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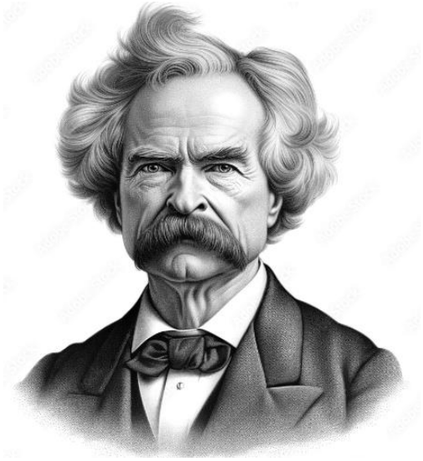
11/6/2024

Normothermic Regional Perfusion: Do the Ends Justify the Means

METHODIST UNIVERSITY HOSPITAL

Outline

1. Background
2. Technique
3. Ethics and Legalities
4. Outcomes



“If you want to change the future, you must change what you’re doing in the present.”

— Mark Twain

Death

Harvard Criteria 1968

- “Irreversible coma” → Brain death/death by neurologic criteria
- the characteristics of irreversible coma—a permanently nonfunctioning brain—included unreceptivity and unresponsiveness, no movements or spontaneous breathing (apnea) and no brain stem reflexes.

The Uniform Determination of Death Act (UDDA), the legal standard for death throughout the United States 1981

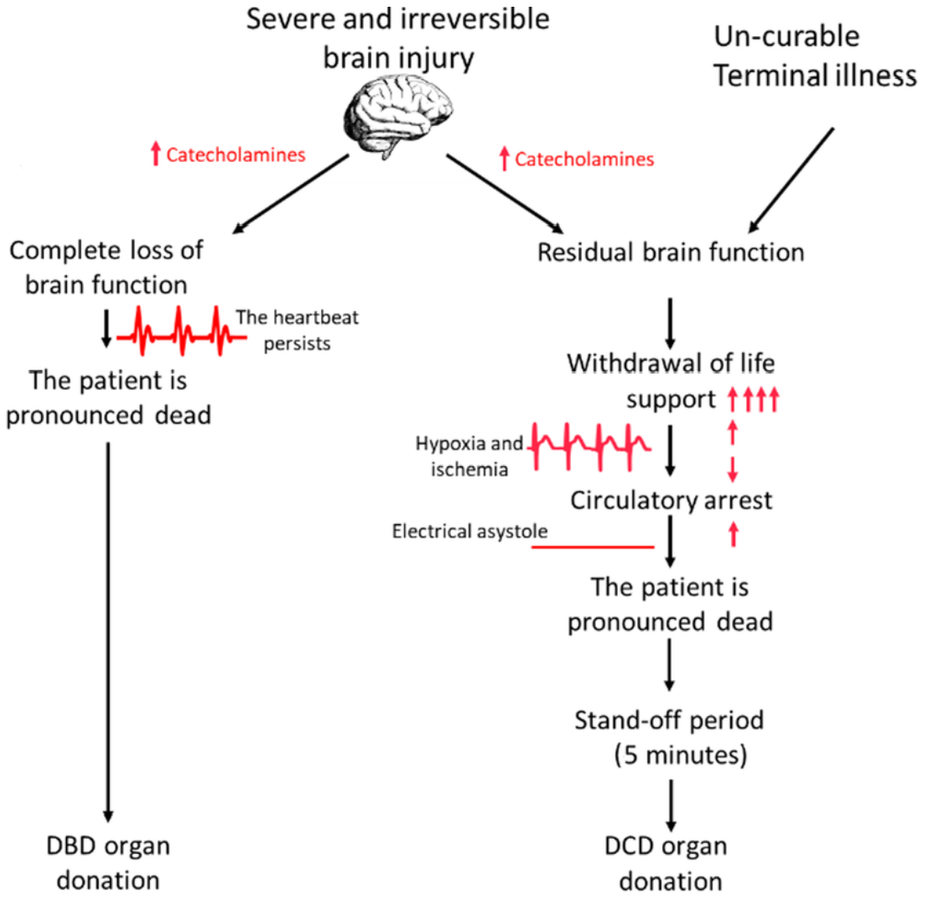
- Death can be declared, in accordance with accepted medical standards, on one of two grounds
  1. irreversible cessation of circulatory and respiratory functions, or
  2. irreversible cessation of all functions of the entire brain, including the brain stem.
- Every state accepted the UDDA, in language or in spirit.

Dead Donor Rule

The dead donor rule is an ethical norm related to deceased organ donation that is often expressed as

- (1) organ donors must be dead before procurement of organs begins; or
- (2) organ procurement itself must not cause the death of the donor.

Two Types of Deceased Organ Donors



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Resumption of Cardiac Activity after Withdrawal of Life-Sustaining Measures

S. Dhanani, L. Hornby, A. van Beinum, N.B. Scales, M. Hogue, A. Baker, S. Beed, J.G. Boyd, J.A. Chandler, M. Chassé, F. D'Aragon, C. Dezfulian, C.J. Doig, F. Duska, J.O. Friedrich, D. Gardiner, T. Gofton, D. Harvey, C. Herry, G. Isac, A.H. Kramer, D.J. Kutsogiannis, D.M. Maslove, M. Meade, S. Mehta, L. Munshi, L. Norton, G. Pagliarello, T. Ramsay, K. Rusinova, D. Scales, M. Schmidt, A. Seely, J. Shahin, M. Slessarev, D. So, H. Talbot, W.N.K.A. van Mook, P. Waldauf, M. Weiss, J.T. Wind, and S.D. Shemie, for the Canadian Critical Care Trials Group and the Canadian Donation and Transplantation Research Program*

ABSTRACT

BACKGROUND
The minimum duration of pulselessness required before organ donation after circulatory determination of death has not been well studied.

METHODS
We conducted a prospective observational study of the incidence and timing of resumption of cardiac electrical and pulsatile activity in adults who died after planned withdrawal of life-sustaining measures in 20 intensive care units in three countries. Patients were intended to be monitored for 30 minutes after determination of death. Clinicians at the bedside reported resumption of cardiac activity prospectively. Continuous blood-pressure and electrocardiographic (ECG) waveforms were recorded and reviewed retrospectively to confirm bedside observations and to determine whether there were additional instances of resumption of cardiac activity.

RESULTS
A total of 1999 patients were screened, and 631 were included in the study. Clinically reported resumption of cardiac activity, respiratory movement, or both that was confirmed by waveform analysis occurred in 5 patients (1%). Retrospective analysis of ECG and blood-pressure waveforms from 480 patients identified 67 instances (14%) with resumption of cardiac activity after a period of pulselessness, including the 5 reported by bedside clinicians. The longest duration after pulselessness before resumption of cardiac activity was 4 minutes 20 seconds. The last QRS complex coincided with the last arterial pulse in 19% of the patients.

CONCLUSIONS
After withdrawal of life-sustaining measures, transient resumption of at least one cycle of cardiac activity after pulselessness occurred in 14% of patients according to retrospective analysis of waveforms; only 1% of such resumptions were identified at the bedside. These events occurred within 4 minutes 20 seconds after a period of pulselessness. (Funded by the Canadian Institutes for Health Research and others.)

The authors' full names, academic degrees, and affiliations are listed in the Appendix. Address reprint requests to Dr. Dhanani at Children's Hospital of Eastern Ontario, 401 Smyth Rd., Ottawa, ON K1M 1N8, Canada, or at sdhanani@cheo.on.ca.

*The members of the site research groups are listed in the Supplementary Appendix, available at NEJM.org.

This article was updated on January 28, 2021, at NEJM.org.

N Engl J Med 2021;384:345-52.
DOI: 10.1056/NEJMoa2022713

Organ Procurement Organizations (OPO)

Conditions for Coverage Outcomes Measures 2020

- Donation rate measure is the number of organ donors in the OPO's DSA as a percentage of inpatient deaths among patients 75 years old or younger with a primary cause of death that is consistent with organ donation.
- Transplantation rate measure is the number of transplanted organs from an OPO's DSA as a percentage of inpatient deaths among patients 75 years old or younger with a primary cause of death that is consistent with organ donation.

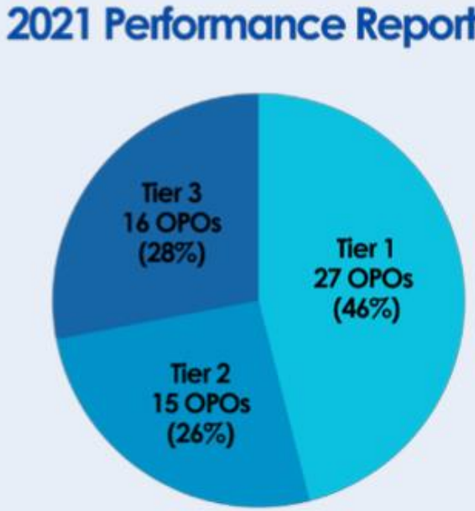
Performance Benchmark

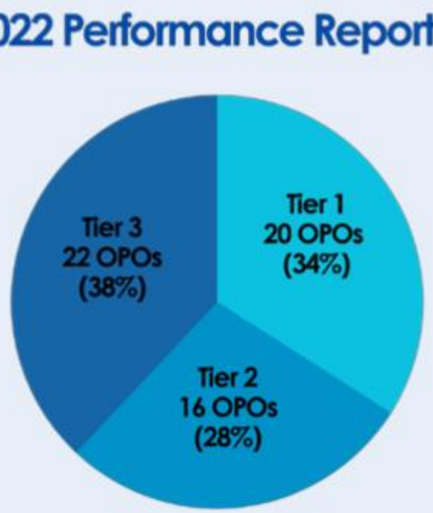
Tier 1 are the highest performing OPOs in the top 25 percent will be assigned to and automatically recertified for another four years.

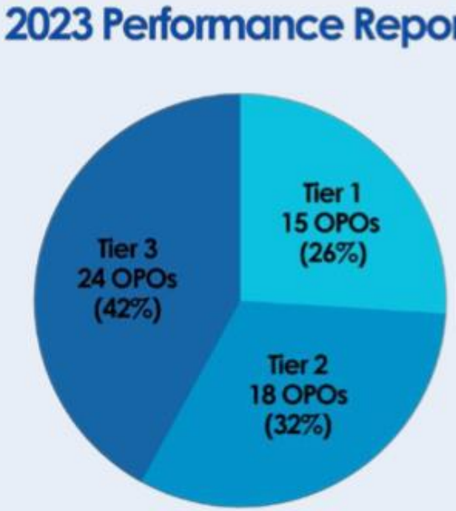
Tier 2 OPOs are the next highest performing OPOs, where performance on both measures exceed the median but do not reach Tier 1 and will not automatically be recertified and will have to compete to retain their Donor Service Area (DSA).

Tier 3 OPOs are the lowest performing OPOs that have one or both measures below the median and will be decertified and will not be able to compete for any other open DSA.

CMS Benchmark Report 2023

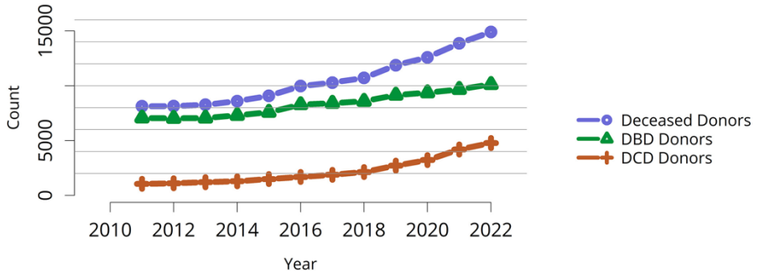




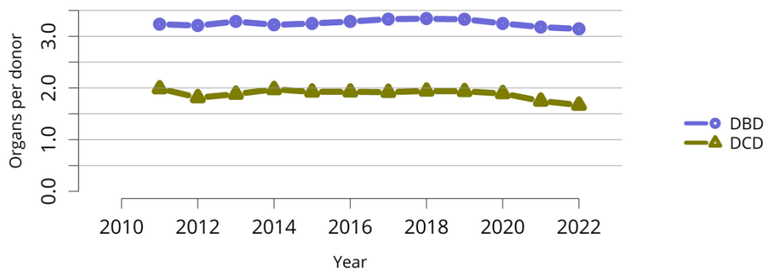


Tier 1 OPOs: In the top 25% for both the donation and transplant rate measures
Tier 2 OPOs: 1 or both measures above the median, but below the top 25%
Tier 3 OPOs: 1 or both measures below the median

Deceased Donors 2010-2022



OPTN/SRTR 2022 Annual Data Report



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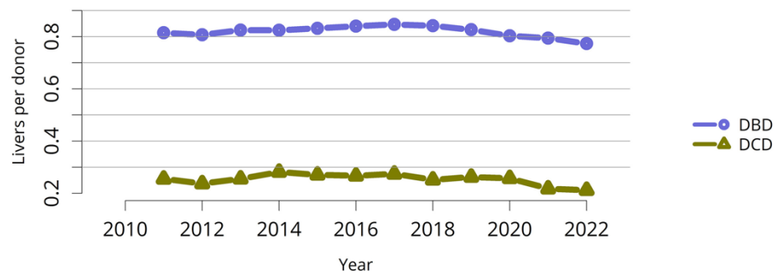
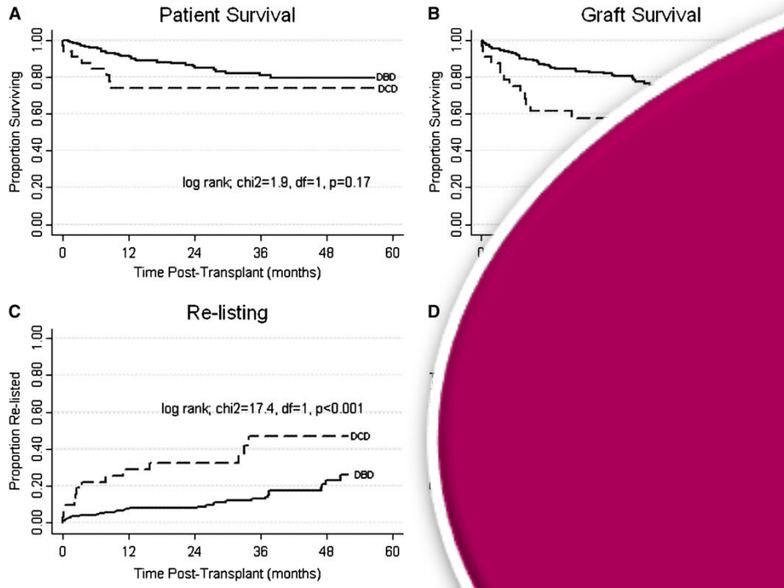


OPTN/SRTR 2022 Annual Data Report

	2012		2022	
Characteristic	**N**	**Percent**	**N**	**Percent**
Mechanism of Death				
Drowning	99	1.2	141	0.9
Seizure	86	1.1	160	1.1
Drug Intoxication	440	5.4	2485	16.7
Asphyxiation	366	4.5	683	4.6
Cardiovascular	1275	15.7	3055	20.5
Electrical	4	0	5	0
Gunshot Wound	766	9.4	961	6.4
Stab	19	0.2	24	0.2
Blunt Injury	1781	21.9	2369	15.9
SIDS	7	0.1	9	0.1
Stroke	2912	35.8	3774	25.3
Natural Causes	195	2.4	903	6.1
Other/unknown	193	2.4	336	2.3

	2012		2022	
Characteristic	**N**	**Percent**	**N**	**Percent**
DCD status				
DBD	7036	86.4	10127	67.9
DCD	1107	13.6	4778	32.1

The Problem with DCD Liver Transplantation



Complication		DCD (%)	DBD (%)	*P* Value
Primary Nonfunction		1 (2.6)	1 (1.3)	1.000
Vascular		5 (13.2)	13 (17.1)	.786
	Hepatic artery thrombosis	0 (0.0)	3 (3.9)	.550
	Hepatic artery stenosis	4 (10.5)	5 (6.6)	.478
	Portal vein thrombosis	0 (0.0)	4 (5.3)	.299
	Portal vein stenosis	0 (0.0)	0 (0.0)	1.000
	Vena cava thrombosis	1 (2.6)	0 (0.0)	.333
	Vena cava stenosis	0 (0.0)	1 (1.3)	1.000
Biliary		7 (18.4)	7 (9.2)	.225
	Biliary leak	1 (2.6)	0 (0.0)	.333
	Biliary necrosis	0 (0.0)	0 (0.0)	1.000
	Biliary abscess	0 (0.0)	1 (1.3)	1.000
	Biliary sludge or stones	3 (7.9)	1 (1.3)	.107
	Anastomotic biliary stricture	7 (18.4)	7 (9.2)	.225
	Ischemic-type diffuse intrahepatic biliary strictures	3 (7.9)	1 (1.3)	.107

Abbreviations: DBD, donation after brain death; DCD, donation after cardiac death

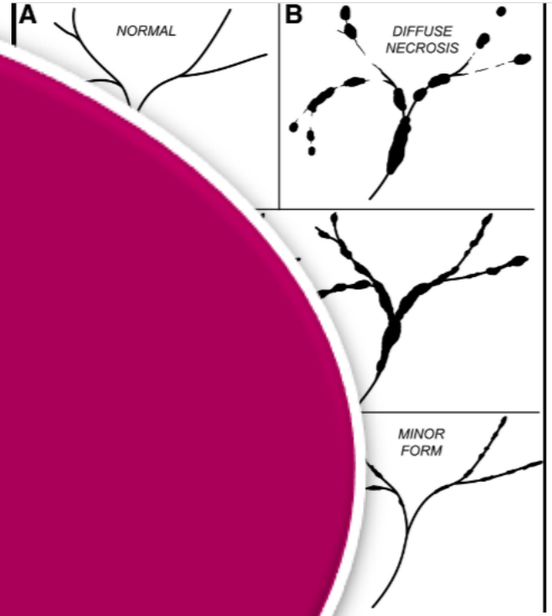


FIGURE 1.

Classification of patterns of ischemic cholangiopathy. A, Normal cholangiogram. B, Diffuse necrosis—severe abnormalities of the entire biliary tree seen shortly after transplant. C, Multifocal progressive—mild to moderate stenosis of the second-order and peripheral ducts that progressively worsen over time. D, Confluence dominant—strictures and casts confined to the biliary confluence that geographically never expand beyond the confluence. E, Minor form—mild radiologic abnormalities consistent with ischemic cholangiopathy that ultimately resolve, never going on to develop more extensive strictures.

Vanatta JM, Dean AG, Hathaway DK, Nair S, Modanlou KA, Campos L, Nezakatgoo N, Satapathy SK, Eason JD. Liver transplant using donors after cardiac death: a single-center approach providing outcomes comparable to donation after brain death. Exp Clin Transplant. 2013 Apr;11(2):154-63.

Skaro AI, Jay CL, Baker TB, Wang E, Pasricha S, Lyuksen… …nsplantation using donors after cardiac death: the untold story. Surgery. 2009 Oct;146(4):543-53.

Croome KP; Mathur AK. Aqe B; Yang,L; Taner T; Heimbach J; Rosen CB, … …opathy Following DCD Liver Transplantation: Distinct Clinical Courses and Long-term Outcomes From a Multicenter Cohort. Transplantation 2022 Jun…

Discarded Donor Livers 2010-2021

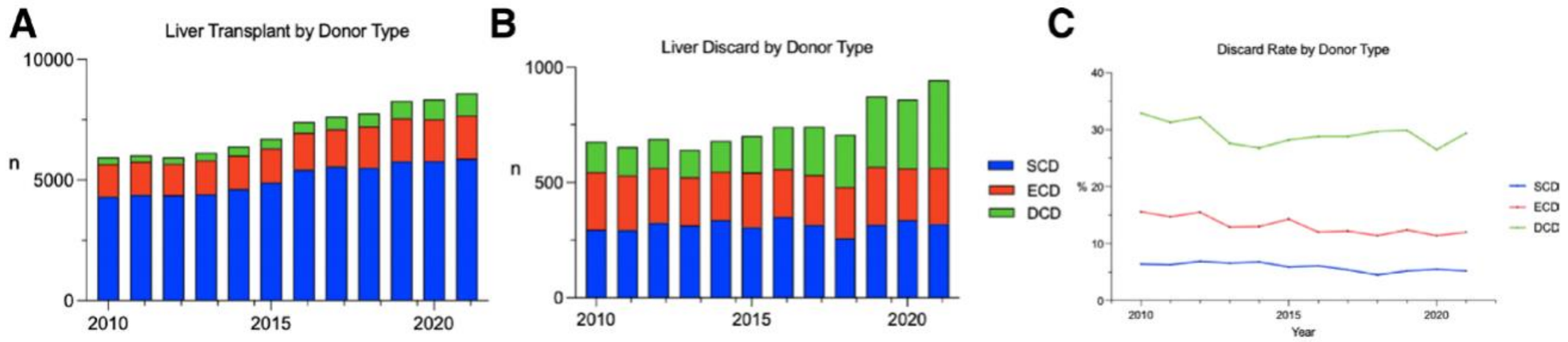
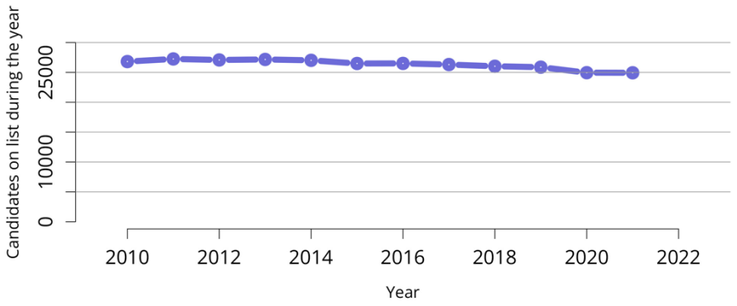


FIGURE 2. Discard and utilization of SCD, ECD, and DCD donors between 2010 and 2021. A, Transplanted livers by donor type from 2010 to 2021. B, Discarded livers by donor type between 2010 and 2021. C, Discard rate by donor type between 2010 and 2021. DCD, donation after circulatory death; ECD, expanded criteria donor; SCD, standard criteria donor.

Torabi J; Todd R, van Leeuwen L, Bekki Y, Holzner M; Moon J; Schiano T; Florman SS, Akhtar MZ. A Decade of Liver Transplantation in the United States: Drivers of Discard and Underutilization. Transplantation Direct 10(6):p e1605, June 2024

Clinical Need



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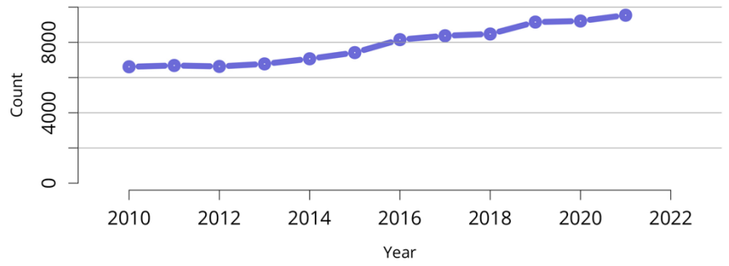

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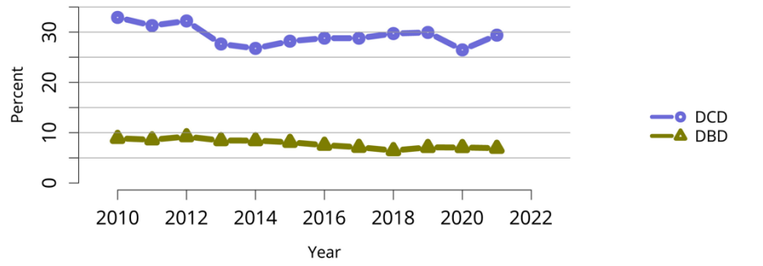

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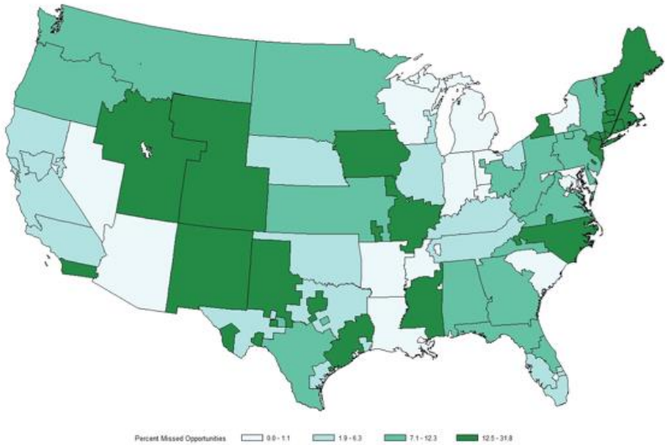


Fig. 4. Map of the 56 continental DSAs shaded by percentage of missed opportunities for donation after cardiac death liver recovery.

- DCD organs are one of the most immediate ways to increase the pool of transplantable organs
- The organs are there, but they are not being used.

Cannon RM, Nassel AF, Walker JT, Sheikh SS, Orandi BJ, Lynch RJ, Shah MB, Goldberg DS, Locke JE. Lost potential and missed opportunities for DCD liver transplantation in the United States. Am J Surg. 2022 Sep;224(3):990-998.

Normothermic Regional Perfusion (NRP)

A recovery technology that makes increasing DCD utilization feasible and with good outcomes.

Post-mortem in situ oxygenated perfusion to the organs intended for transplantation after the patient has been declared deceased and a no-touch period has been observed

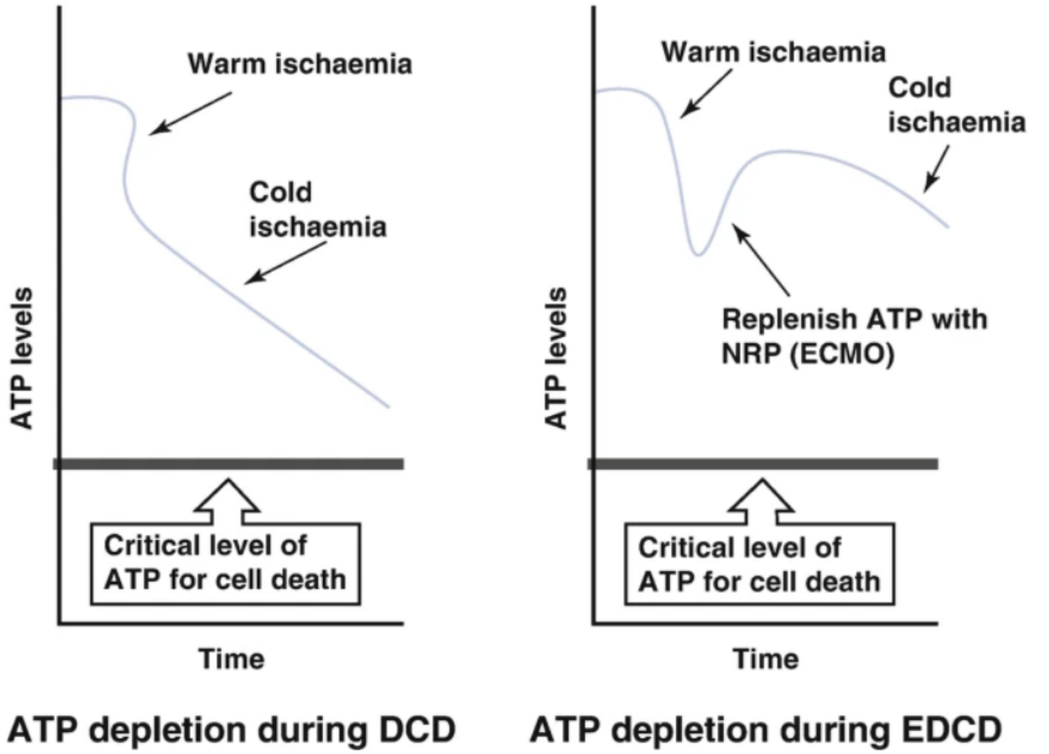
- **A-NRP: Abdominal cavity only**
- **TA-NRP: thoracic and abdominal cavity**

Process and Technique

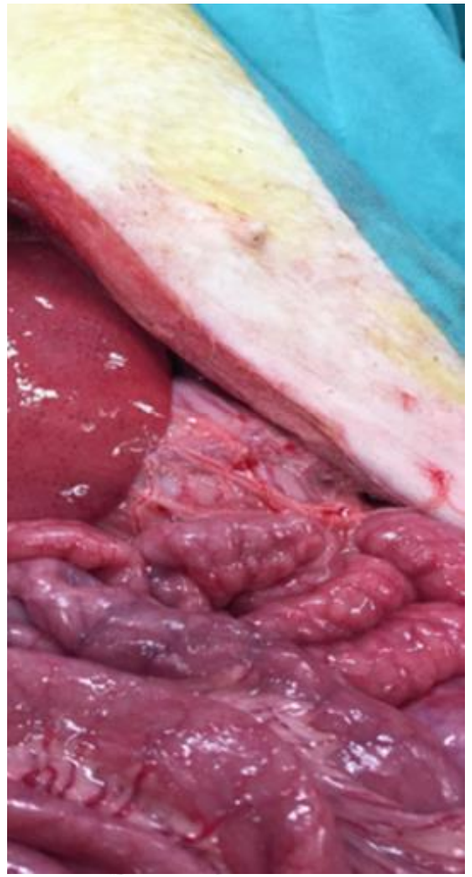
Process: Cannulation, occlusion of blood vessels to the head, initiation of perfusion with warm, oxygenated blood, organ evaluation and intervention, cold perfusion and crossclamp

TA-NRP vs. A-NRP

Fig. 29.7



Depletion pattern of ATP during WIT and CIT during retrieval of organs during DCD and EDCD



American College of Physicians Statement

The American College of Physicians (ACP) issued a statement of concern about the use of controlled donation after circulatory determination of death involving normothermic regional perfusion.

The ACP concludes that the use of DCD protocols involving NRP should be halted until these ethical concerns have been addressed and rejected.

American College of Physicians. 2021. Ethics, determination of death, and organ transplantation in normothermic regional perfusion (NRP) with controlled donation after circulatory determination of death (cDCD): American College of Physicians Statement of Concern. Accessed July 17, 2024. https://assets.acponline.org/acp_policy/policies/ethics_determination_of_death_and_organ_transplantation_in_nrp_2021.pdf.

ACP Statement 2021

Four concerns:

(1) in NRP death does not take its natural course, but that brain death is instead induced by preventing reperfusion of the brain.

(2) the criterion for determination of circulatory death is violated and that the donor is successfully resuscitated.

(3) that the practice is unjust because it disproportionally affects a stigmatized part of the population, namely people with substance abuse.

(4) that lack of transparency in the practice could damage the trust in health care and clinical research.

Irreversible Versus Permanent

Irreversible cessation of circulation means that, once it ceases, it ceases in perpetuity because it will not restart itself spontaneously (autoresuscitation) and it is impossible to restart it with available technology, i.e., it “cannot return.”

Permanent cessation means that once it ceases, it ceases in perpetuity because autoresuscitation will not occur and no medical intervention will be performed to attempt to reestablish it, i.e., it “will not return.”

Declaring Death

Guidelines generally authorize physicians, or designated providers, to declare death once circulation and respiration have ceased permanently and does not require them to await or prove its irreversible cessation.

Permanent cessation has been the time-honored accepted medical practice for the circulatory-respiratory determination of death in settings outside of organ donation.

Pronouncing Death

State death statutes, are based on the UDDA, which uses the term “irreversible” to describe the cessation of circulation and respiration.

- Strict construal of the term could conclude that the DCD donor had not satisfied the legal standard at the time of death declaration.
- The UDDA does not define “irreversible” so less strict construal is plausible.

The Organism as a Whole Integrated Entity

The cessation of syst… the cessation of brain functi…

- …tion

h…

Whe… of autoresu… at the donor no longer … vital vital work of the whole integrated organism.

It is not the intentional exclusion of circulation to the brain that is the cause of the patient's death rather it is underlying disease or condition that led to the decision to withdraw life-sustaining therapies that is the underlying reason for choosing death by circulatory cessation to the entire body.

Collateral Circulation

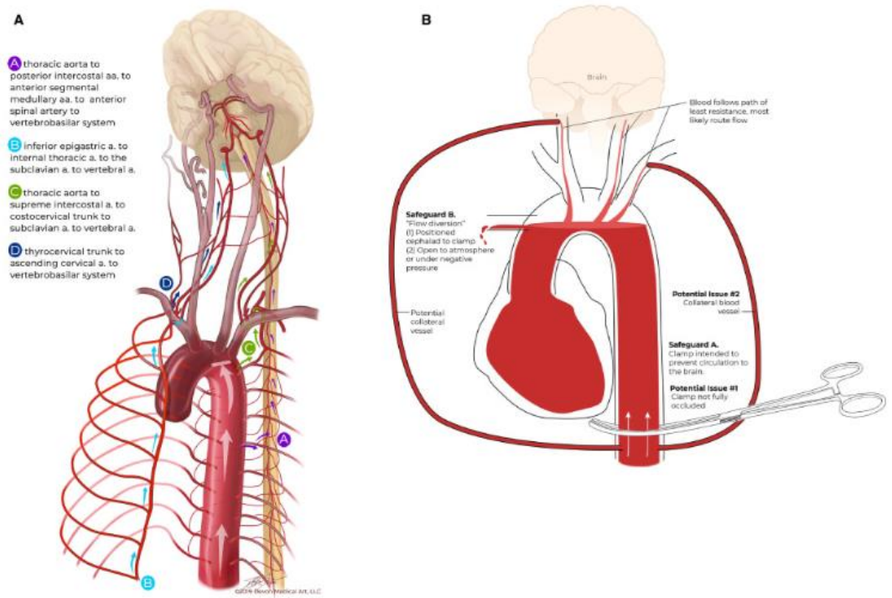


FIGURE 1. A, Potential collateral circulations A to D that could theoretically restore flow and/or perfusion to the brain. B, Proposed solution of flow diversion away from the brain by occluding the descending thoracic aorta and draining the aortic arch arteries to atmosphere either by inserting a large bore cannula into the ascending aorta or draining the arch arteries individually. Any potential collateral flow to the brain should be preferentially diverted to the low resistance large bore subclavian vessels open to atmospheric pressure

Manara A, Shemie SD, Large S, Healey A, Baker A, Badiwala M, Berman M, Butler AJ, Chaudhury P, Dark J, Forsythe J, Freed DH, Gardiner D, Harvey D, Hornby L, MacLean J, Messer S, Oniscu GS, Simpson C, Teitelbaum J, Torrance S, Wilson LC, Watson CJE. Maintaining the permanence principle for death during in situ normothermic regional perfusion for donation after circulatorydeath organ recovery: A United Kingdom and Canadian proposal, American Journal of Transplantation, Volume 20 (8); 2020, 2017-2025

Brain Perfusion

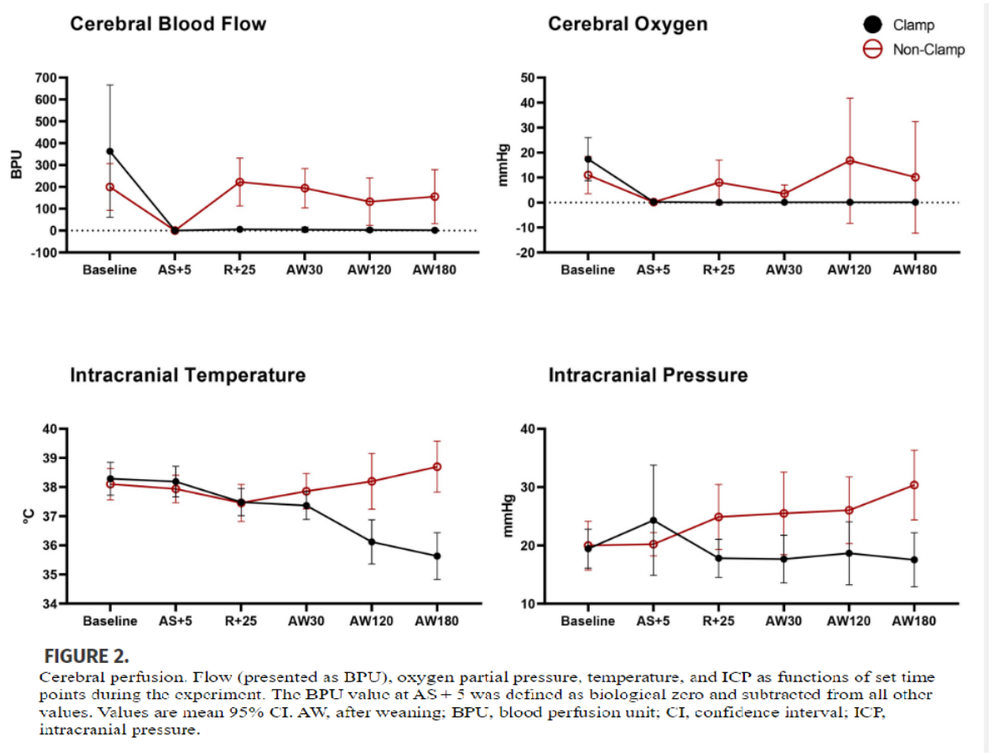


FIGURE 2.
Cerebral perfusion. Flow (presented as BPU), oxygen partial pressure, temperature, and ICP as functions of set time points during the experiment. The BPU value at AS + 5 was defined as biological zero and subtracted from all other values. Values are mean 95% CI. AW, after weaning; BPU, blood perfusion unit; CI, confidence interval; ICP, intracranial pressure.

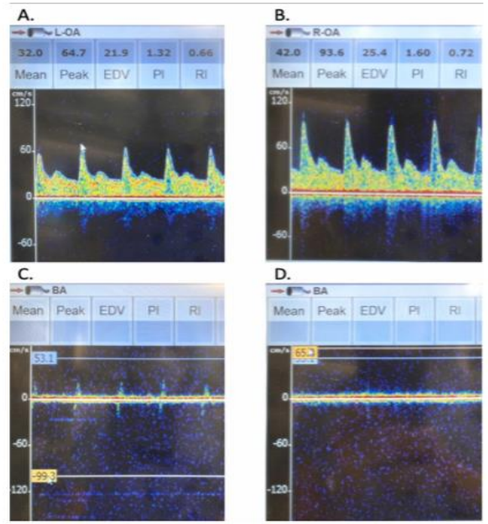


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Figure 3. Transcranial Doppler of donation after circulatory death case 2 performed in the operating room setting. (A) Patient 2: baseline, pre-extubation left carotid artery siphon insonated via the transorbital window at a depth of 56 mm with anterograde blood flow; (B) Patient 2: baseline, pre-extubation right carotid artery siphon insonated via the transorbital window at a depth of 56 mm with anterograde blood flow; (C) Patient 2: baseline, pre-extubation basilar artery insonated via the transforaminal (foramen magnum) window at a depth of 86 mm with nonperfusing isolated systolic spikes/biphasic oscillating flow; (D) Patient 2: postdeclaration of death, there was no anterograde flow, nor isolated spikes/biphasic oscillating flow detected in the posterior circulation (depth 86 mm shown). Similarly, there was no anterograde flow, nor isolated spikes/biphasic oscillating detected in either anterior circulation temporal or orbital windows.

Dalsgaard FF, Moeslund N, Zhang ZL, Pedersen M, Qerama E, Beniczky S, Ryhammer P, Ilkjær LB, Erasmus M, Eiskjær H. Clamping of the Aortic Arch Vessels During Normothermic Regional Perfusion After Circulatory Death Prevents the Return of Brain Activity in a Porcine Model. Transplantation 106(9): 1763-1769, 2022

Frontera JA, Lewis A, James L, Melmed K, Parent B, Raz E, Hussain ST, Smith DE, Moazami N. Thoracoabdominal normothermic regional perfusion in donation after circulatory death does not restore brain blood flow, The Journal of Heart and Lung Transplantation, Volume 42 (9), 2023, 1161-1165.

Outcomes

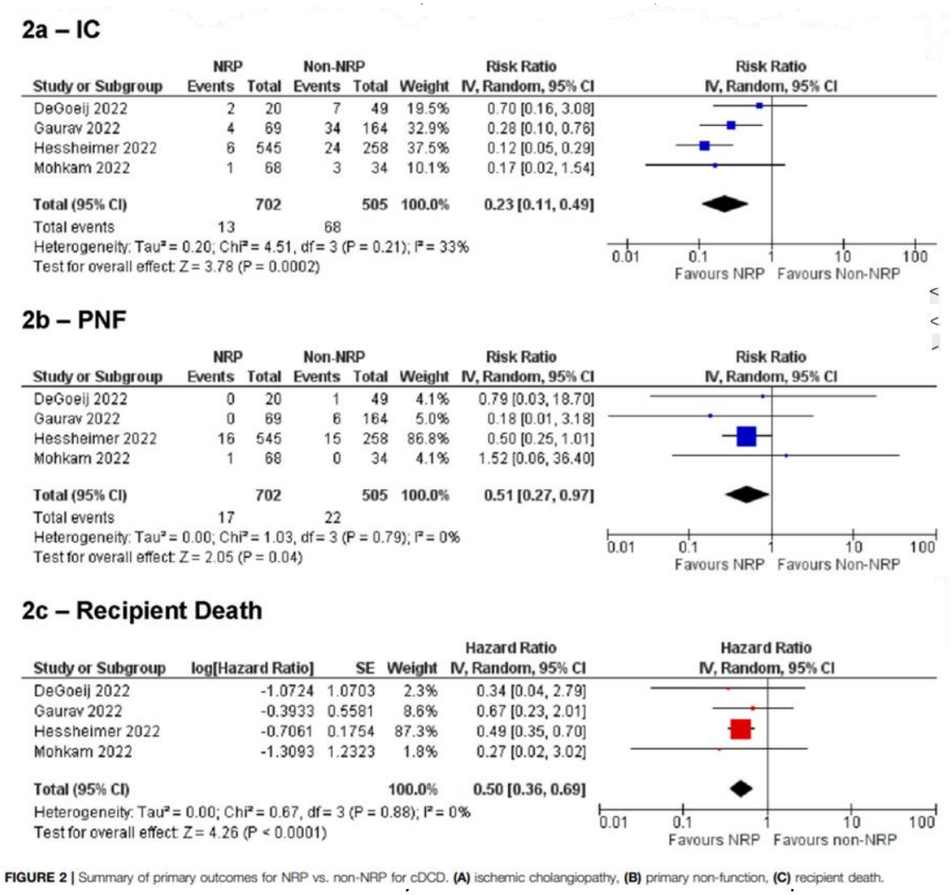


FIGURE 2 | Summary of primary outcomes for NRP vs. non-NRP for cDCD. **(A)** ischemic cholangiopathy, **(B)** primary non-function, **(C)** recipient death.

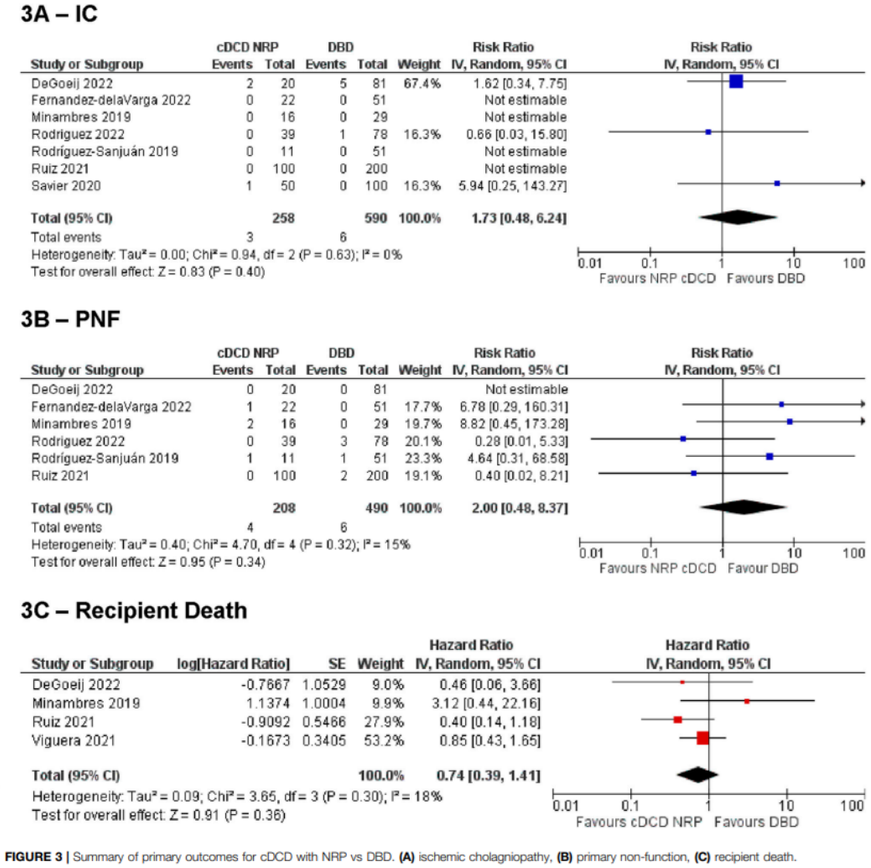


FIGURE 3 | Summary of primary outcomes for cDCD with NRP vs DBD. **(A)** ischemic cholangiopathy, **(B)** primary non-function, **(C)** recipient death.

Hessheime …A, López-Andujar R, At … steiro F, Villegas Herrera M … J, Jiménez C, López-M … lt M, Charco R, Tomé S, Va … J, López D, Blanco G, … ic regional perfusion i … comes and risk factors … 81.

Brubaker AL, Sellers MT, Abt PL, Croome KP, Merani S, Wall A, Abreu P, Alebrahim M, Baskin R, Bohorquez H, Cannon RM, Cederquist K, Edwards J, Huerter BG, Hobeika MJ, Kautzman L, Langnas AN, Lee DD, Manzi J, Nassar A, Neidlinger N, Nydam TL, Schnickel GT, Siddiqui F, Suah A, Taj R, Taner CB, Testa G, Vianna R, Vyas F, Montenovo MI. US Liver Transplant Outcomes After Normothermic Regional Perfusion vs Standard Super Rapid Recovery. JAMA Surg. 2024 Jun 1;159(6):677-685.

Mastrovangelis C, Frost C, Hort A, Laurence J, Pang T, Pleass H. Normothermic Regional Perfusion in Controlled Donation After Circulatory Death Liver Transplantation: A Systematic Review and Meta-Analysis. Transplant International, Volume 37 - 2024 | https://doi.org/10.3389/ti.2024.13263.

Outcomes

Table 3. Early Post-Transplant Outcomes after Kidney Transplant from Deceased Donors

Variable	TA-NRP Heart DCD	DBD	SRR Heart DCD	SRR Non-Heart DCD	p Value
Total, N (%)	219 (0.6)	27820 (71.1)	436 (1.1)	10,630 (27.2)	
Donor factor					
Donor age, y, median (IQR)	28.0 (21.5–34.0)	38.0 (28.0–50.0)	30.0 (24.0–35.2)	43.0 (32.0–53.0)	<0.001
Agonal to clamp, min, median (IQR)	83.0 (69.0–125.0)	NA (NA–NA)	21.0 (18.0–24.0)	23.0 (18.0–30.0)	<0.001
Donor peak serum creatinine, mg/dL, median (IQR)	1.3 (1.1–1.6)	1.5 (1.1–2.1)	1.3 (1.1–1.6)	1.2 (1.0–1.7)	<0.001
Donor hypertension, n (%)					<0.001
No	200 (91.7)	19,933 (72.9)	375 (86.0)	7,105 (67.5)	
Yes, 0–5 y	16 (7.3)	3,549 (13.0)	46 (10.6)	1,547 (14.7)	
Yes, 6–10 y	0 (0.0)	1,267 (4.6)	4 (0.9)	606 (5.8)	
Yes, >10 y	0 (0.0)	1,486 (5.4)	9 (2.1)	685 (6.5)	
Yes, unknown duration	2 (0.9)	1,106 (4.0)	2 (0.5)	582 (5.5)	
Donor diabetes, n (%)					<0.001
No	217 (99.5)	25,181 (92.0)	428 (98.2)	9,617 (91.3)	
Yes, 0–5 y	0 (0.0)	951 (3.5)	7 (1.6)	424 (4.0)	
Yes, 6–10 y	0 (0.0)	437 (1.6)	0 (0.0)	154 (1.5)	
Yes, >10 y	1 (0.5)	521 (1.9)	1 (0.2)	208 (2.0)	
Yes, unknown duration	0 (0.0)	286 (1.0)	0 (0.0)	136 (1.3)	
Cold ischemic time, h, median (IQR)	18.3 (14.4–23.2)	17.2 (11.8–22.9)	17.8 (12.8–22.2)	20.0 (15.7–24.5)	<0.001
Recipient factor					
Recipient age, y, median (IQR)	44.2 (34.7–56.7)	54.3 (41.7–63.8)	49.1 (37.8–58.8)	57.7 (47.7–65.4)	<0.001
Dialysis before transplant, n (%)					<0.001
No	26 (12.9)	4,092 (15.4)	51 (11.9)	1,239 (12.3)	
Yes	175 (87.1)	22,527 (84.6)	379 (88.1)	8,845 (87.7)	
cPRA, median (IQR)	0.0 (0.0–53.5)	0.0 (0.0–41.7)	0.0 (0.0–67.2)	0.0 (0.0–36.9)	0.001
HLA-MM, n (%)					0.001
0	7 (3.2)	1,190 (4.3)	16 (3.7)	517 (4.9)	
1	0 (0.0)	301 (1.1)	6 (1.4)	116 (1.1)	
2	9 (4.1)	1,292 (4.7)	21 (4.8)	507 (4.8)	
3	37 (16.9)	3,904 (14.1)	67 (15.4)	1,487 (14.0)	
4	70 (32.0)	7,533 (27.2)	136 (31.3)	2,996 (28.2)	
5	70 (32.0)	9,092 (32.8)	142 (32.6)	3,501 (33.0)	
6	26 (11.9)	4,427 (16.0)	47 (10.8)	1,499 (14.1)	
Recipient pretransplant dialysis time, y, median (IQR)	4.6 (2.6–7.0)	3.9 (1.9–6.2)	4.3 (2.2–6.4)	4.0 (2.1–6.0)	0.002
Outcomes					
Post-transplant hospital length of stay, d, median (IQR)	4.0 (3.0–5.0)	5.0 (4.0–7.0)	5.0 (4.0–7.0)	5.0 (4.0–7.0)	0.014
Delayed graft function, n (%)					<0.001
No	171 (85.1)	19,981 (75.0)	249 (57.9)	5,767 (57.3)	
Yes	30 (14.9)	6,663 (25.0)	181 (42.1)	4,301 (42.7)	
Recipient serum creatinine at discharge, mg/dL, median (IQR)	2.0 (1.3–4.7)	2.9 (1.5–5.7)	5.6 (2.9–8.5)	5.6 (3.2–8.1)	<0.001

cPRA, calculated panel reactive antibody; DBD, donation after brain death; DCD, donation after cardiac death; HLA-MM, human leukocyte antigen mismatch; IQR, interquartile range; NA, not available; SRR, super rapid recovery; TA-NRP, thoracoabdominal normothermic regional perfusion.

Merani S, Urban M, Westphal SG, Dong J, Miles CD, Maskin A, Hoffman A, Langnas AN. Improved Early Post-Transplant Outcomes and Organ Use in Kidney Transplant Using Normothermic Regional Perfusion for Donation after Circulatory Death: National Experience in the US. Journal of the American College of Surgeons 238(1):p 107-118, 2024.

Benefits

- Improves organ utilization through increased viability
- Reduction in DGF and graft failure for kidneys
- Reduction in biliary complications (IC) and graft failure for livers
- Utilization of medically complex organs, e.g., steatotic livers, high Kidney Donor Profile Index kidneys, elderly donors) from DCD donors
- Multi-organ perfusion at significantly less cost ($5000-9000 vs. $100000-275000, individually)

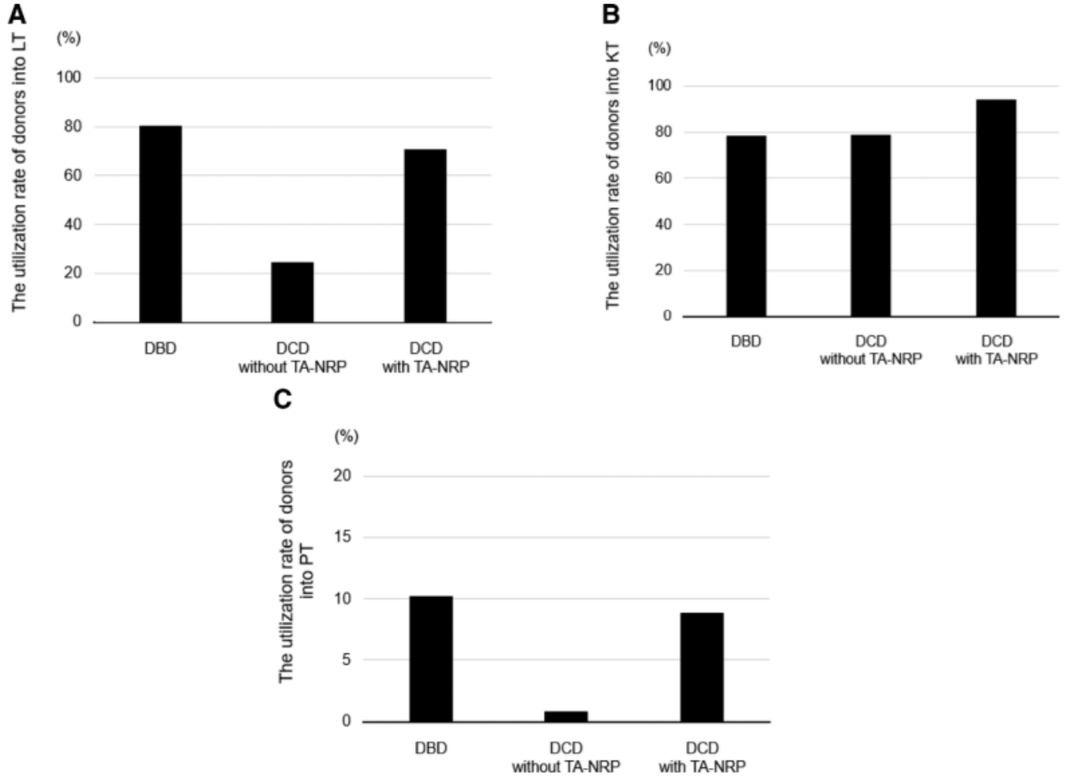
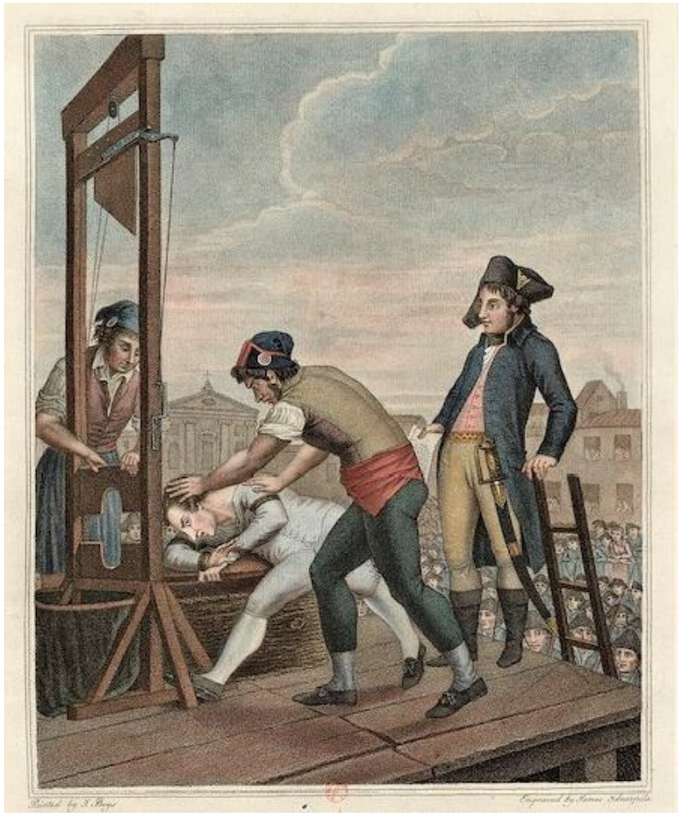


FIGURE 2. Utilization rates of livers (A), kidneys (B), and pancreas (C) were compared between DCD with and without TA-NRP. The utilization rate of liver and pancreas in DCD with TA-NRP donors was significantly higher compared with that in DCD without TA-NRP donors and similar to that of DBD ($P < 0.001$ in both; 70.6% vs 24.4% vs 80.3% and 8.8% vs 0.8% vs 10.2%, respectively). The utilization rate of kidney was also higher in DCD with TA-NRP donors ($P = 0.06$, 78.7% in DBD, 78.2% in DCD without TA-NRP, and 94.1% in DCD with TA-NRP). DBD, donation after brain death; DCD, donation after circulatory death; KT, kidney transplantation; LT, liver transplantation; PT, pancreas transplantation; TA-NRP, thoracoabdominal-normothermic regional perfusion.

Bekki Y, Croome, KP, Myers B; Sasak K, Tomiyama K. Normothermic Regional Perfusion Can Improve Both Utilization and Outcomes in DCD Liver, Kidney, and Pancreas Transplantation. Transplantation Direct 9(3):p e1450, March 2023.

The Decapitation Gambit



Suppose a subject underwent surgical decapitation with care taken to attach both the head and decapitated body portions to life-support systems: a ventilator for the body portion and ECMO machine for the head portion

In which part does the person reside? It would generally be agreed that the person resides in the head-brain portion as the body portion maintained on a ventilator, whose beating heart generates circulation and allows visceral organ functioning, lacks awareness, movement, sensation, breathing, and all other brain functions.

Lizza, J. P. 2011. Where's Waldo? The 'decapitation gambit'and the definition of death. Journal of Medical Ethics 37(12):743–6

A (Potential) Guiding Principle for DCD Donors

Protecting these patients from harm while honoring their views about whether and how to donate their organs for the benefit of others should take priority over the indeterminate questions about whether or how they are dead.

Thank you

THE UNIVERSITY OF TENNESSEE HEALTH SCIENCE CENTER

Questions?