals ($n = 206$). STAI Y-A: State Anxiety Inventory, WLST: withdrawal of life sustaining therapies, OD(-): WLST after OD had already been excluded, OD(+): WLST while OD is still under consideration

Table 2 Anxiety in ICU healthcare professionals

	Physician *n* = 79		Nurses *n* = 127	
	OD(-) *n* = 24	OD(+) *n* = 55	OD(-) *n* = 37	OD(+) *n* = 90
STAI Y-A (state)	34 (27—38)	32 (27–40)	32 (25–37)	29 (26–37)
< 35	15 (63%)	36 (66%)	24 (65%)	65 (72%)
36–45	6 (25%)	9 (16%)	12 (32%)	20 (22%)
46–55	2 (8%)	7 (13%)	1 (3%)	3 (4%)
56–65	1 (4%)	3 (5%)	0	2 (2%)
> 65	0	0	0	0
STAI Y-B (trait)	37 (30–43)	35 (32–43)	35 (32–43)	36 (31–41)
< 35	10 (42%)	27 (49%)	20 (54%)	40 (45%)
36–45	10 (42%)	22 (40%)	12 (32%)	38 (42%)
46–55	3 (12%)	4 (7%)	4 (11%)	10 (11%)
56–65	1 (4%)	2 (4%)	1 (3%)	2 (2%)
> 65	0	0	0	0

WLST Withdrawal of Life Sustaining Therapies, *OD* Organ Donation, *OD(-)*WLST after OD had already been excluded, *OD(+)* WLST while OD is still under consideration, *OPO team* Organ Procurement Organization's team

only by nurses. However almost all ICU healthcare professionals, including nurses, stated that there was no confusion between the WLST decision and the possibility of organ donation, whether for relatives, for the ICU team, or for themselves. It should be noted that among the respondents, 9/79 (11%) physicians and 76/127 (60%) nurses declared that they were not directly involved in the WLST decision-making process.

For the vast majority of ICU healthcare professionals, the period between the WLST decision and its actual implementation was focused on supporting the relatives. For almost all of them, this period did not lead to conflicts between the ICU team and relatives, between the ICU team and the OPO team, or within the ICU team. During this period, exploratory procedures related to organ donation (biological samples, CT scans etc.) were not perceived as difficult by almost all healthcare professionals (10 (8–10) from difficult (0) to not difficult (10)). The purpose of this period was more focused on optimizing the possibility

Table 3 Experiences of ICU healthcare professionals during the three stages of the process of the WLST process

	Physician *n* = 79		Nurses *n* = 127	
	OD(-) *n* = 24	OD(+) *n* = 55	OD(-) *n* = 37	OD(+) *n* = 90
Stage 1. WLST decision-making process				
Factors influencing the decision: from 0 to 10				
Bad prognosis and no treatment plan	10 (9–10)	10 (9–10)	9 (8–10)	10 (8–10)
Patient's wishes	6 (5–8)	7 (1–9)	8 (5–9)	5 (2–9)
Wishes of relatives	6 (3–8)	7 (2–9)	7 (3–9)	8 (5–9)
Possibility of organ donation	1 (0–2)	0 (0–5)	6 (2–9)	8 (3–9)
Those who most influenced the decision				
The medical staff	9 (9–10)	8 (8–10)	9 (7–10)	9 (7–10)
The nursing team	5 (5–8)	5 (3–8)	5 (3–7)	5 (2–7)
The relatives	6 (3–8)	6 (5–8)	5 (3–9)	8 (3–9)
The Organ Procurement Organization's team	0 (0–1)	0 (0–1)	5 (1–8)	5 (0–7)
Stage 2. Period between the WLST decision and its actual implementation				
The length of this period was motivated by				
Psychological support for relatives	8 (6–9)	7 (1–8)	8 (2–10)	7 (5–10)
Relatives' availability and/or wishes	8 (6–9)	7 (1–9)	9 (5–10)	8 (5–10)
Research for medical unsuitability	4 (1–7)	5 (1–7)	5 (0–9)	7 (2–10)
Logistical issues	1 (0–5)	7 (3–9)*	1 (0–5)	4 (0–9)*
Legal issues	1 (0–6)	1 (0–5)	0 (0–3)	1 (0–5)
Purpose of this period: from end-of-life support (0) to organ donation (10)	1 (0–4)	5 (4–7)*	0 (0–1)	9 (5–10)*
Stage 3. Dying and death process				
I felt I changed my usual end-of-life care practices from No (0) to Yes (10)	-	2 (0–8)	-	0 (0–5)
Purpose of the WLST implementation was: from end-of-life support (0) to organ donation (10)	-	5 (1–9)	-	9 (5–10)

Numbers are median and IQR. All data range from 0 to 10

WLST Withdrawal of Life Sustaining Therapies, *OD* Organ Donation, *OD(-)* WLST after OD had already been excluded, *OD(+)*WLST while OD is still under consideration

* :$p < 0.05$

of organ donation than on end-of-life support for healthcare professionals in the OD(+) group, and even more so for nurses than for physicians.

Regarding the dying and death process, relatives were present at the WLST time in 16/24 (67%) situations in the OD(-) group and in 27/55 (49%) situations in the OD(+) group ($p=0.496$). The presence of relatives was perceived as beneficial by almost all healthcare professionals, with no difference between the OD(-) and the OD(+) groups. At the WLST time, the attitude of the people present in the room was perceived as very appropriate by almost all ICU healthcare professionals, with no difference between the OD(-) and the OD(+) groups. In the OD(+) group, the WLST occurred in the ICU in 47/55 (85%) situations. The OPO team and the team in charge of the normothermic regional perfusion were present in the room at the WLST time in 45/55 (82%) situations and 39/55 (71%) situations, respectively. For nurses vs physicians, the purpose of the WLST was more focused toward the possibility of organ donation than on end-of-life support.

Experiences of ICU healthcare professionals of the overall situation and of cDCD in general

The main findings regarding the experiences of ICU healthcare professionals of the overall situation and of cDCD in general are displayed in Table 4 and mostly show satisfactory and/or positive experiences.

Discussion

The main findings of this study are 1) the context of cDCD is not associated with greater anxiety than standard WLST for ICU physicians and nurses surveyed; 2) for nurses, the possibility of organ donation affects the WLST decision, but not for physicians; 3) for nurses and physicians, the possibility of organ donation has an impact, at least in part, on the WLST implementations; 4) cDCD experience is overall positively perceived by ICU healthcare professionals.

In the present study, the vast majority of ICU healthcare professionals did not report state anxiety when caring for potential cDCD donors. Furthermore, the median level of state anxiety in the entire cohort was lower than the clinical threshold of 41, which has been shown to indicate clinical anxiety. It was also lower than the anxiety level recently observed in ICU healthcare professionals during their daily practice [25] or during the covid pandemic [26–28]. Interestingly, in the present study, the level of state anxiety was low while a significant proportion of ICU healthcare professionals had limited cDCD experience. These findings contradict current beliefs regarding these complex situations that are WLST and cDCD. It also adds some nuance to the results of our preliminary qualitative study, which highlighted a significant tension perceived by ICU healthcare professionals between providing end-of-life care and considering the possibility of organ donation in cDCD [11]. A first explanation could be related to the situation of the potential

Table 4 Experiences of ICU healthcare professionals with the overall situation and cDCD in general

	Physicians n=79		**Nurses n=127**	
Experience with the overall situation	OD (-)	OD(+)	OD(-)	OD (+)
From very unsatisfactory (0) to very satisfactory (10)	n=24	n=55	n=37	n=90
Overall patient care	8 (7-9)	9 (8-10)	8 (7-10)	9 (8-10)
Patient end-of-life support by ICU team	9 (8-10)	9 (8-10)	9 (8-10)	9 (8-10)
Patient end-of-life support by relatives	8 (7-9)	9 (8-9)	9 (7-10)	10 (8-10)
Relatives support by ICU team	8 (8-9)	9 (7-10)	9 (8-10)	9 (7-9)
Quality of end-of-life	8 (8-9)	8 (6-10)	7 (7-9)	8 (7-8)
WLST implementation	8 (8-9)	8 (7-10	8 (7-9)	9 (7-9)
Experience of cDCD in general				
From negative (0) to positive (10)				
Global	8 (7-9)		8 (6-10)	
On communication and support to relatives	8 (5-9)		8 (7-10)	
On WLST decision-making process	7 (5-8)		8 (6-10)	
On ICU end-of-life practices	5 (5-8)		8 (5-9)	
On the motivation of ICU team for OD	7 (5-9)		8 (6-10)	
On ethical considerations in general	7 (5-9)		8 (6-10)	
On interpersonal relation and team building	7 (5-8)		8 (6-10)	

WLST Withdrawal of Life Sustaining Therapies, *OD* Organ Donation, *OD*(-)WLST after OD had already been excluded, *OD*(+)*WLST* while OD is still under consideration, *OPO team* Organ Procurement Organization's team, *ICU* Intensive Care Units

cDCD donor himself: cDCD can only be considered if the WLST decision is clearly justified and if the relatives agree to such a decision in a genuine relationship with the ICU team. A second explanation could be related to the cDCD procedure itself: such a complex procedure can only be implemented in an ICU with a favorable ethical climate and with training and formalization initiatives for end-of-life support. Moreover, we show here that ICU healthcare professionals report an overall very positive impact from the implementation of the cDCD and support this procedure, as previously reported [18, 21].

Beyond the assessment of anxiety, this work provides an in-depth understanding of the experiences of ICU healthcare professionals with cDCD. In this study, nurses report the influence of the possibility of organ donation on the WLST decision-making process, whereas physician do not or rarely mention it. This result may be explained by the fact that nurses are less directly involved in the WLST decision. We report that the majority of nurses were not present when the WLST decision was made a few days before the evaluation. This result may also be explained by a lack of communication between physicians and nurses regarding the rationale behind this decision. Differences in professionals' perceptions of the tension between end-of-life care and organ donation should be identified and discussed for each situation. If not, this could undermine ICU professionals' confidence in organ donation and impact the ethical climate within the ICU team.

Our results show that nurses and physician report an impact of organ donation on end-of-life support at the WLST time. Some of the physicians even report that cDCD could change and have a negative impact on their end-of-life practices. In our previous qualitative study, ICU professionals reported a stress during the WLST implementation related to the fact that circulatory death must occur within a short timeframe required for organ donation to be successful. Our study, using a validated quantitative measure, does not show any anxiety related to the pressure to succeed, as reported in our previous qualitative analyses [11]. This pressure on "success" can lead to changes in end-of-life practices, particularly regarding sedative practices. It is also reported that the logistical and technical issues of the cDCD procedure were associated with a modified experience of dying, with an atmosphere not always appropriate for end-of-life support [11]. Interestingly, this ethical issue regarding the permanence of death in relation to the use of normothermic regional perfusion did not emerge in the French debate when the national cDCD protocol was introduced in 2015 [29–31]. Furthermore, this issue did not emerge during our qualitative exploratory research [11]. Therefore, it was not included in the questionnaire.

These results highlight the crucial importance of clarifying intentions between end-of-life support and the possibility of organ donation when caring for a potential donor. Clarifying intentions is the only way to clarify actions and their expected effects [32]. A briefing on the day of the withdrawal of life-sustaining therapies should help clarify these intentions and define everyone's role, so as to combine quality end-of-life care and successful organ donation. Training and procedure formalization should also be pursued, as more education and more experience with cDCD is known to be effective in overcoming reluctance [18, 33]. Simulation training is a promising approach for further improve the process.

To the best of our knowledge, this is the largest study on this topic that examines experience of ICU healthcare professionals in real-life situations. A major strength of the study is the comparison between OD (-) and OD(+) groups, which is relevant for assessing the impact of the possibility of organ donation on end-of-life care. However, our study has several imitations. First, there is a selection bias because the number of ICU healthcare professionals approached is a missing data. ICU healthcare professionals with the lowest level of anxiety about the situation may be overrepresented. Another selection bias is that the OD(-) group is smaller than the OD(+) group. Previous data issued from the French organ donation program report a split between OD(-) and OD(+) of about 50/50 [10]. This is possibly due to an inclusion of favorable situation and doesn't encompass the entire scope of possible situations. Second, questionnaires limit response options and hinder participants from expressing more nuanced or complex experiences and/or perceptions. However, this study sought to complete our qualitative data from in-depth interviews [11]. Third, healthcare professionals were asked to retrospectively rate their anxiety about an event that had already occurred. The assessment may be biased by the occurrence of events other than the patient's death in the ICU healthcare professional's life during the 36 h. Fourth, a larger sample may have allowed for better representativeness of the population, however the sample size was calculated to show a difference on the STAI. Fifth, patients who died in the OD(-) group cannot be assimilated to patients who died after "classical" withdrawal of life sustaining therapies, because organ donation was actually planned by the ICU healthcare professionals and discussed with the relatives. Finally, the results are not necessarily fully generalizable, as the study only explores the experience of ICU healthcare professionals who practice cDCD according to the French national protocol.

Our study provides a much-needed and better understanding of ICU healthcare professionals' experiences of cDCD. Their experiences are clearly not an obstacle of

the development of cDCD. We need to develop practical measures to support professionals in making their intentions clear between end-of-life support and the success of organ donation, and, when needed, to improve communication between physicians and nurses.

Conclusions

cDCD does not increase anxiety in ICU healthcare professionals compared to other situations of WLST. WLST and cDCD procedures could further be improved by improved by supporting professionals in making their intentions clear between end-of-life support and the success of organ donation, and when needed, by enhancing communication between ICU physician and nurses.

Abbreviations

cDCD	Controlled Donation after Circulatory Death
ICU	Intensive Care Units
OD	Organ donation
WLST	Withdrawal of Life-Sustaining Therapies

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12910-024-01093-1.

Supplementary Material 1.

Supplementary Material 2.

Acknowledgements

Marie-Céline Fournier and Olivia Tran Dinh for their support in this research. Members of the CARE-M3 Research Group: Julien Charpentier, Martin Cour, Philippe Gouin, Pierre-Grégoire Guinot, Florence Lallemant, Benjamin Lebas, Anne-Claire Lukaszewicz, Julien Mayaux, Bruno Megarbane, Pierre Perez, Benjamin Rohaut, Hodane Yonis.

Authors' contributions

ML and NK-B contributed to the design of the study protocol, the acquisition, the analysis of the data, the draft of the manuscript, approved the manuscript prepared for publication, and agreed to be accountable for all aspects of the work. FR, OL and CV contributed to the design of the study protocol, revised the work for important intellectual content, approved the manuscript prepared for publication, and agreed to be accountable for all aspects of the work. RB and BC contributed to the analysis of data, revised the work for important intellectual content, approved the manuscript prepared for publication, and agreed to be accountable for all aspects of the work. All other authors, i.e. GA, MAZ, DC, CC, GC, RC, VD, MF, FL, EM, JM, LM, EPD, SP, AR, JCV, MW, participated in data acquisition and approved the manuscript prepared for publication.

Funding

Sources of funding were provided by the *Fondation de France* and by the *Agence de la Biomédecine.*

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study has been approved by the Institutional Review Board: Comité de Protection des Personnes Ile de France XI (address: UVSQ-UFR Simone Veil—2 Av de la Source de la Bièvre 78180 Montigny-le-Bretonneux France). Healthcare professionals who volunteer to participate in a non-interventional study such as this one have received an information letter explaining the objectives of the study and how it will be conducted, in accordance with French regulations. Their consent to the use of their data was explicitly requested by the investigator, who confirmed the participant's consent by signing the consent form.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Department of Anesthesia and Critical Care Medicine, AP-HP, Hôpital Lariboisière, Paris, France. [2]INSERM, MASCOT, U942, Université Paris Cité, Paris, France. [3]INSERM, CESP, U1018, Université Paris-Saclay, UVSQ, Villejuif, France. [4]Médecine Intensive Réanimation, CH La Rochelle, La Rochelle, France. [5]Department of Anaesthesia and Intensive Care, CHRU, Nancy, France. [6]Médecine Intensive Réanimation, CHD Vendée, La Roche-Sur-Yon, France. [7]Department of Medical Intensive Care, Rouen University Hospital, Rouen, France. [8]Department of Intensive Care, Foch Hospital, Suresnes, France. [9]Département d'anesthésie Réanimation Chirurgicale - Coordination Des Prélèvements d'organes Et de Tissus - Hôpital de Bicêtre - GHU Paris Saclay – APHP, Kremlin-Bicêtre, France. [10]Medical and Surgical Intensive Care, Annecy Hospital, Annecy, France. [11]APHP, Department of Anesthesia, Critical Care and Peri-Operative Medicine, Pitié-Salpêtrière Hospital, Sorbonne University, Paris, France. [12]Clinical Research Group ARPE, Sorbonne University, Paris, France. [13]INSERM UMR 1141, PROTECT, Paris, France. [14]Department of Anesthesia and Critical Care Medicine, Hôpital Laënnec, CHU Nantes, Nantes, France. [15]Service de Réanimation Polyvalente, Centre Hospitalier de Valenciennes, Valenciennes, France. [16]Médecine Intensive Et Réanimation, CHU de Tours, CRICS-TRIGGERSEP Network, Tours, France. [17]Département d'anesthésie Et Réanimation, Centre Hospitalier Universitaire de Saint Etienne, Saint Etienne, France. [18]Department of Anaesthesiology and Intensive Care, Pain and Emergency Medicine, Nîmes University Hospital, Nîmes, France. [19]UR UM 103 IMAGINE, Faculty of Medicine, University of Montpellier, Nîmes, France. [20]Intensive Care Unit and Hyperbaric Center, Lille University Hospital, 59037 Lille Cedex, Lille, France. [21]CHU Dijon-Bourgogne, Service de Médecine Intensive Et Réanimation, Coordination Hospitalière de Prélèvement d'organes Et de Tissus, Dijon, France. [22]Service d'Anesthésie Réanimation Chirurgicale, CHU Nantes, Nantes, France. [23]Pôle Anesthésie Réanimations - Coordination PMOT, CHRU Tours, Tours, France. [24]Departement of Anesthesiology and Intensive Care Medecine, Dijon University Hospital, Dijon, France. [25]Famiréa Research Group, Medical Intensive Care Unit, APHP, Hospital Saint-Louis, Paris, France.

Received: 16 February 2024 Accepted: 23 August 2024
Published online: 09 October 2024

References

1. Thuong M, Ruiz A, Evrard P, Kuiper M, Boffa C, Akhtar MZ, et al. New classification of donation after circulatory death donors definitions and terminology. Transpl Int. 2016;29(7):749–59.
2. Lomero M, Gardiner D, Coll E, Haase-Kromwijk B, Procaccio F, Immer F, et al. Donation after circulatory death today: an updated overview of the European landscape. Transpl Int. 2020;33(1):76–88.
3. Smith M, Dominguez-Gil B, Greer DM, Manara AR, Souter MJ. Organ donation after circulatory death: current status and future potential. Intensive Care Med. 2019;45(3):310–21.
4. Sprung CL, Ricou B, Hartog CS, Maia P, Mentzelopoulos SD, Weiss M, et al. Changes in end-of-life practices in European intensive care units from 1999 to 2016. JAMA. 2019;2:1–12.
5. Savoye E, Legeai C, Branchereau J, Gay S, Riou B, Gaudez F, et al. Optimal donation of kidney transplants after controlled circulatory death. Am J Transplant. 2021;21(7):2424–36.
6. Antoine C, Jasseron C, Dondero F, Savier E. French National Steering Committee of donors after circulatory death. Liver transplantation from controlled donors after circulatory death using normothermic regional perfusion: an initial French experience. Liver Transpl. 2020;26(11):1516–21.

7. De Wolf J, Fadel G, Olland A, et al. Controlled donation after circulatory death lung transplantation: Results of the French protocol including in situ abdominal normothermic regional perfusion and ex vivo lung perfusion. J Heart Lung Transpl. 2023;42(8):1093–100.
8. Lesieur O, Genteuil L, Leloup M. A few realistic questions raised by organ retrieval in the intensive care unit. Ann Transl Med. 2017;5(Suppl 4):S44.
9. Da Silva IRF, Frontera JA. Worldwide barriers to organ donation. JAMA Neurol. 2015;72(1):112–8.
10. Le Dorze M, Martin-Lefèvre L, Santin G, Robert R, Audibert G, Megarbane B, et al. Critical pathways for controlled donation after circulatory death in France. Anaesth Crit Care Pain Med. 2022;41(2):101029.
11. Le Dorze M, Martouzet S, Cassiani-Ingoni E, Roussin F, Mebazaa A, Morin L, et al. "A delicate balance"-Perceptions and experiences of ICU physicians and nurses regarding controlled donation after circulatory death. A qualitative study. Transpl Int. 2022;35:10648.
12. Mandell MS, Zamudio S, Seem D, McGaw LJ, Wood G, Liehr P, et al. National evaluation of healthcare provider attitudes toward organ donation after cardiac death. Crit Care Med. 2006;34(12):2952–8.
13. D'Alessandro AM, Peltier JW, Phelps JE. Understanding the antecedents of the acceptance of donation after cardiac death by healthcare professionals. Crit Care Med. 2008;36(4):1075–81.
14. Hart JL, Kohn R, Halpern SD. Perceptions of organ donation after circulatory determination of death among critical care physicians and nurses: a national survey. Crit Care Med. 2012;40(9):2595–600.
15. Bastami S, Matthes O, Krones T, Biller-Andorno N. Systematic review of attitudes toward donation after cardiac death among healthcare providers and the general public. Crit Care Med. 2013;41(3):897–905.
16. Goudet V, Albouy-Llaty M, Migeot V, Pain B, Dayhot-Fizelier C, Pinsard M, et al. Does uncontrolled cardiac death for organ donation raise ethical questions? An opinion survey. Acta Anaesthesiol Scand. 2013;57(10):1230–6.
17. Coleman NL, Bonner A. Exploring Australian intensive care physicians clinical judgement during donation after cardiac death: an exploratory qualitative study. Aust Crit Care. 2014;27(4):172–6.
18. Lee YY, Ranse K, Silvester W, Mehta A, Van Haren F. Attitudes and self-reported end-of-life care of Australian and New Zealand intensive care doctors in the context of organ donation after circulatory death. Anaesth Intensive Care. 2018;46(5):488–97.
19. Squires JE, Graham N, Coughlin M, Chassé M, Linklater S, Greenough M, et al. Barriers and enablers to organ donation after circulatory determination of death: a qualitative study exploring the beliefs of frontline intensive care unit professionals and organ donor coordinators. Transplant Direct. 2018;4(7):e368.
20. Milross LA, O'Donnell TG, Bucknall TK, Pilcher DV, Ihle JF. Exploring staff perceptions of organ donation after circulatory death. Aust Crit Care. 2020;33(2):175–80.
21. Milross L, O'Donnell T, Bucknall T, Pilcher D, Poole A, Reddi B, et al. Perceptions held by healthcare professionals concerning organ donation after circulatory death in an Australian intensive care unit without a local thoracic transplant service: A descriptive exploratory study. Aust Crit Care. 2022;35(4):430–7.
22. Antoine C, Bronchard R, Durin L and the members of the steering committee. Conditions for recovery of organs by donation after circulatory death in a health care facility authorized to recover organs. Agence de la biomédecine 2019. https://www.agence-biomedecine.fr/IMG/pdf/v7_guide_ddac_miii_novembre_2019_eng.pdf
23. Spielberger CD, Gorsuch RL, Lushene R, Vagg PR, Jacobs GA. Manual for the state-trait anxiety inventory 1983. Palo Alto: Consulting Psychologists Press; 1983.
24. Gauthier J, Bouchard S. A French-Canadian adaptation of the revised version of Spielberger's State-Trait Anxiety Inventory. Can J Behaviour Sci. 1993;25(4):559–78.
25. Voultsos P, Koungali M, Psaroulis K, Boutou AK. Burnout syndrome and its association with anxiety and fear of medical errors among intensive care unit physicians: A cross-sectional study. Anaesth Intensive Care. 2020;48(2):134–42.
26. Karabulut N, Gürçayır D, Yaman Aktaş Y, Kara A, Kızıloğlu B, Arslan B, et al. The effect of perceived stress on anxiety and sleep quality among healthcare professionals in intensive care units during the coronavirus pandemic. Psychol Health Med. 2021;26(1):119–30.
27. Lazar AE, Szederjesi J, Coman O, Elekes A, Suciaghi M, Grigorescu BL. Survey on anxiety and post-traumatic stress disorder in intensive care personnel during the COVID-19 pandemic in a medically under-resourced country. Healthcare (Basel). 2022;10(7):1160.
28. Fenzke MN, Viante WJM, Aguiar BF, Gama B da S, Pimenta AM, Miranda FMD. Trait and state anxiety in healthcare professionals of intensive care unit. Rev Gaucha Enferm. 2023;44:e20230028.
29. Manara A, Shemie SD, Large S, Healey A, Baker A, Badiwala M, et al. Maintaining the permanence principle for death during in situ normothermic regional perfusion for donation after circulatory death organ recovery: A United Kingdom and Canadian proposal. Am J Transplant. 2020;20(8):2017–25.
30. Puybasset L, Bazin JE, Beloucif S, Bizouarn P, Crozier S, Devalois B, et al. Critical appraisal of organ procurement under Maastricht 3 condition. Ann Fr Anesth Reanim. 2014;33(2):120–7.
31. Graftieaux JP, Bollaert PE, Haddad L, Kentish-Barnes N, Nitenberg G, Robert R, et al. Contribution of the ethics committee of the French society of intensive care medicine to a scenario for the implementation of organ donation after Maastricht III-type cardiac death in France. Ann Fr Anesth Reanim. 2014;33(2):128–34.
32. Le Dorze M, Barthélémy R, Giabicani M, Audibert G, Cousin F, Gakuba C, et al. Continuous and deep sedation until death after a decision to withdraw life-sustaining therapies in intensive care units: A national survey. Palliat Med. 2023;37(8):1202–09.
33. Witjes M, Jansen NE, van der Hoeven JG, Abdo WF. Interventions aimed at healthcare professionals to increase the number of organ donors: a systematic review. Crit Care. 2019;23(1):227.

Publisher's Note